Technical Memorandum

To:	ESR Developments (Australia) Pty Ltd Level 13, 39 Martin Place, Sydney 2000	**From:**	SLR Consulting Australia
cc:		**Date:**	26 February 2025
		Project No.	610.V30893.00506

RE: Westlink Stage 1
Lot 3 Modification

1.0 Overview

ESR is currently seeking a modification to Lot 3 (MOD) of Westlink Stage 1 (the Project) SSD-9138102. Westlink Stage 1 is located on the corner of Abbotts Road and Aldington Road located within the Mamre Road Precinct (MRP) in Kemps Creek, NSW.

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by ESR Developments (Australia) Pty Ltd (ESR) to prepare a technical memorandum to consider the potential impacts at sensitive receptors due to the proposed use of a diesel generator for the MOD.

Previously, an Air Quality Impacts Assessment (AQIA) for the Project was prepared by RWDI which considered construction and operational impacts[1]. The AQIA methodology referenced an approach developed by the Environmental Protection UK (EPUK) and the UK Institute of Air Quality Management (IAQM), providing an estimate of the contribution of the three main pollutants from the operation of the Project. The guideline is entitled Land-Use Planning & Development Control: Planning for Air Quality (EPUK & IAQM, 2017)[2]. The following operational sources were considered:

- off-site and on-site vehicular movements including trucks idling,
- forklift movements.

The following pollutants were considered:

- particulate matter (as PM_{10} and $PM_{2.5}$),
- oxides of nitrogen (NO_X) and in particular, nitrogen dioxide (NO_2).

The assessment found, considering the EPUK & IAQM, 2017 guideline, that the impact and significance of the Project's operational phase (Masterplan) would result in a *negligible* to *moderate* impacts. In accordance with the EPUK & IAQM guideline, the moderate to negligible impacts would likely result in insignificant effects to the surrounding receptors.

The proposed MOD will include an emergency back-up diesel generator that was not considered in the previous AQIA. This memo summarises SLR's technical opinion on potential impacts to sensitive receptors from the operation of the generator.

The proposed MOD generator is a single 800 kW model CU1102TV - CU1102TVSC-20 generator. Maintenance schedule of the proposed generator would include testing once every six months during the daytime period. In SLR's experience, generator maintenance testing takes less than 1 hour.

---

[1] https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=SSD-9138102%2120221021T015735.518%20GMT Accessed 5 February 2024
[2] https://iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf,

2.0 Pollutants & Criteria

Potential air pollutants of interest for the operation of the Project are considered to be emissions associated with the combustion of fuel in standby generators which include:

- carbon monoxide (CO)
- oxides of nitrogen (NO_x)
- particulate matter (PM_{10} and $PM_{2.5}$)
- sulfur dioxide (SO_2)
- volatile organic compounds (VOCs)
- polycyclic aromatic hydrocarbons (PAHs)

CO is an odourless, colourless gas formed from the incomplete burning of fuels. It can be a common pollutant at the roadside and highest concentrations are typically found in the kerbside environments with concentrations decreasing rapidly with increasing distance from the road.

In atmospheric chemistry, NO_X generally refers to the total concentration of nitric oxide (NO) and nitrogen dioxide (NO_2). NO is a colourless and odourless gas that does not significantly affect human health. However, in the presence of oxygen, NO can be oxidised to NO_2 which can have significant health effects, including damage to the respiratory tract and increased susceptibility to respiratory infections and asthma. NO will be converted to NO_2 after leaving the combustion source at a rate dependent on ambient and atmospheric conditions. NO_2 is generally the primary pollutant of concern for diesel fired power generation, given the ratio of emissions to the NO_2 ambient air quality criterion.

Both natural and anthropogenic processes contribute to the atmospheric load of particulate matter. Coarse particles ($PM_{2.5-10}$) are derived primarily from mechanical processes, resulting in the suspension of dust, soil, or other crustal materials from roads, farming, mining, dust storms, and so forth. Coarse particles also include sea salts, pollen, mould, spores, and other plant parts. Fine particles, or $PM_{2.5}$, are derived primarily from combustion processes, such as vehicle emissions, wood burning, coal burning for power generation, hazard reduction burns, and bush fires. Fine particles also consist of transformation products, including sulphate and nitrate particles, and secondary organic aerosol from VOC emissions. The size of particle determines their behaviour in the respiratory system, including how far the particles can penetrate, where they deposit, and how effective the body's clearance mechanisms are in removing them. $PM_{2.5}$, and particularly the ultrafine sub-micron particles, may penetrate beyond the larynx and into the thoracic respiratory tract, and evidence suggests that particles in this size range are more harmful than the coarser component of PM_{10}.

Sulfur in fuel converts to sulfur oxides during combustion, hence emissions of SO_2 are directly related to the concentration of sulfur in the fuel. Diesel contains more sulfur than gas, as there is negligible sulfur content in Australian natural gas and LPG.

VOCs have high vapour pressure at normal room-temperature conditions. Their high vapour pressure leads to evaporation from liquid or solid form and emission release to the atmosphere. VOCs are emitted by a variety of sources, including motor vehicles. VOCs that are often typical of these sources include benzene, toluene, ethylbenzene and xylenes (often referred to as ‘BTEX’). Biogenic (natural) sources of VOC emissions are also significant (e.g., vegetation).

PAHs typically result from the incomplete combustion of organic material (such as coal, petrol, diesel, and wood). PAHs are toxic and carcinogenic, the degree to which is dependent on the type of PAH. PAHs typically occur in mixtures and the risk that that the mixture may pose depends on its composition. The toxicity of a mixture of PAHs is therefore often expressed as a single number representing the equivalent concentration of the most toxic or carcinogenic congener, benzo(a)pyrene (B(a)P).

The rate and composition of air pollutant emissions from generator engines is a function of several factors, including the type and size of the generators, fuel type and operating load. For diesel fired generators, the pollutants with the highest emission rates relative to their ambient air quality criteria, and therefore the pollutant with the highest risk of exceeding those criteria is NO_2. This assessment therefore considers only emissions of NOx from the generators, the rationale being that if compliance with the $NO_{2.5}$ criterion is demonstrated, compliance for all other pollutants would also be implicitly demonstrated.

Criteria

NSW EPA has established ground level air quality impact assessment criteria for air pollutants to achieve appropriate environmental outcomes and to minimise associated risks to human health as published in the Approved Methods. The criteria are the defining ambient air quality criteria for NSW (provided **Table 1)**, derived from the National Environment Protection Council (NEPC), are considered appropriate for this AQIA.

Table 1 Project Air Quality Goals

Pollutant	Averaging time	Criteria
NO_2	1 hour	164 µg/m^3
	Annual	31 µg/m^3

3.0 Existing Conditions

3.1 Background Air Quality

A summary of the monitored pollutant concentrations for the last five years (2020-2024) is presented in **Table 2**.

Table 2 Summary of Air Quality Monitoring Data at Bringelly AQMS (2020-2024)

Pollutant	PM_{10}		$PM_{2.5}$		NO_2		SO_2	
Averaging Period	Maximum 24-hour	Annual	Maximum 24-hour	Annual	Maximum 1-hour	Annual	Maximum 1-hour	Maximum 24-hour
Units	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
2020	241.8 (11)	18.1	78.1 (12)	8.2	61.5	6.3	62.9	8.6
2021	69.0 (1)	15.0	57.4 (3)	7.2	49.2	7.1	25.7	5.7
2022	28.7	11.9	17.8	5.0	45.1	5.9	28.6	5.7
2023	53.2 (1)	15.7	45.4 (3)	6.7	51.3	6.2	25.7	8.6
2024	58.1	15.9	17.2	6.6	65.6	7.7	34.3	5.7
Average	98.2	15.2	49.7	6.8	51.8	6.4	35.8	7.2
Criteria	**50**	**25**	**25**	**8**	**164**	**31**	**215**	**57**
# numbers in brackets represent number of exceedances of relevant criteria recorded each year.								

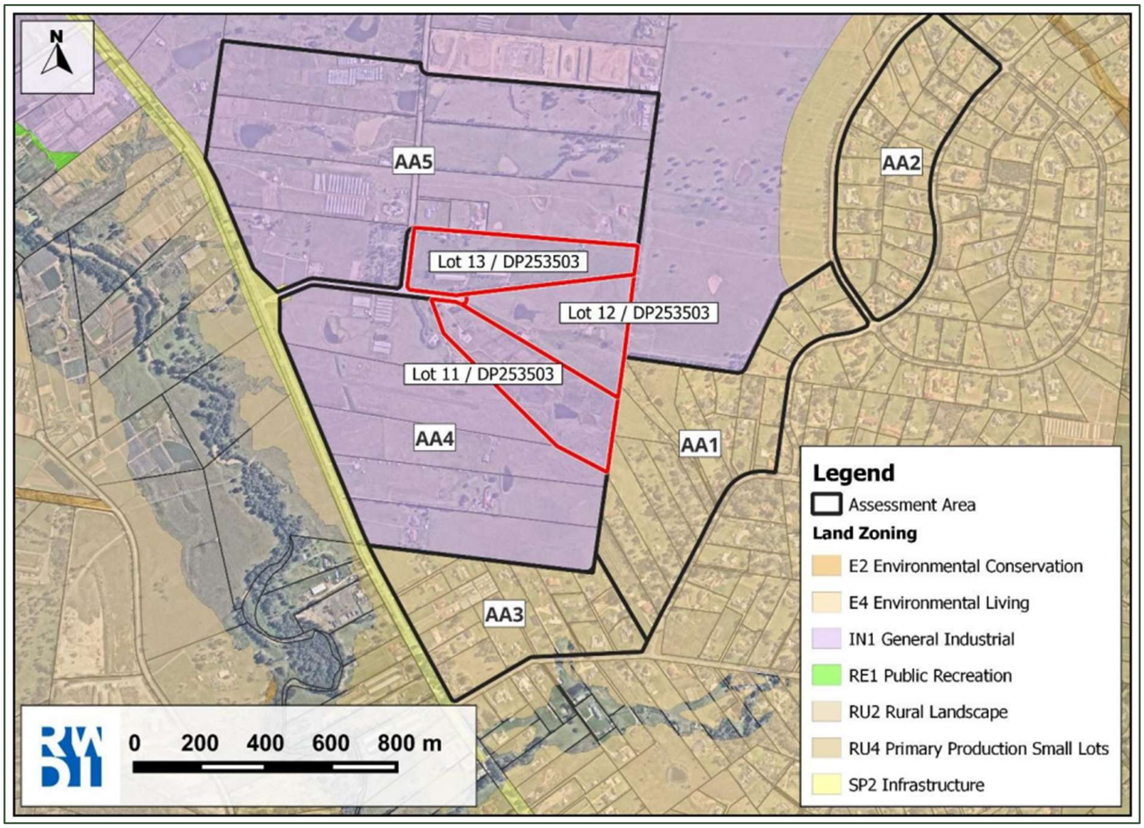
3.2 Sensitive Receivers

The nearest sensitive receivers identified in the AQIA are described as the following:

> *" Sensitive receivers located in the vicinity of the development are located on the eastern boundary on Mt Vernon Road, Kerrs Road, and Bowood Road and are presented as assessment areas AA1, AA2 and AA3, respectively.*
>
> *The receivers in AA4 and AA5 are existing residential houses within the industrial zoning. The residential receivers in AA1, AA2 and AA3 are located within 150m to 600m from the site. The isolated residential receivers in AA4 and AA5 are located within 40m to 50m from the site."*

These locations are shown in **Figure 1**. Based on this, SLR considers 40 m to be the minimum distance to a potentially impacted sensitive receptor.

Figure 1 RWDI Identified Sensitive Receptors



Source: RWDI, Reference #2101343, 2022

4.0 Comparative Analysis

SLR consulting has conducted several dispersion analysis assessments for developments utilising diesel generators for emergency back-up power. One such assessment was conducted for the use of a temporary mobile high voltage injection unit (HVIU) to support unplanned power emergencies in a rural community in Western Australia (WA), hereby referred to as the WA Assessment.

The WA Assessment considered the impacts from 6 diesel generators always operating simultaneously, at all times, on the closest sensitive receptor 30 m west of the generators. The assessment assumed use of generators similar to Aggreko NHC20/KTA50G12 1250 kVA diesel-powered units, in the absence of generator specific emission specifications. The specifications of those generators are summarised in **Table 3**, compared to the available details of the proposed MOD generator. The electrical output of that generator type is similar to that of the proposed generator for the MOD. It is likely therefore that the NOx emissions would be comparable.

Table 3 WA Assessment Diesel Generator Specifications

Parameter	Units	WA Assessment	Proposed MOD
Individual			
Electrical generation capacity	kW	1,080	800kw
Fuel rate: individual	L/h	270	187
NOx emission rate: individual	g/kWh	14.35	N/A
Stack release height	m	3.66	N/A
Stack diameter	m	0.2	N/A
Stack Temperature	°C	450	N/A
Stack exhaust velocity	m/s	57.4	N/A
NOx Emission Rate	g/s	4.3	N/A
Total Generators combined			
Electrical generation capacity	MW	6.5	800kw
Fuel rate	L/h	1,620	187
NOx Emission Rate	g/s	25.8	N/A
N/A = Not available. Generator specific information related to the stack and stack emissions are not available at this stage.			

Table 4 presents the WA Assessment predicted incremental maximum 1-hour and annual average NO_2 concentrations at 30 m. It presents predicted impacts from the six 1080 kW generators (6,480 kW total) considered in the WA Assessment, which has an incremental impact of 943 µg/m³. It is reasonable to consider that 1 x 800 kW generator would result in incremental concentrations of approximately 12% of this, i.e. that is equal to the ratio of a single 800kW to the total 6480 kW assessed in the WA Assessment, which would be an incremental NO_2 concentration of 116 µg/m³.

Table 4 Maximum Predicted NO_2 Concentrations at Sensitive Receptors

Receptor Distance	Number of generators	Total Capacity (kW)	1-Hour Incremental [a]		1-Hour Cumulative	Annual		Annual Cumulative
			NOx (µg/m³)	NO_2 (µg/m³)	NO_2 (µg/m³)	NOx (µg/m³)	NO_2 (µg/m³)	NO_2 (µg/m³)
30 m	6	1080	3143	943	992	198	59	67
Criteria					164			31
a 99.9th percentile as specified by the Air Emissions Guideline for 1 hour incremental impacts.								

It is noted that in NSW the assessment criteria is 100th percentile, however the assessment criteria in WA is 99.9th percentile for 1-hour incremental impacts. Adopting the 99.9th percentile instead of the 100th percentile helps to account for outliers and extreme short-term spikes that may not be representative of actual meteorological conditions by capturing the highest sustained levels but avoiding being skewed by rare, very short-term fluctuations. As inherent uncertainties exist in air dispersion models and monitoring data, using a 99.9th percentile accounts for expected variability while ensuring a robust assessment.

The WA Assessment assumes 30% conversion of NOx to NO_2 before the plume arrives at the receptor location noting that this assumption is likely to significantly over-predict NO_2 concentrations at nearfield receptors. In the experience of SLR, typically ambient conversion of NOx to NO_2 is less than 30%.

Based on the WA Assessment comparison, assuming the proposed MOD generator has similar emission rates and release height, it is unlikely that the proposed generator will result in cumulative concentrations significantly greater than the criterion at 30 m, and further dispersion will likely reduce concentrations at the receptors located 40 to 50 m away.

In addition, the WA Assessment assumed the generators ran continuously through the year, from which that maximum was predicted. The MOD generator is likely to operate for approximately 2 hours a year for maintenance and therefore the likelihood of this maximum occurring at a sensitive receptor is very low.

At the time of writing, information on the historical power interruptions at the Site is unavailable. A study conducted by SLR for a similar facility in Eastern Creek observed the following for that site:

- the site had two power interruptions in the past ten years
- each interruption consisted of the loss of one of four feeder supplies
- the two interruptions lasted for 13 minutes and 21 minutes, respectively
- loss of one feeder to that site did not require all generators to be used to provide emergency power.

Assuming that the performance of the future network supplying the power is similar to the existing network performance, it can be concluded that the actual likelihood of an exceedance of the air quality criteria at nearby sensitive receptors due to the emergency operation of the Project is negligible.

5.0 Recommendations

An elevated released height is also good practice as it assists in dispersion and will also help prevent potential impacts to workers onsite during maintenance testing.

The following actions can assist in limiting the potential impacts from the generators:

- Install a stack to increase the release height of emissions to a minimum of 3.7 m.
- Conduct maintenance when wind direction is away from the closest sensitive receptors.

6.0 Closure

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by ESR Developments (Australia) Pty Ltd (ESR) to prepare a technical memorandum to consider the potential impacts at sensitive receptors due to the proposed use of a diesel generator for the MOD.

A comparative analysis of NO_2 impacts from a dispersion modelling assessment of emergency backup generators from a previous SLR assessment was conducted. It showed that the emissions from the single 800kW generator at the proposed MOD are unlikely to result in cumulative concentrations significantly greater than the criterion at the closest receptor. In addition, the MOD generator is likely to operate so infrequently that the likelihood of the maximum incremental impact occurring at a sensitive receptor is very low.

Therefore the proposed generator, with recommendations in place, poses a low risk of impact to amenity and health.

Regards,

Kate Barker, BSc
Senior Project Consultant – Air Quality