The Mayor of London's Nursery Air Quality Audit Programme

Rachel McMillan Nursery School, London Borough of Greenwich

FEBRUARY 2020

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ACKNOWLEDGEMENTS & CONTRIBUTIONS

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DISCLAIMER

The contents of this report and its recommendations are principally based on the findings of the independent audit as of the date it was undertaken, and may not account for subsequent changes in local policy, conditions and/or circumstances in and/or around the nursery.

Supplier

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NON-TECHNICAL EXECUTIVE SUMMARY

Long-term exposure to poor air quality contributes to thousands of premature deaths in London. The Mayor wants London to have the best air quality of any major world city by 2050. Young children are amongst the most vulnerable to air pollution's effects. Toxic air can stunt their growth, causing significant health problems in later life.

In May 2018, the Mayor launched a programme of air quality audits to help clean up toxic air and protect the health of young children in 20 nurseries in some of London's most polluted areas.

The **Air Quality Audit** followed a structured approach, with desktop research and air quality modelling, followed by fieldwork and air quality monitoring. Recommendations were then developed based on the consultations with nursery staff and borough officers.

The audit has assessed both outdoor and indoor air pollution levels.

Outdoor pollutants are generated by industrial processes and traffic emissions, and can migrate indoors through windows, doors and other means of ventilation.

Indoor air pollution arises from a mixture of pollutants generated inside a building including building materials and furnishings, and through activities such as cooking, heating, smoking and use of paints, varnishes, cleaning products and air fresheners.

Indoor air pollution is still a relatively new area of study, and our understanding is still evolving as further evidence is collected on the complex interactions taking place, and the extent to which they affect our health.

Audit Findings

Nitrogen oxides (NO$_x$) - Short-term exposure to concentrations of NO$_2$ can cause inflammation of the airways, increasing susceptibility to respiratory infections and to allergens.

The results of the three-month baseline monitoring showed that NO$_2$ concentrations were highest at the **roadside** (37µg/m³), with local road traffic emissions contributing significantly to roadside concentrations.

The three months of baseline NO$_2$ monitoring provides a snap-shot of concentrations in and around the nursery across the winter and spring months. However, in one of the three months, the measured NO$_2$ concentrations exceeded the legal limits (annual mean NO$_2$ national Air Quality Objective of 40µg/m³).
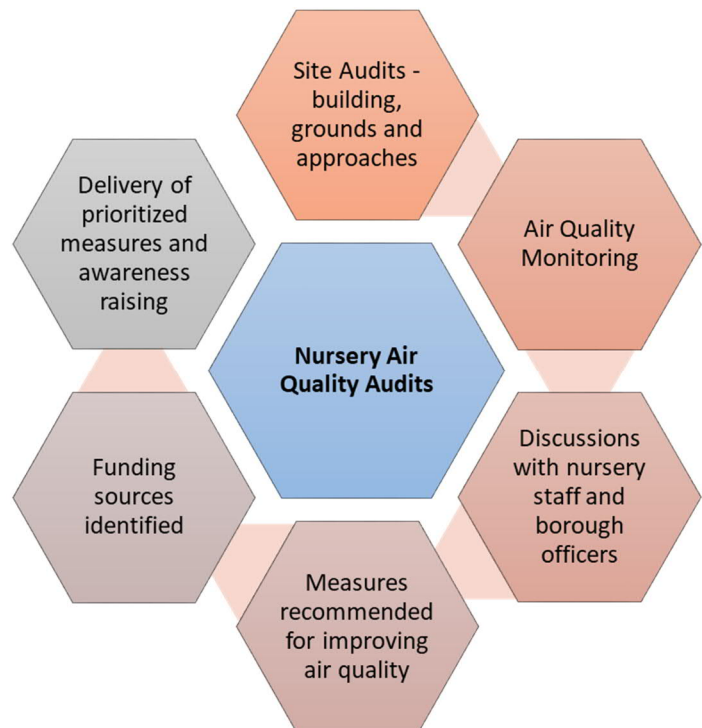
NO_2 concentrations become increasingly dispersed away from the roadside, and fall to 33µg/m³ in the playground, which is partially screened from traffic by fencing and some trees and shrubs. Concentrations at the nursery entrance are of a slightly higher level (35µg/m³) to the playground. Whilst concentrations were found to be below national legal limits, known as Air Quality Objectives, there is no 'safe' level and children would still benefit from further reductions. Children will also be adversely affected by their journeys to and from nursery. **Inside the nursery,** the indoor concentrations fall to 21-26µg/m^3.

Volatile Organic Compounds (VOCs) are emitted from vapours arising from petrol and solvents. In a nursery setting these are likely to originate from a wide variety of products, including furnishing, carpets, upholstery, cleaning products and air fresheners. In the UK, building regulations recommend total Volatile Organic Compounds (TVOCs[1]) concentrations should be below 300 µg/m^3. In the nursery they were found to be 94.6 µg/m^3. The majority of VOCs identified were likely to be from the fragrances, perfumes and alcohols in, cleaning materials and solvents.

> Overall the monitoring found that indoor air quality at the nursery met legal standards, however there are no entirely safe levels of exposure to harmful pollutants, and the children would still benefit from further reductions.

Formaldehyde are emitted from vapours arising from solvents and adhesives. In a nursery setting these are likely to originate from glues, adhesives and finishing's. Exposure can cause burning sensations of the eyes, nose, and throat, coughing, wheezing, nausea and skin irritation. The World Health Organisation (WHO) indoor air quality guideline[2]. The World Health Organisation (WHO) indoor air quality guideline for short and long-term exposures to formaldehyde is 100 µg/m^3. In Nell Gwynn they were found to be 4.04 µg/m^3.

The wider area around the nursery was assessed using the London Atmospheric Emissions Inventory (LAEI), which showed that pollution levels reducing with distance, away from the heavily trafficked Creek Road. NO_2 concentrations are predicted to be highest along the southern boundary of the nursery, which is closest to the main road.

Particulate Matter (PM_{10} and $PM_{2.5}$)[3] is derived from a wide range of sources, including industrial processes, road traffic, dust and brake and tyre wear. The fine component of PM_{10}, known as $PM_{2.5}$, is formed by combustion and is believed to be the main cause of the harmful effects of particulate matter.

Nearly 50% of NO_x emissions in London are from road transport. Larger diesel vehicles in particular are major contributors to local air pollution. Approximately **12,900 vehicles per day travel**

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[1] TVOC is a grouping of a wide range of organic chemical compounds to simplify reporting when these are present in ambient air or emissions.

[2] Chapter 5.8 Formaldehyde. WHO Air Quality Guidelines – Second Edition, 2001

[3] PM_{10} is particulate matter with an aerodynamic diameter of less than 10 micrometres (10µm). $PM_{2.5}$ is particulate matter with an aerodynamic diameter of less than 2.5 micrometres (2.5µm).

within 200m of the nursery. Buses make up only 3% of these vehicle movements, but contribute 24% of the transport related NO_x emissions locally. Similarly, HGVs only account for 5% of the total traffic but contribute 28% of emissions. Cars account for 28% of emissions.

Key observations – summary of potential issues

- Rat-running running along Stowage / McMillan Street / Deptford Green to avoid the A200 Creek Road / A2209 Deptford Church Street signalised junction
- Lack of a safe crossing outside the school entrance, mixed with a staggered junction at McMillan Street / Stowage / Deptford Green results in parents and children having to cross amongst traffic
- Unsafe parking and engine idling by some parents observed – including stopping on keep clears, parking on corners and engine idling
- Heavy traffic flows, including large numbers of buses and HGVs along A200 Creek Road – resulting in exposure to air pollution to parents and children accessing the nursery from the south
- A large HGV was present outside the nursery pedestrian entrance during peak arrival time of parents and children. The school noted that this was not normal.
- Shelters 3, 4 and 6 exposed and reliant on natural ventilation, while located adjacent to the road in the most polluted area of the site
- The heritage listed buildings suffer from poor insulation resulting in greater heat loss and increased boiler run times. Higher temperatures during warmer weather, requiring windows/doors to be opened and greater exposure.
- Flues from four of the boiler rooms discharging at wall height directly onto the outdoor area.
- Limited scooter parking, with no weather protection, to encourage children to scoot to school. The buggy area to the rear of the school is noted to fill up.

Audit Recommendations

The Mayor is implementing a significant programme of London-wide measures to improve air quality, including the introduction of the Ultra-low Emission Zone, tougher emission standards for the London wide Low Emission Zone, and the introduction of low emission buses, which will contribute significantly to addressing some of the issues identified.

Based on the preceding desktop research, site audits and stakeholder feedback, a range of **recommended measures and initiatives** have been identified. See Table 4 for full list of measures. Some of the key measures were considered to be:

- **Improved crossing environment and reduced rat running -** the local roads (Stowage, McMillan Street and Deptford Green) are used as rat runs for vehicles avoiding the A200 Creek Road. At the same time, the staggered junction adjacent to the school entrance results in a blind-corner for pedestrians and drivers – resulting in safety issues.
- **Promote cleaner routes to school** – it was agreed that more work could be done to identify and promote cleaner routes to school, in particular avoiding the A200 Creek Road and A2209 Deptford Church Street. The school noted that they undertake a number of walking 'expeditions' to the market, along the River Thames and Albany Theatre.
- **Air filtration systems and improved insulation** – the uneven temperatures in the building at different times of the year especially between the different buildings and shelters create additional burning of the gas boilers and opening of windows to ventilate exposing children to emissions. Improved insulation of the windows and doors would improve heat loss in winter and regulate

temperatures in the warmer months. Alternatively, air filtration systems could be used to improve the indoor air quality before improved insulation is installed.

Next Steps

In working with the nursery and air quality and transport borough officers to complete the air quality audit, we found there to be a passionate group of individuals, who were enthusiastic about improving local air quality for the children, and the wider community as a whole.

The **borough and nursery should investigate the scope for rapidly delivering key measures** from the recommendations.

To take forward the recommendations, the nursery and borough will need to continue to work closely, building on the relationships already in place. A wide range of **potential funding** sources are identified within the report (See Appendix F), and boroughs and nurseries are encouraged to apply for these where appropriate to maximise the potential for delivering the recommendations.

Each nursery will be given a starter grant of £4,500 by the GLA to help kick-start the implementation of recommendations. The GLA will liaise with the nurseries and boroughs to agree which recommendations the grant will be used for.

Summary of Nursery related recommendations

The full range of recommendations primarily applicable to the nursery, as opposed to highways measures to be delivered by the borough or TfL, are as follows. See Table 4 for further details on these measures.

Nursery Grounds

Additional scooter / buggy parking
Divert flues to roof level to reduce exposure to the playground

Nursery Building

Improved heating and insulation taking into consideration the heritage status of the nursery
Ventilation systems with air filtration
Add indoor plants
Switch to lower VOC cleaning products

Behavioural Measures

Become part of the STARS scheme, ultimately attain Gold status
Prepare 'Welcome Packs' for new pupils / parents
Join Healthy Early Years London scheme, ultimately attain a Gold award
Awareness raising amongst staff
Engagement activities with parents
Anti-idling and considerate driving campaign
Promote cleaner routes to the nursery avoiding the A200 Creek Road where possible
Monitor London Air website / app

1. INTRODUCTION

1.1. BACKGROUND

1.1.1. Long-term exposure to poor air quality contributes to thousands of premature deaths in London. There is strong scientific evidence of the acute health effects of short-term exposure to very high pollution levels experienced during air pollution episodes.

1.1.2. Tackling air pollution is one of the Mayor of London's top priorities, and he recognises that co-ordinated action is required to reduce exposure, especially amongst the most vulnerable such as young children, whose lungs are still developing.

1.1.3. The London Environment Strategy, published in May 2018, seeks to reduce the number of Londoners whose lives are blighted by poor air quality. The Mayor wants London to have the best air quality of any major world city by 2050, going beyond the legal requirements to protect human health and minimise inequalities. This include commitments to act to improve air quality in and around schools and nurseries and provide enhanced information to Londoners.

Why Nurseries?

1.1.4. The Mayor is particularly concerned about the impacts of poor air quality on vulnerable groups such as children, the elderly and those with pre-existing health conditions such as asthma and cardio-vascular diseases. Young children are amongst the most vulnerable of the at-risk groups, as their lungs are still developing, and toxic air can stunt their growth, causing significant health problems in later life. The World Health Organization (WHO) also recognises younger children as being a vulnerable group to air pollution, making nurseries a key consideration in improving air quality.

1.1.5. A study led by Kings College in East London found that primary school children had on average 5% lower lung capacity than those growing up in rural areas. A UNICEF report published in December 2017 highlights the impact of air pollution on the critical growth that occurs in the brain in the first 1,000 days of life, making children exposed to pollution more vulnerable to developmental problems. UNICEF estimate that 17 million children globally are breathing air so toxic it is affecting their brain development. Air pollution exacerbates asthma, which affects 1 in every 11 children in England.

The Mayor's Nurseries Air Quality Audits

1.1.6. In May 2018, the Mayor launched a programme of air quality audits to help clean up toxic air and protect the health of young children in 20 nurseries in some of London's most polluted areas. The nurseries were selected based on assessments of predicted annual mean nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) levels near the nursery, and in agreement with the respective local authority.

1.1.7. The aim is to establish a robust process and toolkit of measures, which the London boroughs and nursery schools can roll out, so that every nursery that is located in an area of high pollution can benefit from this approach.

1.1.8. This programme builds on the approach founded in the Mayor's School Air Quality Audit Programme completed in March 2018, and the audit reports the Mayor recently commissioned on indoor air quality in London's primary schools, which included the Toolkit of Measures to Improve Air Quality at

Schools.[4] The programme is led and funded by the Greater London Authority (GLA) and the audits were conducted by global engineering consultancy WSP, who have visited each of the nurseries, assessing indoor and outdoor air pollution sources, and how children travel to the nurseries.

1.1.9.   Road transport is a major contributor to emissions, and has a significant impact on air quality, accounting for around half of NO_x emissions. Whilst private car use is decreasing, congestion is increasing[5]. Without significant intervention, as the Capital grows rapidly these trends are set to continue.

1.1.10. In response the Mayor is implementing a significant programme of measures, including bold proposals to reduce London's deadly air pollution and protect the health and wellbeing of all Londoners, including:

- **The Ultra Low Emission Zone** (ULEZ) launched in central London on 8 April 2019. It replaced the T-Charge (Toxicity Charge) and means that vehicles that do not meet the strict ULEZ emissions stands are charged to drive in the zone, 24 hours a day, every day of the year. It is expected that the ULEZ will reduce road transport emissions of nitrogen oxides (NO_x) by around 45 per cent in the central London zone.
- **Expanding the ULEZ and tightening the Low Emission Zone (LEZ).** The ULEZ will expand to inner London, up to the North and South Circulars, in October 2021, and emissions standards for heavy vehicles in the London-wide LEZ will be tightened (to Euro 6) in October 2020.
- **Cleaning up London's buses.** The Mayor is transforming London's bus fleet with a retrofit programme covering thousands of buses, and only procuring hybrid or zero emission double decks since 2018.
- **Cleaning up the taxi fleet**. From 2018, TfL has stopped new diesel taxis from being licensed in London and all new taxis need to be zero emission capable. TfL provide financial incentives to enable this switch to cleaner taxis and over 175 rapid charge points have been installed, with many dedicated to the trade.
- **Low emission neighbourhoods –** have been funded across London to pioneer measures to promote the use of low emission vehicles and improve local air quality, including low emission

[4] https://www.london.gov.uk/sites/default/files/school_aq_audits_-_toolkit_of_measures_dr_v3.3.pdf

[5] London Assembly, London stalling: Reducing traffic congestion in London, January 2017, Transport for London, Travel in London - Report 9 data, 2017

- vehicle only streets, measures to promote deliveries by cycle cargo bikes and low emission vehicles, and bold proposals to promote walking and cycling.
- **The London Environment Strategy** – is an ambitious strategy, with a particular focus on air quality published in 2018, and seeks to address the most urgent environmental challenges facing London, to safeguard its environment over the longer term. This strategy establishes aims for London, which include having the best air quality of any major city, and a zero-carbon city by 2050, with energy efficient buildings, clean transport and clean energy. The Mayor is providing funding through his Greener City Fund to create and improve green spaces and to plant trees.
- **The Draft London Plan -** published in November 2017, places a considerable emphasis on air quality. The aim of policies is to ensure that new developments are designed and built, as far as is possible, to improve local air quality and reduce the extent to which the public are exposed to poor air quality.
- **Healthy Streets Approach** - the Mayor is embedding the 'Healthy Streets' approach in transport strategy. This promotes a holistic approach to improve the health, liveability, social cohesion and economic prosperity of an area.
- **The Mayor's Transport Strategy 2018 -** The Mayor has set out ambitious plans to improve transport in London over the next 25 years. The Mayor's ambition for 80% of trips in London to be made on foot, by cycle or using public transport by 2041, and a commitment to make the entire transport system zero-emission by 2050.

1.1.11. These measures are already starting to have a measurable impact on pollution levels in London. However, the Mayor also wanted to take early action at 20 nurseries located in areas with some of the highest air pollution levels, so has provided £250k funding to commission this programme.

1.1.12. The Mayor's Nurseries Air Quality Audits Programme follows the approach developed as part of the Mayor's School Air Quality Audit Programme, identifying a combination of hard-hitting measures and quick win improvements, to minimise the impacts of toxic air on nursery children in some of the worse affected areas across London. This is both in terms of reducing the sources of harmful emissions, as well as reducing the exposure to these emissions.

1.2. OBJECTIVES

1.2.1. The key objectives of the Mayor's Nurseries Air Quality Audit Programme are to:

- Audit and identify the sources of poor outdoor air quality and exposure by children at 20 state-funded nurseries and their surrounding nursery catchment areas, including NO_2, PM_{10} and $PM_{2.5}$.
- Audit and identify the sources of poor indoor air quality and potential exposure by children attending the nurseries, and establishing a baseline of indoor air quality.
- Assess the feasibility of installing air filtration systems at the selected nurseries' sites.
- Trial and monitor the effectiveness of air filtration systems in at least 5 of the nurseries.
- To identify, evaluate and recommend measures within and around the nurseries' that will help a borough and nursery to reduce particulate matter, emissions and children's exposure to poor air quality, and award grant funding to deliver some of the recommended measures.
- To engage nursery communities and raise awareness about the impacts of air pollution, including an introduction to Transport for London's STARS programme and the GLA's Healthy Early Years London Programme.
- To engage eligible London boroughs and other relevant stakeholders to inform the context and feasibility of the proposed recommendations.

2. AUDIT APPROACH

2.1. OVERALL AUDIT APPROACH

2.1.1. The Mayor's Nurseries Air Quality Audits follow the structured approach established through the preceding audit programme of Primary Schools, but this time included air quality monitoring of both indoor and outdoor air pollution. The structured approach the audit followed is summarised in Figure 1 below.

Figure 1 – Overview of Approach
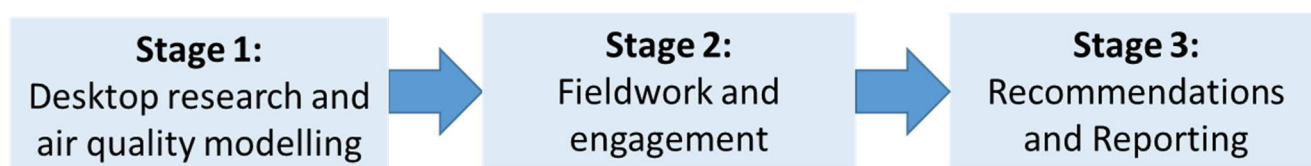
2.1.2. Each audit consists of broadly three key stages:

Stage 1: Desktop research and air quality modelling

2.1.3. Prior to the site visit **air quality modelling** was undertaken for the area around the nursery, with an assessment of the contribution to emissions made by each vehicle type on the roads around the nursery.

2.1.4. A **desktop review** of the local areas around the nursery site, and the wider catchment was also undertaken, to highlight key features for the auditor to assess further on site. This includes sources of pollution, causes of exposure, and notable features in the local area which may have a bearing on the potential mitigation measures (i.e. bus routes, pedestrian crossing locations, nearby construction sites, physical barriers such as railways or rivers). The nurseries STARS[6] travel plan progress was also reviewed for reference ahead of the audits.

Stage 2: Fieldwork and consultation

2.1.5. A site visit to the nursery was undertaken by the WSP auditor and officers at the borough who deal with air quality, transport planning and school/ nursery travel.

2.1.6. Observations were undertaken with the borough officers and nursery staff during the peak arrival/ departure time, to capture as much information as possible on drop-off and waiting activity in and around the nursery, **identifying external sources of emissions** close to the nursery, and the areas where the children are exposed to poor air quality when approaching the nursery.

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[6] STARS is TfL's accreditation scheme for London schools and nurseries, promoting travel to school sustainably, actively, responsibly and safely by championing walking, scooting and cycling.

2.1.7. The external observations were then followed by an **audit of the building and grounds** which was undertaken with the assistance of the facilities manager, to enable the auditor to familiarise themselves with its layout, and the proximity of classrooms and playgrounds to areas of poor air quality. The audit included a review of the nurseries boilers, and considered features likely to lead to emissions of indoor air pollutants, such as building ventilation, evidence of fresh air intrusion, and identifying use and location of potential pollutant sources.

2.1.8. A key element of the audits was to capture the views of nursery staff, the wider nursery community, and relevant borough officers, to gain an understanding of operational considerations, behavioural traits and recent history of the nursery.

2.1.9. A **brainstorming session** was then undertaken, with staff from the nursery and the borough officers in attendance. This session served several functions. It enabled the auditor to capture additional information on other issues and concerns not observed directly, and additional information on issues such as whether there are any plans for extensions or additional pupil intake for example. Whilst from the borough officers, we could establish what planned or committed development is nearby, proposed or previously considered transport schemes etc. We then discussed a range of potential measures to address the issues discussed and collected feedback and suggestions from the borough and nursery representatives to inform the recommended measures.

2.1.10. Nursery staff were also consulted regarding what they felt would be the most suitable and effective form of **engagement activity**, which could be undertaken at the nursery to raise awareness of air pollution, its causes, the health impact, and a range of measures to reduce air pollution.

2.1.11. A 3-month baseline **air quality survey** was undertaken to monitor Nitrogen Dioxide (NO_2), Formaldehyde and Volatile Organic Compounds (VOCs) at sites both inside and outside the nursery building, in order to capture any attenuating influence the indoor environment may have on NO_2 concentrations.

Stage 3: Recommendations and Reporting

2.1.12. The auditor reviewed the findings of the audit and preparatory assessments, with the specialist support of air quality, transport planning and buildings specialists, to develop advice and recommendations. The auditor was also able to draw on an updated version of the toolkit of best practice measures and case study examples, developed for the previous primary school audit programme.

2.2. AUDIT SCHEDULE – RACHEL MCMILLAN NURSERY SCHOOL

2.2.1. Table 1 provides further detail of the audit schedule and key participants from the nursery and borough.

Table 1 – Audit Details

Date of Audit	Friday 1st February 2019	
Nursery Representatives	Rachel Hogarth-Smith (Head Teacher)	
Borough Representatives	Lily Jones (Air Quality Officer) Camilla Olofsson (School Travel Officer) Joel De Mowbray (Principal Transport Planner)	
WSP Auditors	Daniel Quan	
Itinerary	**Timings**	**Description**
	0800 - 0830hrs	Initial observations and site familiarisation by WSP auditors
	0830 – 0900hrs	Site walk and observations with borough travel plan coordinator/ air quality officer and school staff
	0900 – 0930hrs	Internal site walk to appreciate the layout of the building/playgrounds etc.
	0930 – 1130hrs	Brainstorming Workshop
	1130 - 1230hrs	School Building audit

3. CONTEXT AND INITIATIVES

3.1. NURSERY CONTEXT

Figure 2 - Nursery Context

Borough: Greenwich

Address: McMillan Street, SE8 3EH

Pupil Numbers: 150

Age Range:
0-4 years

Gender:
Mixed

Type: Local authority nursery school

Deprivation Rank: 4

Children who speak English as an additional language:

Higher than average

Children with disabilities or special educational needs:

Higher than average

3.1.1. **Rachel McMillan Nursery School** is located in South-East London and sits within the Borough of Greenwich.

3.1.2. At the time of the audit the nursery had **104 full-time equivalent children**, however numbers can range between 130 and 160 children at any one time with higher pupil numbers tending to occur in the summer term.

3.1.3. The desktop review, site audit and subsequent discussions with the school confirmed that most children walk to school (including those dropped off in buggies). Some parents were noted to drive, with the school indicating that some drive from a while away.

3.1.4. Less than half of the 30 staff drive to work and purchase permits to park along Deptford Green. Surveys indicate that about 10 staff members live locally, and walk or cycle to work.

3.1.5. Approximately **12,900 vehicles per day travel** on the core roads within a 200m radius of the nursery[7]. This is within the 2nd quartile in terms of traffic volumes amongst of the 20 nurseries assessed as part of this programme. For context, in the UK in 2017[8] the average traffic flow on urban minor roads was 2,100 vehicles, and 19,200 vehicles on an urban A-road.

3.1.6. The subsequent two pages illustrate the context of the nurseries within the local area.

  - The **outer context** plan highlights key roads and land uses in the area, including the frequencies of buses, as well as other notable sources of air pollution. The figure also illustrates the key walking routes taken by the children when approach the nursery.
  - The **inner context** plan provides detail on the main accesses (both pedestrian and vehicular) to the nursery, and the location of the playgrounds where children are most exposed to air pollution.

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[7] The traffic flows and vehicles splits presented are based on the average number of vehicles on each LAEI modelled road link within 200m radius of the nursery in the LAEI 2013 base.

[8] DfT Road Traffic Estimates: Great Britain 2017 (2018)

Figure 3 – Outer Context Plan

Evelyn Street

47 (6/hr each way)
188 (8/hr each way)
199 (6/hr each way)
N1 (2/hr each way)
N199 (2/hr one way)

Stowage

188 (8/hr each way)
199 (6/hr each way)
N1 (2/hr each way)
N199 (2/hr one way)

A200

A200

Deptford High Street

47 (6/hr each way)
188 (8/hr each way)
199 (6/hr each way)
N1 (2/hr each way)
N199 (2/hr one way)

47 (6/hr each way)

Deptford Church Street

Creekside

Contains Ordnance Survey data © Crown copyright and database right 2017.

Key

⭐ Rachel McMillan Nursery School and Children's Centre

🚏 Bus Stop

➡ Bus Route

— Cycle Route

🚆 Train Station

Ⓤ Underground Station

Local Centre

Green Space

⛽ Petrol Station

↔ At-grade Pedestrian Crossing

— Key Pedestrian routes to school

↖ Pedestrian Access
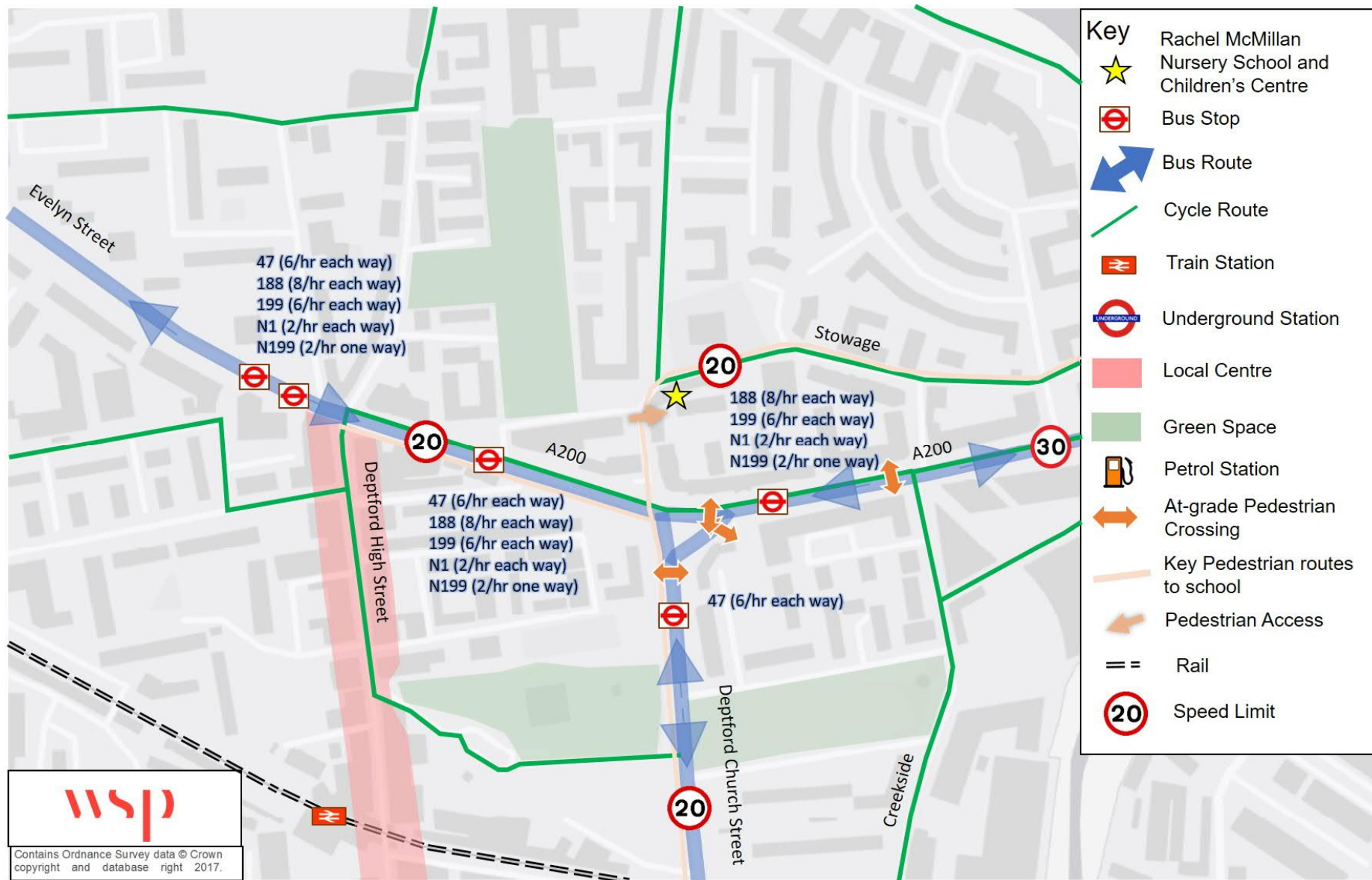
= = Rail

⑳ Speed Limit

Figure 4 – Inner Context Plans

3.2. PLANNED SCHEMES & RECENT INITIATIVES

3.2.1.   There are number of major developments planned or under construction within the immediate locality of the nursery, including:

CONVOYS WHARF, LEWISHAM

3.2.2.   Convoys Wharf is a major development that has outline planning permission for 3,500 new homes. The development is located to the north-east of the nursery within the neighbouring London Borough of Lewisham. It will also **provide a hotel and a variety of retail land use space. Additionally, the development will provide approximately 1800 car parking spaces alongside public transport improvements, including a river bus service and new bus routes.**

> Potential impact of development:
> - Air pollution associated with construction activity.
> - Potential for additional traffic once completed.

3.2.3.   A number of notable schemes and initiatives were also highlighted, that will have a significant bearing on the air quality around the nursery, these include:

WIDER SCHEMES

ULTRA LOW EMISSION ZONE (ULEZ) AND LOW EMISSION ZONE (LEZ)

3.2.4.   The recently launched ULEZ will operate 24 hours a day, 7 days a week within the same area as the current Congestion Charging Zone (CCZ). All cars, motorcycles, vans, minibuses, buses, coaches and heavy goods vehicles (HGVs) will need to meet exhaust emission standards, or pay a daily charge. In the case of petrol cars and vans this means Euro 4, and Euro 6 for diesels. HGVs and coaches are also Euro 6. Further details on emissions standards and classification of vehicles can be found through TfL.

3.2.5.   The London-wide Low Emission Zone (LEZ) is being tightened to a Euro VI emissions standard for heavy duty vehicles (buses, coaches, Heavy Goods Vehicles (HGVs) from October 2020. The ULEZ will be expanded for light duty vehicles (such as cars, vans and motorcycles) so that all vehicles are subject to emissions standards, within an area roughly bounded by the North and South Circular Roads, from October 2021. It is forecast that an expanded ULEZ and tighter LEZ standards will result in 22 per cent less harmful nitrogen oxide (NOx) from road transport in the borough from 2021.
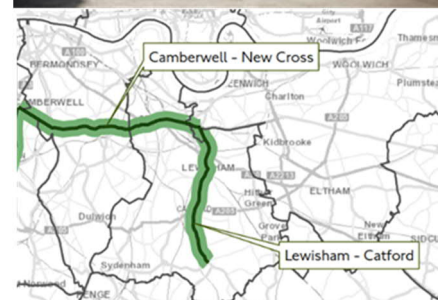
> Impact of scheme:
> - Reduced air pollution as more polluting vehicles are discouraged from travelling in the ULEZ.

LOW EMISSION BUSES

3.2.6.   Since 2018, all new double deck buses are hybrid or zero emission. The Mayor has also launched an £85m programme to upgrade around 5,000 buses so that the entire fleet meets the Euro VI emissions standard in 2020. Around 75 per cent of all TfL buses – including all buses operating in the ULEZ – now meet or exceed the strict ULEZ emission standards. By October 2020 every TfL bus in London – over 9,000 buses - will meet or exceed the ULEZ standards. This will mean that next year the entire city will become a Low Emission Bus Zone.

3.2.7.   Twelve new low Emission Bus Zones are being introduced in areas where Londoners are exposed to some of the highest levels of nitrogen dioxide pollution. The Mayor has completed ten of these zones, reducing NOx emissions from buses by an average of 90 per cent along some of the capital's most polluted roads. The Mayor will complete delivery of all 12 routes ahead of schedule in 2019 rather than 2020. Of relevance locally is the proposed low emission bus zones from Camberwell to New Cross – from Blackheath Road via Camberwell Green and Peckham High Street to Wood's Road, which will significantly benefit the nursery as it includes Peckham Road.

Impact of scheme:
- Reduced air pollution as buses are replaced with low emission buses.

LOCAL SCHEMES

CYCLE SUPERHIGHWAY 4

3.2.8.   Transport for London's Cycle Superhighway 4 (CS4) is planned to run along Creek Road, with construction set to begin in summer 2019. CS4 will create a continuous segregated cycle route between Tower Bridge and Greenwich, and improve pedestrian facilities and public spaces.

Impact of scheme:

- Improved travel options locally via sustainable travel (walking and cycling).

HEALTHY EARLY YEARS LONDON ACCREDITATION

3.2.9.   Healthy Early Years London (HEYL) is an awards scheme funded by the Mayor of London which supports and recognises achievements in child health, wellbeing and development in early years settings.

3.2.10.   Building on the success of Healthy Schools London, HEYL will help reduce health inequalities by supporting a healthy start to life across themes that include eating, oral and physical health and early cognitive development.

3.2.11.   HEYL complements and enhances the statutory Early Years Foundation Stage framework, adding to the focus on children, families and staff health and wellbeing.

3.2.12.   The four levels of Awards – HEYL First Steps, Bronze, Silver and Gold – can be used to improve and support practice in all Early Years settings.

3.2.13. Rachel McMillan Nursery School is currently part of HEYL.

Impact of schemes:

- Awareness raising and promotion of sustainable travel options, lessening sources of emissions and incidences of exposure.

4. AIR QUALITY AUDIT FINDINGS

4.1.1. The air quality audit findings are summarised in this chapter as follows:

- Baseline air quality; and
- Observed issues, emission sources and potential exposure

4.1. BASELINE AIR QUALITY

4.1.1. The air quality audit used a combination of modelled and measured data to establish the local, baseline pollution levels in and around each nursery.

4.1.2. Three pollutants were monitored in and around the nursery, these were **nitrogen dioxide (NO$_2$)**, **formaldehyde (CH$_2$O)** and **Volatile Organic Compounds (VOCs)**. All three pollutants can cause respiratory inflammation which can exacerbate to respiratory problems such as asthma and bronchitis at high levels.

4.1.3. NO$_2$ is both a primary and secondary pollutant, derived from emissions of nitrogen oxides (NO$_x$) from combustion sources. In London key sources include road vehicles and domestic boilers. Vehicle emissions contribute significantly to local increases in concentrations especially near busy roads.

4.1.4. VOCs are made up of a range of organic compounds, including formaldehyde. They have a significant photochemical oxidant forming potential and contribute to the formation of secondary pollutants, such as NO$_2$. They arise from a wide variety of products commonly used in homes and workplaces, including furnishing, carpets, upholstery, cleaning products and air fresheners.

4.1.5. Formaldehyde is a notable VOC, and can be released from furniture, finishes and building materials, and is formed in chemical reactions from combustion processes, such as smoking, heating, cooking or candle burning.

4.1.6. Baseline air pollutant monitoring was undertaken for three months. At Rachel McMillan Nursey School, five NO$_2$ diffusion tubes, one formaldehyde diffusion tube and one VOC diffusion tube were deployed in the following locations:

Nitrogen Dioxide (NO$_2$)
- roadside outside the nursery
- immediately outside the nursery entrance
- playground
- immediately inside the nursery entrance
- inside a nursery classroom.

Formaldehyde and VOCs
- Inside a nursery classroom.

4.1.7. See Appendix C for further details on the location of the diffusion tubes.

Figure 5 - Comparison of the average NO$_2$ concentrations at Rachel McMillan Nursery School (µg/m^3)
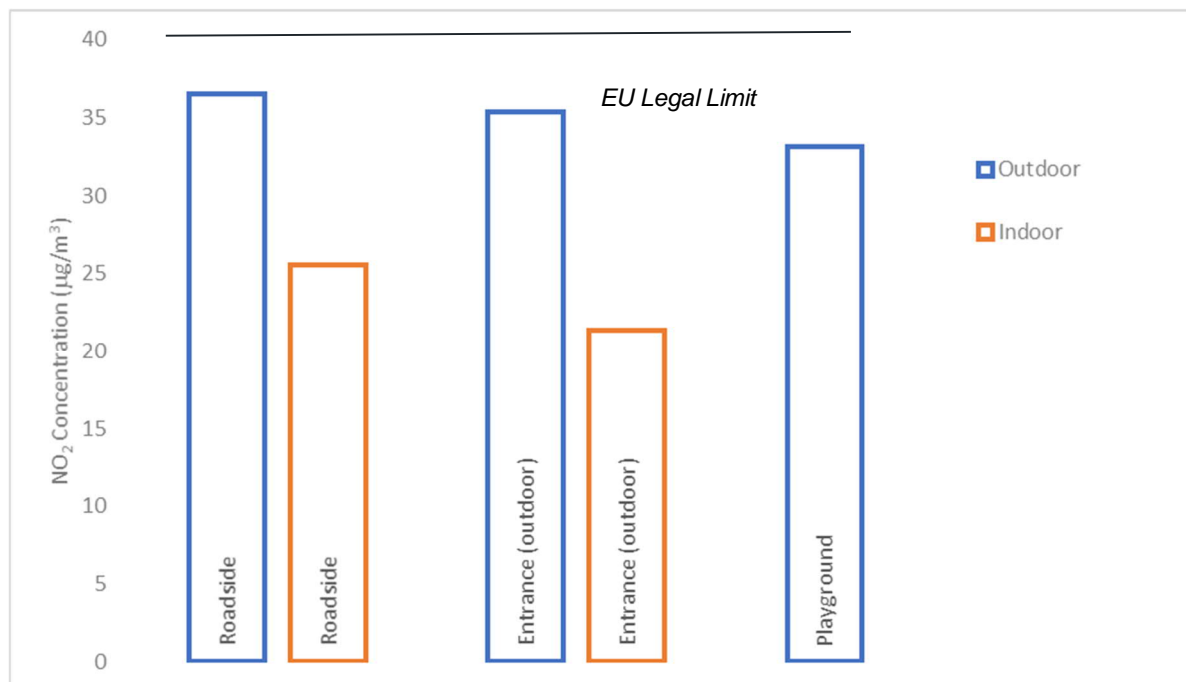
4.1.8. The results of the three-month baseline NO$_2$ monitoring at Rachel McMillan Nursery School, shown in Table 2.

Table 2 – Rachel McMillan Nursery School: Three Month Baseline NO$_2$ Monitoring Results (µg/m^3)

Diffusion Tube Location	Indoor / Outdoor Location	Baseline NO$_2$ Monitoring Results - NO$_2$ (µg/m^3)			
		January	February	March	Average
Roadside	Outdoor	40.40	-	32.69	36.55
Playground	Outdoor	36.02	35.33	27.99	33.11
Nursery entrance	Outdoor	39.45	35.31	31.47	35.41
Nursery entrance	Indoor	22.17	21.83	20.09	21.36
Classroom	Indoor	28.66	23.93	24.06	25.55
Ratio of indoor to outdoor (I/O) concentrations		0.56	0.62	0.64	0.60

4.1.9. NO$_2$ concentrations were found to be highest at the **roadside** (36.55µg/m^3), with local road traffic emissions contributing significantly to roadside concentrations.

4.1.10. The three months of baseline NO_2 monitoring provides a snap-shot of concentrations in and around the nursery across the winter and spring months, when concentrations are likely to be at their highest due to elevated NO_x emissions driven by the cold weather. However, in one of the three months, the measured NO_2 concentrations exceeded the annual mean NO_2 national Air Quality Objective (AQO) of 40µg/m³.

4.1.11. NO_2 concentrations fall to 33.11µg/m³ in the **playground**, which is partially screened from traffic by fencing and some trees and shrubs. Concentrations at the **nursery entrance** are of a slightly higher level (35.41µg/m³) to the playground.

4.1.12. **Inside the nursery**, concentrations fall by 7-18µg/m³ compared to external concentrations. It should be noted that indoor NO_2 is not regulated against EU limits, it is regulated against HSE exposure limits.

4.1.13. Previous research undertaken for the GLA found that outdoor NO_2 concentrations and the airtightness of the building envelope explained 84% of the variation between classrooms, indicating the influence of strong outdoor pollution sources and the importance of the building envelope. Overall, **indoor to outdoor (I/O) ratios** in both seasons ranged from 0.3-0.5 in an airtight, contemporary school compared with 0.7-0.9 in Victorian schools that have original wooden window frames.

4.1.14. The NO_2 I/O ratio was 0.60 at Rachel McMillan Nursery School, indicating that uncontrolled infiltration rates are at the lower end of the spectrum, and so offers a reasonable level of protection to its occupants relative a more airtight building.

4.1.15. The results of the three-month baseline VOC and Formaldehyde monitoring are shown in Table 3.

Table 3 – Rachel McMillan Nursery School: Three Month Baseline Formaldehyde and VOC Monitoring Results (µg/m³)

Pollutant	Baseline Formaldehyde and VOC Monitoring (µg/m³)			
	January	February	March	Average
VOCs	70.3	73.4	140.0	94.6
Formaldehyde	3.04	5.05	4.03	4.04

4.1.16. **Volatile Organic Compounds (VOCs)** are emitted from vapours arising from petrol and solvents. In a nursery setting are likely to originate from a wide variety of products, including furnishing, carpets, upholstery, cleaning products and air fresheners. Exposure can cause irritation to the eyes and upper airways. In the UK, building regulations recommend total Volatile Organic Compounds

(TVOCs[9]) concentrations should be below 300 µg/m³. In Rachel McMillan they were found to be 94.6µg/m³. The majority of VOCs detected were chemical species which could be identified as being likely to be indoor pollutants, and included fragrances, perfumes and alcohols, likely to be products derived from use of cleaning materials and solvents.

4.1.17. **Formaldehyde** are emitted from vapours arising from solvents and adhesives. In a nursery setting these are likely to originate from glues, adhesives and finishing's. Exposure can cause burning sensations of the eyes, nose, and throat, coughing, wheezing, nausea and skin irritation. The World Health Organisation (WHO) indoor air quality guideline[10] for short- and long-term exposures to formaldehyde is 100 µg/m³. In Rachel McMillan they were found to be 4.04 µg/m³.

4.1.18. In addition to the monitoring undertaken at the site, 2013 baseline annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations have been estimated for each nursery from the **London Atmospheric Emissions Inventory** (LAEI) maps.

4.1.19. Briefly, the LAEI model provides mapped annual mean NO_x, NO_2, PM_{10} and $PM_{2.5}$ concentrations on a 20m x 20m basis for the whole of London from a base-year of 2013 for 2020, 2025 and 2030.

4.1.20. The LAEI uses air pollution emission estimates from a wide range of sources including transport, industrial, domestic and commercial combustion, agriculture and long-range transport using the most up-to-date activity data, emission factors and projection factors.

4.1.21. Figure 5 shows the 2013 LAEI baseline annual mean NO_2 concentrations within the vicinity of Rachel McMillan Nursery School.

4.1.22. The changes in colours show the change in the change in pollution gradients, with distance, away from the heavily trafficked Creek Road. NO_2 concentrations are predicted to be highest along the southern boundary of the nursery, which is closest to the main road.

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[9] TVOCs denote a wide-ranging group of organic chemical compounds. For simplicity they are commonly reported together.

[10] Chapter 5.8 Formaldehyde. WHO Air Quality Guidelines – Second Edition, 2001

Figure 6 - LAEI Baseline Annual Mean NO₂ Concentrations within the Immediate Area of Rachel McMillan Nursery School

4.1.23. Nearly 50% of NOx emissions in London are from road transport. Vehicle emissions data for the LAEI modelled road links within 200m of the nursery, split by source, have been analysed to identify the key sources contributing to NO_2 in the vicinity of the nursery.

4.1.24. The pie chart below shows that while buses make up only 3% of vehicle movements, they contribute 24% of the transport related NO_x emissions locally. Similarly, HGVs only account for 5% of the total traffic but contribute 28% of emissions. However, it should be noted that with TfL's commitment to upgrading the whole bus fleet to the cleanest Euro VI vehicles as a minimum, by October 2020, that the emissions contributed by buses will be expected to fall significantly.

Figure 7 – Average Road Transport – by Vehicle Type (within 200m of nursery)
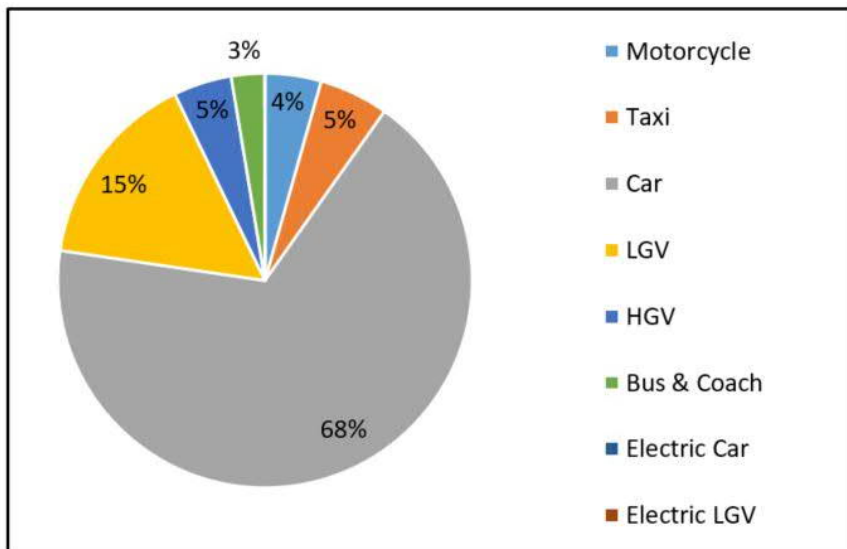

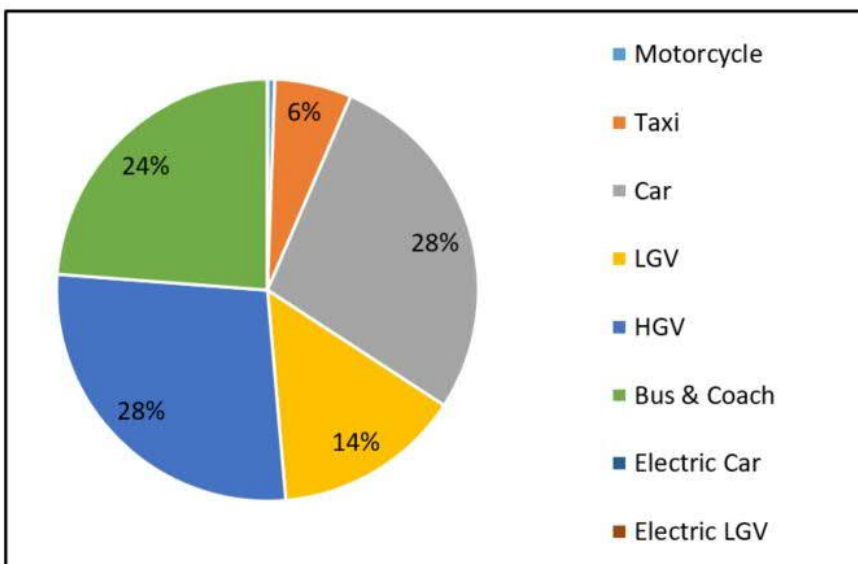**Figure 8 – Average Road Transport NO_x Emissions by Vehicle Type (within 200m of nursery)**

4.1.25. The pie charts below illustrate that PM_{10} and $PM_{2.5}$, like NOx, are emitted in higher levels by large vehicles such as buses, HGVs and LGVs, though not to the same extent. Buses make 3% of vehicle movements, and contribute 15% of the transport related PM_{10} emissions locally, and 9% of $PM_{2.5}$.

Figure 9 – Average Road Transport PM$_{10}$ Emissions by Vehicle Type (within 200m of nursery)
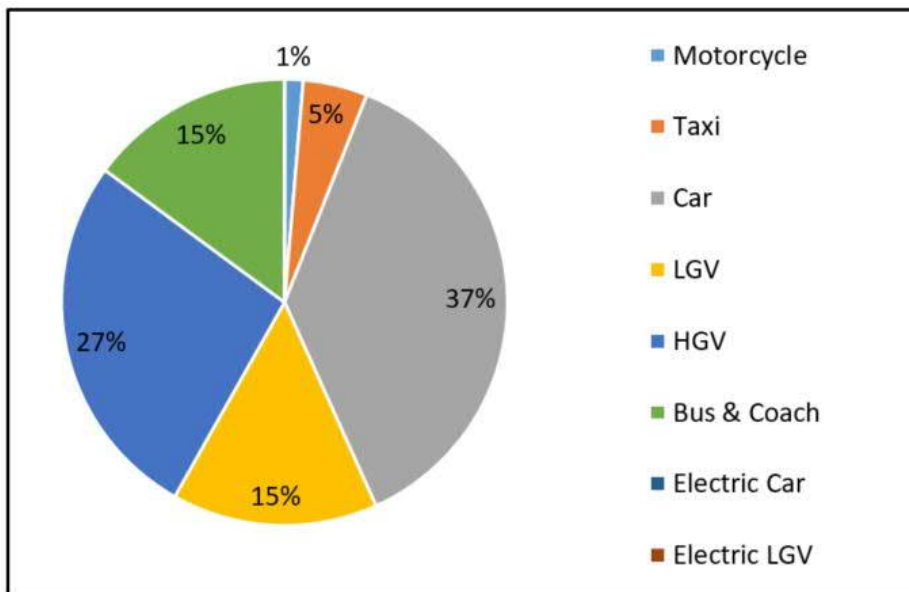

Figure 10 – Average Road Transport PM$_{2.5}$ Emissions by Vehicle Type (within 200m of nursery)
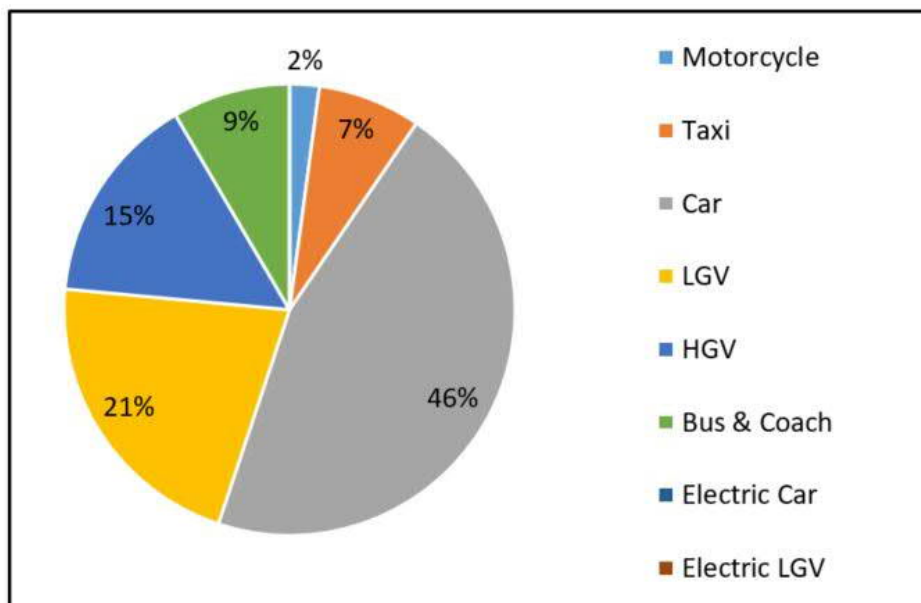
4.1.26. Figures 11-13 show the 2013 LAEI baseline annual mean NO$_x$, PM$_{10}$ and PM$_{2.5}$ concentrations in within 2km of Rachel McMillan Nursery School. The contours (changes in colours) show how the pollution gradient changes, with distance, away from the heavily trafficked roads and other key sources.

4.1.27. PM$_{10}$ and PM$_{2.5}$ sources are much more universal and dispersed than NO$_2$ sources. A proportion of PM$_{2.5}$ and PM$_{10}$ is imported via weather events from regions outside of London, with other contributions coming from combustion processes, cleaning street sweeping/ dust re-entrainment, construction dust, etc. Therefore, concentration profiles of PM$_{10}$ (Figure 11) and PM$_{2.5}$ (Figure 12) appear less defined than for NO$_2$.

Figure 11 – 2013 LAEI Baseline Annual Mean NO₂ Concentrations within 2km of Rachel McMillan Nursery School
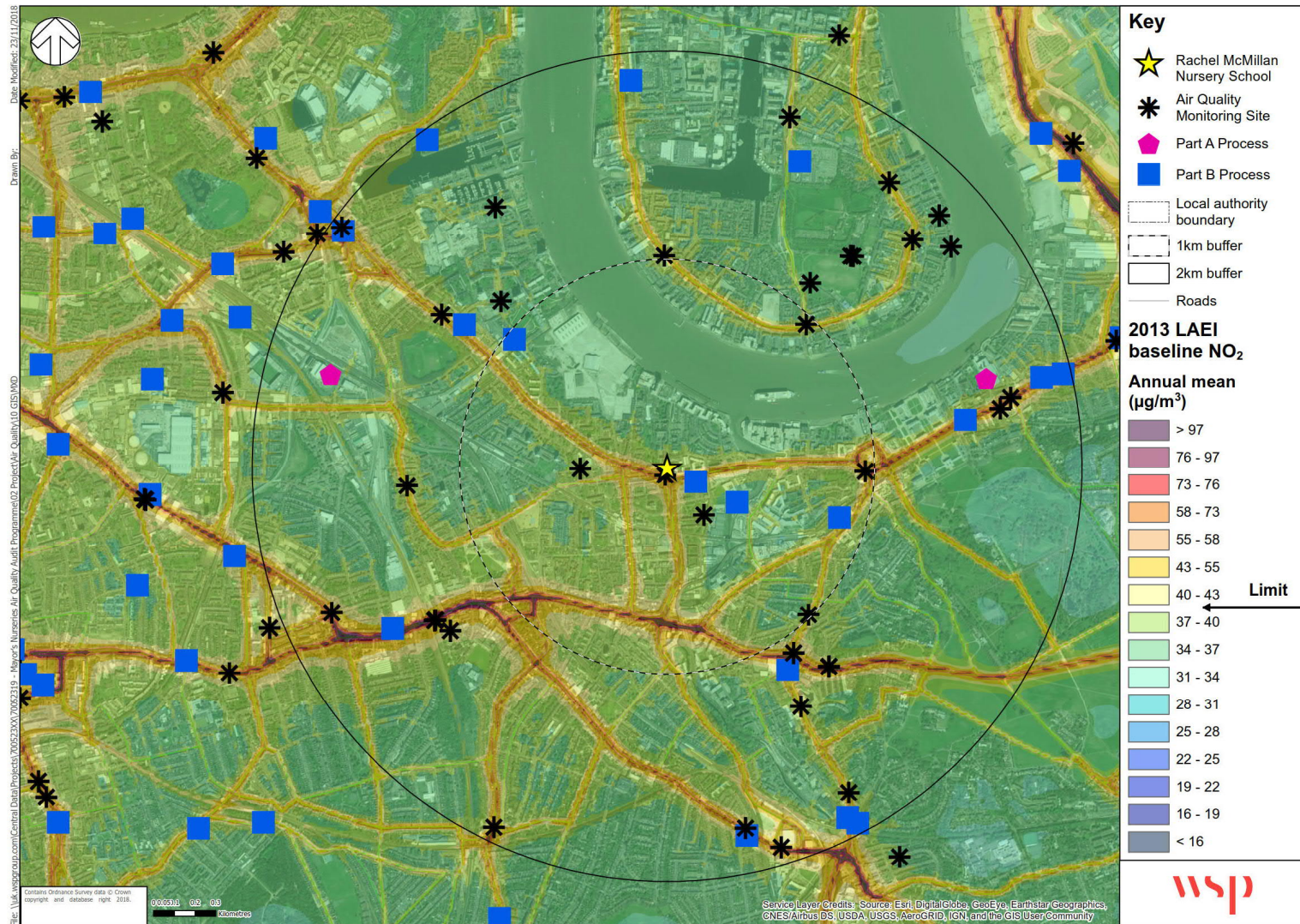
Note: Part A and B Processes include regulated industrial installations that have the potential to cause pollution and are required to have an Environmental Permit to operate, including facilities which carry out industrial processes, waste activities, mobile plant and solvent emission activities

Figure 12 - 2013 LAEI Baseline Annual Mean PM$_{10}$ Concentrations within 2km of Rachel McMillan Nursery School
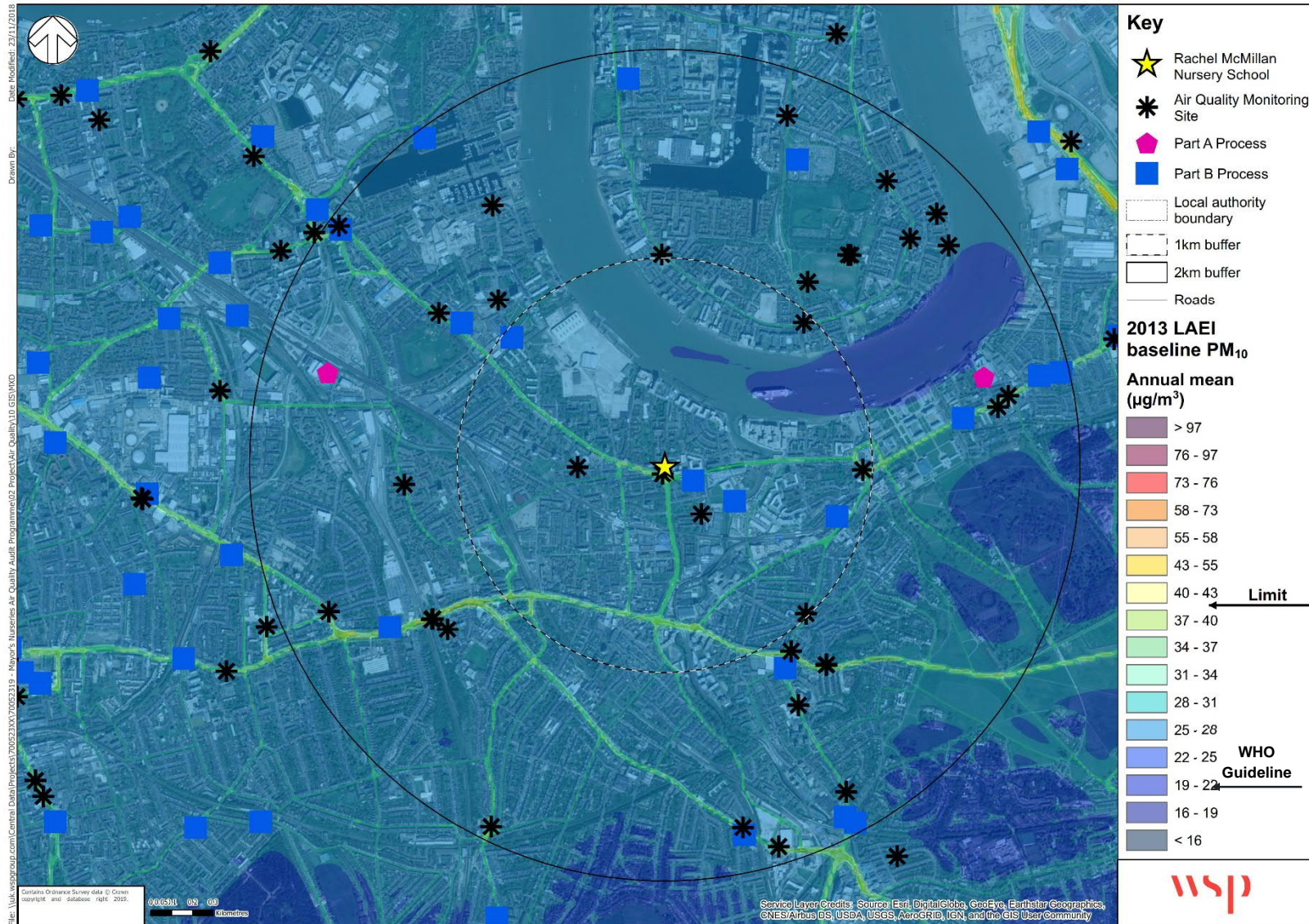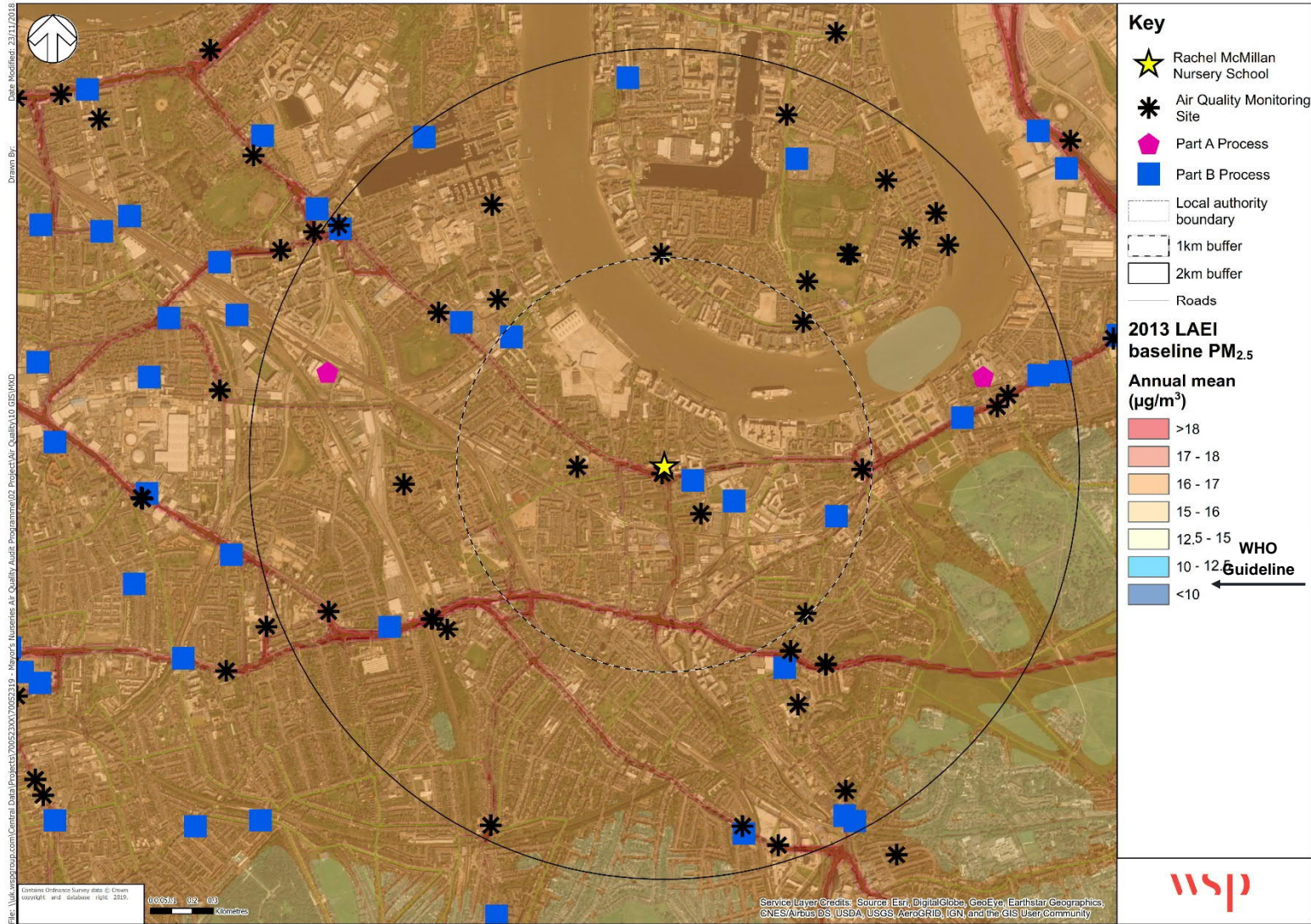
Figure 13 - 2013 LAEI Baseline Annual Mean PM$_{2.5}$ Concentrations within 2km of Rachel McMillan Nursery School

4.2. HIGHWAYS – KEY OBSERVATIONS

4.2.1. The main access to the school is on McMillan Street, adjacent to the staggered junction with Stowage and Deptford Green. The nursery is located just north of the **A200 Creek Road, which is the main source of local air emissions**. Based on observations, there was an even split amongst children approaching the school from all directions. Children access the north along Deptford Green, along Stowage to the west, and McMillan Street from the south and east.

4.2.2. Children travelling to / from the south and east have to cross the busy A200 Creek Road that is the main source of emissions in the immediate area. In addition, children accessing the nursery along Stowage, are subject to local emissions from a number of vehicles using the road as a rat run. In addition, the footpath is quite narrow introducing safety risks.

4.2.3. Whilst the majority of children walk or scoot to the school, a number of parents were dropping off children by car. There are no parking restrictions on the roads around the school during peak drop off and pick up times. A permit holders only parking restriction is in place from 12pm to 2pm (Monday to Friday) to discourage all-day parking.

4.2.4. As a result, the **kerb space is noted to be congested** around peak arrival time, particularly around the entrance. This includes **stopping on the keep clears**, parking on-corners and **engine idling**, worsening local air quality and exposure, and creating an unsafe environment for children walking amongst queueing traffic and crossing between parking vehicles with limited visibility, potentially discouraging more children from walking or scooting as a consequence.

4.2.5. In addition to the school related traffic, a significant number of **vans and lorries** use the roads around the school as a **rat run** to avoid congestion along the A200 Creek Road. This results in considerable **queuing and congestion around the school** – especially at the staggered junction of McMillan Street / Stowage / Deptford Green. This junction has no dedicated crossing facilities and is a blind corner. This poses **road safety issues** for parents and children crossing the road to access the nursery.

4.2.6. The vehicles were noted to travel at **relatively high speeds**. In particular, at the junction of McMillan Street and the A200 Creek Road which has a raised table. Vehicles were noted to drive over the pedestrian footway to cut the corner. During the audit, a HGV was delivering to the school during peak arrival time. This was stated to be a rare occurrence.

4.2.7. It is however recognised that travel to school by car is only a small contributor to overall poor air quality around the school, and that the majority of air pollution in this location will be associated with wider background emissions.

Summary – Key Issues

- Rat-running running along Stowage / McMillan Street / Deptford Green to avoid the A200 Creek Road / A2209 Deptford Church Street signalised junction
- Lack of a safe crossing outside the school entrance, mixed with a staggered junction at McMillan Street / Stowage / Deptford Green results in parents and children having to cross amongst traffic
- Unsafe parking and engine idling by some parents observed – including stopping on keep clears, parking on corners and engine idling
- Heavy traffic flows, including large numbers of buses and HGVs along A200 Creek Road – resulting in exposure to air pollution to parents and children accessing the nursery from the south

Nursery entrance along McMillan Street

Parking along McMillan Street
(permit holders: Mon-Fri, 12 noon – 2pm)

Raised junction of McMillan Street and A200
Creek Road – used as a rat run

Parking along McMillan Street with loading

Vehicles travelling along Stowage / McMillan Street

4.3. NURSERY GROUNDS / BUILDING - KEY OBSERVATIONS

4.3.1.   The nursery entrance is located on McMillan Street, just south of the staggered junction of McMillan Street / Stowage / Deptford Green. The entrance leads to an outdoor area from which the classrooms (shelters) open onto and are accessed.

4.3.2.   The school is **heritage listed** being constructed in the early 1900's, with the classrooms split over a number of buildings. The classrooms are known as shelters.

4.3.3.   Shelters 1, 2 and the family room are located in the middle of the site. Shelters 3, 4, 6, the offices and community room back externally onto the road network. The external buildings have windows which open into the road, however they are not opened as they are broken. Shelter 5 is located to the rear of the site. It is the most recent addition to the nursery and is constructed from shipping containers.

4.3.4.   Reflecting the heritage nature of the buildings, the shelters are reliant on **natural ventilation** by opening windows and doors which face onto the playground. The playground forms an outdoor classroom environment, with children able to flow freely between the playground and shelters.

4.3.5.   The nursery playground is extensive and located between the shelters and to the south of the site. A group of tall apartment buildings shelter the playground from the A200 Creek Road. The playground also has **extensive greenery including mature trees, shrubs and planting**.

4.3.6.   The school has seven boilers distributed across six boiler rooms and were considered in excellent working order. The **flues exit at wall level, with a number exiting directly onto the playground area**. This would increase children's exposure to local emissions.

4.3.7.   The classrooms large windows and doors, and given the age of the building are likely to be **poorly insulated**, which would result in greater heat loss, and so potentially increased run times by school boilers, and therefore greater emissions. It also results in higher temperatures during warmer weather, requiring windows/doors to be opened and so greater exposure. The school noted that heating is not even between shelters.

4.3.8.   Shelter 6 is prone to **overheating** in winter (due to the heating system) and also very hot in summer. Shelter 4 is known to be very cold in winter as the heating system is not effective. It is also very hot in summer.

4.3.9.   The school noted that the **windows and doors of all the shelters need replacing and upgrading**, which is prohibitively expensive in order to meet the heritage requirements.

4.3.10. School **deliveries** take place on the school keep clears at the southern entrance, with variable delivery times. On the audit day an HGV was observed to delivery at peak arrival time immediately outside the main entrance. However, this was noted to be an uncommon occurrence.

Summary – Key Issues

- Shelters 3, 4 and 6 exposed and reliant on natural ventilation, while located adjacent to the road in the most polluted area of the site
- The heritage listed buildings suffer from poor insultation resulting in greater heat loss and increased boiler run times. Higher temperatures during warmer weather, requiring windows/doors to be opened and greater exposure.
- Flues from four of the boiler rooms discharging at wall height directly onto the outdoor area.
- Limited scooter parking, with no weather protection, to encourage children to scoot to school. The buggy area to the rear of the school is noted to fill up.

- The nurseries plant room boilers vent their exhausts into the playground, and one the two kitchen ducts exists onto the front playground.
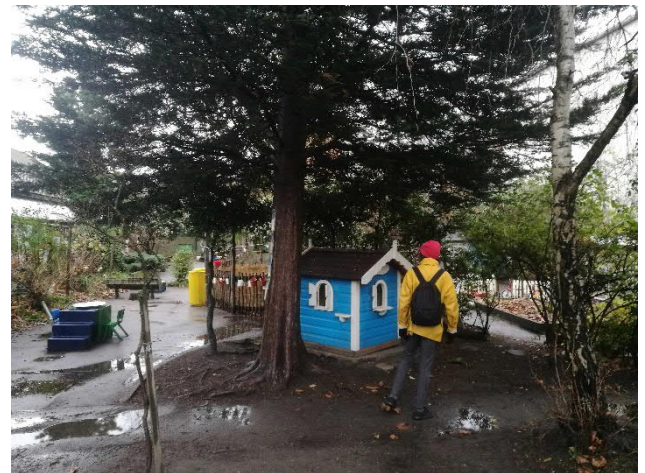

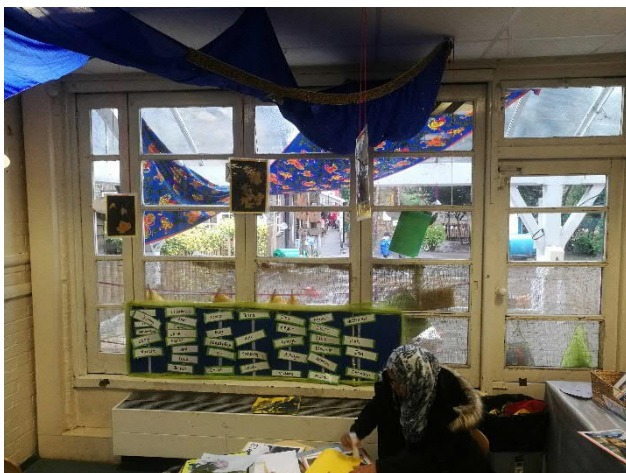**Scooter parking area at main entrance**

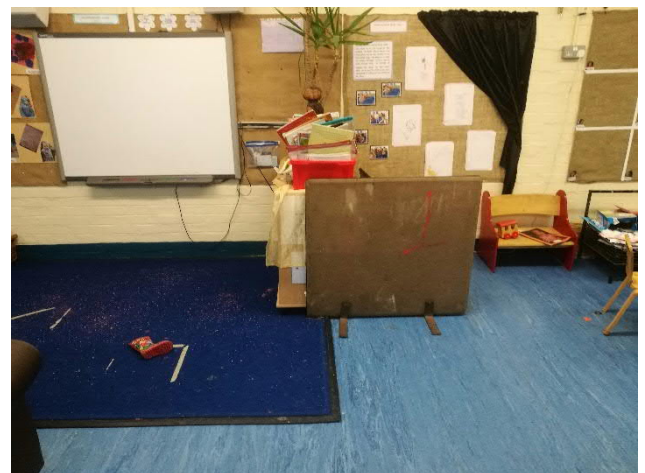**Example flue that discharges at wall height**

Nursery playground area

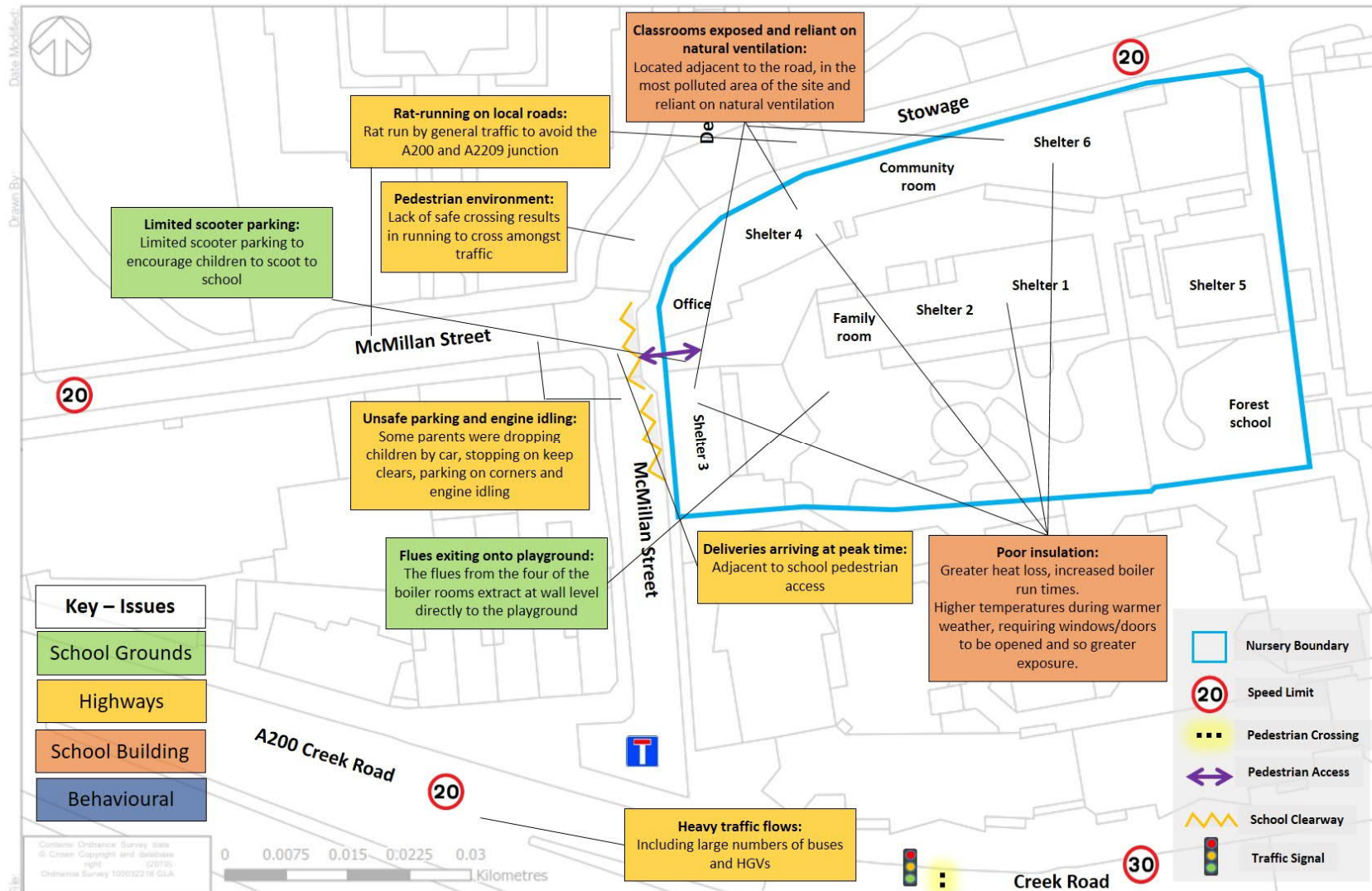**Nursery playground area with extensive greening**

Classroom (shelter) with ageing windows

Example of internal classroom (shelter)

4.4. KEY OBSERVATIONS – SUMMARY OF ISSUES

Figure 14 - Summary of Potential Issues Map

5. RECOMMENDATIONS

5.1. DEVELOPING THE RECOMMENDATIONS

5.1.1. Based on the preceding desktop research, site audits and stakeholder feedback, a range of recommended measures and initiatives have been identified to deliver air quality improvements and reduced exposure to air pollution. The recommendations will not in themselves solve the air quality problem, but will each contribute directly or indirectly to helping improve the situation in and around the nurseries.

5.1.2. These recommendations are drawn from a comprehensive Air Quality Audit **Toolkit of Measures**, researched and developed as part of the Mayor's Primary School Air Quality Audit Programme, and updated as part of this programme (see Appendix E for further details).

5.1.3. The toolkit has been compiled from a review of best practice approaches and new technologies, including both well established and simple measures, and more innovative or harder hitting measures. The measures include both physical measures and softer behavioural measures.

5.1.4. The characteristics of the local area, nursery site and building have then been accounted for in identifying and tailoring a suitable package of measures to address the issues identified in causing sources of pollution or exposure to air pollution. These recommendations have also sought to be cognisant of any relevant existing plans for the local and wider area around the nursery (see Section 3.2).

5.1.5. A key facet of this approach, and the palette of measures from which measures were identified, is that they represent a holistic approach, as promoted by the Healthy Streets approach, in seeking to address a broad range of factors which each influence how streets are used, how people travel and consequently how clean the air is in and around the nursery. As such whilst a number of measures are less directly related to air quality, they were felt to offer the potential for contribute indirectly, for example through creating a better and safer environment for travelling by sustainable modes.

5.1.6. Table 4 on the following page sets out the list of recommendations. For the purposes of this assessment they have been categorised as proposals associated with:

- **Highways** – where recommendations would predominantly be delivered by either the borough council or TfL, who manage the highways.
- **Nursery grounds** – where the nursery, often supported by the borough council, would typically deliver the types of measures recommended.
- **Nursery building** – as with the nursery grounds, the building measures would primarily be delivered by the nursery and borough council.
- **Behavioural** – many of the behavioural measures can be delivered at minimal cost by the nursery, sometimes with the support of the borough council or TfL.
- **Wider measures** – these are larger schemes or policy changes, which would need to be delivered by TfL, the borough council or the UK Government.

5.1.7. In order to enable comparison of each measure, and to assist the nursery, borough and other stakeholders, in determining which measures to prioritise, each has been assessed against a series of key criteria:

- **Potential Air Quality Improvement**

  - Low – nominal measureable change but a tangible reduction in sources or exposure
  - Medium – a small measurable change in air quality
  - High – a large measureable improvement in air quality

- **Wider Benefits**

  - Such as improved safety, visual amenity, child health and welfare, improve learning environments, costs savings, promotion of sustainable transport, contributes to STARS or Healthy Early Years London.

- **Cost** *(Note these reflect the overall costs, but these may vary amongst difference stakeholders)*.

  - Low - <£10k
  - Medium - £10k-100k
  - High - >100k

- **Deliverability**

  - Quick Win – readily deliverable within 12 months
  - Medium term – deliverable within 1-3 years
  - Longer term – only deliverable in the longer term (i.e. over 3 years)

- **Stakeholder Support**

  - Low – likely to be significant objections which could delay/prevent the scheme
  - Medium – may be some objections and will require consultation but not significant delays
  - High – likely to have strong support from key stakeholders

5.1.8. These are high level comparative analyses intended to offer a means of considering the recommendations against one another in relative terms.

5.1.9. Further, more detailed research and options development would be required to quantify these recommendations in greater detail, such as would be undertaken in a subsequent feasibility study.

5.1.10. The implementation of the measures will be dependent on securing funding to enable delivery over time (see section 5.8), as well as undertaking feasibility assessments and scheme prioritisation.

Table 4 – Recommended measures for consideration

Measure	Description	Purpose	Potential Air Quality Improvement			Wider Benefits	Cost			Deliverability			Stakeholder Support		
			Low	Medium	High		Low	Medium	High	Quick Win	Medium Term	Long Term	Low	Medium	High
Highway (Key Stakeholder: School / Borough)															
1	Improved Crossing Environment and Reduced Rat Running	Investigate the opportunity to improve the staggered junction and crossing of McMillan Street / Stowage / Deptford Green. The volume and speed of the vehicles travelling along Stowage results in safety issues, especially for children and parents trying to cross the road. Measures should be investigated to discourage rat-running along Stowage, McMillan Street and Deptford Green.	Reduce exposure		X		▪ Road safety	X				X		X		
2	School Keep Clear Markings	Refresh and extend 'School Keep Clear' markings to prevent parents / guardians using the space during peak drop-off / pick-up hours where idling activity was observed.	Reduce sources	X			▪ Road safety	X				X			X	
3	Anti-Idling	Conduct an anti-idling campaign outside the school to encourage parents to switch off their vehicles.	Reduce sources and exposure	X				X			X					X
4	Improve visibility of nursery	Increase prominence of nursery to encourage more responsible driving and parking amongst passing traffic – i.e. themed bollards outside the nursery.	Reduce sources and exposure, promoting walking, scooting and cycling by providing improved local conditions	X			▪ Road safety	X			X					X
5	Promote cleaner routes to school	Encourage children to avoid busy routes, in particular, the A200 Creek Road and A2209 Deptford Church Street. In conjunction with awareness raising.	Reduce exposure	X				X			X					X

| Measure		Description	Purpose	Potential Air Quality Improvement			Wider Benefits	Cost			Deliverability			Stakeholder Support		
				Low	Medium	High		Low	Medium	High	Quick Win	Medium Term	Long Term	Low	Medium	High
6	Healthy Streets approach, sustainable transport and roadspace reallocation from vehicular traffic	Continue to follow the Healthy Streets approach, promote sustainable transport and roadspace reallocation from vehicular traffic, and take a proactive role in endorsing the approach and supporting these initiatives, and equally hold TfL, London Councils and the GLA to account in implementing these principles.	Reduce sources and exposure			X	▪ Promotion of sustainable travel			X			X		X	
7	Future planning conditions – construction / freight traffic	Future freight / construction vehicles associated with new developments can be required to use only Euro 6 compliant vehicles and ULEVs as they become available, with consolidation of trips and re-timing of deliveries to off-peak periods as part planning permissions. Construction Logistics Plan (CLPs) guidance could ensure construction vehicles avoid school start / finishing times.	Reduce sources and exposure	X			▪ Promotion of sustainable transport ▪ Road safety	X					X		X	
Nursery Grounds (Key Stakeholder: Nursery / Borough)																
8	Scooter / Buggy Parking	Increase scooter and buggy parking spaces to encourage sustainable / healthy travel behaviour, particularly near the main entrance.	Promoting walking, scooting and cycling by providing improved local conditions	X			▪ Promotion of sustainable transport ▪ Supports STARS objectives	X			X					X
Nursery Building (Key Stakeholder: School / Borough)																
9	Improved insulation	Review building insulation against the building code. Subject to findings, install new insulation panels or spray on polyurethane foam between ceiling beams to improve energy efficiency, reduce heat loss, lessen energy usage, and potentially boiler run-times. Potentially less	Reduce sources and exposure	X			▪ Reduced energy consumption and reduced operating costs		X	X	X				X	

Measure		Description	Purpose	Potential Air Quality Improvement			Wider Benefits	Cost			Deliverability			Stakeholder Support		
				Low	Medium	High		Low	Medium	High	Quick Win	Medium Term	Long Term	Low	Medium	High
		heat gain in hot weather, lessening need for ventilation via opening doors/windows.					▪ Improved learning environments									
10	Air Filtration Systems	Consider investing in air filtration systems in classrooms most exposed to poor air quality and reliant on natural ventilation. These systems are relatively high cost, only cover a single room per unit, and do require ongoing maintenance and power consumption, but have demonstrated some encouraging initial scientific evidence of efficacy. They can also assist with virus elimination/ reduction. The findings of the Air Filtration System trials will be available to inform this decision in early 2020. The potential air quality improvement from Air Filtration System is identified as being low, however this is subject to the findings of the trial.	Reduce exposure to emissions	X			▪ Improved learning environments ▪ Child health and welfare	X			X				X	
11	Divert boiler flues away from playground	Divert boiler flues to the rooftop and away from the playground, to raise their exhaustion height further away from children playing. Flues and extraction equipment should ideally be exhausting above roof ridge height to aid quick dispersal. In some cases there can be complications with raising their exhaustion height further due to pressure drops, so specialist advice should be sought.	Reduce exposure to emissions	X				X			X				X	
12	Add indoor plants	Consider deploying additional air purifying plants. Whilst the research to date is inconclusive, and further testing is required, some studies have found certain house plants can remove CO_2, and that the growing substrate, and the microorganisms within, are involved in the removal of pollutants. A limitation is that tests often include a greater number of potted plants than would be feasible	Reduce exposure to emissions				▪ Improved learning environments ▪ Visual amenity	X			X					X

	Measure	Description	Purpose	Potential Air Quality Improvement			Wider Benefits	Cost			Deliverability			Stakeholder Support		
				Low	Medium	High		Low	Medium	High	Quick Win	Medium Term	Long Term	Low	Medium	High
		indoors to achieve measurable concentration reductions, so the density provided by green walls may be more suitable, and studies are now beginning to investigate green walls and, additionally, how the substrate may influence removal – as measured with VOCs. (University of Birmingham and the Royal Horticultural Society). Plants also have a number of wider health benefits, including promoting reductions in stress. https://www.cibsejournal.com/technical/plants-as-a-building-service/ provide		(green)				(green)			(green)					(green)
13	Switch to lower VOC cleaning products	Switch to lower VOC alternative cleaning products, such as unperfumed cleaning products.	Reduce sources and exposure	X				X			X				X	
Behavioural Measures *(Key Stakeholder: School/ Borough)*																
14	Promote cleaner routes to the nursery	Encourage parents to approach the nursery along less polluted routes. This can have a real impact on short-term exposure and is something that parents can be proactive with. The nursery could promote apps / websites such as 'www.walkit.com' to a) promote walking, and b) promote the suitable walking routes to avoid air pollution hotspots	Reduce exposure to emissions	X			▪ Awareness raising	X			X				X	
15	Staff Engagement	Awareness raising session amongst staff about the impacts / costs of heating classrooms and share best practice.	Reducing sources and exposure	X				X			X					X
16	Behaviour change	Prepare 'Welcome Packs' for new pupils / parents that includes the promotion of apps / sites such as 'www.walkit.com' to: a) promote walking to / from school, and b) promote the suitable walking routes to avoid air pollution hotspots.	Behavioural measures / reducing exposure to emissions.	X			▪ Awareness raising ▪ Secure community buy-in for measures	X			X				X	

	Measure	Description	Purpose	Potential Air Quality Improvement			Wider Benefits	Cost			Deliverability			Stakeholder Support		
				Low	Medium	High		Low	Medium	High	Quick Win	Medium Term	Long Term	Low	Medium	High
17	Sign up to the STARS programme	Sign up the STARS programme which would entail achieving a range of measures promoting active travel and reduced emissions, also signposting additional initiatives and avenues of support. The framework also helps document and track progress, and implement recommendations.	Behavioural measures / reducing exposure to emissions.	X			• Awareness raising • Secure community buy-in for measures	X			X	X				X
18	Attain a Gold Award in Healthy Early Years London	This will entail reviewing its practice in promoting health & wellbeing and evidence achieving the planned outcomes.	Behavioural measures / reducing exposure to emissions.	X				X			X					X
Wider Measures *(Key Stakeholder: Borough/ TfL/ GLA/ Central Government*																
19	Targeted scrappage scheme for polluting vehicles being driven in London	Ensure parents and staff are aware of the low income scrappage scheme being introduced by the Mayor and TfL, so that those that are eligible apply to the scheme. Encourage central Government to at a minimum match-fund the Mayor's scrappage commitments, to help enable even more Londoners to switch from polluting vehicles to ultra-low emission vehicles and more sustainable forms of transport.	Reduce sources and exposure			X				X			X	X		

5.2. KEY RECOMMENDATIONS

Figure 15 – Summary Recommendations Map
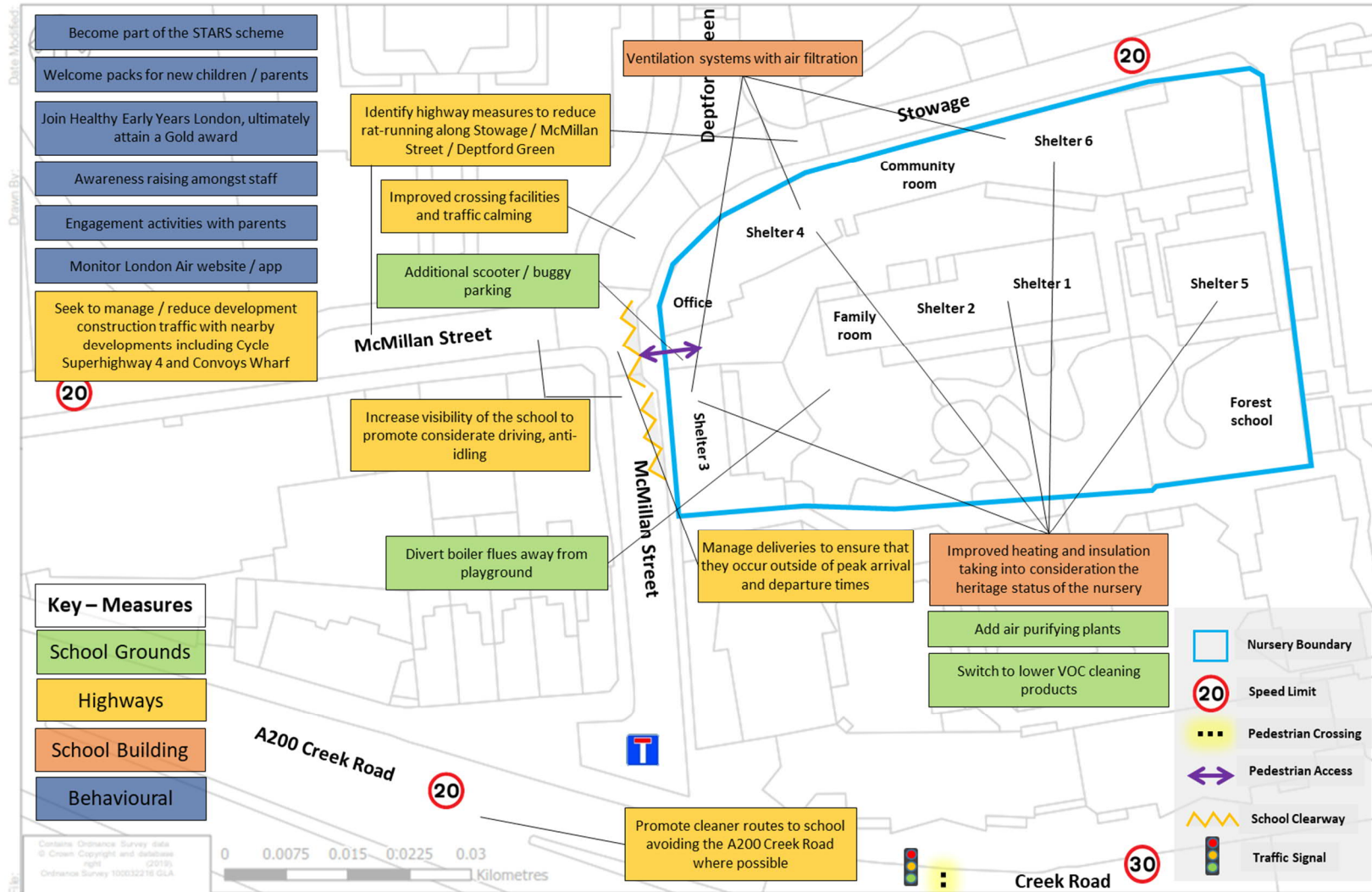
5.3. PRIORITISED MEASURES FOR THE NURSERY

5.3.1. To help prioritise what measures should be progressed for the nursery, borough officers and representatives of the nursery were asked:

'Based on the toolkit of measures and the findings of the observations and initial analysis, what are the measures you would prioritise for the nursery?'

5.3.2. Some of the more key measures were considered to be (in no particular order):

- **Improved crossing environment and reduced rat running** - As mentioned previously, the local roads (Stowage, McMillan Street and Deptford Green) are used as rat runs for vehicles avoiding the A200 Creek Road. At the same time, the staggered junction adjacent to the school entrance results in a blind-corner for pedestrians and drivers - resulting in safety issues, especially for children and parents trying to cross the road. Discussions during the audit indicated that the Borough was aware of the issue and were looking into potential measures include banning right turns onto the A200 Creek Road from McMillan Street and improving the pedestrian crossing environment at the staggered junction. Improvements in the pedestrian environment may encourage more parents and children to walk to the nursery and therefore encourage sustainable travel.

- **Promote cleaner routes to school -** It was agreed that more work could be done to identify and promote cleaner routes to school, in particular avoiding the A200 Creek Road and A2209 Deptford Church Street. The school noted that they undertake a number of walking 'expeditions' to the market, along the River Thames and Albany Theatre. Surveying and mapping out the cleaner green routes to school could be used to inform parents on route choice dropping off and picking up children, as well as for the staff when undertaking 'walking expeditions'. As a result, this will help to reduce the children's exposure to air pollution when walking to and from the nursery.

- **Air filtration systems and improved insulation** - The uneven temperatures in the building at different times of the year especially between the different buildings and shelters create additional burning of the gas boilers and opening of windows to ventilate exposing children to emissions. Improved insulation of the windows and doors would improve heat loss in winter and regulate temperatures in the warmer months. Alternatively, air filtration systems could be used to improve the indoor air quality before improved insulation is installed.

5.4. STARS ACCREDITATION SCHEME FOR NURSERIES

5.4.1. STARS is TfL's world leading school and nursery travel accreditation scheme, inspiring young Londoners to travel smarter and more sustainably, and should form the framework within which the behaviour change related components of the above recommendations are recorded.

5.4.2. Many of the recommendations would also serve to contribute towards the required 'travel activities' and 'support activities' required to attain Gold status – which should ultimately be the aim for the nursery.

5.4.3. Equally by embracing the STARS process, delivering sustainable travel activities, achieving modal shift targets and demonstrating effective community engagement, the nursery will have successfully delivered air quality improvements through reduced travel by cars. The framework of STARS

enables the nursery and borough to document, track and share their continued progress, and embed and implement the recommendations throughout the nursery community.

5.4.4. Nurseries are encouraged to note any air quality related activity undertaken on their TfL STARS profile stars.tfl.gov.uk, and to help inspire other nurseries, they are required to tell their story for each activity they have delivered.

5.4.5. Rachel McMillan Nursery School is not currently part of STARS but has stated that they would be keen to join the programme. Our recommended measures for the nursery include a number or initiatives that would also count towards the achieving their Gold STARS scheme accreditation, including: 'anti-idling awareness raising measures' and 'park and stride'. STARS activity cards are available for these measures, as well as wide range of other topics https://stars.tfl.gov.uk/Explore/Idea.

5.5. HEALTHY SCHOOLS LONDON

5.5.1. The Healthy Schools London programme should also as framework for promoting sustainable transport measure that will contribute towards improved local air quality. To achieve the Healthy Schools London Bronze award, one of the criteria is that "*the nursery promotes active travel to and from nursery*", and provides a number of examples, including:

- By implementing a nursery travel plan and running active travel initiatives such as:
- walk/cycle to nursery days
- walkers/cyclers breakfast clubs
- cycling at break times
- pedestrian skills and cycle training
- active travel competitions
- accreditation programmes

5.5.2. The nurseries must complete the following statements:

- Active Travel is promoted by:
- Nursery travel plan: Date awarded/reviewed
- Active travel initiatives including:

5.5.3. Our recommended measures for the nursery include a number or initiatives that would also count towards these criteria, including a variety of proposals to promote improved environments for walking, scooting and cycling, and initiatives to promote behaviour change and raise awareness of benefits of active travel.

5.6. AIR QUALITY ALERTS

5.6.1. When high and very high air pollution is forecast, air quality alerts are displayed at many public locations across London including 2,500 bus stop countdown signs and all Tube stations. Alerts and guidance are also available via social media, an app and a text alert service providing information and guidance on the alert level.

5.6.2. The Mayor has recently (January 2018) expanded his existing air quality alerts systems and appointed King's College London to continuously monitor air pollution using the existing air quality monitoring network and cutting-edge modelling tools, delivering alerts as required. They will also directly notify a wider group of stakeholders so that the alerts are disseminated more widely and targeted at Londoners who are most vulnerable to the impacts of poor air, including nurseries.

5.6.3. Each nursery has been provided with further information via email on what the alert means, and how to reduce pupils' personal exposure, and they can contact AirQualityLondon@london.gov.uk for more information.

5.7. ENGAGEMENT

5.7.1. Engagement activities to raise awareness of the issue of air quality amongst children and the nursery community are fundamental to achieving change.

5.7.2. Following consultation with the nurseries and borough council as part of the audit process, bespoke awareness raising posters and web material were provided for each nursery – see Appendix D.

HEALTHY EARLY YEARS LONDON (HEYL)

5.7.3. Building on the success of Healthy Schools London, Healthy Early Years London is an awards scheme funded by the Mayor of London that supports and recognises early years setting achievements in child health, wellbeing and school readiness. Healthy Early Years London focuses on the whole child and gives settings a framework for their activity with children, parents, carers and staff and the wider community. HEYL will help to reduce health inequalities by creating environments which support a healthy start to life and promote a whole setting and targeted approach across a number of themes including Sustainability-active travel and air quality.

5.7.4. HEYL complements and enhances the statutory Early Years Foundation Stage (EYFS) framework, providing further focus on children, families and staff health and wellbeing. There are 4 levels of Awards: HEYL First Steps, Bronze, Silver and Gold. HEYL can be used as an improvement tool to support practice in all Early Years settings including active travel:

- Active travel is supported and encouraged, both for journeys to and from the setting and for trips (e.g. walking, scooting)
- The setting is signed up to receive air quality alerts from www.airtext.info/alerts
- There are activities and information available for parents and carers to support sustainability including: active travel, recycling or energy saving
- Practitioners are able to discuss and advise parents and carers on active travel

5.8. FUNDING OPPORTUNITIES

5.8.1. A wide range of potential funding sources are available and should be considered to progress some of the measures outlined above, as set out in the figure below.

Figure 16 – Summary of Funding Opportunities
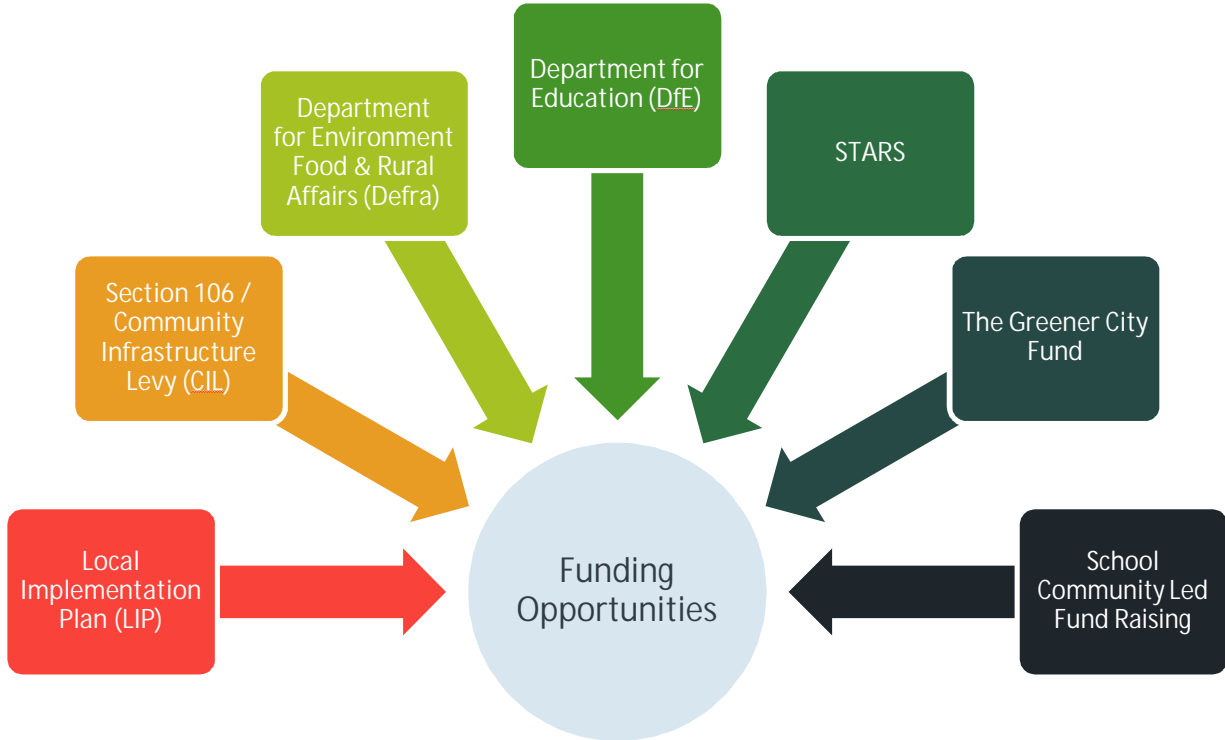
Local Implementation Plan (LIP)

5.8.2. A primary source of funding is linked to the Local Implementation Plan (LIP) 3 that will provide spending from April 2019 until April 2020. The guidance on bidding specifically referenced the need to improve air quality at schools and nurseries.

Section 106 / Community Infrastructure Levy (CIL)

5.8.3. Section 106 (S106) agreements and Community Infrastructure Levy (CIL) are potential sources of funding towards measures to address local air pollution. A Community Infrastructure Levy (CIL) is a planning charge introduced by the government via the Planning Act 2008.

TfL Liveable Neighbourhoods

5.8.4. A Liveable Neighbourhood scheme will deliver attractive, healthy and safe neighbourhoods for people and involves changes to improve conditions for walking and cycling and reducing traffic dominance – all of which can play a part in reducing air pollution. The programme has a budget totalling £85.9m over the five financial years (2017/18 – 2021/22), excluding the funding for the remaining Major Schemes that will be completed during this period.

Department for Environment Food & Rural Affairs (Defra) Air Quality Grant Scheme

5.8.5. Defra's air quality grant scheme provides funding to eligible local authorities to help improve air quality. The scheme helps local authorities to make air quality improvements and to meet their statutory duties under the Environment Act 1995.

Department for Education (DfE)

5.8.6. There may be scope for delivering some of the measures identified through DfE funding for nursery buildings and land, including capital funding for nurseries and academies, such as the Condition Improvement Fund, Priority School Building Programme, Early Years Capital Fund.

5.8.7. Additionally, the Salix Energy Efficiency Loan Scheme provides funding for nurseries through DfE, to reduce energy costs through the installation of energy efficiency technologies.

Greener City Fund

5.8.8. The Mayor's Greener City Fund (www.london.gov.uk/greenercity) includes a range of programmes to create and improve green spaces and encourage tree planting in London. This is part of the Mayor's commitment to making a London a National Park City. The Community Tree Planting Grant and Community Green Space grant schemes are open to applications from nurseries.

RE:FIT

5.8.9. RE:FIT London is jointly funded by the GLA and the European Union European Regional Development Fund. The programme helps public sector organisations save carbon, energy and money by retrofitting buildings to make them more energy efficient. The RE:FIT London Programme Delivery Unit is an expert team which provides free end to end support to deliver projects.

TfL STARS Reward Scheme

5.8.10. Whilst there is no specific funding attached to STARS, as gaining STARS accreditation helps boroughs reduce car travel, and increase cycling and walking, they often choose to link it to incentives – such as local grant funding through their LIP programmes.

5.8.11. It is increasingly important that boroughs seek to create a portfolio of funding opportunities, and with that in mind other potential funding sources include:

- **Local Clinical Commissioning Groups (CCG)**
- **Health and Wellbeing Boards:**
- **Charitable Trusts**
- **Local business funding**
- **Consortium approach** – pooling funding with other boroughs and achieve economies of scale

Nursery Community Led Fund Raising Initiatives

5.8.12. As well as the specific funding opportunities outlined above, there is an important role for the nursery, Ward Councillors, the Parent's Teachers Association (PTA) and Nursery Governors, both in a lobbying and leadership capacity, and as vehicles for fundraising to support and promote particular measures and initiatives.

Other Funding Sources

5.8.13. There are several grant funding bodies who may be interested in funding recommendations particularly if a borough links up with a community organisation.

5.8.14. Boroughs could also seek to influence the Joint Strategic Needs Assessment process undertaken by Health and Well Being Boards and Directors of Public Health. This is the process which looks at local clinical, health and well -being population needs, and on which Clinical Commissioning Groups (CCGs) base their funding priorities.

Other sources of funding for green infrastructure

5.8.15. Potential sources of funding for green infrastructure in nurseries include:

- The Tree Council's **Trees for Schools** programme
- The **Woodland Trust** offers free trees for schools and nurseries.
- The **Gregg's Foundation Environmental Grants** offer up to £2,000 for projects that improve the physical environment
- **Tesco Bags of Help** offer up to £4,000 to projects including school and nursery grounds
- **The Big Lottery Fund's Awards for All programme** offers up to £10,000 for projects that "improve the places and spaces that matter to communities", including nurseries
- **Trees for Cities** –match-fund the creation of Edible Playground teaching garden space, School Greening projects and Trees for Schools
- **Groundwork London** –support nurseries in designing and implementing green interventions.[11] Groundwork London's Our Space award[12] offers grants between £500 and £5,000.

5.8.16. See Appendix F for further information on potential funding sources.

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[11] https://www.groundwork.org.uk/Sites/london/pages/school-air-quality-greening

[12] https://www.groundwork.org.uk/Sites/london/pages/our-space-award

5.9. MONITORING

5.9.1. An important outcome of the nursery air quality audits will be in assessing the effectiveness of different schemes and initiatives implemented, so that the findings can be used to continually update and refine the toolkit of measures for use in future audits.

5.9.2. Whilst it will likely prove difficult to disaggregate the impact of a range of measures when implemented simultaneously, by recording this information across all participating nurseries in London, and pooling the findings, it will provide some useful overall insights into what types of solutions work best in practice amongst a given set of conditions.

5.9.3. In order to undertake these assessments and build on the baseline dataset generated as part of this audit, it will be essential to plan a programme of monitoring post implementation of any measures. This monitoring may include a wide range of metrics including surveys, traffic information, and air quality monitoring. The scope for monitoring should be proportionate to the extent of the problem and the scale of the investment.

5.9.4. Where possible such monitoring should cover:

- Key pollutants (NO_x, PM_{10}, $PM_{2.5}$), and/or
- a range of other suitable metrics (i.e. travel to nursery mode shares, STARS and Healthy Schools accreditations, traffic counts (as a proxy for road transport emissions), nursery buildings and boiler conditions, surveys and behavioural responses of parents/staff).

6. NEXT STEPS

6.1.1. In working with the nursery and borough officers to complete the air quality audit, we found there to be a passionate group of individuals, who were eager to make a difference, and enthusiastic about delivering a range of solutions to improve local air quality for the children, and the wider community.

6.1.2. The borough and nursery should investigate the scope for rapidly delivering key measures from the recommendations, to achieve a combination of quick win improvements for the nursery, whilst also thinking more holistically about how some of the medium to longer term recommendations can be progressed, to deliver more transformational change. By participating in this audit, the following steps have been completed:

- **Identified the sources of poor outdoor air quality** and exposure at nursery and within the surrounding catchment areas.
- **Identified the sources of poor indoor air quality** and potential exposure by children attending the nurseries, and established a baseline of indoor air quality.
- **Engaged the borough and other relevant stakeholders** to inform the context and feasibility of the proposed recommendations.
- **Identified, evaluated and developed recommended measures** within and around the nurseries' that will help a borough and nursery to reduce particulate matter, emissions and children's exposure to poor air quality.
- **Raised awareness within the nursery community** about the impacts of air pollution.

6.1.3. In order to take forwards the recommendations identified within this report, the nursery and borough council will need to continue to work closely, building on the relationships already in place. A wide range of potential funding sources are identified within the report, and borough councils and nurseries are encouraged to apply for these where appropriate to maximise the potential for delivering the recommendations. The nursery has an important leadership role in ensuring that measures to reduce exposure and emissions are included in the nurseries strategic plans.

6.1.4. STARS is an ongoing process, and the nursery should continue working towards the targets they have set, and continue adding to their air quality related activities, and uploading evidence to contribute towards achieving and sustaining higher levels of accreditation. An important outcome from this project will be to build on our knowledge of how effective different measures prove to be over time, so that the findings can be used to continually update and refine the toolkit of measures for use in future audits. The findings of the Air Filtration System trials currently underway will be made available as an update to the toolkit of measures.

6.1.5. We also hope that the borough and nursery will come together as part of a wider School and Nursery Air Quality forum, to share their experiences with other nurseries and boroughs facing similar challenges. A wide range of guidance and useful literature is available to support further studies, schemes or initiatives for improving local air quality – see Appendix A.

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