REPORT

VOLUME 3

Environmental Impact Statement

Prestons Waste Treatment Facility

Submitted to:

NSW Department of Planning, Industry and Environment

Submitted by:

Hi Quality Waste Treatment Services Pty Ltd

Golder Associates Pty Ltd
Level 8, 40 Mount Street, North Sydney, New South Wales 2060, Australia

20142192-052-R-Rev0 - Appendices E to F

August 2021

APPENDIX E

Noise Impact Assessment

REPORT

Noise Impact Assessment

Environmental Impact Statement, Prestons Waste Treatment Facility

Submitted to:

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Waste Treatment Services

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20142192-046-R-Rev1

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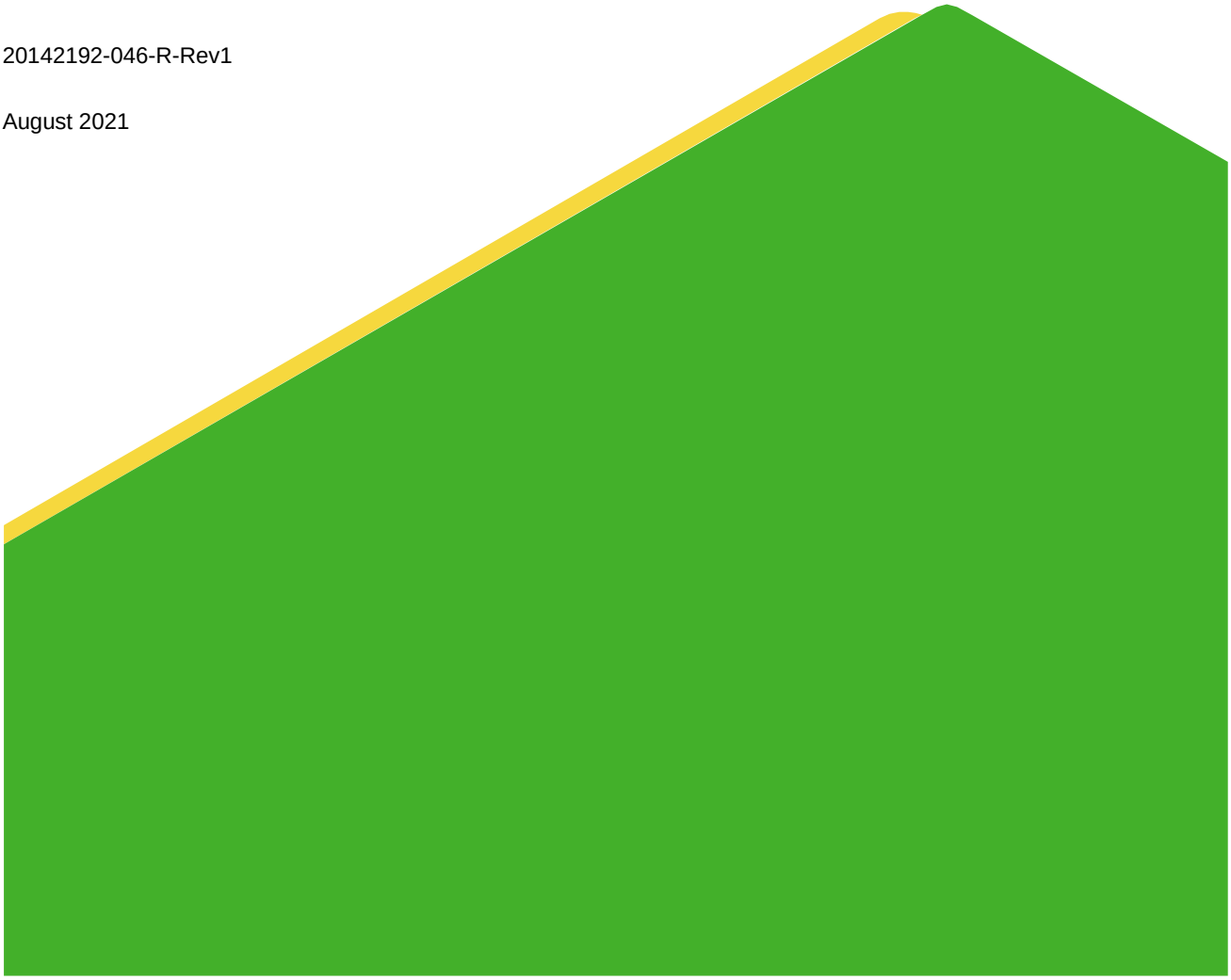

Distribution List

1 electronic copy - Hi-Quality

1 electronic copy - Golder Associates Pty Ltd

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DEFINITIONS

A-weighted	A measuring instrument response which modifies sound in such a way that the resulting level is similar to that perceived by the human ear.
dB	Decibel.
dB(A)	A-weighted sound pressure level measured in decibels.
L_{Aeq}	The A-weighted sound pressure level of the same acoustic energy as the A-weighted time varying sound pressure level when determined over the same period.
L_{Amax}	The maximum A-weighted sound pressure level reached during a measurement period.
L_{A10}	The A-weighted noise level exceeded for 10% of the measurement period L_{A10} is regarded as the best descriptor of traffic noise and is normally used to characterise average maximum noise levels.
L_{A90}	The A-weighted noise level exceeded for 90% of the measurement period. L_{A90} is regarded as the best descriptor of background noise.

1.0 INTRODUCTION

Hi-Quality Waste Treatment Services Pty Ltd (Hi-Quality) retained Golder Associates Pty Ltd (Golder) to complete a noise and vibration assessment report to address the Secretary's Environmental Assessment Requirements (SEARs 9346594) for the proposed Waste Treatment Facility (WTF) located at 9 Whyalla Place, Prestons NSW 2170 (the Site). This assessment is to be included within the Environmental Impact Statement (EIS) for the WTF.

Potential noise impacts due to construction and operation of the WTF were assessed in accordance with the Noise Policy for Industry (NSW EPA, 2017). In the assessment the WTF is considered an "industrial premises" and/or "warehouse" and a "modification of an existing development"; i.e., a new WTF at an existing industrial premises.

The noise assessment includes:

- Measurement of existing noise levels at nearby noise-sensitive receptors;
- Noise emissions calculations for primary external noise sources:
  - three strobic fans serving the building HVAC and air emissions control system; and
  - waste delivery trucks.
- Noise attenuation calculations to predict noise impacts from the site operations at local receptors.

The assessment has been undertaken by suitably qualified Golder's noise professionals and compares the results to the relevant NSW noise criteria (NSW EPA, 2017). Methods and results of the noise assessment are described in the following sections of this report.

2.0 PROJECT DESCRIPTION

2.1 Construction

Construction associated with the modification of the existing facility will be undertaken in two stages. The duration of Stage 1 is estimate at 1-2 months and Stage 2 approximately 4 months. While the construction period is longer than 3-weeks, individual construction/modification activities will be shorter in duration (weeks) and not occur continuously. Some construction/modification activities occur indoors limiting their potential noise impacts. Examples of specific construction activities include, but may not be limited to, the following:

- Minor demolition;
- Minor earthworks;
- Construction of Weighbridges and Weighbridge office;
- New driveway;
- Building extension;
- HVAC System Integration;
- Fire Management System Upgrade; and
- Internal fit out – pits, push wall, bunding, water treatment plant, fire wall.

The equipment necessary for the construction of the Project may include compaction equipment, backhoes, excavators, rollers, truck, concrete pumping equipment, air compressors, concrete vibrators and saws, mobile cranes and welders.

To mitigate potential noise impacts during construction, they will be scheduled to occur between 07:00 to 18:00 Monday to Friday and 08:00 to 13:00 on Saturdays. No work on Sundays or public holidays is proposed.

2.2 Operation

The proposed WTF includes a bulk soil waste treatment facility and bioremediation facility, water treatment facility, storage and consolidation of material and ancillary infrastructure. The WTF is planned to accept approximately 270,000 tonnes per annum (tpa) of waste. The Project would receive waste 24 hours a day, while processing and dispatch operations are undertaken between 7:00 am and 6:00 pm Monday to Saturday and 8 am to 6 pm Sundays and Public Holidays.

Waste trucks enter the facility and unload waste material after the roll-up doors have been closed. The treatment activities all take place inside the building. The proposed layout of the WTF is presented in Figure 1.

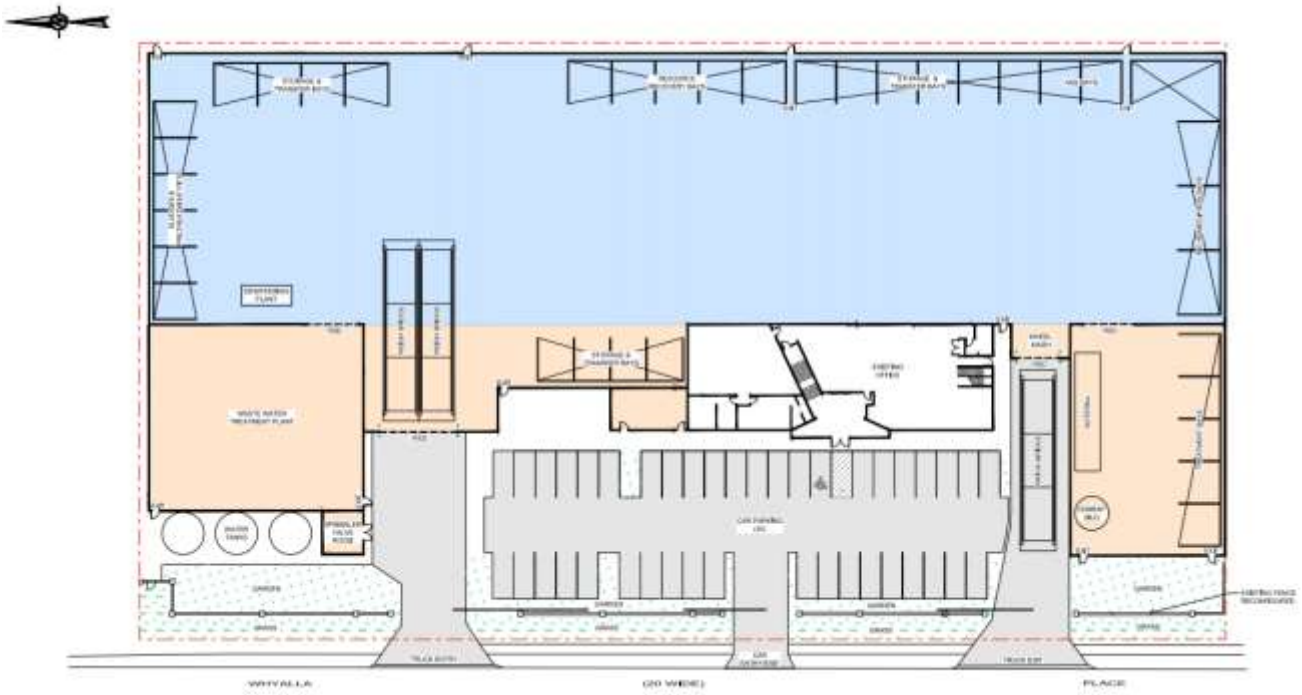

Figure 1: Proposed layout of WTF

3.0 EXISTING AMBIENT NOISE

Unattended noise monitoring was undertaken at two noise-sensitive receptor locations and the Site. The locations were selected as those closest to the site with acceptable instrument siting requirements. Noise monitoring at the Site occurred during the period 25 June 2020 to 2 August 2020. The purpose of the noise monitoring is to establish the existing ambient noise levels in the area.

Monitoring locations include a residential property at 301 Hoxton Park Road and the Mercure Sydney Liverpool Hotel, these are location approximately 500m to the north and 350m from the Site respectively and are presented in Appendix A along with the location of the WTF. These locations were used to assess potential noise impacts of the WTF operations on nearby noise-sensitive receptors.

There is also a noise-sensitive receptor (church) located within an industrial building approximately 350m to the north of the Site. This church is near the existing arterial road of Hoxton Park Road. The operating hours of the church are during the Day and Evening noise assessment periods and are listed as 9:30 am to 8;30 pm.

The baseline measurements at the Mercure Hotel 350 m north west of the Site are considered representative of the church location.

Noise monitoring was undertaken using Class 1 unattended noise loggers and in accordance with AS1055.1 "*Acoustics – Description and Measurement of Environmental Noise*". The continuous noise levels were logged over a period of approximately 7 days to assess the variability of L_{A90}, L_{Aeq} and L_{Amax} levels at the noise monitoring locations.

Results of the noise monitoring for day, evening and night periods are presented in Table 1 as the rating background noise levels (RBL). Data identified to be affected by adverse weather conditions or likely extraneous noise was excluded from the subsequent calculations.

Table 1: Noise monitoring results - RBL

Monitor ID	GPS Co-ordinates (UTM)	Description	Period	Sound pressure level (dB(A))	
				L_{90}	L_{eq}
Logger 1	349054, 5785574	Mercure Hotel	Day	50	56
			Evening	51	55
			Night	48	53
Logger 2	348926, 5786977	301 Hoxton Park Road	Day	57	67
			Evening	55	66
			Night	49	62
Logger 3	348926, 5786977	9 Whyalla Place (the Site)	Day	50	60
			Evening	49	56
			Night	50	58

4.0 NOISE ATTENUATION CALCULATIONS

4.1 Methodology

Noise attenuation calculations are used to determine the noise levels at noise-sensitive receptors within the vicinity of the proposed WTF. The calculation of noise attenuation does not take into consideration the suppression and mitigation effect of the environment surrounding the source. This includes buildings and trees (as per International Organization for Standardization ISO 9613 *Acoustics – Attenuation of Sound during Propagation Outdoors*).

The noise attenuation calculations inputs include:

- The distance of the noise-sensitive receptors from the source;
- Sound pressure levels of three strobic ventilation fans; and
- Sound pressure levels of the trucks delivering material to the facility.

The noise attenuation calculations assume external noise sources are the contributing factor when assessing impacts at the noise-sensitive receivers.

The processes within the WTF building including mobile plant such as excavators, road trucks, front-end loaders and a high sheer mixer, are assumed to be predominately mitigated through: management practices required under NSW Government Code of Practice: Managing Noise and Preventing Hearing Loss at Work 2019; and the noise suppression of the building.

The noise impacts at the receptors have been calculation as worst-case scenario, with no mitigation or screening affects from the surrounding environment (trees or buildings) and the noise generated from site being continuous and combined.

The results are considered to be the maximum predicted sound levels at each receptor, regardless of the specific local conditions.

4.2 Project Noise Trigger Levels

Table 2 presents the Amenity Noise Levels (ANLs) for the noise-sensitive receptors based on the existing acoustic environment as measured during the noise monitoring programme (Noise Policy for Industry, NSW EPA, 2017).

Table 2: Noise-Sensitive Receptor Amenity Noise Levels (ANLs)

Criteria	Noise Amenity Level – urban residential	Noise Amenity Level – hotel / motel
Day	60 dB(A)	65 dB(A)
Evening	50 dB(A)	55 dB(A)
Night	45 dB(A)	50 dB(A)

Table 3 presents the Project Noise Trigger Levels (PNTLs) calculated as per guidance in NSW EPA Noise Policy for Industry, 2017.

Table 3: Project Noise Trigger Levels – intrusiveness and amenity

Criteria	Intrusiveness noise level[1] LAeq, 15min (dB(A))		Project amenity noise level[2] LAeq, 15min (dB(A))	
	Urban residential	Hotel	Urban residential	Hotel
Day	62	55	58	63
Evening	60	56	48	53
Night	54	53	43	48

Notes:
[1] Intrusiveness noise level is LAeq,15min ≤ RBL (Table 1) + 5 dB(A).

[2] Project amenity noise level (ANL) is the ANL (Table 2) minus 5 dB(A) plus 3 dB(A) to convert from a period level to a 15-minute level.

The PNTL is the lower, more stringent, value of the intrusiveness and amenity noise levels. However, in accordance with Section 2.1 of the NSW EPA Noise Policy for Industry, 2017, “Intrusive noise levels are only applied to residential receivers (residences). For other receiver types identified… only the amenity levels

apply"[1]. Therefore, project amenity noise levels apply to the hotel noise-sensitive receiver regardless of the above calculations.

The PNTLs adopted for this assessment are shown in Table 4.

Table 4: Adopted Project Noise Trigger Levels

Criteria	Urban residential	Hotel
Day	58 dB(A)	63 dB(A)
Evening	48 dB(A)	53 dB(A)
Night	43 dB(A)	48 dB(A)

4.3 Assessment of meteorological conditions

To determine the significance of the local meteorology in relation to the potential for creating noise-enhancing conditions, hourly meteorological (MET) data for the year 2018 was examined. The MET data was obtained from the closest the Bureau of Meteorology (BOM) automatic weather station; Holsworthy (Station No. 95761), approximately 9 km to the south-east of the Site.

The MET assessment involved quantifying occurrence of temperature inversions (F and G class stability categories) for the night-time period (6pm – 7am), and then for all assessment periods (day, evening and night) during stability categories A, B, C and D with light winds up to and including 3 m/s. The temperature inversion, which create noise-enhancing conditions, are deemed significant based on a threshold occurrence of 30%, in accordance with the provisions in the NSW EPA Noise Policy for Industry, 2017.

Noise-enhancing meteorological conditions were calculated to occur 35% of the 2018 MET data set. This is over the defined threshold of 30%, therefore noise-enhancing meteorological conditions were adopted for the assessment and are presented in Table 5.

Table 5: Adopted noise-enhancing meteorological conditions.

Period	Meteorological Conditions
Daytime and evening	Stability categories A–D with light winds up to 3 m/s.
Night-time (6pm – 7am)	Stability categories A–D with light winds up to 3 m/s and stability category F with winds up to 2 m/s.

Predicted noise levels at the sensitive receivers under noise-enhancing meteorological conditions were calculated in CadnaA software using the CONCAWE Noise Propagation Model. The results are shown in Table 7 and Table 8.

4.4 Noise Sources

The operational activities undertaken at the WTF include:

- Bulk Soils Treatment;

[1] NSW EPA (2017) Noise Policy for Industry, p7.

- Sediments and Sludges Pre-Treatment;
- Acid Sulphate Soils Treatment;
- Liquid Waste Treatment; and
- Waste Storage and Transfer.

The materials for these processes, will be received, treated, stockpiled and loaded out within the building, with the entry and exit roller doors kept closed except when receiving or loading out. The majority of the noise sources associated with the WTF operation occur within the confines of the building. Internal noise sources include:

- road trucks delivering waste;
- front-end loaders transferring waste;
- a Roterra unit used to treat bulk soils and sludge; and
- a dust collector serving the Roterra unit area.

Noise from these sources will be managed in accordance with the “NSW Government Code of Practice: Managing Noise and Preventing Hearing Loss at Work, 2019”.

Both the Roterra unit and the dust collector have been located indoors to reduce external noise. The dust collector is located in the main building compartment but services the building compartment where the Roterra unit is located (Figure 1). The Roterra and its dust collector will only operate during the day, and do not operate continuously.

The existing warehouse is a concrete walled facility. As a WTF, the facility will include minor building additions to be constructed of pre-fabricated concrete panels. This assessment assumes that sound from the internal noise sources are mitigated by the building envelope.

The primary noise sources for WTF are trucks delivering waste and three vertical exhaust ventilation fans (strobic fans) located on the roof of the building. The three strobic fans service the HVAC system and the air emissions control device for particulate matter and volatile organic compounds. The air emissions control system and strobic fans are located in and on the small compartment outside the “storage and transfer bays” along the west wall of the main WTF compartment (Figure 1).

The WTF will receive waste 24 hours a day. However, waste treatment operations will occur between 7 am and 6: pm Monday to Saturday and 8 am to 6 pm Sundays and Public Holidays. Movement of waste delivery trucks and operation of the strobic fans is conservatively assumed to occur simultaneous for 24 hours per day, seven days per week, with all three strobic fans operating continuously at full capacity.

In practice, the three strobic fans will be dynamically controlled as part of the HVAC system. During daytime when treatment activities are taking place, up to three fans will operate continuously. During evenings and overnight the WTF requires less ventilation and will operate the strobic fans at a reduced capacity. The sound pressure levels (SPL) for the equipment are presented in Table 6.

Table 6: Sound Pressure Levels of Major External Noise Sources

Source	Quantity	Hours of operation	Sound frequency (Hz)	Total sound pressure level (dB(A)	Distance measured (m)
Strobic ventilation fans	3	24 hours	spectral	78	3
B-Double Truck	100/continuous	24 hours	spectral	80	10

Truck sound pressure levels were obtained from similar equipment listed in “Update of Noise Database for Prediction of Noise on Construction and Open Sites” from the United Kingdom Department for Environment Food and Rural Affairs (2004) and from Golder’s internal noise database. Sound pressure levels for the strobic ventilation fans were provided by the fan manufacturer attached as Appendix B.

The noise attenuation calculations for trucks was completed assuming the continuous presence of a truck at the entry or exit of the WTF. These trucks are also conservatively assumed to operate at the vehicles maximum sound pressure level. If calculations were performed assuming the trucks are idling and/or that their presence is only temporary (not continuous), the predicted SPLs at the noise-sensitive receiver would be lowered by approximately 5 dB(A).

5.0 VIBRATION

Construction activities for the WTF include minor demolition and building additions (see Section 6.1) but do not require activities that produce impulse-type vibrations (e.g., pile driving). Trucks delivering waste and the operation of the front-end loaders and the Roterra unit also have the potential to produce vibrations. However, these sources are located inside the building, are intermittent, and will occur mostly during the day. Sensitive community receivers (e.g., Mercure Hotel) are more than 350 m from the Site. Consequently predicted offsite vibration impacts are considered very low to negligible.

If vibration impacts become a concern, they can be assessed via on-site monitoring. The NSW DEC (2006) “Assessing Vibration: a technical guideline” (Vibration Guideline) and NSW Transport Roads and Maritime Services (2016) “Construction Noise and Vibration Guideline”, sets out the criteria under which such an assessment is to be completed.

6.0 ASSESSMENT OF NOISE IMPACTS

6.1 Construction

The construction generated noise is to be managed following the Department of Environment and Climate Change NSW (DECC), Interim Construction Noise Guidelines, 2009 (Guideline) and NSW Environment Protection Authority Draft Construction Noise Guideline, 2020. The DECC Guidelines present the option for a qualitative method under which construction noise can be assessed. The DECC Guidelines states the qualitative assessment may be used for short-term works, those that are not likely to affect an individual or sensitive land use for more than three weeks. The construction of the WTF will exceed the three-week period, however the majority of the facility is to be established within the existing onsite building with minimal external construction to take place Therefore, Section 5 of the DECC Guidelines ‘Qualitative assessment method’ has been deemed appropriate for the assessment of construction noise impacts.

The following list details the external construction works.

External works:

- Installation of weighbridges;

- A new driveway;
- An extension at the north west and south west of the buildings for the Waste Water Treatment and Soil Treatment facilities; and
- Installing the HVAC System.

The potential noise generating activities associated with these external works include minor demolition to remove part of the existing slab and portion of the existing warehouse wall, minor earthworks for footing and drainage. The extension is to be achieved through installation prefabricated concrete panels and the external component of the HVAC system will be erected by crane.

The other work required to construct the WTF will be internal fit outs and installations and therefore have less potential for noise impacts. These works include:

- Fire management system installation;
- Internal HVAC systems;
- Installing tanks, silos, pumping and dosing systems;
- Building a laboratory;
- Installing a wheel wash station; and
- Internal bays and facility areas.

Much of the WTF construction takes place inside the existing building and the site sits within an industrial area zoned IN3 Heavy Industrial, with the closest residential receptors approximately 500m away. The construction will take place within Standard Construction Hours (DECC Guidelines) of 07:00 to 18:00 Monday to Friday and 08:00 to 13:00 on Saturdays with no work on Sundays and public holidays.

Based on this assessment a Noise Management Plan developed as part of the Construction Environmental Management Plan (CEMP) as set out under the qualitative assessment method of the DECC Guidelines is considered satisfactory for managing the construction generated noise.

This Noise Management Plan will include:

- Identification of the surrounding noise-sensitive land use;
- A description of working hours and practices to minimise noise;
- A list of high noise equipment or processes along with mitigation/minimising measures where possible;
- A complaint register and written process for handling complaints;
- Community notification procedures, informing surround properties of potential noisy works and controls in place to minimise these activities; and
- Contractor involvement. A description of noise generating activities will be discussed in the morning toolbox with workers to be involved in reducing the effects where possible.

6.2 Road Traffic Noise Impacts

The NSW Road Noise Policy (DECCW 2011) outlines noise assessment criteria, applied to particular types of projects including, noise impacts for existing residences affected by additional traffic on existing arterial roads generated by land use development.

The WTF is predicted to add an average of 565 trucks per week or 81 trucks per day (assuming even year-round operation, 7 days of the week). There are a number of arterial roads connecting the industrial area to

the closest major freeway (M7) and Hoxton Park Road to the north. Traffic data summaries estimate the M7 (north and south bound exit ramps) as having approximately 1000 vehicles per hour with more than 20% of these being heavy vehicles (200 per hour). Hoxton Park Road (east and west bound) is estimated at approximately 2,400 vehicles per hour with 11% of these being heavy vehicles (265 per hour).

These two roads have over 11,000 heavy vehicle trips during a 24-hour period, assuming consistent hourly road use. The additional 81 trucks per 24-hours due to the WTF operation results in less than a 1% increase in heavy vehicle traffic. Potential noise impacts from this marginal increase in road traffic noise are considered very low to negligible.

6.3 WTF Operation

The results of the noise attenuation assessment for operations are presented in Table 7 and Table 8. The noise assessment has been conducted for a complete 24-hour period allowing Day, Evening and Night periods to be assessed for extended operating hours and includes the calculations for potential noise-enhancing meteorological conditions. The predicted SPLs are also compared to the PNTLs (as described in Section 4.2) to assess whether further mitigation and management measures are required to address NSW noise limits.

Table 7: Sound Pressure Levels (SPL) at noise-sensitive Receptor 1 – Mercure Hotel

Meteorological Conditions	Predicted SPL [dB(A)]			Project noise trigger levels		
	Day Mon-Sat 7am–6pm Sun 8am-6pm	Evening Mon-Sun 6pm-10pm	Night	Day 63 dB(A)	Evening 53 dB(A)	Night 48 dB(A)
Standard	44	44	44	✓	✓	✓
Noise-enhancing	45	45	45	✓	✓	✓

Table 8: Sound Pressure Levels (SPL) at noise-sensitive Receptor 2 – 301 Hoxton Park Road

Meteorological Conditions	Predicted SPL [dB(A)]			Project noise trigger levels		
	Day Mon-Sat 7am–6pm Sun 8am-6pm	Evening Mon-Sun 6pm-10pm	Night	Day 58 dB(A)	Evening 48 dB(A)	Night 43 dB(A)
Standard	42	42	42	✓	✓	✓
Noise-enhancing	43	43	43	✓	✓	✓

The predicted SPLs at Receptors 1 and 2 do not exceed the PNTLs for the day, evening and night periods and are therefore compliant with the criteria.

6.4 Noise Management and Mitigation

The WTF operation does not exceed the PNTLs for the day, evening or night-time periods. The primary sources of noise for the WTF are external sources; i.e., the three strobic fans and trucks delivering waste.

The noise emitted by the strobic fans is reduced through use of a silencer system that is part of the fan construction. The total sound pressure level of the strobic fans, including silencer mitigation, is presented in Table 6.

The noise assessment is considered conservative because the strobic fans are assumed to operate 24-hours per day, 7-days per week, with all three ventilation fans operating continuously at full capacity. In practice, the three strobic fans will be dynamically controlled as part of the HVAC system. During daytime when treatment activities are taking place up to three fans may operate continuously. During evenings and overnight the WTF requires less ventilation and will operate with fewer strobic fans or at a reduced fan capacity. This approach helps mitigate noise during the periods with lower PNTLs and would reduce impacts at sensitive noise receptors below the conservative estimates presented in Table 7 and Table 8.

Management of truck generated noise at the entry and exit weigh bridge locations will also help mitigate off site noise impacts. The noise attenuation calculations for delivery trucks were completed assuming the continuous presence of a truck at the entry or exit of the WTF. Truck noise emissions also assume the vehicles are producing their maximum sound pressure level. This results in a conservative prediction of potential impacts at the noise-sensitive receptors.

7.0 CONCLUSION

A noise impact assessment was completed for Hi-Quality's proposed WTF in Preston's NSW. Results of the noise assessment are summarized as follows:

- The noise generated during construction of the WTF will be managed according to the DECC Guidelines. This includes completing a qualitative noise assessment, working within the 'recommended standard hours', and minimising or substituting loud processes (such as using an alternative to 'beeper' style reversing alarms).
- The predicted noise levels at Receptor 1 and Receptor 2 do not exceed the PNTLs for the day, evening and night periods.
- The noise emissions used to assess impacts at Receptors 1 and 2 are considered conservative since:
  - the WTF was assessed as though waste processing occurs 24-hours per day;
  - no noise suppression from the surrounding buildings and trees was considered;
  - noise for waste delivery trucks was assessed as a continual presence at the WTF entry and exit points while also operating at the vehicles maximum sound power level; and
  - the noise calculations were performed under noise-enhancing meteorological conditions.
- The additional vehicle traffic from the WTF (approximately 1% increase) is not expected to have any measurable effect on the noise levels existing residences.
- Vibration from construction and operation of the WTF are not predicted to cause offsite impacts. If necessary, monitoring can be undertaken during the construction phase to assess potential impacts.

Signature Page

Golder Associates Pty Ltd

Carl Van Brink
Environmental Scientist

Cameron S. McNaughton, PhD, CAQP, CPEng
Principal Air Quality Consultant

CVB/CMc/cl:jem

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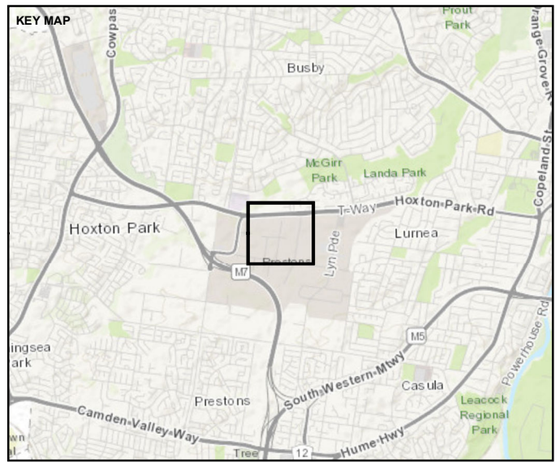
https://golderassociates.sharepoint.com/sites/125733/project files/6 deliverables/20142192-046-r noise assessment/20142192-046-r-rev1.docx

APPENDIX A

Noise Monitoring Locations

KEY MAP



LEGEND

- Proposed Waste Treatment Facility
- Cadastre Boundary
- Noise Logger Location

0 50 100 150 200

1:3,000 METRES

NOTE(S)
1. PROJECTION: GDA 1994 MGA ZONE 56.

REFERENCE(S)
1. AERIAL IMAGERY SOURCED FROM NEARMAP.COM. DATE OF CAPTURE 26/01/2021.
2. STATE DATA SOURCED FROM DATA.NSW.GOV.AU.

CLIENT
HI QUALITY

PROJECT
HI QUALITY WASTE FACILITY EIS PRESTONS

TITLE
SITE LOCALITY AND RECEPTORS

CONSULTANT
GOLDER

YYYY-MM-DD	2021-04-28
DESIGNED	-
PREPARED	MAH
REVIEWED	CVB
APPROVED	MDT

PROJECT NO.	CONTROL	REV.	FIGURE
20142192	046-R	1	2

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25mm

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APPENDIX B

Strobic Ventilation Fans

Project: Preston HQW Rev2 **Reference: Preston HQW**

Fan Model: TS4S750A15M

Running Fan: 3 / Redundant Fans: 0

Fan Construction

- All Fans Certified by AMCA Standards - Fans have been tested in accordance with AMCA 210 (Air Performance) and AMCA 300 (Sound Performance) in an AMCA certified test chamber.
- Full Scaled Fan Performance Tested and Certified in AMCA Approved Test Chamber
- Up to 150,000 Hour L10 Bearing Life
- Fans Balanced to 0.5 mils Peak-Peak Vibration
- Extended Motor Leads and Grease Fittings for Easy Installation and Maintenance
- System Fully Sealed with Chemical Resistant Gaskets
- 316 Stainless Steel Hardware
- Mixed flow induced dilution high plume fan, AMCA Arrangement 4, AMCA 99 Class "C" Spark Resistance

Fan Color

- Color – Standard Steel Gray

Fan Coating

- Standard Epoxy Coating - 8-11 Mils
- Interior – Sherwin Williams (KAS9V0004), Valspar (PFY900010) 8-11 Mils DFT
- Exterior – Sherwin Williams (KAS9V0004), Valspar (PFY900010) 8-11 Mils DFT

Touchup Paint

- Touchup Paint Kit

Outlet (Nozzle/Silencer)

- Nozzle - TS4 Silencer Nozzle, Small
- Wind Band Assembly - Standard Entrainment Windband
- Inline Silencer - TS4 4 ft Outlet Silencer

Fan Options

- Fan Flow - No Selection Requested and Not Included
- Vibration - No Selection Requested and Not Included

Motor

- Motor Horsepower – 75 HP (Premium Efficiency)
- Motor Voltage – 415 Volt w/ Shaft Grounding Kit
- Motor Phase – 3 Ph
- Frequency – 50 Hz
- Motor RPM – 1475 RPM
- Frame Size – 280S
- Motor Manufacturer – ABB (or equivalent)

Disconnects

- Switch - Switch Included With Motor
- Interlock - No Selection Requested and Not Included

Plenum

- Internal Water Drainage Systems
- Internal and External Lifting Lugs on All Fans
- Description – TS4 Side Inlet Single Wall 1X3
- Configuration – 1X3
- Dimensions
    - Length - 6858 mm.
    - Width - 1816 mm.
    - Height - 1829 mm.

Plenum Coating

- Color – Standard Steel Gray
- Standard Epoxy Coating - 12 mils
- Interior – Duraplate 154, 10-12 Mils DFT
- Exterior – Duraplate 154, 10-12 Mils Base; Acrolon 218, 2 Mils Top

Vortex Breaker

- Description – Multi-Fan Vortex Breaker

Isolation Dampers Qty (3) / Fan System

- Description – Aluminum Airfoil Opposed Blade, Coated (Spec D)
- Dimensions
  - Width – 1372 mm.
  - Height – 1372 mm.
  - Depth – 165 mm.
- Actuator – AF24-S, Electric Actuator, Single Wall, 24V

Bypass Dampers Qty (2) / Fan System

- Description – Aluminum Airfoil Opposed Blade w/ Acoustic Louver (Spec Q)
- Dimensions
  - Width – 1524 mm.
  - Height – 1219 mm.
  - Depth – 292 mm.
- Actuator – AMB24-SR, Electronic Actuator, Belimo, 24V, 2-10V/4-20mA Pro

Plenum Options

- System Flow - No Selection Requested and Not Included
- Wind Sensor - No Selection Requested and Not Included

Rain Hood

- Rain Hood – Rain Hood for TS4 - Coated

Jib Socket

- Included with multiple-fan plenums

Mounting Flange

- Description – Flange to Mount Plenum on Steel TS-4, 1X3

Weights (all weights are for a single item)

- Nozzle Assembly – 208.7 kg.
- Motor – 695 kg.
- Fan and Housing – 1479.6 kg.
- Plenum – 1727 kg.

Strobic Air Corporation
A Cincinnati Fan Company
140 W Orvilla Rd.
Lansdale, PA 19446
Phone: (215) 723-4700 | Fax: (215) 723-7401
www.choosetristack.com | www.strobicair.com

Project: Preston HQW Rev2 - Fan Reference: Preston HQW
Fans: 3 (operating) / 0 (redundant)

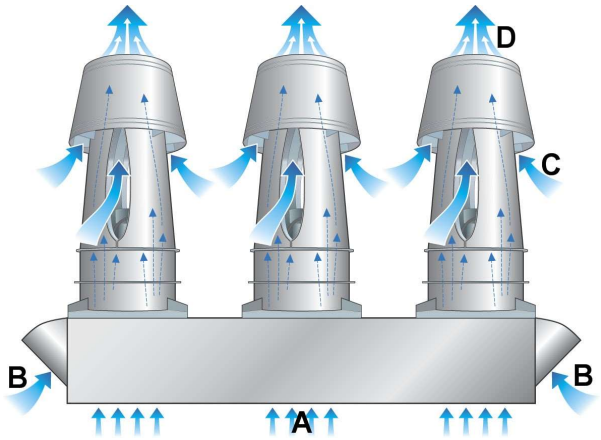
Tri-Stack™

A: Inlet Flow
51.6 m^3/s

B: Bypass Flow
0.288 m^3/s

C: Entrained Flow
33.727 m^3/s

D: Total System Flow
85.615 m^3/s



Operating Conditions

Inlet Static Pressure: **805 Pa**	Inlet Flow per Fan: **17.2 m^3/s**	Inlet Flow Total: **51.6 m^3/s**
Inlet Air Temperature: **21 deg C**	Ambient Air Temp.: **21 deg C**	Altitude at Site: **0 m**
Inlet Air Density: **1.201 kg/m^3**	Ambient Air Dens: **1.201 kg/m^3**	Operating Frequency: **44.5 Hz**

Fan Performance Data - (single fan)

Fan Model: **TS4S750A15M**

Fan Flow Rate: **17.296 m^3/s**	Nozzle Velocity: **40 m/s**	Effective Stack Height:
Total Flow: **28.538 m^3/s**	Wind Band Area: **1.48 sq. m**	16 kph Wind: **33 m**
Operating Speed: **1313 rpm**	Min. Motor Hp: **75 kW**	24 kph Wind: **23 m**
Dilution Ratio: **166 %**	Corrected BHP: **36.56 kW**	

Altitude and Temperature Corrections

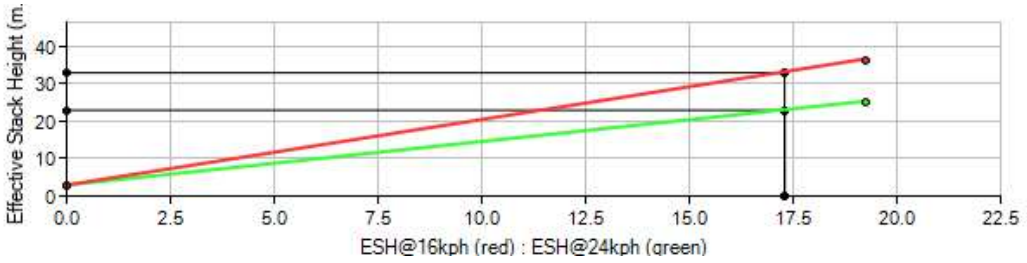
Mixed Air Density:	Mixed Air Temperature:	Corrected Static Pressure:
1.201 kg/m^3	**21 deg C**	**805 Pa**

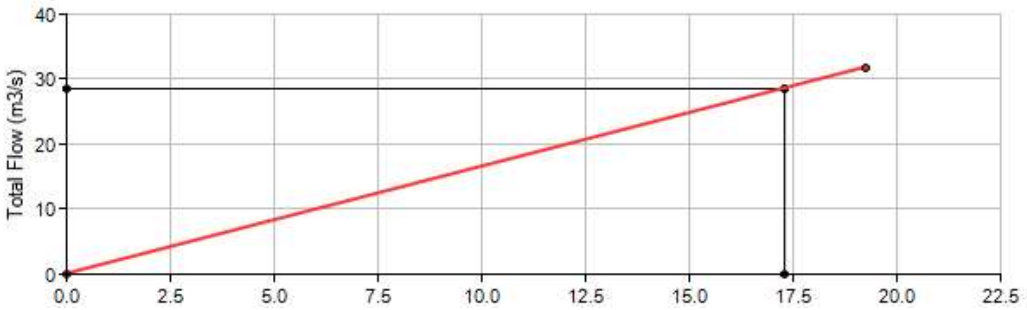
Comments

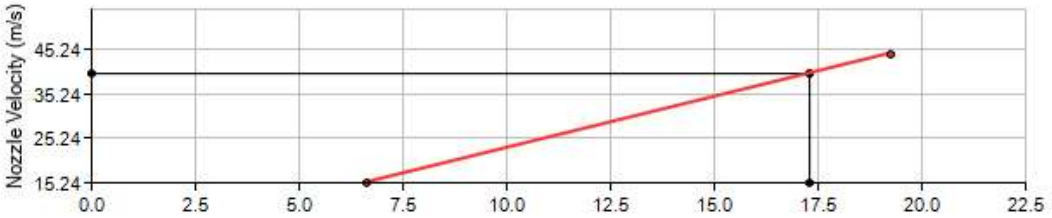
1. Number of fans running does not include redundant fan.
2. Inlet static pressure had been derated for discharge nozzle, windband, airfoil isolation damper, and outlet silencer
3. Inlet static pressure had been derated for system effects through the mixing box, based on the factory-recommended duct configurations.
4. Consult factory for additional derations when duct configurations do not meet factory guidelines.
5. Add an additional 37 pa. static pressure for gravity isolation dampers (usable on single fan mixing boxes only).
6. Effective stack height from roof line is given for fan without a mixing box, mounted on a .5 m high curb.
7. Stack height calculated using Briggs equation, per ASHRAE Fundamentals (1997).

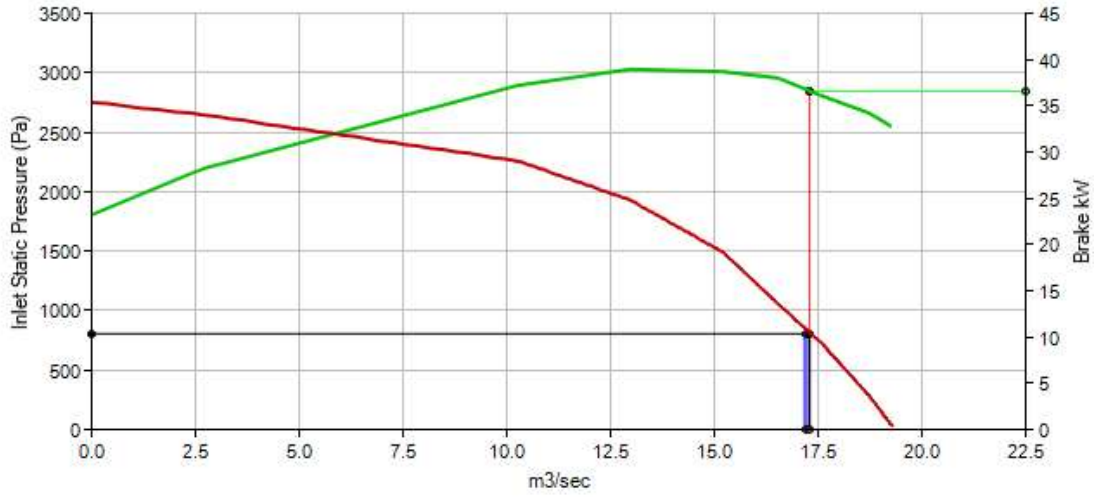
Fan Model: TS4S750A15M
Reference: Preston HQW

Speed: 1313 RPM
Mixed Air Density: 1.201 kg/m^3









Inlet Static Pressure has been Derated for Discharge Nozzle, Windband, Airfoil Isolation Damper, and Outlet Silencer, as well as System Effects Based on Factory-Recommended Duct Configurations. Add an additional 37 pa. for Gravity Isolation Dampers (On Single Fan Plenums Only).
Consult Factory for Additional Deration for Duct Configurations that do not meet Factory Guidelines.
Effective Stack Height at Stated Wind Speed from Roof Line for Fan w/o Mixing Box, mounted on a .5 m high curb. Add height of mixing box.

Fan Outlet Sound Data For Fan Model TS4S750A15M.
Number of Fans Running: 3 - With silencer, at 44.5Hz

Frequency	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Outlet Sound Power Levels	102	107	104	102	101	97	91	82
Corrections for 3 Fans Running	5	5	5	5	5	5	5	5
Dynamic Insertion Loss for nozzle silencer	-5	-8	-9	-11	-12	-12	-10	-6
Dynamic Insertion Loss for outlet silencer	-4	-4	-4	-4	-4	-4	-4	-4
Corrected Outlet Sound Power Levels	98	100	96	92	90	86	82	77

Corrections for 3 m Distance	-17	-17	-17	-17	-17	-17	-17	-17
Sound Levels (3 m)	81	83	79	75	73	69	65	60
'A' Scale Corrections	-26	-16	-9	-3	0	1	1	-1
dB'A' Spectrum (3 m)	55	67	70	72	73	70	66	59

Net Sound Level at 3 m: 78dB'A' (at 50Hz) / 75dB'A' (at 44.5Hz)

Frequency	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Outlet Sound Power Levels	102	107	104	102	101	97	91	82
Corrections for 3 Fans Running	5	5	5	5	5	5	5	5
Dynamic Insertion Loss for nozzle silencer	-5	-8	-9	-11	-12	-12	-10	-6
Dynamic Insertion Loss for outlet silencer	-4	-4	-4	-4	-4	-4	-4	-4
Corrected Outlet Sound Power Levels	98	100	96	92	90	86	82	77

Corrections for 15 m Distance	-31	-31	-31	-31	-31	-31	-31	-31
Sound Levels (15 m)	67	69	65	61	59	55	51	46
'A' Scale Corrections	-26	-16	-9	-3	0	1	1	-1
dB'A' Spectrum (15 m)	41	53	56	58	59	56	52	45

Net Sound Level at 15 m: 64dB'A' (at 50Hz) / 61dB'A' (at 44.5Hz)

Not all inline and silencer nozzle combinations have been tested in conjunction with each other for sound performance. The results of the additional attenuation of both sets of silencers in this arrangement is conservatively estimated based off of similar applications. Please contact Strobic Air for additional information regarding sound values.

Last revised date October, 2015

Strobic Air Corporation
A Cincinnati Fan Company
140 W Orvilla Rd.
Lansdale, PA 19446
Phone: (215) 723-4700 | Fax: (215) 723-7401
www.choosetristack.com | www.strobicair.com

Preston HQW Rev2

Strobic Air Energy Analysis and Comparison for Preston HQW

Fan Data

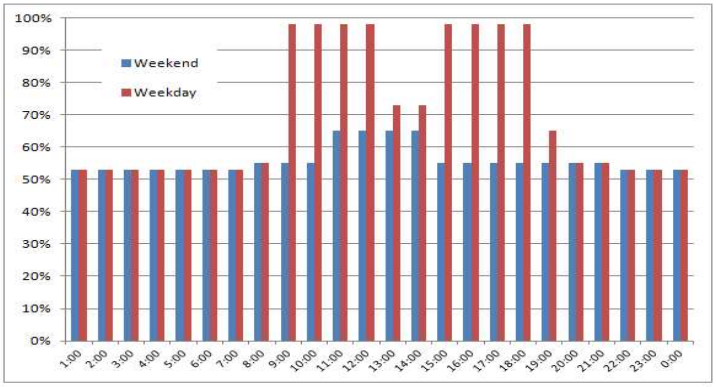
Model: **TS4S750A15M**

Fans Running/Redundant: **3 / 0**

Motor HP: **75 BkW (Premium Efficiency)**
Motor Voltage: **415**
Motor RPM: **1475**

Design Flow Rate: **51.6 m^3/sec**
Design Static Pressure: **805 Pa.**

Electric rate: **0.15**



*Fume Hood Diversity Schedule is the standard taken from ASHRAE 90.1-2007 App. G. Energy usage and cost are calculated using values which maintain the minimum safe nozzle velocity for the specified fans.

Annual Power Cost To Run the System

At Full Speed[1]

Fan Flow Rate: **51.888 m^3/sec**
Static Pressure: **805 Pa.**
Bypass Air: **0.288 m^3/sec**
Frequency: **44.5 Hz**
Bhp: **109.8 BkW**
Est. Annual Kw used: **714,790.70 kw/year**
Est. Annual Operating Cost: **$107,218.60**

With a Strobic Air Smart System & VFD(s)[1, 2]

Fan Flow Rate: **Varies by Demand**
Static Pressure: **Varies by Demand**
Bypass Air: **Varies by Demand**
Frequency: **Varies by Demand**
Bhp: **Varies by Demand**
Est. Annual Kw used: **355,941.80 kw/year**
Est. Annual Operating Cost: **$53,391.28**

Annual Savings:

$53,827.32 [3]

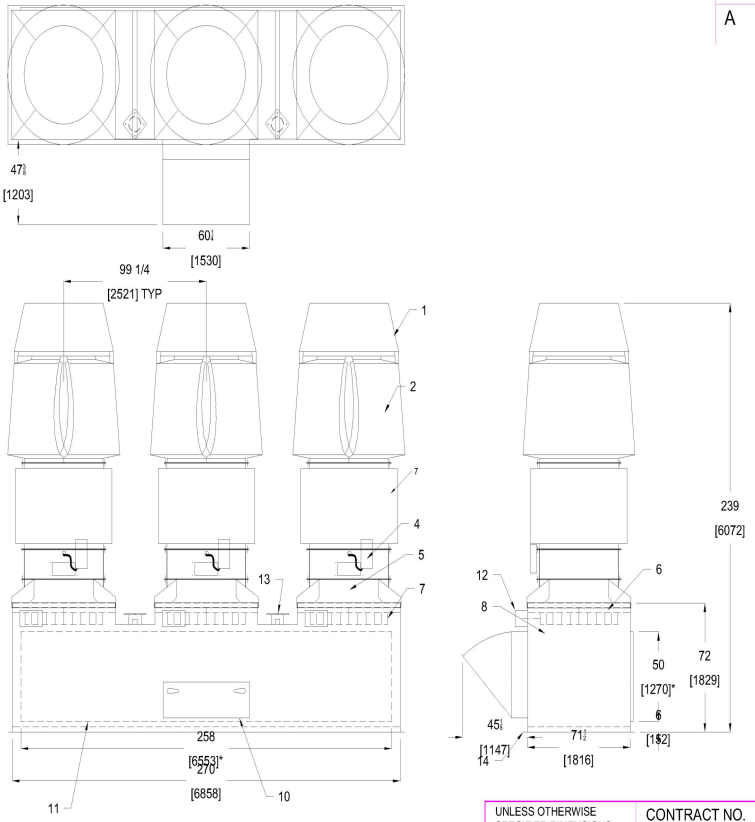
Strobic Air's Smart System continuously monitors system demand to optimize control of the fans and dampers to maintain the design nozzle velocity while minimizing energy consumption. The Smart System also allows for easy monitoring and control of fans, as well as secure remote access to fan controls. Option are available to monitor and account for other factors (e.g. atmospheric conditions).

[1]Costs listed are estimated annual fan operating cost only, based on the fan(s) operating at standard atmospheric conditions.
[2]Savings calculated based on reduced demand percentages as specified by ASHRAE 90.1-2007 App. G. Actual demand may vary.
[3]Since the actual demand may vary from the ASHRAE 90.1-2007 App. G. standard, actual savings may vary.
** Any additional equipment costs or savings from energy recovery systems are not factored in.

Project Drawings

Fan reference: Preston HQW

REVISION			
LTR.	DESCRIPTION	DATE	APPROVED
A	CHANGED TOTAL WEIGHT	2/26/15	ARM



NOTES:
1) ENTRAINMENT WIND BAND (TYP-3)
2) TRI-STACK SILENCER NOZZLE (TYP-3)
3) MOTOR (TYP-3) (NOT SHOWN)
4) DISCONNECT SWITCH (TYP-3)
5) FAN HOUSING (TYP-3)
6) VORTEX BREAKER (TYP-3) (OPTIONAL)
7) ISOLATION DAMPER (TYP-3)
8) SINGLE-WALLED MIXING PLENUM
9) BYPASS DAMPER W/RAINHOOD (TYP-2)
10) ACCESS DOOR
11) 258" LONG X 50" WIDE DUCT CONNECTION*
12) ISOLATION DAMPER ACTUATOR (TYP-3)
13) JIB SOCKET (OPTIONAL)
14) 3" FLANGE FOR MOUNTING TO STRUCTURE
15) 4' OUTLET SILENCER (TYP-3)

ADDITIONAL NOTES:
I) STROBIC AIR RECOMMENDS THAT DUCT INLET CONDITIONS FOLLOW ASHRAE & SMACNA GUIDELINES TO MINIMIZE SYSTEM EFFECT. MAXIMUM INLET VELOCITY SHOULD NOT EXCEED 1200 FPM

II) MOUNTING INSTRUCTIONS: PLENUM TO HAVE FULLY SUPPORTED PERIMETER. PLENUM CAN BE EITHER STEEL MOUNTED OR CURB MOUNTED. OVERALL SIZE OF CURB SHOULD BE (A - 2") X (B - 2")

TOTAL WEIGHT: 16,063 LBS. [7,286 KG]

DIMENSIONS GIVEN IN INCHES [MILLIMETERS]

NOTE: BECAUSE WE ARE CONSTANTLY STRIVING TO IMPROVE OUR PRODUCTS, WE RESERVE THE RIGHT TO PROVIDE VERSIONS OF THESE PRODUCTS WITH SLIGHT VARIATIONS FROM THOSE ILLUSTRATED HERE.

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* INLET DIMENSIONS GIVEN ARE STANDARD SIXES SIZED FOR A 1200 FPM INLET VELOCITY WITH BOTH FANS RUNNING AT 2" W.G. PLEASE CONSULT FACTORY IF INLET CONDITIONS ARE LESS THAN 2" W.G. AS OPENING SIZE MAY NEED TO BE ADJUSTED TO ACCOMODATE THIS MAXIMUM INLET VELOCITY (SEE NOTE I)

** WEIGHTS ARE CALCULATED BASED ON THE GIVEN DIMENSIONS, USING BOTH STANDARD NOZZLES AND SILENCER NOZZLES. THESE ARE MAXIMUM VALUES ONLY, AND COULD CHANGE SLIGHTLY DEPENDING ON SPECIFIC MODEL NUMBERS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERENCES ARE = XX = = XXX=	CONTRACT NO.	(3) TS-4 FANS SIDE INLET W/ SILENCER NOZZLES & 4' OUTLET SILENCERS SINGLE WALL PLENUM	
	APPROVALS / DATE	STROBIC AIR® CORPORATION 700 EMLEN WAY TELFORD, PA. 18969	
MATERIAL	DRAWN ECA 4/9/09		
	CHECKED		
	LAYOUT		
FINISH	U.S. PATENT NO. 6,431,974 U.S. PATENT NO. 6,112,850 U.S. PATENT NO. 4,806,706 CANADIAN PATENT NO. 1,277,171	SIZE B / CODE IDENT. NO. TS4_3_SI_SN4FT_SW / DRAWING NO. 040909E-1	
		SCALE: N.T.S.	SHEET 1 OF 1

PDF Drawing CAD Drawing Revit Drawing

Strobic Air Corporation
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Tel: 215-723-4700 • Fax: 215-723-7401
tristack@strobicair.com • www.strobicair.com

SUBMITTAL REVIEW

The Strobic Safety Design Response Team has reviewed the equipment selections in the attached submittal for compliance with the American National Standards Institute Z9.5 (1992), "Standard for Laboratory Ventilation". All scheduled performance requirements are supplied by the owner's representative. Designed in conformance with AMCA 99, AMCA 211, AMCA 311 & ASHRAE handbook.

Discharge Velocity: The review indicates the equipment performance meets the minimum discharge velocity requirements of 3000 fpm.

Wind Analysis: Strobic has assumed that the owner's representative has conducted or reviewed the need for a study of the air flow patterns around the building / site (wind analysis) similar to the procedures outlined in the ASHRAE Handbook (1999), Chapter 43, and has also performed or reviewed the need for a Dispersion Analysis. The performance data in this submittal is presented in a format that notes both effective stack height (plume rise) and wind band dispersion, for easy verification of these analyses by the owner's representative.

Equipment Height: Where architectural screen heights and adjacent building heights are known, Strobic has reviewed the equipment heights for conformity to ANSI Z9.5.

Redundancy Requirements: Redundancy requirements were reviewed where system operations were supplied by the owner's representative.

System Effects: Inlet velocities and potential system effects immediately adjacent to the plenum supplied with this equipment were not reviewed. Factory supplied connections have been sized for the fan's flow rate. It is recommended that this size be maintained and free from bends for at least 3 diameters up stream of the fan to avoid system effects. If inlet velocities exceed 1500 fpm or if elbows are located near the duct connection, system effects and reduced fan performances could result. Strobic certifies the fan flow and pressure performance stated in this submittal are de-rated for losses through plenum (at duct inlet velocities of up to 1500 fpm), isolation damper, fan and outlet stack arrangements supplied by the factory only.

Vibration Isolation: Vibration isolation is normally not required with curb installations. If fans are hard mounted on a structural base, we recommend a full perimeter support with waffle pad isolation. However, a review of the roof structure should be conducted by the owner's representative for structural rigidity and possible resonance at the fan frequency, particularly at 900 rpm. When adjustable speed drives are employed, it may be necessary to avoid certain frequencies where resonance with ductwork, roof and other structural members may occur. Strobic recommends that the start-up services by the drive manufacturer be employed after the building controls are fully installed to assist in air balance, drive control logic, vibration and motor overload avoidance.

Motors: The motors supplied with this equipment are designed for standard 230/460 volt applications and have been prewired at the factory to the voltage specified by the owner's representative. Input voltage to the motor must be supplied to within 10% of the nameplate volts. Otherwise, damage to the motor could result. Standard motors are usable on a 208 volt system; however, the minimum supply voltage requirement is 207 volts. Supplying these motors with lower voltage may produce insufficient motor torque with the motor unable to achieve full speed. Low or high voltage (beyond the +/-10% range) can also cause motor overheating, increased amp draw (even with higher voltages), reduced motor life, and damage not covered by warranty. If low or high voltage is suspected, contact the factory for special motors designed for your voltage before the order is released to production.

Sound Levels: The published sound power levels presented in this submittal are based on actual tests conducted on a like-size fan in accordance with AMCA 300 procedures. The resultant sound levels are calculated based on formulas shown in the Strobic Engineering Guide. Cautionary Note: These formulas and explanations are simplified in the interest of brevity. They are accurate enough for most laboratory situations. However, these calculations are not intended to replace a more sophisticated analysis where it may be needed, particularly atmospheric effects and where site structures may cause reflected sound effects. When attenuators are employed, resultant airborne path sound levels may be lower than radiated stack sound levels and may require further analysis in critical neighborhood exposures.

UL705 Certification: All systems are certified, tested and labeled under UL 705.

Factory Certification: All fans are tested at the factory for vibration, amperage draw and mechanical integrity. A permanent record of these tests is maintained at the factory and is available upon written request.

Seismic Requirements: Although Strobic Air fans have been tested to resist a 125 mph crosswind without the need for guy wires (when installed according to factory specifications), Strobic Air drawings are not seismic recommendations. It may be necessary to have a licensed professional engineer review the local building code requirements where the equipment is to be installed.

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valspar
if it matters, we're on it.®

Technical Data

1101 South 3rd Street
Minneapolis, MN 55415
612-851-4374

Date: May 17, 2018

Product # PFY90001

Product Description: YELLOW EPOXY TANK COATING

Specifications			
Physical Properties:			
Chemical Type	EPOXY		
Specific Gravity	1.43 ± 0.05		
Theoretical Coverage	134.81 SQ FT/LB @ 1 MIL		
Other Information			
Film Properties		**Method**	
Recommended Film Thickness			5 - 7 MIL
Flexibility (Conical Mandrel)		ASTM D-522	PASS
Adhesion		ASTM D-3359	PASS
Gloss (60 degrees)		ASTM D-523	90 Minimum GU
Cure Cycle	10 MIN. AT 400F		
Appearance	SMOOTH		
Application	ELECTROSTATIC SPRAY		
Pretreatment:	All testing was performed on clean panels with appropriate pretreatment. Proper pretreatment will enhance performance of this product.		
Substrate:	IRON PHOSPATE CHEMCIAL WASH		
Maximum Field Use Dry Film Thickness			
Number of Coats			
Recoat/Cure Time			
Maximum Thinner			
End Use			

The data on this sheet represent typical values. Since application variables are a major factor in product performance, this information should serve only as a general guide. Valspar assumes no obligation or liability for use of this information. **UNLESS VALSPAR AGREES OTHERWISE IN WRITING, VALSPAR MAKES NO WARRANTIES, EXPRESS OR IMPLIED, AND DISCLAIMS ALL IMPLIED WARRANTIES INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR FREEDOM FROM PATENT INFRINGEMENT. VALSPAR WILL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES.** Your only remedy for any defect in this product is the replacement of the defective product, or a refund of its purchase price, at our option. The information in this sheet, as well as the products referenced herein, shall be considered "Confidential Information". Wet samples and uncured samples of these products shall be maintained as confidential and shall not be disclosed to any third party without the prior written permission of Valspar.

TECHNICAL INFORMATION

POWDURA® GRAFFITI RESISTANT POLYESTER URETHANE POWDER COATING

PRODUCT DESCRIPTION

KAS9V0004

CF Strobic Gray

POWDURA® Graffiti Resistant Polyester Urethane Powder Coatings are formulated to be resistant to most graffiti. They offer a unique combination of high hardness, abrasion and scratch resistance, resistance to graffiti cleaners, and exterior durability. Typical applications include buses, subways, signs, public telephones, and park furniture.

Storage: Powdura® Powder Coatings should be kept in a dry and cool area at temperatures below 80°F (27°C). When not in use, store powder in sealed containers: fine powders are hygroscopic.

Substrate Preparation: Substrate should be free of grease, oil, dirt, fingerprints, drawing compounds, any contamination, and surface preparation treatments to ensure optimum adhesion and coating performance properties. The use of a chemical conversion coating prior to the application of a powder coating is strongly recommended.

Testing: Due to the wide variety of substrates, surface preparation methods, application methods, and environments, the customer should test the complete system for adhesion, compatibility and performance prior to full-scale application.

CAUTIONS

Thoroughly review product SDS prior to using this product. Please consult your local sales representative or your local Sherwin-Williams facility for additional information.

APPLICATION

Cure Schedule:	10min@205°C(400°F)
Film Thickness Range(mils):	2.5-4.0 mils

ATTRIBUTES

Specific Gravity(g/ml):	1.26
Coverage at 1.0 Mil(ft^2/lb):	153.2
60° Gloss: (ASTM D-523)	85-999
Adhesion: (ASTM D-3359)	5B
Flexibility: (ASTM D-522)	1/8"
Pencil Hardness: (ASTM D-3363)	2H-3H
Impact Resistance(in.lb): (ASTM D-2794)	Dir 160 in-lbs Rev 160 in-lbs

Note: Performance measured using 24-gauge Bonderite® 1000 test panels.

Shelf Life: 12 Months

Sherwin-Williams recommends that all material be used in FIFO order (first in - first out). Materials that exceed the recommended shelf life should be tested prior to use.

Note:

Product Data Sheets are periodically updated to reflect new information relating to the product. It is important that the customer obtain the most recent Product Data Sheet for the product being used. The information, rating and opinions stated above pertain to the material currently offered and represent the results of tests believed to be reliable. However, due to variations in customer handling and methods of application, which are not known, or under our control, The Sherwin-Williams Company cannot make any warranties or guaranties as to the end results.

01 00X

MN Powder

04-Nov-2019

The Sherwin-Williams Company

Industrial & Marine Coatings

SeaGuard Marine & Specialty Coatings

Dura-Plate 154®

Strobic Air Corporation [Laboratory Exhaust Equipment Coating Specifications]

High Performance Interior Corrosion Resistant Coating System

A high solids, high build amine epoxy coating that will withstand extreme conditions of abrasion and corrosion.

Surface Preparation & Comments

- Abrasive blast clean to Sa2.5 (ISO 8501-1:1988) or SSPC-SP10. If oxidation has occurred between blasting and application, the surface should be reblasted to the specified visual standard. Surface defects revealed by the blast cleaning process, should be ground, filled, or treated in the appropriate manner
- A sharp, angular surface profile of 2-3 mils (50-75 microns) is recommended.

Area Size: 1 ft²

#	Product Name	Coat Type	VS (%)	Application Method	DFT (mil)	Overcoating Interval€Min - Max (77°F)	Pot Life at 77°F (25°C) (77°F)	PSR (ft²/gal)
1	Dura-Plate 154	Full Coat	85	Airless Spray, Brush, Roller, Air Spray	10.0	16 Hr - 7 Day	45 Min	136

Sherwin-Williams Dura-Plate® 154 is a high density barrier coating which provides broad spectrum chemical resistance and environmental protection in a one coat high build application. This diversity of chemical resistance establishes Dura-Plate® 154 as the material of choice for protection of fume hoods, fan blades, condenser housings and other chemical process equipment.

For specific chemical resistance requirements please consult Strobic Air Corporation's technical department.

The Sherwin-Williams Company

Industrial & Marine Coatings

SeaGuard Marine & Specialty Coatings

Dura-Plate 154®
Acrolon™218 HS

Strobic Air Corporation [Laboratory Exhaust Equipment Coating Specifications]

High Performance Exterior Corrosion Resistant Coating System (with added ultraviolet protection)

A high solids, high build amine epoxy base coating that will withstand extreme conditions of abrasion and corrosion with a high gloss urethane top coating that provides color and gloss retention for exterior exposure.

Surface Preparation & Comments

- Abrasive blast clean to Sa2.5 (ISO 8501-1:1988) or SSPC-SP10. If oxidation has occurred between blasting and application, the surface should be reblasted to the specified visual standard. Surface defects revealed by the blast cleaning process, should be ground, filled, or treated in the appropriate manner
- A sharp, angular surface profile of 2-3 mils (50-75 microns) is recommended.

Area Size: 1 ft²

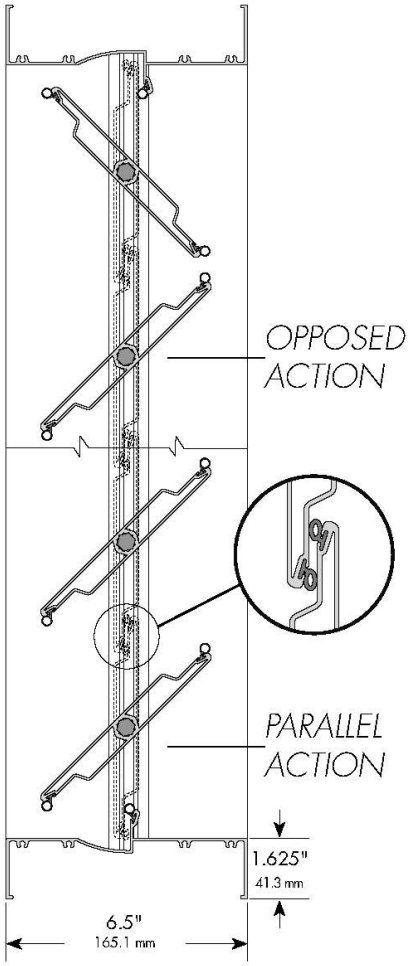
#	Product Name	Coat Type	VS (%)	Application Method	DFT (mil)	Overcoating Interval€Min - Max (77°F)	Pot Life at 77°F (25°C) (77°F)	PSR (ft²/gal)
1	Dura-Plate 154	Full Coat	85	Airless Spray, Brush, Roller, Air Spray	10.0	16 Hr - 7 Day	45 Min	136
2	Acrolon 218 HS	Full Coat	65	Airless Spray, Brush, Roller	3.0	8 Hr – 3 months	2 Hr	346

The Sherwin-Williams Dura-Plate® 154 base coat is a high density barrier coating which provides broad spectrum chemical resistance and environmental protection in a one coat high build application. This diversity of chemical resistance establishes Dura-Plate® 154 as the material of choice for protection of fume hoods, fan blades, condenser housings and other chemical process equipment.
The Sherwin-Williams Acrolon 218 HS top coat is an acrylic polyurethane finish providing excellent durability and color and gloss protection for exterior exposure.

Isolation Dampers - Spec D

Aluminum Damper 6" Deep Frame, Opposed Blade, Safety Screen, Epoxy Coated

Flanged to Duct
Install Type



Patent Pending

S E R I E S 1 0 0 0

AIR-FOIL CONTROL DAMPER WITH FULL-PROFILE FRAME & ELEVATED TEMPERATURE OPTIONS

Manufactured for Strobic Air Corporation only.

1. Extruded aluminum (6063-T5) damper frame is not less than 0.080" (2.03 mm) in thickness. Damper frame is 6.5" (165.1 mm) deep x 1.625" (41.3 mm), with mounting flanges on both sides of frame. Mounting holes are pre-drilled on rear flange only.
2. Specifically engineered frame profile provides a larger free area and reduced pressure drop.
3. Blades are extruded aluminum (6063-T5) air-foil profiles.
4. Blade and frame seals are extruded silicone, secured in an integral slot within the aluminum extrusions. Seals are mechanically fastened to prevent shrinkage and movement over the life of the damper.
5. Bearings are composed of a bronze oilite inner bearing (fixed around a 7/16" (11.11 mm) aluminum hexagon blade pivot pin) rotating within a bronze oilite outer bearing inserted in the frame.
6. Adjustable 7/16" (11.11 mm) x 24" (609.6 mm) hexagonal drive rod is stainless steel. U-bolt fastener and hexagonal retaining nuts are zinc-plated steel. These provide a positive connection to blades and linkage.
7. Aluminum and corrosion-resistant zinc-plated steel linkage hardware is installed in the frame side, complete with cup-point trunnion screws for a slip-proof grip. Trunnion bearing is bronze oilite.
8. Dampers are designed for operation in temperatures ranging from -40°F (-40°C) to 300°F (149°C).
   (This is not a UL approved product. For UL Approved Smoke Dampers refer to Series 1000 SM and 1000 SM SW Specifications)
9. Leakage does not exceed 3 cfm/ft² (15.2 l/s/m²) against 1 in w.g. (0.25 kPa) differential static pressure.
10. Dampers are custom made to required size, without blanking off free area.
11. Dampers are available with either opposed blade action or parallel blade action.
12. Dampers are available in Flanged to Duct install type only.
13. Installation of dampers must be in accordance with TAMCO's current installation guidelines, provided with each damper shipment. *(Note that all technical information available on TAMCO's web site at www.tamcodampers.com supersedes and takes precedence over all information contained within the printed catalog.)*

PAINT FINISH: Spraylat Powder Coat Gray Primer.

FLANGED TO DUCT TYPE

Finished damper O.D. is 3.25" (82.6 mm) greater than opening width & height dimensions

Minimum section size:	4½"w x 4¼"h	*(115 mm x 108 mm)*
Maximum section size:	25 ft²	*(2.3 m²)*
	60"w x 60"h or	*(1524 mm x 1524 mm) or*
	48"w x 75"h	*(1220 mm x 1905 mm)*

Multiple sections cannot be linked and each section must be operated independently.

Always provide opening width and height dimensions, when ordering.
Width dimension is always parallel to blades.
Height dimension is always perpendicular to blades.

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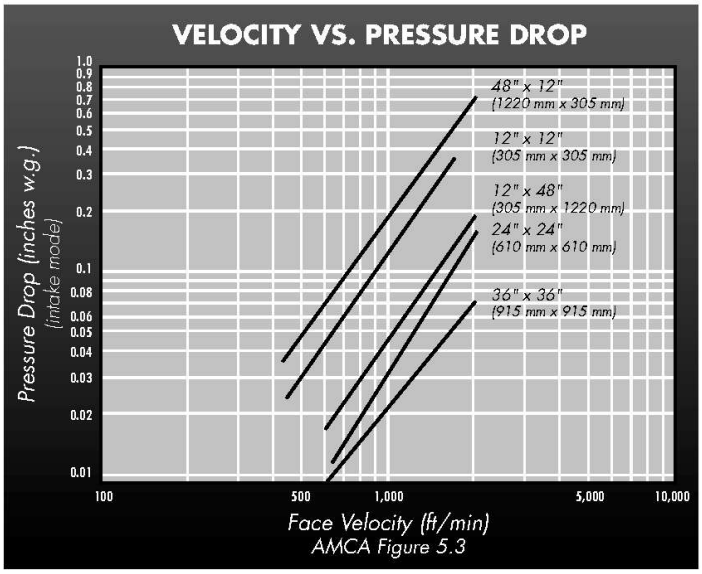
PERFORMANCE DATA

SERIES 1000
AIR-FOIL CONTROL DAMPER



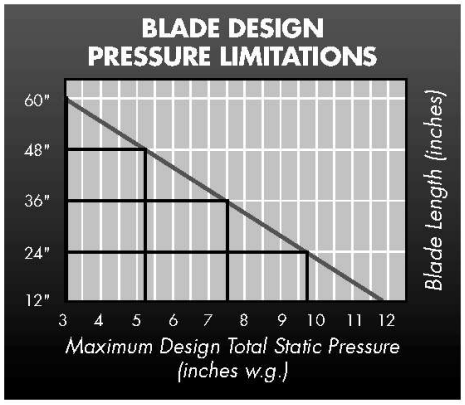
FREE AREA

FEET SQUARED

HEIGHT (inches) \ WIDTH (inches)	12	24	36	48	60	72	84	96	108	120
12	0.73	1.46	2.19	2.92	3.65	4.13	4.86	5.59	6.32	7.05
24	1.63	3.25	4.88	6.50	8.13	9.21	10.83	12.46	14.08	15.71
36	2.47	4.77	7.16	9.54	11.93	13.52	15.90	18.29	20.67	23.06
48	3.28	6.56	9.84	13.13	16.41	18.59	21.88	25.16	28.44	31.72
60	4.18	8.35	12.53	16.71	20.89	23.67	27.85	32.02	36.20	40.38
72	5.07	10.15	15.22	20.29	23.67	28.75	33.82	38.89	42.27	47.35
84	5.44	10.88	16.31	21.75	27.19	30.81	36.25	41.69	47.13	52.56
96	6.23	12.46	18.69	24.92	31.15	35.30	41.53	47.58	53.99	60.22
108	7.13	14.25	21.38	28.50	35.63	40.38	47.50	54.63	61.75	68.88
120	8.02	16.04	24.06	32.08	40.10	45.45	53.47	61.49	69.51	77.54

PERCENTAGE

HEIGHT (inches) \ WIDTH (inches)	12	24	36	48	60	72	84	96	108	120
12	73.00	73.00	73.00	73.00	73.00	68.83	69.43	69.88	70.22	70.50
24	81.50	81.25	81.33	81.25	81.30	76.75	77.36	77.88	78.22	78.55
36	82.33	79.50	79.56	79.50	79.53	75.11	75.71	76.21	76.56	76.87
48	82.00	82.00	82.00	82.06	82.05	77.46	78.14	78.63	79.00	79.30
60	83.60	83.50	83.53	83.55	83.56	78.90	79.57	80.05	80.44	80.76
72	84.50	84.58	84.56	84.54	78.90	79.86	80.52	81.02	78.28	78.92
84	77.71	77.71	77.67	77.68	77.69	73.36	73.98	74.45	74.81	75.09
96	77.88	77.88	77.88	77.88	77.88	73.54	76.16	74.34	74.99	75.28
108	79.22	79.17	79.19	79.17	79.18	74.78	77.40	75.88	76.23	76.53
120	80.20	80.20	80.20	80.20	81.20	75.75	76.39	76.86	77.23	77.54



Series 1000 dampers, whose blade length exceeds the maximum design pressure, may be reconfigured to maintain a blade length compatible with the required system pressure by increasing the number of sections per damper and thereby reducing each damper section's blade length. Appropriate intermediate structural support will be required for all multiple-section damper assemblies. *(Refer to line 13 in the specifications on page 1 and to TAMCO's Aluminum Damper Installation Guidelines.)*

Example: 1 section damper of 60"w x 36"h (1524 mm x 915 mm) at 5 in w.g. (1.24 kPa) would need to be built in 2 sections of 30"w x 36"h (762 mm x 915 mm).

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TAMCO®
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NFBUP, NFBUP-S, NFXUP, NFXUP-S

On/Off, Spring Return, 24 to 240 VAC

Torque min. 90 in-lb, for control of air dampers

Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact, or a manual switch.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

Operation

The NFB and NFX series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator.

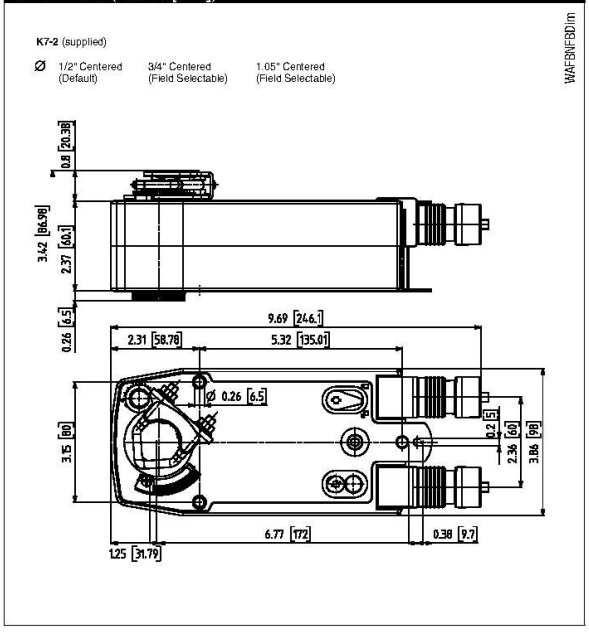
The NFB and NFX series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°.

The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches.

The NFBUP-S and NFXUP-S versions are provided with two built-in auxiliary switches. These SPDT switches provide safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at +10°, the other switch function is adjustable between +10° to +90°. The NFBUP, NFBUP-S, NFXUP and NFXUP-S actuator is shipped at +5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.

Technical Data		NFBUP, NFBUP-S, NFXUP, NFXUP-S
Power supply		24...240 VAC -20% / +10%, 50/60 Hz 24...125 VDC ±10%
Power consumption	running	6 W
	holding	2.5 W
Transformer sizing		6 VA @ 24 VAC (class 2 power source) 6.5 VA @ 120 VAC 9.5 VA @ 240 VAC
Electrical connection		
NFBUP...		3 ft, 18 GA appliance cable, 1/2" conduit connector **-S models:** Two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
NFXUP...		3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance cable, with or without 1/2" conduit connector **-S models:** two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables with or without 1/2" conduit connectors
Overload protection		electronic throughout 0 to 95° rotation
Control		on/off
Torque		90 in-lb [10 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor	< 75 seconds
	spring	20 seconds @ -4°F to 122°F [-20°C to 50°C]; < 60 seconds @ -22°F [-30°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		Nema 2, IP54, Enclosure Type2
Housing material		zinc coated metal and plastic casing
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		<50dB(A) motor @ 75 seconds ≤62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		4.15 lbs (1.9 kg), 4.4 lbs (2.0 kg) with switches
† Rated Impulse Voltage 4kV, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.		
NFBUP-S, NFXUP-S		
Auxiliary switches		2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°

Dimensions (Inches [mm])



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Accessories

AV 8-25	Shaft extension
IND-AFB	Damper position indicator
K7-2	Universal clamp for up to 1.05" dia jackshafts
KH-AFB	Crank arm
TF-CC US	Conduit fitting
Tool-06	8mm and 10 mm wrench
ZG-100	Universal mounting bracket
ZG-101	Universal mounting bracket
ZG-118	Mounting bracket for Barber Colman® MA 3../4.., Honeywell® Mod III or IV or Johnson® Series 100 replacement or new crank arm type installations
ZG-AFB	Crank arm adaptor kit
ZG-AFB118	Crank arm adaptor kit
ZS-100	Weather shield (metal)
ZS-150	Weather shield (polycarbonate)
ZS-260	Explosion-proof housing
ZS-300	NEMA 4X housing

Note: When using NFBUP, NFBUP-S, NFXUP, NFXUP-S actuators, only use accessories listed on this page.

For actuator wiring information and diagrams, refer to Belimo Wiring Guide.

Typical Specification

On/Off spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a jackshaft up to a 1.05" diameter. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided having the capability of one being adjustable. Actuators with auxiliary switches must be constructed to meet the requirements for Double Insulation so an electrical ground is not required to meet agency listings. Actuators shall be cULus Approved and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

Wiring Diagrams

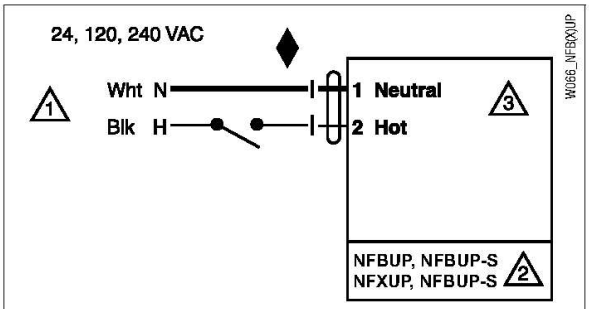
INSTALLATION NOTES

1. Provide overload protection and disconnect as required.
2. ***CAUTION** Equipment Damage!*
   Actuators may be connected in parallel.
   Power consumption and input impedance must be observed.
3. No ground connection is required.
4. For end position indication, interlock control, fan startup, etc., NFBUP-S and NFXUP-S incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 90°.

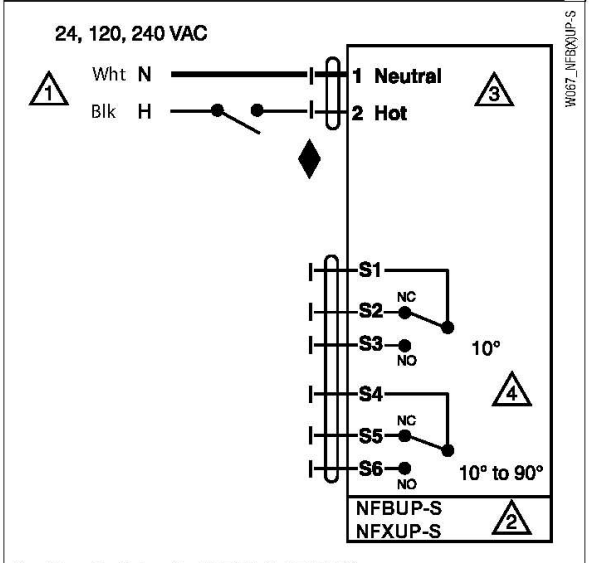
APPLICATION NOTES

- Meets cULus requirements without the need of an electrical ground connection.

***WARNING** Live Electrical Components!*
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



On/Off wiring for NFBUP, NFXUP



Auxiliary Switches for NFBUP-S, NFXUP-S

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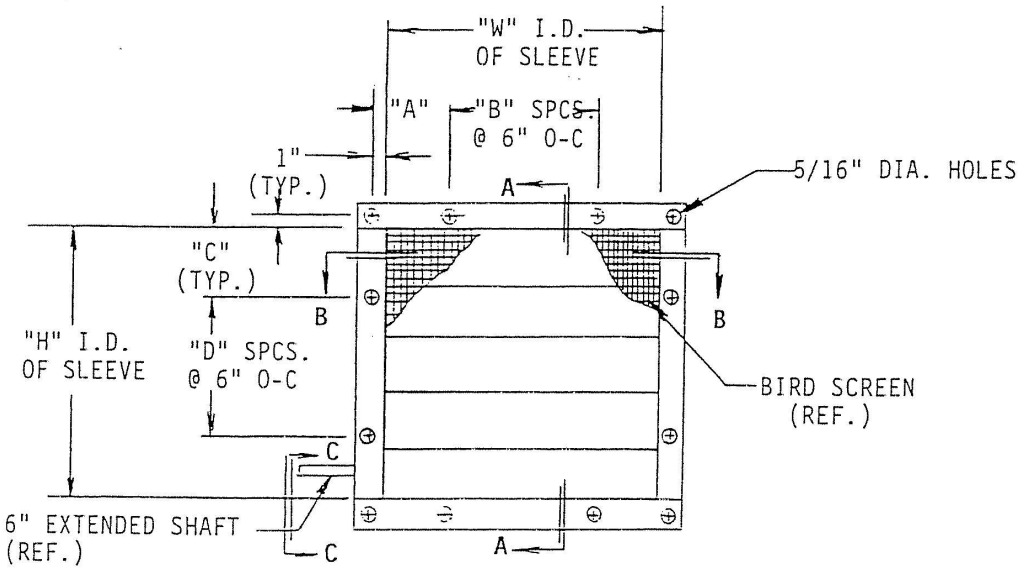
CHG LTR	REVISION	DATE	APVD
A	SEE ECN - 7623	3/99	



FRONT ELEVATION

ITEM	QTY	"W" I.D.	"H" I.D.	"A"	"B"	"C"	"D"
A		48"	36"	4"	7	3"	5
B		42"	34"	4"	6	3"	4
C		60"	36"	4"	9	3"	5
D		60"	48"	4"	9	3"	7

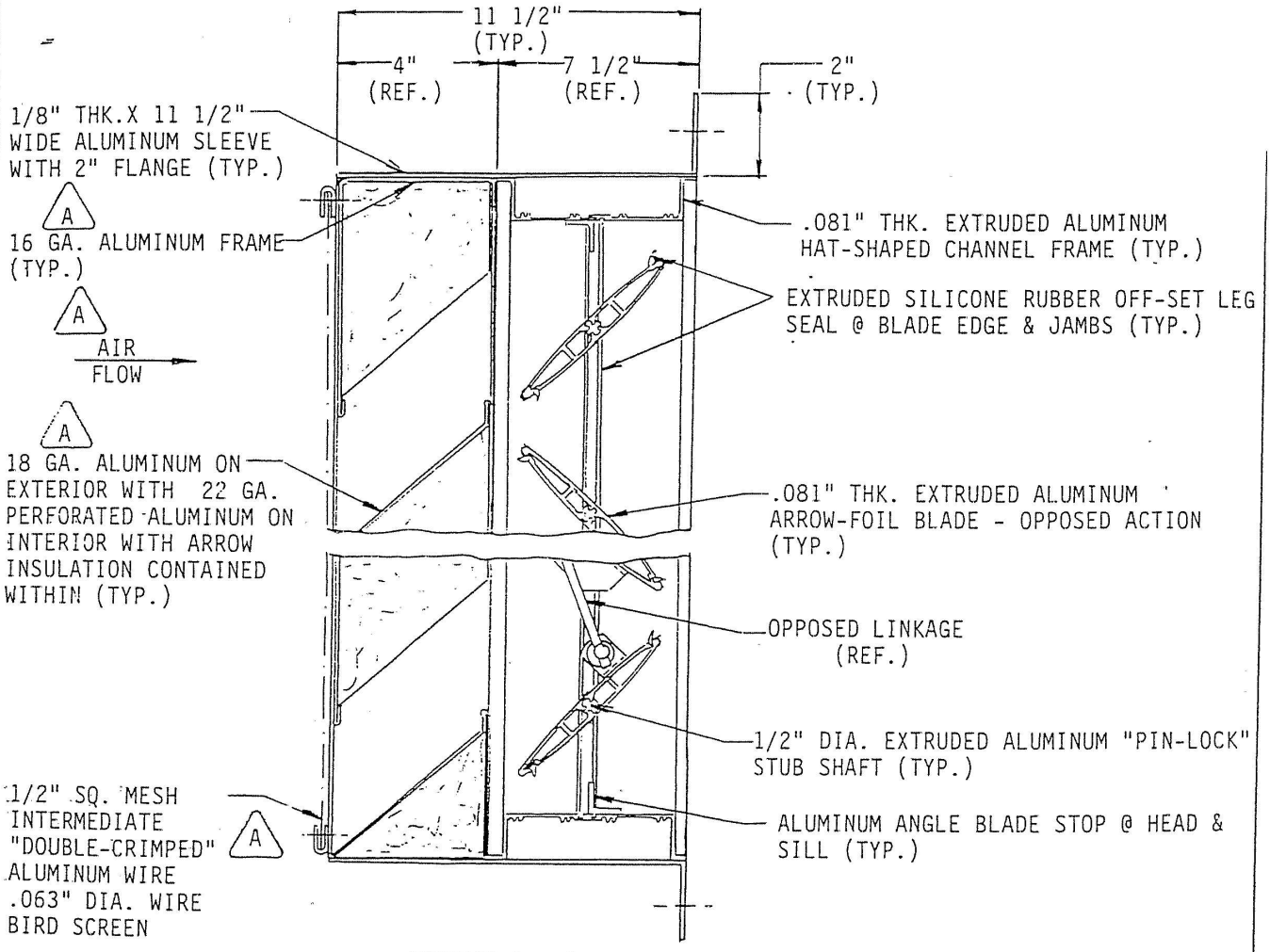
NOTES:
1. FINISH: MILL.
2. DAMPER GREATER THAN 48" WIDE ARE MADE IN (2) SECTIONS AND DRIVEN BY ONE DRIVE SHAFT

ARROW UNITED INDUSTRIES
A Divison of Mestek, Inc.
314 Riverside Drive - P.O. Box 69 - Wyalusing, PA 18853

AGENT:

CUST. STROBIC AIR		FS-401-HF LOUVER & OBDAF-207 IN SLEEVE	
CONTR.			
ARCH.			
P.O.		PROJECT	
DWN. T.B.	DATE 1/18/99	ARROW JOB NO. E-3000	DWG. NO. 35914
CKD.	EDR. 11118		SHT 1 OF 4

CHG LTR	REVISION	DATE	APVD
A	SEE ECN - 7623	3/99	



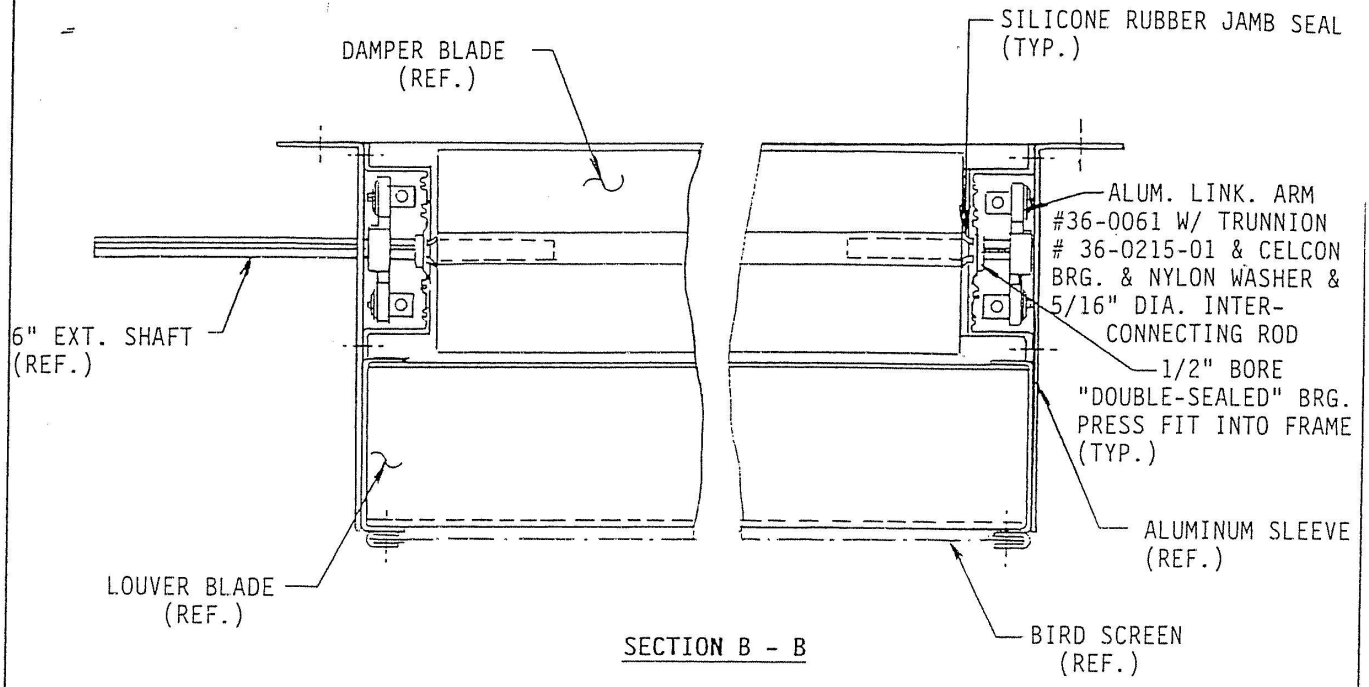
SECTION A - A

ARROW UNITED INDUSTRIES
A Divison of Mestek, Inc.
314 Riverside Drive - P.O. Box 69 - Wyalusing, PA 18853

AGENT:

CUST. STROBIC AIR		FS-401-HF LOUVER & OBDAF-207 IN SLEEVE	
CONTR.			
ARCH.			
P.O.		PROJECT	
DWN. T.B.	DATE 1/18/99	ARROW JOB NO. E-3000	DWG. NO. 35914
CKD.	EDR. 11118		SHT 2 OF 4

CHG LTR	REVISION	DATE	APVD
A	SEE ECN - 7623	3/99	



SECTION B - B

ARROW UNITED INDUSTRIES
A Divison of Mestek, Inc.
314 Riverside Drive - P.O. Box 69 - Wyalusing, PA 18853

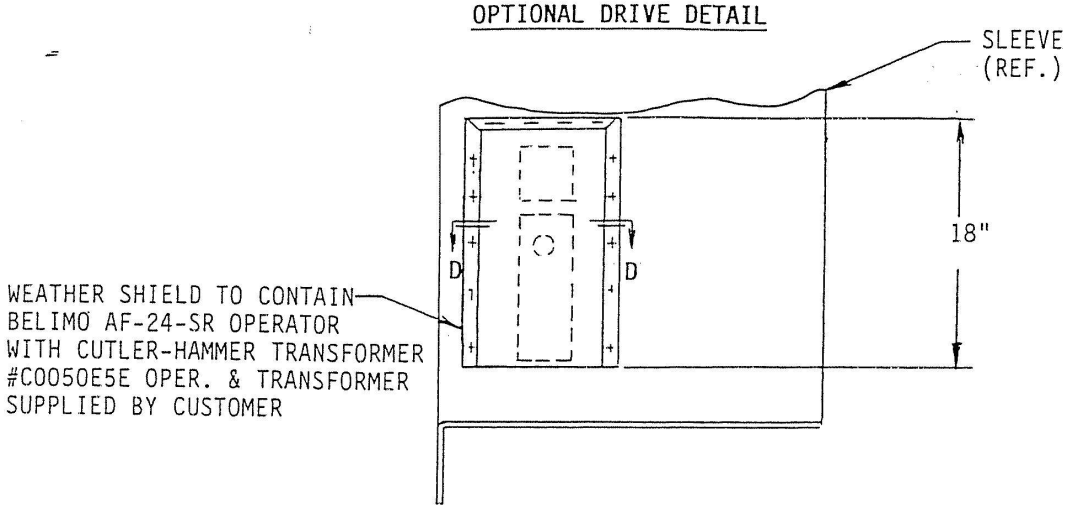
AGENT:

CUST. STROBIC AIR		FS-401-HF LOUVER & OBDAF-207 IN SLEEVE	
CONTR.			
ARCH.			
P.O.		PROJECT	
DWN. T.B.	DATE 1/19/99	ARROW JOB NO.	DWG. NO. 35914
CKD.	EDR. 11118	E-3000	SHT 3 OF 4

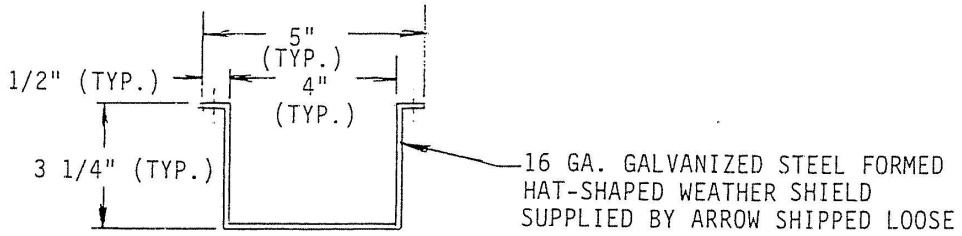
CHG LTR	REVISION	DATE	APVD
A	SEE ECN - 7623	3/99	

A

OPTIONAL DRIVE DETAIL



SECTION C - C



SECTION D - D

ARROW UNITED INDUSTRIES
A Divison of Mestek, Inc.
314 Riverside Drive - P.O. Box 69 - Wyalusing, PA 18853

AGENT:

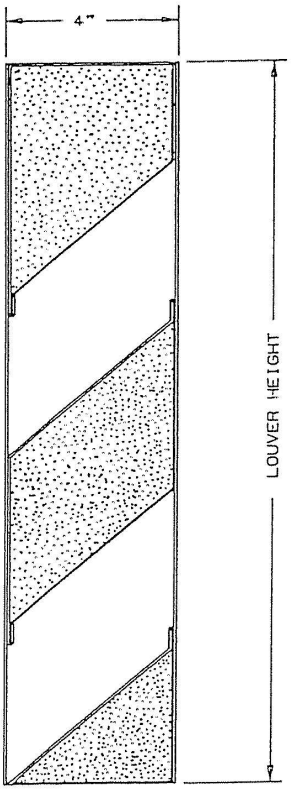
CUST. STROBIC AIR		FS-401-HF LOUVER & OBDAF-207 IN SLEEVE	
CONTR.			
ARCH.			
P.O.		PROJECT	
DWN. T.B.	DATE 1/19/99	ARROW JOB NO. E-3000	DWG. NO. 35914
CKD.	EDR. 11118		SHT 4 OF 4

ARROW ACOUSTICAL LOUVER 4" DEEP

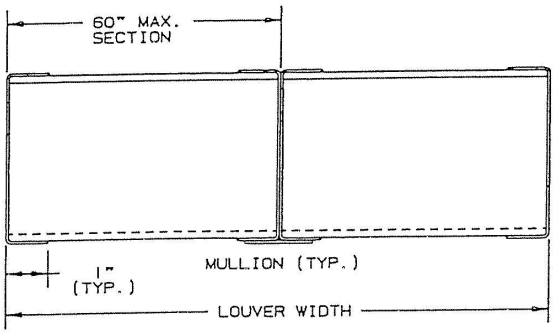
TYPE FS-401-(LF/HF)

FORMED STEEL - 45° STATIONARY

THE ARROW MODEL FS-401 IS A NARROW DEPTH LOUVER, ONLY 4" DEEP.



NOT TO SCALE



SPECIFICATIONS

FRAME: 16 GA. GALVANIZED STEEL
BLADE: 18 GA. GALVANIZED STEEL ON EXTERIOR WITH 22 GA. GALVANIZED PERFORATED STEEL ON INTERIOR SURFACE. APPROXIMATE BLADE CENTERS 7 1/2"
INSULATION: ARROW SOUND INSULATION
SCREEN: 1/2" SQ. MESH, 19 GA. GALVANIZED (.041"), WHEN INDICATED
CONSTRUCTION: RIVETED AND OR WELDED, WITH HEAD, SILL AND BLADES CONTAINED WITHIN JAMBS

FINISH: MILL, OTHER _____
MINIMUM PANEL SIZE: 12"x18"
MAXIMUM SINGLE PANEL SIZE: 60"x96"

FOR PERFORMANCE DATA - SEE REVERSE SIDE

LOUVERS WILL BE FABRICATED 1/2" SMALLER THAN OPENING SIZE UNLESS OTHERWISE SPECIFIED.

ITEM	QTY.	OPENING SIZE WIDTH	OPENING SIZE HEIGHT	LOUVER SIZE WIDTH	LOUVER SIZE HEIGHT	MULL	SCREENS TYPE	SCREENS LOC

UNION MADE

ARROW UNITED INDUSTRIES
A DIVISION OF MESTEK, INC.
314 RIVERSIDE DRIVE
WYALUSING, PA 18853
TEL: (717)746-1888 FAX: (717)746-9286

AGENT: _____

ARCH./ENG.:
CONTR.:
PROJECT:
EDR: ECN: JOB:
DATE: DWN.: DWG.:

LOUVER MODEL FS-401

ACOUSTICAL LOUVER

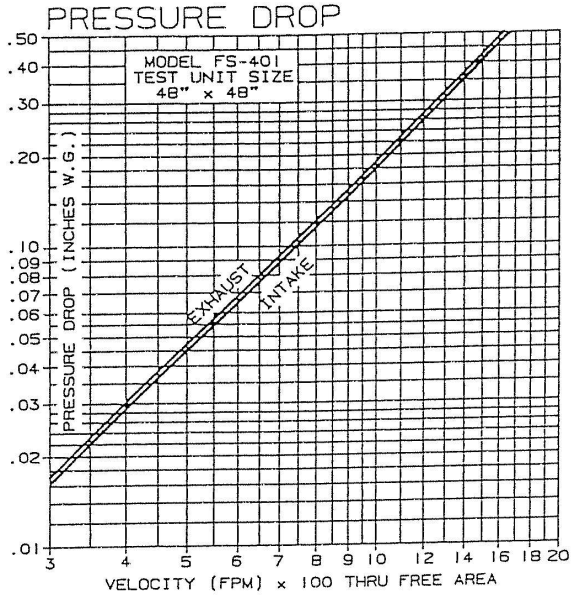
FORMED STEEL - STATIONARY

PERFORMANCE DATA

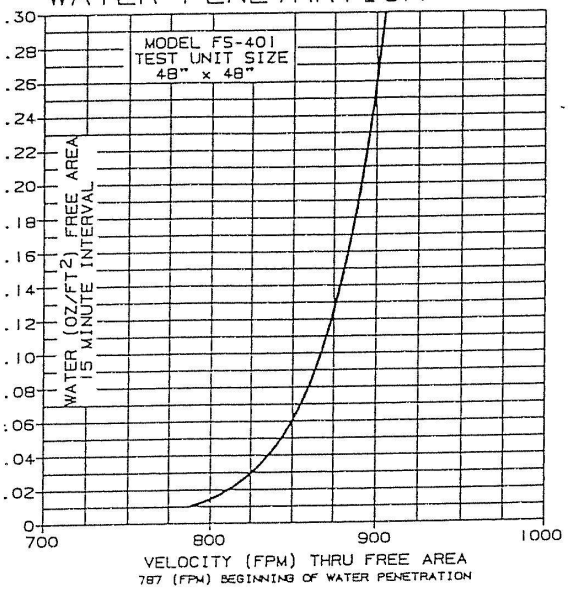
TESTS OF A 48" x 48" SAMPLE BY AN *AMCA REGISTERED LABORATORY ACCORDING TO AMCA STANDARD 500 SHOWS WATER PENETRATION TO BE LESS THAN .02 OZ. PER SQ. FT. WATER PENETRATION AT 787 FPM (FREE AREA VELOCITY) WITH LESS THAN .11" W.G. PRESSURE DROP (INTAKE), AND .12" W.G. PRESSURE DROP (EXHAUST).

RATINGS DO NOT INCLUDE EFFECTS OF BIRDSCREEN.

PRESSURE DROP



WATER PENETRATION



FREE AREA

FREE AREA (SQ. FT.)									
	WIDTH								
HEIGHT	12"	18"	24"	30"	36"	42"	48"	54"	60"
12"	.17	.27	.37	.48	.58	.68	.78	.89	.99
24"	.47	.75	1.03	1.32	1.60	1.88	2.16	2.24	2.72
36"	.68	1.09	1.50	1.91	2.32	2.73	3.13	3.54	3.95
48"	1.02	1.63	2.24	2.85	3.46	4.07	4.51	5.29	5.91
60"	1.19	1.91	2.62	3.34	4.05	4.77	5.48	6.20	6.91
72"	1.53	2.45	3.37	4.29	5.21	6.13	7.05	7.97	8.89
84"	1.72	2.76	3.79	4.83	5.86	6.90	7.93	8.96	10.00
96"	2.04	3.27	4.50	5.72	6.95	8.18	9.40	10.63	11.85

* AMCA REGISTERED LABORATORY IS A LABORATORY EQUIPPED AND STAFFED TO CONDUCT TESTS ACCORDING TO THE APPROPRIATE AMCA TEST METHOD AND WHICH HAS BEEN LICENSED AS A AMCA REGISTERED LABORATORY.

THE ARROW MODEL FS-401 ACOUSTICAL LOUVER LOW FREQUENCY AND HIGH FREQUENCY SOUND PERFORMANCE DATA IS PRESENTED IN TWO SEPERATE TABLES. REVIEW THE APPROPRIATE TABLE AND SELECT THE ATTENUATION VALUE FOR THE DESIGN NOISE CRITERIA CORRECTIVE ACTION REQUIRED.

MODEL FS-401-LF (LOW FREQUENCY)

OCTIVE BAND / FREQUENCY	1 / 63	2 / 125	3 / 250	4 / 500	5 / 1000	6 / 2000	7 / 4000	8 / 8000
FREE FIELD OF NOISE REDUCTION (db)	12	14	12	12	9	11	13	15

MODEL FS-401-HF (HIGH FREQUENCY)

OCTIVE BAND / FREQUENCY	1 / 63	2 / 125	3 / 250	4 / 500	5 / 1000	6 / 2000	7 / 4000	8 / 8000
FREE FIELD OF NOISE REDUCTION (db)	8	7	9	10	14	16	16	18

AMB24-SR

Proportional Control, Non-Spring Return, Direct Coupled, 24V, for 2 to 10 VDC and 4 to 20 mA

Torque min. 180 in-lb for control of damper surfaces up to 45 sq ft.

Application

For proportional modulation of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications.

The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp, 1/2" self-centered default. A crankarm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication or master-slave applications.

Operation

The actuator is not provided with and does not require any limit switches, but is electronically protected against overload. The anti-rotation strap supplied with the actuator will prevent lateral movement.

The AMB series provides 95° of rotation and a visual indicator indicates position of the actuator. When reaching the damper or actuator end position, the actuator automatically stops. The gears can be manually disengaged with a button on the actuator cover.

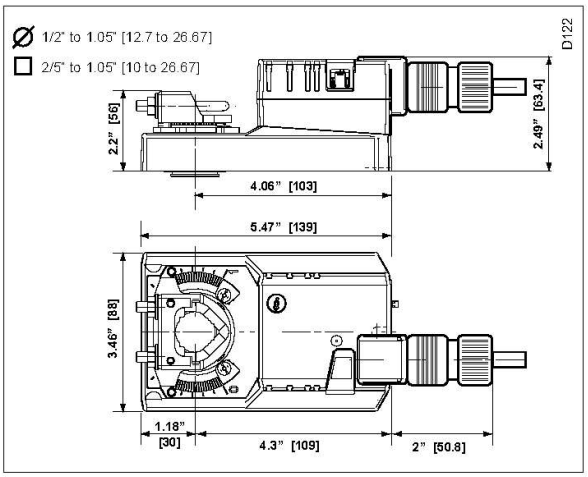
The AMB24-SR... actuators use a sensorless Brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuator's rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in holding mode.

Add on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions

Technical Data	AMB24-SR
Power Supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power Consumption	2.5 W (0.4 W)
Transformer Sizing	5 VA (Class 2 power source)
Electrical Connection	3 ft, 18 GA plenum rated cable 1/2" conduit connector
Overload Protection	electronic throughout 0 to 95° rotation
Operating Range Y	2 to 10 VDC, 4 to 20 mA
Input Impedance	100 kΩ (0.1 mA), 500Ω
Feedback Output U	2 to 10 VDC (max 0.5 mA)
Angle of Rotation	max. 95°, adjust. with mechanical stop
Torque	180 in-lb [20 Nm]
Direction of Rotation	reversible with ↷/↶ switch. Actuator will move: ↷ =CCW with decreasing control signal (10→2V) ↶ =CW with decreasing control signal (10→2V)
Position Indication	reflective visual indicator (snap-on)
Manual Override	external push button
Running Time	95 seconds, constant independent of load
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient Temperature	-22°F to +122°F [-30°C to +50°C]
Storage Temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA 2/IP54
Housing Material	UL94-5VA
Agency Listings†	cULus acc. to UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE acc. to 89/336/EEC
Noise Level	<45dB(A)
Servicing	maintenance free
Quality Standard	ISO 9001
Weight	2.2 lbs [1000 Kg]

†Rated Impulse Voltage 800V, Type of action 1, Control Pollution Degree 3.

Dimensions (All numbers in brackets are in millimeters.)



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Accessories

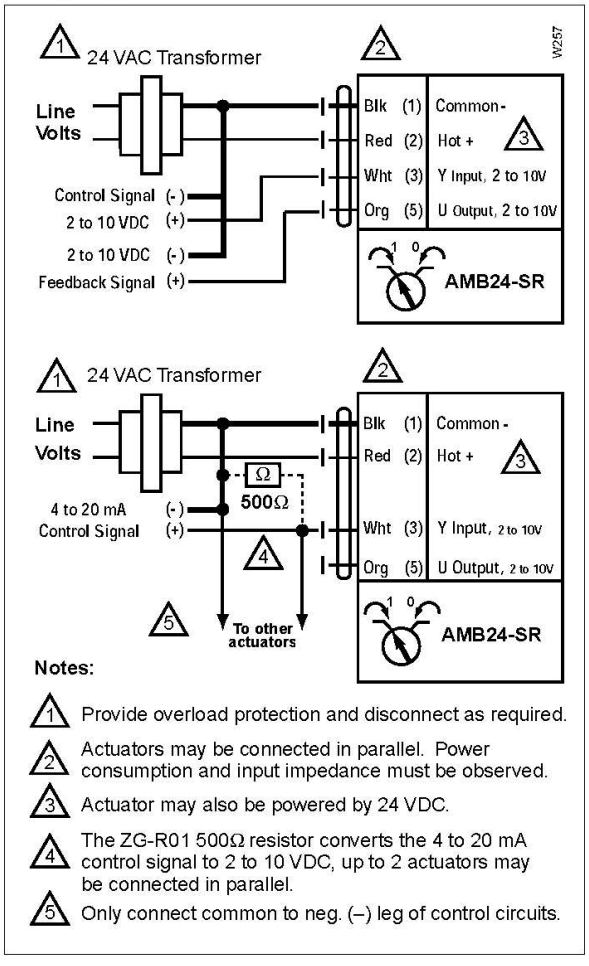
K-SA	Reversible Clamp
ZG-100	Universal Mounting Bracket
ZG-101	Universal Mounting Bracket
ZG-103	Universal Mounting Bracket
ZG-104	Universal Mounting Bracket
Z-SMA	AM/SM to AM Retrofit Mounting Bracket
ZG-NMA	Crankarm Adaptor Kit
AV8-25	Universal Shaft Extension
ZG-JSA (-1, 2, 3)	Jackshaft Adaptors for Hollow Jackshafts
ZS-100	Weather Shield - Steel
ZS-150	Weather Shield - Polycarbonate
ZS-260	Explosion Proof Housing
ZS-300 (-1) (-5)	NEMA 4X Housing
Tool-06	8 mm & 10 mm Wrench
S1A, S2A	Auxiliary Switch (es)
P370	Shaft Mount Auxiliary Switch
P...A	Feedback Potentiometers
SGA24	Min positioners in NEMA 4 housing
SGF24	Min positioners for flush panel mounting
PTA-250	Pulse Width Modulation Interface
IRM-100	Input Rescaling Module
ADS-100	Analog to Digital Switch
ZG-R01	Resistor for 4 to 20 mA Conversion
NSV24 US	Battery Back-Up Module
ZG-X40	Transformer

Note: When using AMB24-SR... actuators, only use accessories listed on this page.

AMB24-SR - Typical Specification:
Proportional control damper actuators shall be electronic direct-coupled type, which require no crankarm and linkage and be capable of direct mounting to a shaft up to 1.05" diameter. Actuators must provide proportional damper control in response to a 2 to 10 VDC or, with the addition of a 500Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. Actuators shall have Brushless DC motor technology and be protected from overload at all angles of rotation. Actuators shall have reversing switch and manual override on the cover. Run time shall be constant and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position indication. Actuators shall be cULus listed, have a 5-year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

AM

Wiring Diagram



Notes:

1. Provide overload protection and disconnect as required.
2. Actuators may be connected in parallel. Power consumption and input impedance must be observed.
3. Actuator may also be powered by 24 VDC.
4. The ZG-R01 500Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.
5. Only connect common to neg. (–) leg of control circuits.

2 to 10 VDC and 4 to 20 mA control of AMB24-SR

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Project Submittal Comments

Date	Added by	Comment

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APPENDIX C

Important Information

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This Report constitutes or is part of services ("Services") provided by Golder to its client ("Client") under and subject to a contract between Golder and its Client ("Contract"). The contents of this page are not intended to and do not alter Golder's obligations (including any limits on those obligations) to its Client under the Contract.

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By date, or revision, the Report supersedes any prior report or other document issued by Golder dealing with any matter that is addressed in the Report.

Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification

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APPENDIX F

Air Quality Impact Assessment

REPORT

Air Quality Impact Assessment

Environmental Impact Statement, Prestons Waste Treatment Facility

Submitted to:

Daniel Blair
General Manager
Waste Treatment Services

Hi-Quality
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Prestons, NSW 2170

Submitted by:

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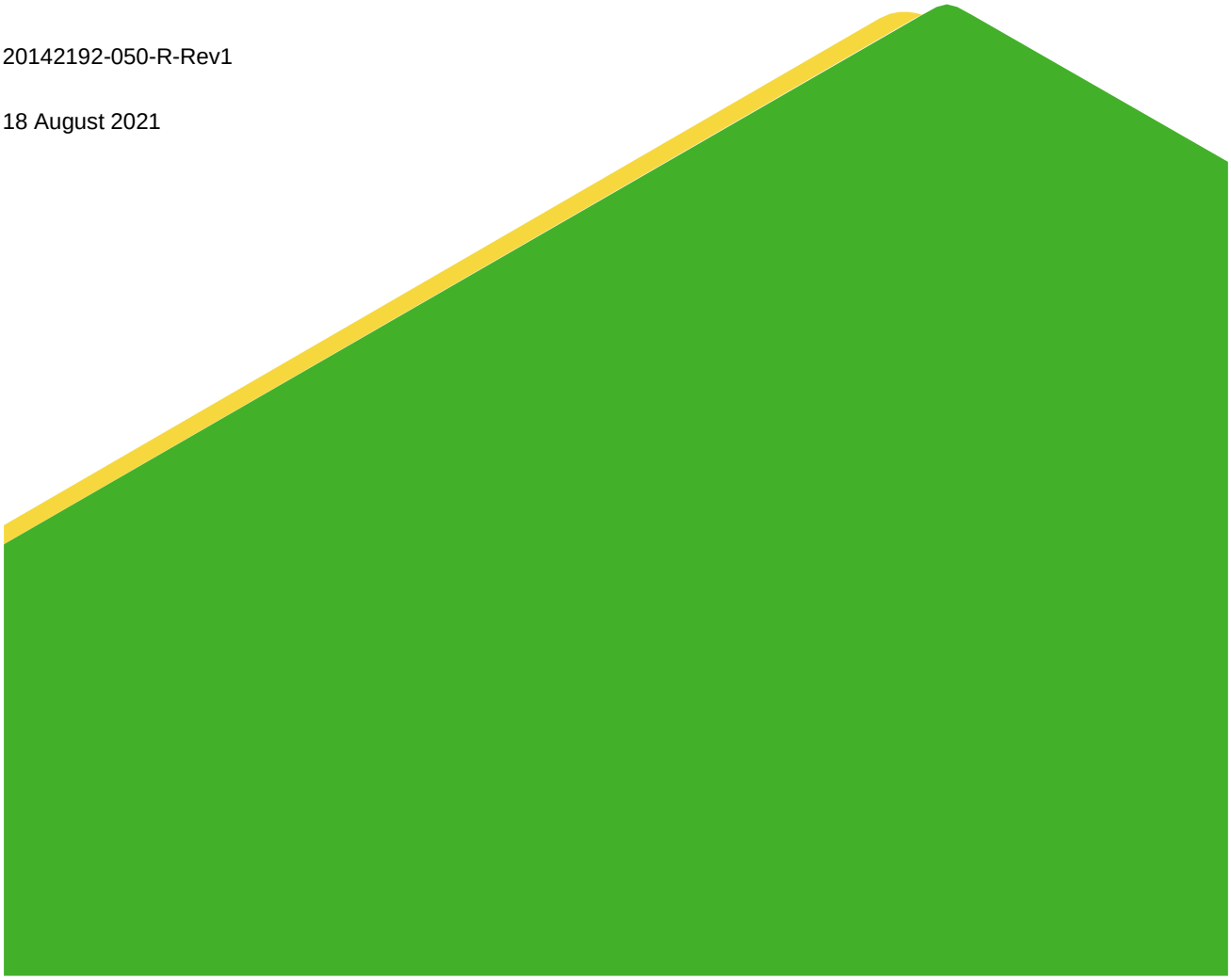
18 August 2021



Distribution List

1 electronic copy - Hi-Quality

1 electronic copy - Golder Associates Pty Ltd

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1.0 INTRODUCTION

Hi-Quality Waste Treatment Services Pty Ltd. (Hi-Quality) retained Golder Associates Pty Ltd (Golder) to complete an Air Quality Impact Assessment (AQIA) to address the Secretary's Environmental Assessment Requirements (SSD-9346594) for the proposed Prestons Waste Treatment Facility (WTF) located at 9-13 Whyalla Place, Prestons New South Wales (NSW) 2170 (the Site). Air quality SEARS to be addressed in the AQIA include the following:

- A quantitative assessment of the potential air quality, dust and odour impacts of the development in accordance with the relevant Environmental Protection Authority guidelines;
- The details of the building and air handling systems and strong justification for any material handling, processing or stockpiling external to buildings; and
- details of proposed mitigation, management and monitoring measures.

The NSW Environment Protection Authority (EPA) included additional requirements, including:

- Demonstrate that the HVAC system can mitigate all key pollutants and capture fugitive dust and vapours generated in the WTF (including asbestos); and
- Benchmark proposed air pollution control and mitigation measurements against best available practice.

The AQIA that follows includes a description of the WTF activities and potential impacts on air quality during the construction and operations phases.

Potential air quality impacts during WTF construction are reviewed and emissions managed through design and implementation of a construction-phase Air Quality Management Plan (AQMP).

Potential air quality impacts due to the WTF operation are assessed through analysis of baseline air quality, development of an air emissions inventory for key contaminants including dust and odour, followed by predictions of potential impacts on nearby sensitive receptors using the air quality dispersion model AERMOD.

The air emissions inventory for the air quality model includes analysis of engineering and management controls implemented to reduce emissions of particulate matter, volatile organic compounds and odours associated with the proposed waste handling, storage and treatment activities.

The AQIA criteria were adopted as per the NSW Environmental Authority (EPA) document, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW EPA, 2016). The methods and results of the AQIA are described in the following report.

Results of the air quality modelling broadly indicate compliance with the relevant assessment criteria and do not warrant on-site air quality monitoring. However, post-commissioning stack testing will be undertaken to validate the performance of the air emissions control system and to validate the model indicating very low to negligible effects to air quality beyond the project boundary.

2.0 PROJECT DESCRIPTION

2.1 Project Location

The proposed location of the WTF is 9-13 Whyalla Place, Prestons NSW 2017 (Figure 1). The Site is situated in an industrial area zoned IN3 Heavy Industrial and bounded by Hoxton Park Road to the north and the M7 Freeway to the south.

For the purposes of this assessment, predicted maximum ground level concentrations will be compared to their relevant criteria at the WTF property boundary.

2.2 Construction Activities

Construction associated with the modification of the existing facility will be undertaken in two stages. The duration of Stage 1 is estimate at 1-2 months and Stage 2 approximately 4 months. While the construction period is longer than 3-weeks, individual construction/modification activities will be shorter in duration (weeks) and not occur continuously. Some construction/modification activities occur indoors limiting their potential air quality impacts. Examples of specific construction activities include, but may not be limited to, the following:

- Minor demolition;
- Minor earthworks;
- Construction of Weighbridges and Weighbridge office;
- New driveway;
- Building extension;
- HVAC System Integration;
- Fire Management System Upgrade; and
- Internal fit out – pits, push wall, bunding, water treatment plant, fire wall.

The equipment necessary for the construction of the Project may include compaction equipment, backhoes, excavators, rollers, truck, concrete pumping equipment, air compressors, concrete vibrators and saws, mobile cranes and welders.

2.3 Process Description

The proposed WTF includes a bulk soil waste treatment facility and bioremediation facility, water treatment facility, storage and consolidation of material and ancillary infrastructure. The WTF is planned to accept approximately 270,000 tonnes per annum (tpa) of waste. Appendix A summarises waste flows at the WTF by type. This includes the following:

- Up to 110,000 tpa of bulk solids with the potential to produce particulate matter (dust);
- Up to 70 million litres (ML) of liquid waste with the potential to produce volatile organic compound (VOC) emissions;
- Up to 20,000 tpa (each) of bulk solids or soil that may be contaminated with heavy metals (e.g., arsenic, chromium or lead); and
- Up to 20,000 tpa of bulk solids, soil or liquids that may be contaminated with poly- and perfluoroalkyl substances (PFAS).

The Project would receive waste 24 hours a day, while processing and dispatch operations would be undertaken between 7:00 am and 6:00 pm Monday to Saturday and 8 am to 6 pm Sundays and Public Holidays.

Waste trucks will enter the facility via roll-up doors that will be closed prior to trucks unloading waste material. Solid and liquid waste treatment activities all take place within specific work areas inside the building (Figure 2).

To provide a safe work environment, air emissions generated in specific work areas are to be collected by the heating, ventilation and air conditioning system (HVAC) (see Appendix B for HVAC System Design). The HVAC system design is based on:

- the future building configuration;
- the number of air exchanges needed to provide fresh air and for comfort heating/cooling; and
- to maintain slight negative pressure on the building envelope (to minimize fugitive air emissions).

Contaminated air collected by the HVAC system is sent for treatment in air emissions control devices prior to discharge to air. The proposed air emissions treatment systems include Particulate Matter (PM) filters and Activated Carbon (AC) filters to remove Volatile Organic Compounds (VOCs) and odour.

Air emissions from the WTF will be discharged from three vertical strobic fans at 11.7 m above ground level. The strobic fans will be controlled dynamically, operating at higher flow rates when dusty or volatile materials are being delivered, handled or treated, and operating at lower intensities in the evening or at night, when only waste delivery is scheduled to occur.

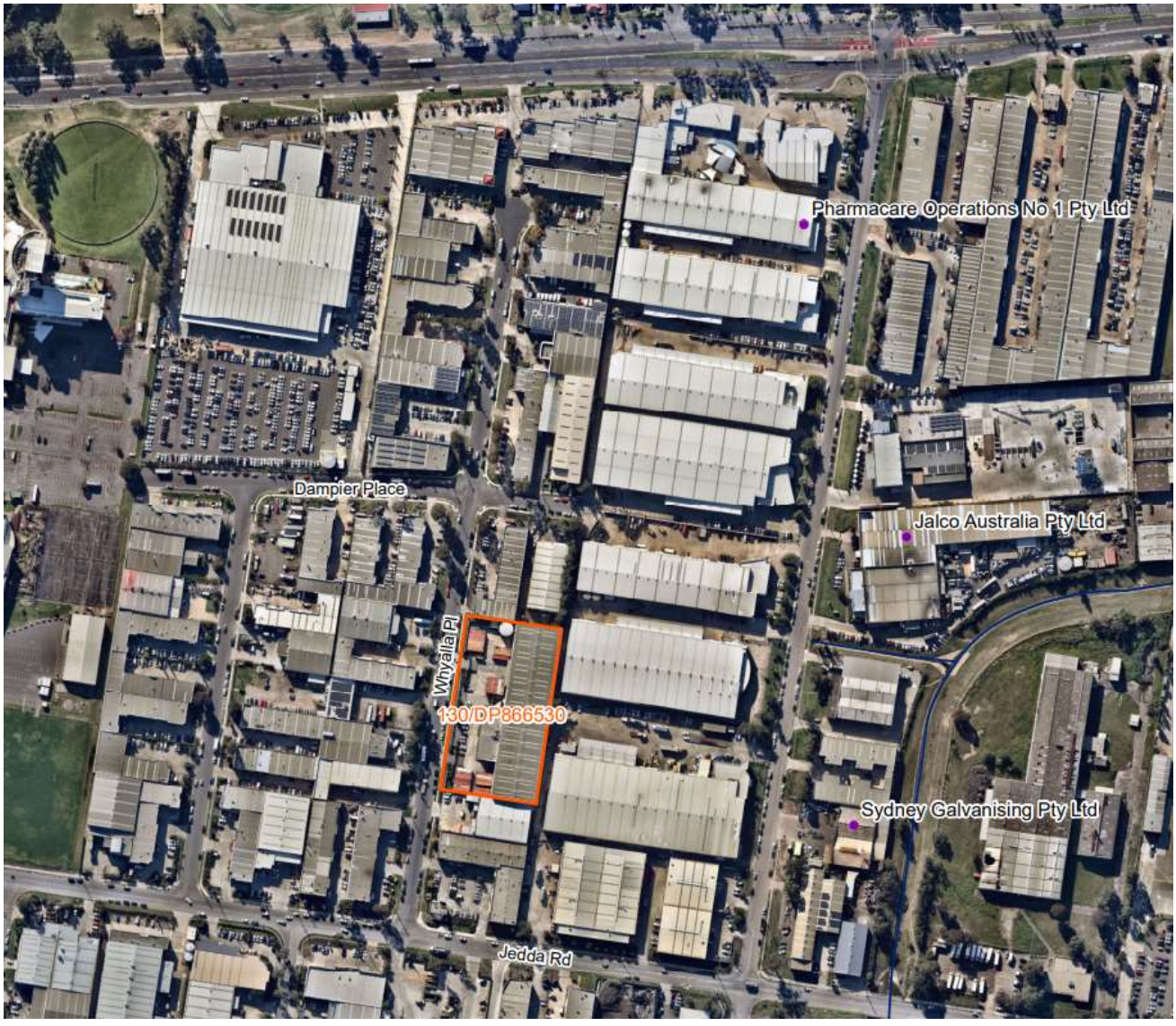

Figure 1: Site location

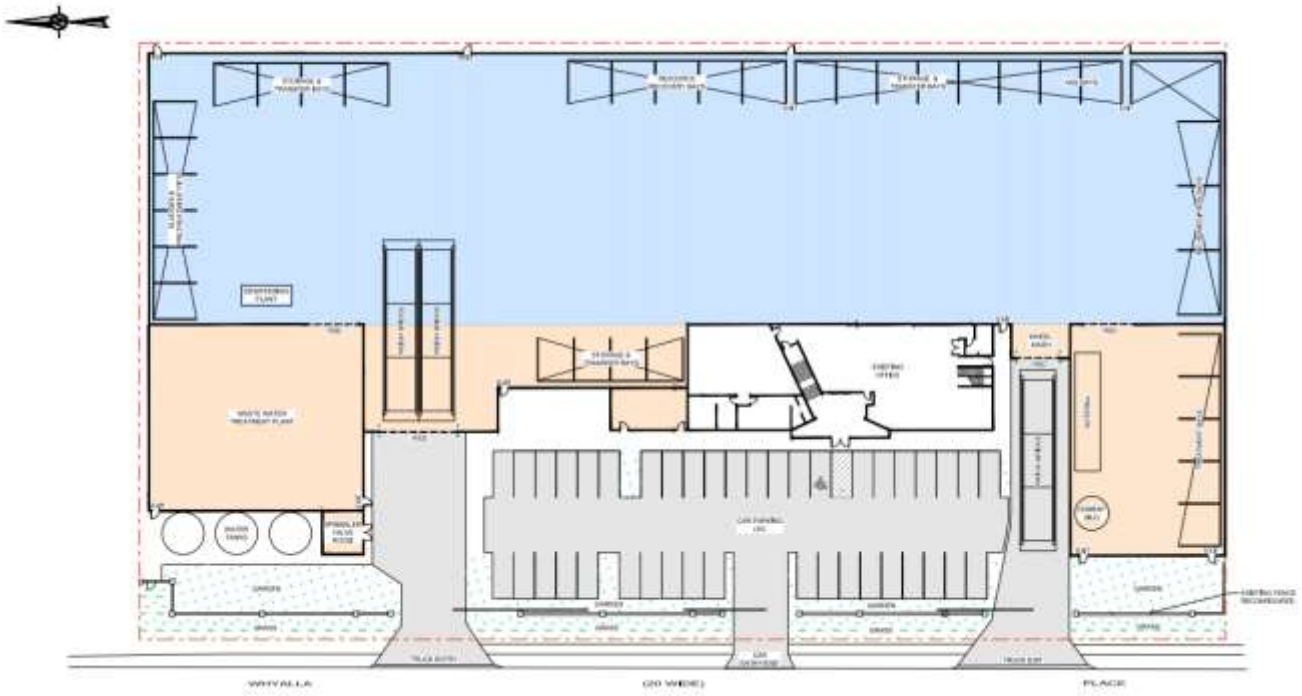

Figure 2: Layout of WTF

3.0 ASSESSMENT CRITERIA

The *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA, 2016), lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW. Table 1 presents the assessment criteria used for the AQIA. The pollutants in Table 1 were selected based on Hi Quality's experience at their Waste Treatment Facility in Queensland and Golder's professional experience in air emissions from waste handling and treatment. Section 2.2 in Appendix D outlines these priority pollutants.

There are no NSW or Australian ambient air quality criteria for PFAS compounds. The Air Quality Division of Michigan's (USA) Department of Environment, Great Lakes and Energy have derived a health-based screening levels for PFAS of 0.07 µg/m³ for a 24-hour averaging period[1]. This health-based screening level has been adopted for this assessment.

Table 1: Assessment Criteria

Pollutant	Averaging Period	Concentration	Percentile required	Units
$PM_{2.5}$[a]	24 hour	25	100th	µg/m³
$PM_{2.5}$	Annual	8.0	100th	µg/m³
PM_{10}[b]	24 hour	50	100th	µg/m³
PM_{10}	Annual	25	100th	µg/m³
Total suspended particulates (TSP)	Annual	90	100th	µg/m³

[1] https://www.michigan.gov/documents/pfasresponse/Frequently_Asked_Questions_on_Air_Quality_Related_Issues_-_Air_Quality_Workgroup_MPART_663729_7.pdf

Pollutant	Averaging Period	Concentration	Percentile required	Units
Arsenic and compounds (As)	1 hour	0.090	99.9th	µg/m3
Chromium VI compounds (Cr)	1 hour	0.090	99.9th	µg/m3
Lead (Pb)	Annual	0.5	100th	µg/m3
Benzene	1 hour	29	99.9th	µg/m3
Trichloroethylene (TCE)	1 hour	500	99.9th	µg/m3
PFAS	24 hour	0.07	100th	µg/m3

Notes:
[a] Particulate matter smaller than 2.5 micrometres in aerodynamic diameter ($PM_{2.5}$)
[b] Particulate matter smaller than 10.0 micrometres in aerodynamic diameter (PM_{10})

4.0 BASELINE AIR QUALITY DATA

Baseline air quality data were obtained from the NSW Environmental Protection Authority's ambient air quality monitoring station (AAQMS) located at Liverpool, NSW. These data include hourly $PM_{2.5}$ and PM_{10} observations from 1 January 2015 to 31 December 2020.

Table 2 summarises the following raw data statistics for the Liverpool AAQMS data:

- Number (N) of available hourly data records for the year and the completeness of the data expressed as a percent of all hours in the year; i.e., percent complete;
- Annual mean, median, standard deviation (Stdev), minimum and maximum hourly concentrations; and
- Annual number of 24-hr particulate matter impact assessment criteria exceedances, based on:
  - 24-hr averages of the raw hourly data;
  - 24-hr average $PM_{2.5}$ impact assessment criteria of 25 µg/m3; and
  - 24-hr average PM_{10} impact assessment criteria of 50 µg/m3.

Years 2017, 2018 and 2019 were chosen as the three consecutive assessment years for the air quality modelling used in the AQIA. These are the unshaded rows in Table 2. The reasons for selecting these years include the following:

- A consecutive 3-year period of data broadens the time frame of the assessment and provides information on inter-annual variability;;
- Year 2015 was excluded because it is the oldest and has the lowest percent completeness for both $PM_{2.5}$ and PM_{10};
- Year 2016 was excluded due to data issues incompatible with the MET software; and
- Year 2020 was excluded due to atypically large influence of bush fire smoke in background PM concentrations in that year.

A detailed summary of the baseline air quality data and analysis can be found in Appendix C.

Table 2: Raw 1-hr Liverpool particulate matter data statistics

Year	Size	N	Mean	Median	Stdev	Min	Max	Percent Complete	24-hr PM Exceedances
		#	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	%	#
2015	$PM_{2.5}$	7909	8.5	7.1	7.7	-2.5	74	90%	2
	PM_{10}	8384	18	16	12	-8.9	198	96%	1
2016	$PM_{2.5}$	8044	8.8	7.3	8.2	-2.5	110	92%	4
	PM_{10}	8711	19	17	13	-10	181	99%	3
2017	$PM_{2.5}$	8009	8.9	7.3	8.5	-2.5	205	91%	5
	PM_{10}	8664	21	18	14	-10	257	99%	2
2018	$PM_{2.5}$	8369	10	8.3	8.8	-2.5	160	96%	8
	PM_{10}	8634	24	20	19	-9	481	99%	13
2019	$PM_{2.5}$	8313	13	8.5	22	-2.5	437	95%	32
	PM_{10}	8667	28	21	34	-8.5	730	99%	29
2020	$PM_{2.5}$	8397	9.1	6.8	10	-10	168	96%	9
	PM_{10}	8508	21	17	23	-9.4	830	97%	8

5.0 CONSTRUCTION PHASE AIR QUALITY

The construction generated air quality impacts are to be managed by adhering to a Construction Air Quality Management Plan (CAQMP). The objective of a CAQMP is to reduce impacts to air quality in accordance with National Environment Protection (Ambient Air Quality) Measure 2003 (NSW).

The construction of the WTF is proposed to be undertaken in two stages, the duration of Stage 1 is estimate at 1-2 months and Stage 2 approximately 4 months. The majority of the facility is to be established in the existing onsite building with minimal external construction. The potential for impacting air quality is greater during external earthwork or demolition work, and the air quality impacts are likely to be predominately fugitive dust and PM. The following list details the external construction work:

- Installation of weighbridges;
- A new driveway;
- An extension at the north west and south west of the buildings for the Wastewater Treatment and Soil Treatment facilities; and
- Installing the HVAC System.

Potential air quality impacts during external construction activities include minor demolition to remove part of the existing slab and portion of the existing warehouse wall, minor earthworks for footings and drainage. The

building extension is to be constructed using prefabricated concrete panels and the HVAC system will be erected and installed by crane.

A large portion of the work required to construct the WTF will be internal fit outs and installations. This provides a lower potential for air quality impacts due to less invasive activity, minimal earthworks and the mitigation effects of the building structure. These works include:

- Fire management system installation;
- Internal HVAC systems;
- Installing tanks, silos, pumping and dosing systems;
- Building a laboratory;
- Installing a wheel wash station; and
- Internal bays and facility areas.

Due to a significant portion of the construction activities taking place inside an established building and minimal invasive or demolition work occurring externally, development of and adherence to a CAQMP is deemed appropriate for managing air quality impacts during the construction phase.

This CAQMP will include, but may not be limited to, the following:

- Identification of the surrounding land use and local stakeholders;
- Displaying the name and contact details of person(s) responsible for air quality at the site boundary;
- Recording all air quality complaints, identify causes and incorporating measures to reduce emissions in a timely manner;
- Include all site staff at the morning toolbox in a discussion for planning the work day around dust suppression and minimisation;
- Structure high dust generating activities (earthworks and demolition) around days with low windspeed and stop or pause these activities during dry and windy conditions;
- Loads shall be covered on trucks transporting material to and from the construction site;
- Spray the site regularly to supress dust and use a water-assisted sweeper along the access road to reduce the potential for material to be tracked off site; and
- Cover and weight stockpiles to prevent wind erosion when they are inactive.

6.0 EMISSIONS INVENTORY

A detailed emissions inventory based on waste types and their handling and treatment processes was completed to support the AQIA for the WTF. The details of emissions factors and methods used to estimate emissions of particulate matter, VOC's and PFAS from the WTF ventilation stacks are included in Appendix D.

6.1 Priority Emission Types

Based on the analysis presented in Appendix D, four types of emissions were prioritized for assessment. These include:

- Particulate matter (dust) generated from the handling and treatment of bulk solids and soils. This includes:
  - Particulate matter smaller than 2.5 micrometres in aerodynamic diameter ($PM_{2.5}$);
  - Particulate matter smaller than 10.0 micrometres in aerodynamic diameter (PM_{10});

  - Total suspended particulate matter (TSP);
- Metals in dust. These are parameterized by assuming up to 5 wt% of metals in PM_{10} focusing on the toxic metals arsenic (As), chromium (Cr) and lead (Pb).
- Volatile organic compounds, including halogenated hydrocarbons, that can lead to offensive odours. Since presence of these compounds, nor their emissions, can be estimated reliably, these emissions are parameterized assuming they comprised entirely of either:
  - Benzene; or
  - Trichloroethylene.
- PFAS compounds in bulk solids, soils or liquids. For the purposes of this assessment, 100% of the PFAS are assume to be particulate bound, and they are assumed to occur at the National Environmental Management Plan Version 2 (January 2020) (NEMP) maximum permissible PFAS content of 50 mg/kg in solids.

6.2 Air Emissions Control

Particulate matter, VOC and odour emissions from the Project will be mitigated using both engineering controls and management controls. The proposed emissions controls were developed collaboratively between Hi-Quality, Golder and HVAC Alliance, a qualified HVAC sub-consultant. The following engineering and management controls are proposed for the WTF. Please see Appendix D for additional information on emissions and their control.

Engineering Controls:

- Compartment 1 is served by a series of overhead vents along the north wall. These are designed to draw contaminated air from near the emitting activities and route this air to the common inlet plenum for the air emissions control system;
- Three-sided fabric curtains will be installed in relevant working areas to reduce the escape of fugitive dust and vapours during material handling and processing and to improve the collection efficiency of contaminated air by the HVAC system;
- VOC and odour emissions are potentially generated by the WWTP in Compartment 2 while treating hydrocarbon or solvent contaminated liquids. The WWTP is a sealed vessel so VOC and odour capture efficiency is predicted to be high. VOC and odour emissions captured in this area are routed directly to the common outlet plenum for the air emissions control system;
- Raw water tanks are to be fitted with screw lock (or similar) inlet fittings to reduce spillage. Tank relief vents will include vapour recovery systems ducted to the HVAC system during product loading/unloading;
- Potentially large volumes of fugitive dust may be generated when using the Roterra unit to treat bulk soils and sludge in Compartment 3. All emissions from Compartment 3 are routed directly to a dedicated filter-cartridge based dust collector (Camfil Model GSX48). The dust collector has a manufacturer-stated PM removal efficiency of 99.99% for particles down to 0.5 micrometers in geometric diameter. The dust collector is located in Compartment 1 and will vent treated exhaust air directly into Compartment 1;
- Emissions collected in Compartments 1 and 2 are routed to a common inlet plenum for the building's air emissions control system. This system includes the following components, listed in order of exhaust flow:
  - Common inlet plenum serving Compartments 1 and 2;

  - PM filter box;
  - VOC and odour filter box; and
  - Common outlet plenum;
  - Three (3) strobic exhaust fans operating in parallel.
- Fresh air is provided to each of the compartments by motorised dampers fitted behind weatherproof louvres located along the western wall of compartment 1 & 2 and the northern wall of compartment 3 (see Figure 3).

The PM filter box will be equipped with a G4-rated, 30/30 Dual 10 high capacity disposable carboard pre-filter and an F7-rated, Hi-Flo spun glass high-capacity filter. The PM removal efficiencies as a function of size for each filter type are summarized in Table 2. The combined removal efficiencies for the two filters are calculated as 75% for $PM_{2.5}$, 95% for PM_{10} and 97.5% for TSP. No additional PM removal is assumed to occur as air passes through the VOC molecular filters, which is a conservative assumption.

The VOC and odour filter box will be equipped with VG440 molecular filters filled with Camfil's LGS048 media. Compound specific removal efficiencies were not available for the LGS048 media. However, the carbon-based LGS048 media is tailored by the vendor for the removal of VOC's and odour.

This assessment uses the predicted removal efficiencies for a 50:50 mixture of activated carbon and Purafil CP. This is the media formulation currently in use at Hi-Quality's Waste Treatment Facility in Yatala, Queensland. The use of Purafil CP type of media is to increase the removal efficiency of BTEX compounds and halogenated VOC's (e.g., TCE), as compared to the use of activated carbon only (see comparison in Appendix D).

Management Controls

Management controls include policies and procedures designed to reduce the generation of PM and VOC emissions, especially fugitive emissions. Examples of proposed management controls include:

- No idling of mobile plant and haul trucks when not in use;
- Material loading/unloading and handling procedures designed to reduce fugitive dust emissions; e.g., high-speed roller-doors required to be closed during material loading/unloading and handling;
- Operation of emissions control devices according to their manufacturer's specifications;
- Regular preventive maintenance of emissions control devices according to their manufacturer's specifications;
- Wheel wash station at the Facility exit to reduce soil track-out and generation of fugitive dust outside the building envelope;
- Fogging suppression systems where deemed necessary in Compartment 3 treatment bays and will be installed in other areas if necessary;
- Compartment 3 manual on/off switches to focus air collection in the active 1 of 5 treatment bays being used for stockpiling treated waste discharged from the Roterra unit. These HVAC controls system will allow a single stockpile bay hood to collect, and send for treatment, approximately 95% of the total air flow through the space;
- Fabric side curtains front drop curtain to 4 m on bioremediation treatment bays are designed to contain minor contaminant generation from handling and turning process; and

- Overall the building compartments will be maintained at > -5 Pascals (Pa) while in 'daily treatment mode'. When in 'after hours mode', the building can exhaust air system from each compartment shall be reduced and associated outside air inlet dampers closed off to maintain > -5 Pa whilst saving energy.

Safe minimum ventilation rates will be determined through design development and reviewed during commissioning. Where materials are dropped off outside of daily treatment times, the 'after hours mode' shall revert to 'daily treatment mode' for the duration of unloading activity. The truck leaving the facility will trigger a 1hr run on timer before reducing to "after hours mode'.

6.3 Air Emissions Summary

For additional details on how the emissions inventory for the WTF was generated please see the document in Appendix D. A summary of the total emission rates, and the rates per stack for each priority pollutant is presented in Table 3.

Table 3: Emission rate

Pollutant	Total emission (g/day)	Emission rate per stack (g/s)
$PM_{2.5}$	1,260	4.9×10^{-3}
PM_{10}	1,670	6.5×10^{-3}
TSP	1,790	6.9×10^{-3}
As	46	1.8×10^{-4}
Cr	46	1.8×10^{-4}
Pb	46	1.8×10^{-4}
Benzene	8.0	3.7×10^{-4}
TCE	9.7	4.5×10^{-4}
PFAS	0.022	1.7×10^{-7}

7.0 AIR QUALITY MODELLING

The potential impact to air quality from the proposed WTF is assessed by using an air dispersion model to predict the maximum ground level concentration of pollutants at the WTF property boundary. The Level 2 modelling assessment was conducted in accordance with *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW EPA, 2016) using the AERMOD model. The assessment also incorporates guidance from the EPA Victoria Publication 1551 '*Guidance notes for using regulatory air pollution model AERMOD in Victoria*'.

AERMOD is a steady-state plume modelling system with three components: AERMOD (dispersion model), AERMAP (terrain data pre-processor) and AERMET (meteorological data pre-processor). Modelling of emissions was undertaken using AERMOD View Version 9.8.3, which provides a graphical interface for the AERMOD air dispersion model.

The following section provide additional details related to air quality modelling of the WTF emissions.

7.1 Meteorological data

The simulation of air quality impacts from the Site requires the use of representative hourly meteorological data spanning an entire calendar year for surface and upper air observations.

Meteorological data files covering the three years 2017 to 2019 were developed using the AERMOD meteorological pre-processor AERMET.

The following hourly surface observations are required for input into AERMET:

- wind speed;
- wind direction;
- temperature;
- cloud cover;
- Net solar radiation; and
- Relative humidity.

The closest the Bureau of Meteorology (BOM) automatic weather station is:

- Holsworthy (Station No. 95761), approximately 9 km to the south-east of the Site.

For locations where site specific meteorological observations are not available within 5 kilometres of the Site, a prognostic meteorological model can be used to generate the data, as per EPA Victoria guidance. Due to the distance of the Holsworthy MET Station from the Site, approximately 9 km, Golder decided to use the Air Pollution Model (TAPM) developed at CSIRO Marine and Atmospheric Research to generate site specific meteorological data.

The TAPM datasets were used as inputs to AERMET to generate meteorological files covering the three year period of: 1 January 2017 to 31 December 2019. Results from AERMET were then used as input to AERMOD. Upper air data was estimated using the AERMET Upper Air Estimator.

7.2 TAPM Model Set-up

Prognostic models, such as TAPM, solve the equations of atmospheric dynamics to produce physically realistic three-dimensional meteorological fields, such as wind, temperature, humidity, surface fluxes, and boundary-layer structure. They are the models used in weather forecasting and climate research, and as a basis for dispersion modelling. Data from local climate stations are optional and local flows arise through the dynamic forcing simulated by the computational model. Larger-scale fields (up to global scale) are required for their initialisation and ongoing boundary updates.

TAPM was run for the years 2017 to 2019 and configured with a nested model grid coverage designed to capture, broad scale synoptic flows, regional and broader scale sea breezes and land breezes, regional and broader wind channelling around terrain features and influence of land use.

The following TAPM setup was used:

- Outer grid of 10 km × 10 km with nested grids of 3 km and 1 km;
- 100-by-100-by-100 horizontal grid points centred at the location of the required data point;
- 25 vertical levels;
- Nine-second terrain height database; and

- TAPM default databases for land use and sea surface temperature.

The parameters used for the model runs are shown Table 4 and apply to the meteorological component of TAPM. The pollution dispersion components of TAPM have not been used. All other input parameters took default values.

Table 4: TAPM Configuration Parameters

Parameter	Value
Start and end dates	1 January 2017 – 31 December 2019
Grid Centre (UTM Co-ordinates [m])	(303991.29, 6243375.15)
No. of grids	3
No. of horizontal grid points	100 x 100
Horizontal grid spacing	10 km, 3 km, 1 km
No. of vertical levels	25 (up to 8000 m)
Monthly deep-soil moisture content (12 values)	0.15 m^3/m^{-3} (model default)
Topography	TAPM datasets

7.3 Modelling Domain

A modelling domain of 5 km by 5 km was created for the air quality model. The domain is centred on the WTF site with a Cartesian grid spacing of 50 m.

Shuttle Radar Topography Mission (SRTM) three arc-second global digital surface model elevation data was used to create a topographical Cartesian grid centred on the Site and with a horizontal spatial resolution of 90 m.

7.4 Sensitive Receptors

Sensitive receptors are defined within *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW EPA, 2016) as including "…where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area". The Site is situated within a heavy industrial zone, therefore the closest sensitive receptors are the neighbouring businesses and adjacent premises. These are included in the model using a Cartesian grid with spacing of 50 m.

7.5 Building downwash

Building downwash is a phenomenon caused by structures near to emission sources influencing atmospheric turbulence. Airflow is rapidly mixed to the ground as frictional forces and pressure gradients cause the development of stagnations and eddies in the wake of buildings downwind of elevated sources.

AERMOD contains the PRIME algorithm, which is used to predict building downwash effects. Influencing building dimensions were calculated using the USEPAs Building Profile Input Programme (BPIP).

To evaluate the occurrence of building downwash, the position and dimensions of each structure relative to the source must be identified for each possible direction of wind flow. Table 5 provides details of the buildings that may influence the emission source and have been included in the model.

All buildings surrounding the Site within approximately 200 m were determined to have potential for building downwash and added to AERMOD. The height and dimensions of each building were estimated using Google Earth and Google Street View.

Table 5: Modelled building

Building	Height (m)	Dimensions (m)
WTF	12	125 x 40
Northern Buildings	9	50 x 65
North West Building	12	100 x 55
Western Buildings 1	12	100 x 80
Western Buildings 2	10	115 x 60
South West Building 1	9	70 x 70
Southern Buildings	10	65 x 80
Eastern Building	12	130 x 50
South East Building	10	110 x 55
North East Building 1	10	120 x 50
North East Building 2	10	120 x 30

7.6 Ventilation stack parameters

The WTF is proposed to have three standalone vertical exhaust ventilation stacks (strobic fans) located to the front of the WTF. These ventilation stacks serve an air emissions control device that includes filters to reduce particulate matter emissions and activated carbon to reduce emissions of VOCs and odour. Further details related to the emissions control technologies can be found in Appendix D.

Discharge parameters for the strobic fans were provided by HVAC Alliance, the HVAC system designer for the WTF. A summary of these parameters is presented in Table 6.

Table 6: Emission source parameters

Parameter	Emission Source		
Description	Stack 1	Stack 3	Stack 3
Source type	Point	Point	Point
Release type	Free vertical	Free vertical	Free vertical
Co-ordinates (UTM)*	303991.41, 6243376.43	303991.29, 6243375.15	303991.18, 6243373.88
Release height (m)	11.7	11.7	11.7
Gas exit temperature (ºC)	ambient	ambient	ambient
Diameter (m)	0.95	0.95	0.95
Gas exit velocity (m/s)	40	40	40
Exhaust flow rate m^3/hour	28.5	28.5	28.5

7.7 Model results

The NSW EPA (2016) guidance separates pollutants into impacts assessment criteria ($PM_{2.5}$, PM_{10}, TSP and lead) and individual toxic pollutants (arsenic, chromium, benzene, and TCE).

The impact assessment criteria values must be achieved by the 100th percentile value (the highest ranked average concentration) predicted by the model for each 24-hour and annual period, including the corresponding baseline concentration. For the individual toxic pollutants, the 99.9th percentile (the ninth highest 1-hour average concentration) prediction by the model for each year, must meet the criteria without baseline concentrations.

The maximum predicted Project-only Ground Level Concentration (GLCs) at any location within the modelled domain, outside the Site boundary at gridded sensitive receptors for each modelled pollutant are presented in Table 7. The maximum predicted GLCs for each assessment criteria, including baseline concentrations are presented in Table 8. Concentration isopleths for particulate matter are presented in Appendix E.

The results presented in Table 7 show that the magnitude of changes to 24-hr and annual $PM_{2.5}$, PM_{10} and TSP concentrations are small (<5%, <3% and <1%) compared to their corresponding criteria. After adding the background PM concentrations (Table 8) the days with highest PM impacts from the WTF are all compliant with their relevant 24-hour criteria. Exceedances of the annual $PM_{2.5}$ and PM_{10} criteria are a result of exceedances in the baseline PM data and are not due to emissions from the WTF.

The 1-hr average compliance criteria for metals (arsenic, chromium VI) are the 99.9th percentile prediction by the model; i.e., the ninth highest 1-hour average concentration. The maximum (99.9th) predicted 1-hour GLCs at the grided receptors outside the WTF boundary for all years modelled (2017 to 2019) are above the criteria. The next sub-section provides additional context for the 1-hr metals results.

The 1-hr average compliance criteria for benzene and TCE are the 99.9th percentile prediction by the model (i.e., the ninth highest 1-hour average concentration) whereas the PFAS criteria is the 100th percentile or the highest 1-hour average concentration. Model results for benzene, TCE and PFAS are all below the predicted 1-hour GLCs at the grided receptors outside the WTF boundary for all years modelled (2017 to 2019).

Odour was not modelled in this AQIA due to a lack of data for the accepted waste streams, however odorous VOCs were modelled, and the results were up to 3 order of magnitude below the applicable criteria. The results for these compounds (benzene and TCE) indicate low levels of related odour.

Table 7: Project-only results

Pollutant	Averaging period	Criteria	Units	2017	2018	2019
$PM_{2.5}$[a]	24 hours	25	µg/m³	0.76	0.91	0.82
$PM_{2.5}$[a]	Annual	8.0	µg/m³	0.16	0.18	0.15
PM_{10}[a]	24 hours	50	µg/m³	1.0	1.2	1.1
PM_{10}[a]	Annual	25	µg/m³	0.22	0.24	0.19
TSP [a]	Annual	90	µg/m³	0.23	0.26	0.21
As[b]	1 hour	0.090	µg/m³	0.130	0.140	0.100
Cr[b]	1 hour	0.090	µg/m³	0.130	0.140	0.100
Pb[a]	Annual	0.5	µg/m³	0.006	0.006	0.005
Benzene [b]	1 hour	29	µg/m³	0.27	0.29	0.22
TCE [b]	1 hour	500	µg/m³	0.32	0.35	0.26
PFAS	24 hour	0.070	µg/m³	0.0002	0.0002	0.0005

Notes:

[a] 100th percentile (highest value) as required for assessment against the criterion

[b] 99.9th percentile (9th highest value) as required for assessment against the criterion

Table 8: Project results including baseline

Pollutant	Averaging period	Criteria	Units	2017	2018	2019
$PM_{2.5}$	24 hours	25	µg/m³	6.4	3.2	4.4
$PM_{2.5}$	Annual	8.0	µg/m³	9.1	10	13[1]
PM_{10}	24 hours	50	µg/m³	9.4	9.0	13
PM_{10}	Annual	25	µg/m³	21	24	28[2]
Total suspended particulates (TSP)[3]	Annual	90	µg/m³	0.23	0.26	0.25

Notes:

[1,2] Exceedances from baseline making very low contribution as shown in Table 7.

[3] does not include baseline as no baseline data is available

7.8 Discussion of Metals Results

The results of the air quality model indicate the potential for an exceedance of the 1-hr criteria for metals As and Cr (IV). However, these exceedances are primarily the results of conservatism in the assessment and numerical artifacts.

Examples of conservatism in the assessment of metals include the following:

- The emissions inventory conservatively assumes:
  - The annual maximum metal-contaminated waste throughput of 20,000 t/year;
  - The hourly maximum metal-contaminated waste throughputs of 150 t/hr; and
  - The maximum permissible metals content (5 wt%) for each of the 150 t/hr that are handled.
- The air quality model conservatively assumes:
  - Emissions of metals-contaminated PM for each hour of every year in the simulation; and
  - No deposition of the metal-contaminated PM being emitted.

To provide context for these results we discuss the magnitude, duration and frequency of the predicted exceedances.

Magnitude

Using conservative assumptions, including maximum metal-contaminated waste throughput, metals content (5 wt%) and no PM deposition, the magnitude of the exceedances of the 1-hr criteria are only 11% to 55% of the assessment criteria.

Frequency

Both As and Cr are below the 0.09 µg/m^3 criteria at the 44th ranked 1-hour average concentration for 2018; the year with the highest predicted metals (in PM) concentrations among the 3 years modelled. Hourly metals emissions rates in the model are fixed. Therefore, including even the 1st to 44th highest predictions, meteorological conditions that could lead to potential exceedances occur only 0.5% of the hours in a year (i.e., 44 hours / 8670 hours per year). Using the 99.9th percentile (i.e., eliminating the top 8 hourly predictions), the exceedance frequency is only 0.4%.

Duration

Operating at a maximum throughput capacity of 150 t/hr 24-hrs per day, handling and treatment of 20,000 tonnes (each) of metal-contaminated waste would be completed in approximately 6 days. For waste containing exclusively As, Cr, or Pb, this results in up to approximately 18 days per year where emissions of PM containing these metals actually occur, hourly. This emissions duration can be compared to the parameterization in the model, which assumes these emissions occur 24-hours per day, 365 days per year. In other words, processing metal-contaminated waste only occurs 5% of the time.

The probability that an hourly exceedance may occur can be estimated by multiplying the conservatively predicted exceedance frequency (0.05%) by the predicted annual duration that the WTF will be treating metal-contaminated waste (5.0%). The result is an estimate 0.025% probability of an exceedance occurring in any given year. This is equivalent to 2-hrs per year.

Focusing on exceedance frequencies at the 99.9th percentile (0.42%) for duration of As and Cr only, waste is treated (3.3%) the probability of an hourly exceedance drops to just 0.014% or just 1 hour. Given the other conservatism included in the model (e.g., maximum metals wt% and no PM deposition), the probability of actual exceedances of the 1-hr criteria for metals (As and Cr) are deemed very low to negligible.

8.0 FOLLOW UP MONITORING

Using conservative assumptions, the AQIA indicate air emissions from the WTF are compliant with the relevant NSW criteria at the property boundary. The exception is emissions of metals As and Cr, for which the

model conservatively predicts the potential for up to 2 hrs per year when an exceedance is possible under unfavourable meteorological conditions.

Based on the air quality model results presented in the AQIA fenceline air quality monitoring of PM, metals, VOC's or odour does not appear warranted at this time.

However, to validate the model predictions in the AQIA, post-commissioning stack testing will be undertaken. This post-commissioning testing will include:

- Stack testing upstream and downstream of the air emissions control system to validate the manufacturer-stated PM and VOC removal efficiencies;
- Stack testing for size resolved PM ($PM_{2.5}$ and PM_{10}) and a metals in PM assay while treating bulk solids or wastes containing heavy metals; and
- Stack testing for VOCs or odour while treating wastes containing hydrocarbons, industrial solvents and/or odorous wastes.

If post-commissioning stack testing indicates the model predictions are conservative, then stack testing will be repeated on a once-in-three years basis.

If post-commissioning testing indicates that there is the potential for air impacts, then fenceline or local air quality monitoring will be undertaken. This air quality monitoring could include, but may not be limited to, the following:

- Size resolved fenceline particulate matter monitoring ($PM_{2.5}$ or PM_{10});
- Dust deposition gauge monitoring;
- Hydrocarbon or VOC monitoring; or
- Total reduced sulfur compound or odour monitoring.

9.0 CONCLUSIONS

An air quality impact assessment was undertaken for Hi Quality's proposed Waste Treatment Facility in Preston's NSW.

Potential air quality impacts associated with the construction phase can be managed through implementation of a CAQMP due to minimal earth disturbance and demolition works.

The assessment for WTF operation included analysis of baseline air quality, development of an air emissions inventory, and predictions of maximum ground level concentrations using the air dispersion model AERMOD. Results of the air quality modelling were compared to 24 hour and annual NSW impact assessment criteria ($PM_{2.5}$, PM_{10}, TSP and lead) and individual toxic pollutants criteria (arsenic, chromium, benzene, and trichloroethylene). There are no NSW or Australia air quality criteria for poly- and perfluoroalkyl substances (PFAS) and the WTF is predicted to handle and store, rather than treat PFAS-contaminated waste. However, for the assessment, handling of bulk solids contaminated with PFAS were considered and a health-based screening level from the US State of Michigan was used as the PFAS assessment criteria.

The maximum predicted particulate matter ($PM_{2.5}$, PM_{10} and TSP) GLCs at gridded receptors outside the WTF boundary for all years modelled (2017 to 2019) occurs in 2019 and 2018, with- and without-baseline PM concentrations, respectively. Baseline inclusive concentrations for $PM_{2.5}$ and PM_{10}, are all below the 24-hour average GLC criteria for all years modelled.

The annual average GLCs for $PM_{2.5}$ are above the criteria for all years modelled. This is due to high annual background concentrations (i.e., above the criteria in each year) and not emissions from the WTF. The maximum predicted annual $PM_{2.5}$ GLC at the nearest grided receptor outside the WTF boundary, without baseline data is 0.18 µg/m^3 and occurs in 2018. This value is just 2.3% of the annual criteria of 8.0 µg/m^3.

The annual average GLCs for PM_{10} are below the criteria with the addition of baseline data for years 2017 and 2018. In 2019 annual average PM_{10} is above the criteria but this is due to annual average baseline for PM_{10} in 2019 being above the criteria without the addition of PM_{10} emissions from the WTF. The annual average PM_{10} GLC in 2019, without baseline data (0.19 µg/m^3) is lower than 2017 and 2018 annual averages (0.22 and 0.25) and are all <1% of the criteria.

The annual average GLCs for TSP are below the criteria for all years modelled. There is no baseline data available, however the maximum Annual average (2018) had a predicted GLC of 0.26 µg/m^3, compared to the criteria of 90 µg/m^3.

The maximum predicted 1-hour metals (arsenic, chromium VI) GLCs at grided receptors outside the WTF boundary are predicted to exceed the criteria in all three years modelled. Emissions of As and Cr were conservatively modelled for every hour of the year, even though these emissions would only occur hourly for about 12 days per year. Since the ranked 1-hr As and Cr concentrations drop below the criteria at the 44th ranked occurrence, this indicates that the probability of an exceedances actually occurring is very low to negligible; i.e., less than 2-hours in any year. To confirm model conservatism, a post-commissioning stack test for particulate matter and metals found in PM is recommended.

The maximum predicted benzene and TCE 1-hour GLCs at the nearest grided receptor outside the WTF boundary for all years modelled (2017 to 2019) are below the criteria. While odour was not modelled explicitly in this AQIA, the results of two odorous VOCs (benzene and TCE) are three order of magnitude (1000X) below the applicable criteria, indicating very low to negligible risks to loss of amenity due to odour emissions.

The maximum predicted PFAS GLCs at a grided receptor outside the WTF boundary for all years modelled is 0.0005 µg/m^3 in 2019 and is well below the health-based screening criteria adopted for this assessment (0.070 µg/m^3).

Based on the results of the AQIA, fenceline air quality monitoring does not appear warranted. However, post-commissioning stack testing for PM and metals, and VOC's or odour will be undertaken in order to validate model predictions and conservatism. Stack testing will occur on a once-in-three years schedule for the life of the WTF. If necessary, in future air quality monitoring of PM, metals in PM, VOC's or odour can be undertaken to confirm compliance with the applicable NSW air quality criteria.

10.0 IMPORTANT INFORMATION

Your attention is drawn to the document titled - "Important Information Relating to this Report", which is included in Appendix F of this report. The statements presented in that document are intended to inform a reader of the report about its proper use. There are important limitations as to who can use the report and how it can be used. It is important that a reader of the report understands and has realistic expectations about those matters. The Important Information document does not alter the obligations Golder Associates has under the contract between it and its client.

Signature Page

Golder Associates Pty Ltd

Carl Van Brink
Environmental Scientist

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Principal Air Quality Consultant

CVB/CMc/cvb:jem

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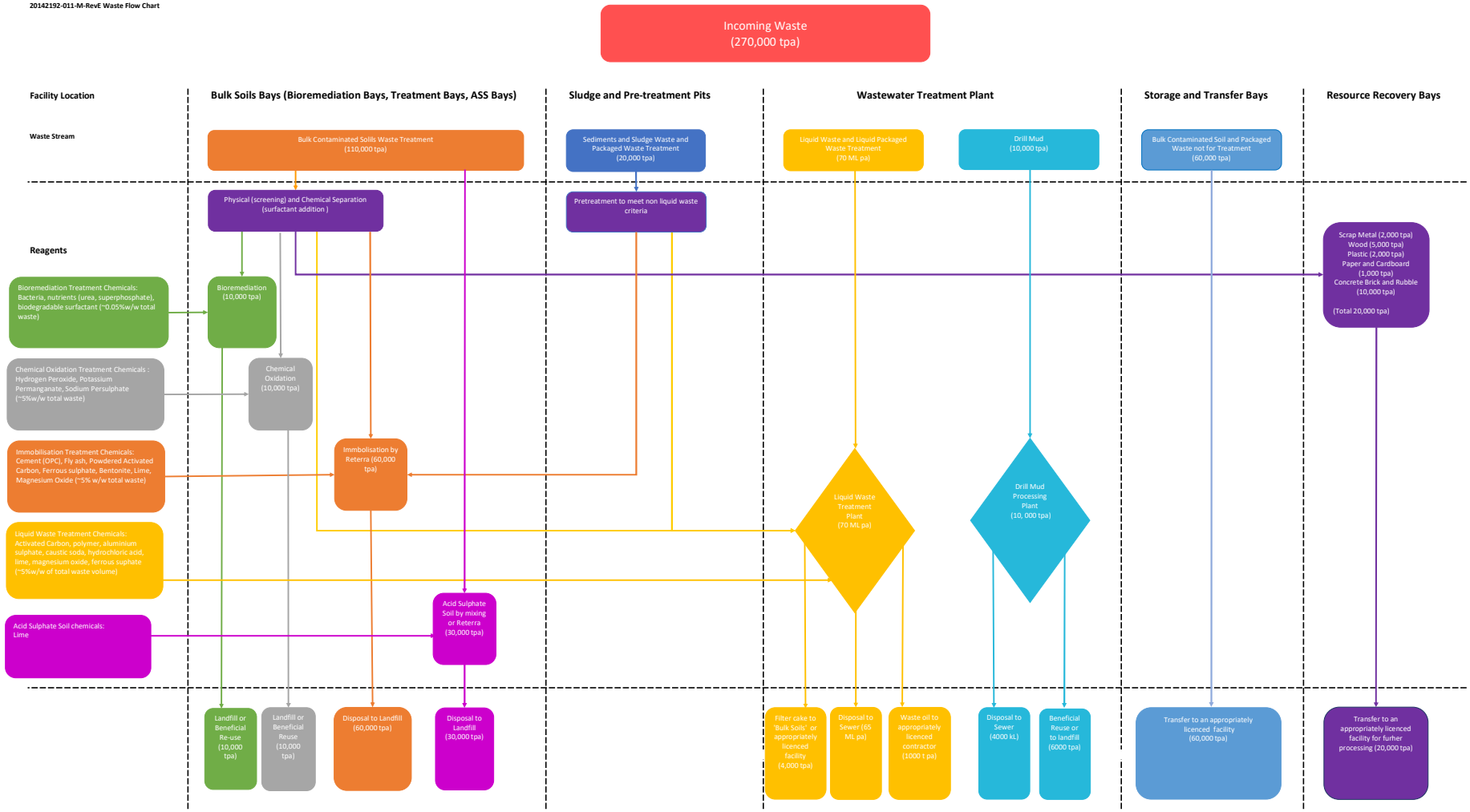
https://golderassociates.sharepoint.com/sites/125733/project files/6 deliverables/20142192-050-r-air quality impact assessment/20142192-050-r-rev1 - air quality impact assessment.docx

Appendix A

Waste Flows

Prestons Waste Treatment Facility Waste Flows

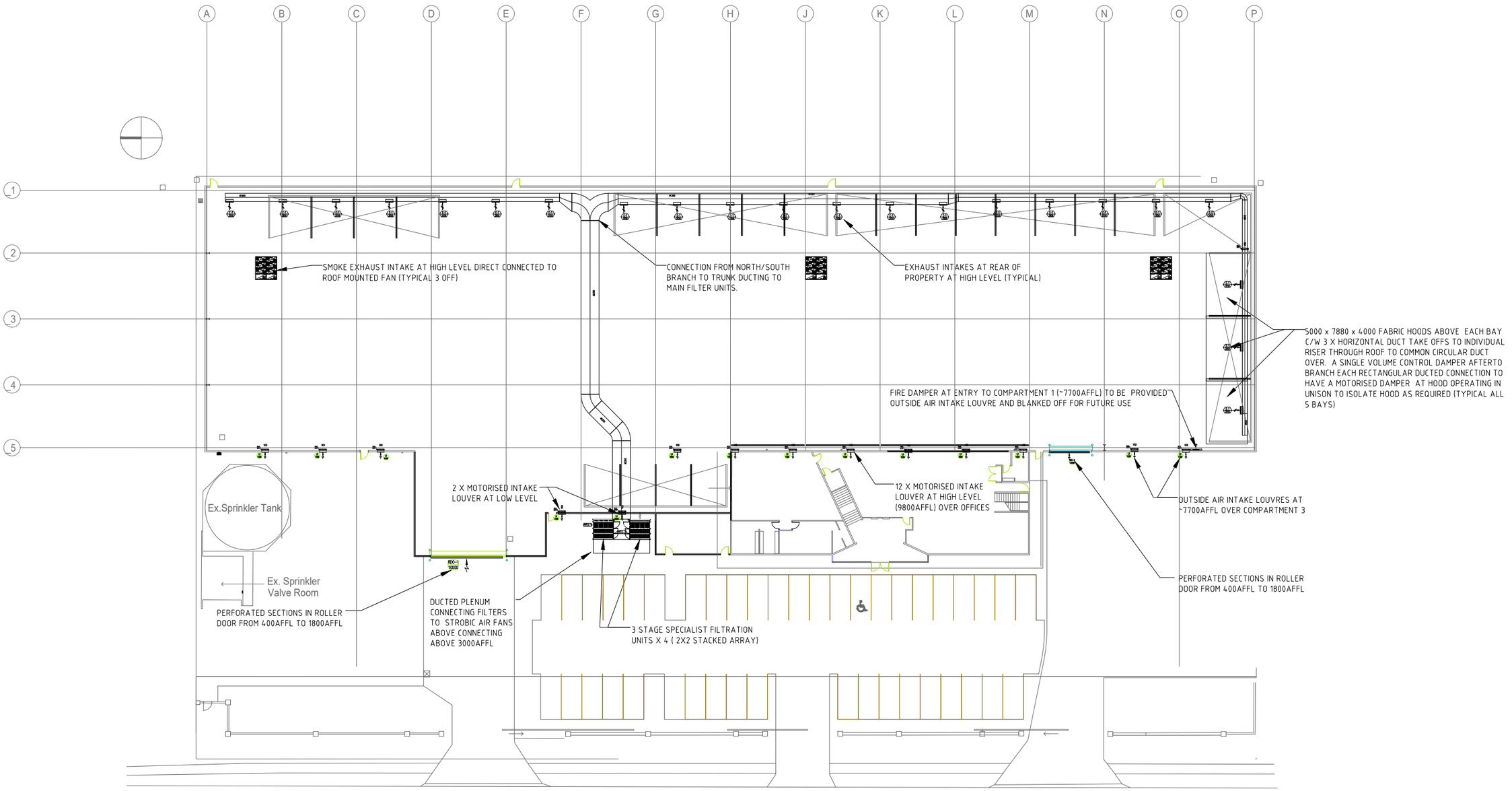
DRAFT
15/8/2021
JM/TR/jm
20142192-011-M-RevE Waste Flow Chart



Note: Bulk soils may be stored in the storage and transfer bays upon receipt at the facility prior or awaiting dispatch.
Drill Mud solids would be stored in the storage and transfer bays prior to dispatch

Appendix B

HVAC Design



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STRICTLY CONFIDENTIAL

PROJECT STAGE:

	SIGNATURE	DATE
☐ CD		
☐ DD		
☐ TD		
☐ IFC		

QUALITY RECORD :

HVAC Alliance
ABN 44 612 366 006

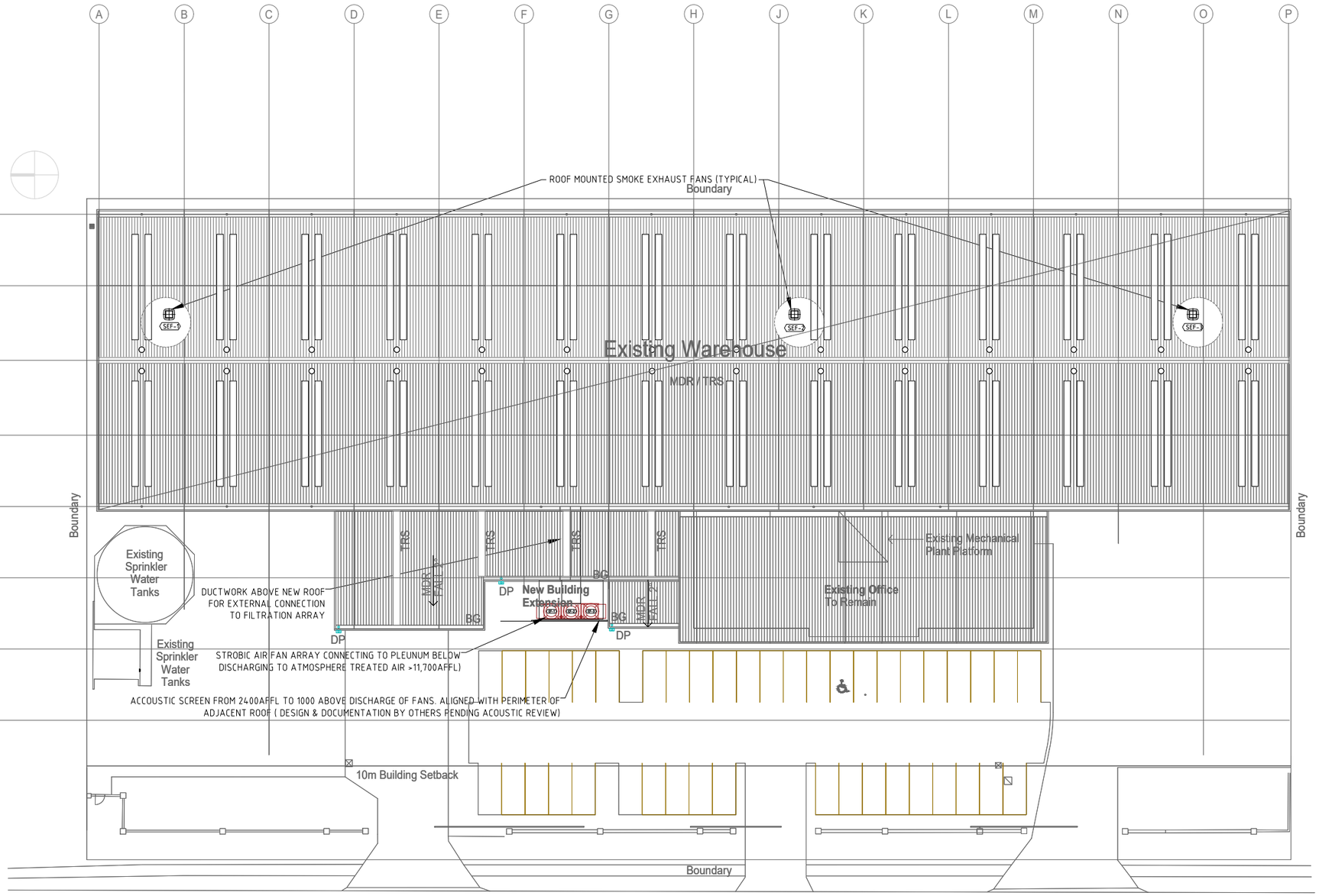
HI-QUALITY GROUP

CLIENT

N KEY PLAN

DRAWING TITLE:
MECHANICAL SERVICES
STAGE 1 - WASTE TREATMENT FACILITY
GROUND LEVEL VENTILATION LAYOUT
9 WHYALLA PL

STATE: NSW		REGION: PRESTON	
ENG: P.L	DRAWN: P.L	QA: P.L	
PROJECT No: HVACA-HWQ-002			
CADREF No: M003			
SCALE 1:500	SHEET No. 1 OF 6	REV. P1	



Whyalla Place

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PROJECT STAGE:

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☐ TD		
☐ IFC		

QUALITY RECORD :

HVAC Alliance
ABN 44 612 366 006

HI-QUALITY GROUP

CLIENT

N KEY PLAN

DRAWING TITLE:
MECHANICAL SERVICES
STAGE 1 - WASTE TREATMENT FACILITY
ROOF LEVEL VENTILATION LAYOUT
9 WHYALLA PL

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ENG: P.L	DRAWN: P.L	QA: P.L
PROJECT No: HVACA-HWQ-002		
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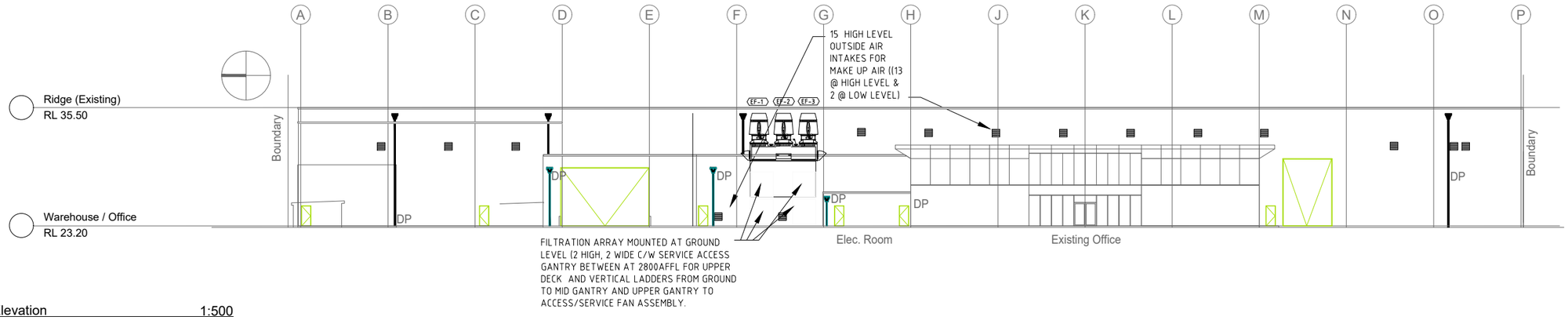

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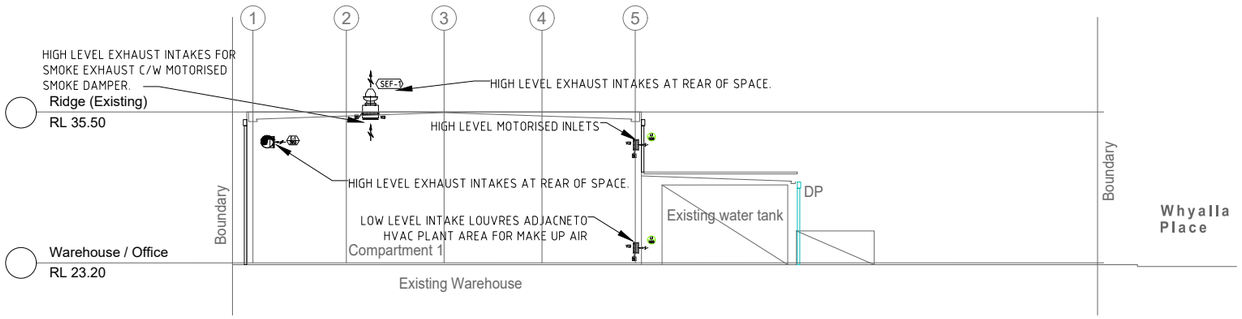

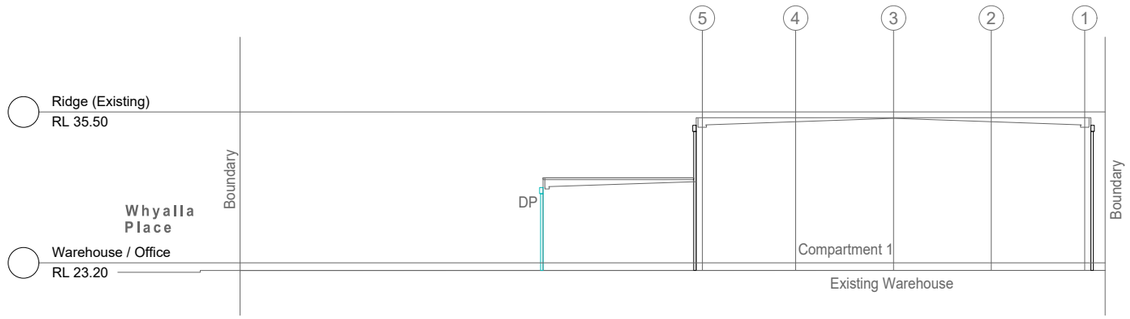

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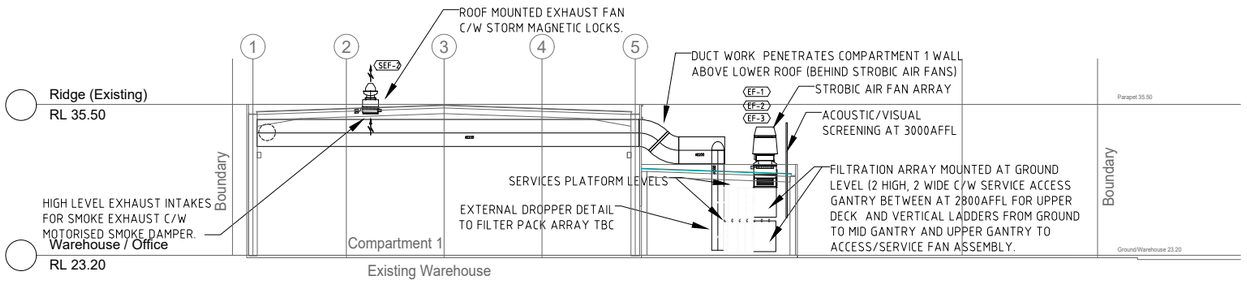

04 - Section - Warehouse 1:500

03 - South Elevation 1:500

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P1	06/06/2021	P.L	CONCEPT HVAC	P.L

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☐ TD		
☐ IFC		

QUALITY RECORD :

HVAC Alliance ABN 44 612 366 006

HI-QUALITY GROUP

CLIENT

N KEY PLAN

DRAWING TITLE:
MECHANICAL SERVICES
STAGE 1 - WASTE TREATMENT FACILITY
ELEVATIONS & SECTIONS
9 WHYALLA PL

STATE: NSW	REGION: PRESTON	
ENG: P.L	DRAWN: P.L	QA: P.L
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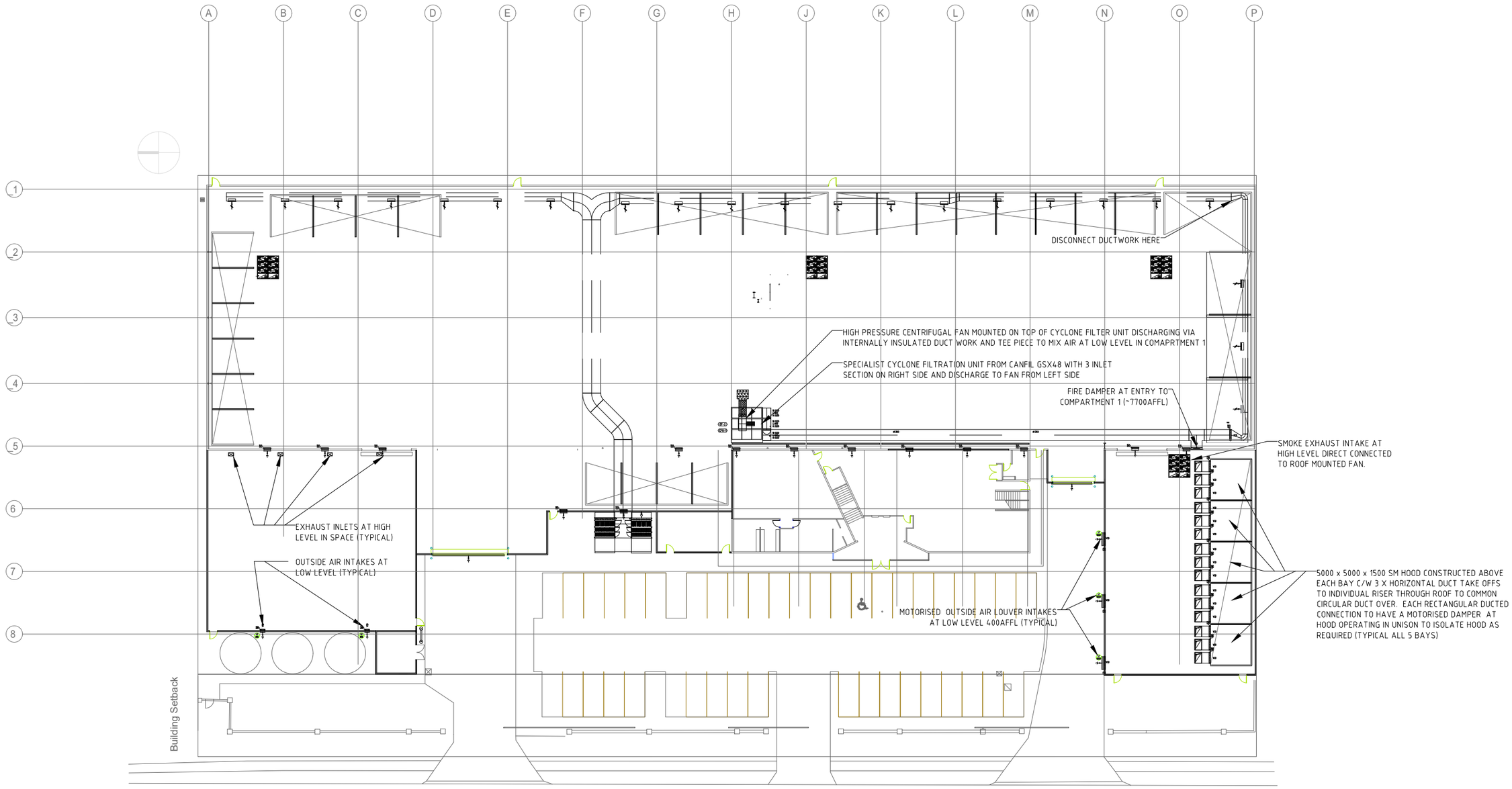

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P1	06/06/2021	P.L	CONCEPT HVAC	P.L

STRICTLY CONFIDENTIAL

PROJECT STAGE:

	SIGNATURE	DATE
☐ CD		
☐ DD		
☐ TD		
☐ IFC		

QUALITY RECORD :

HVAC Alliance
ABN 44 612 366 006

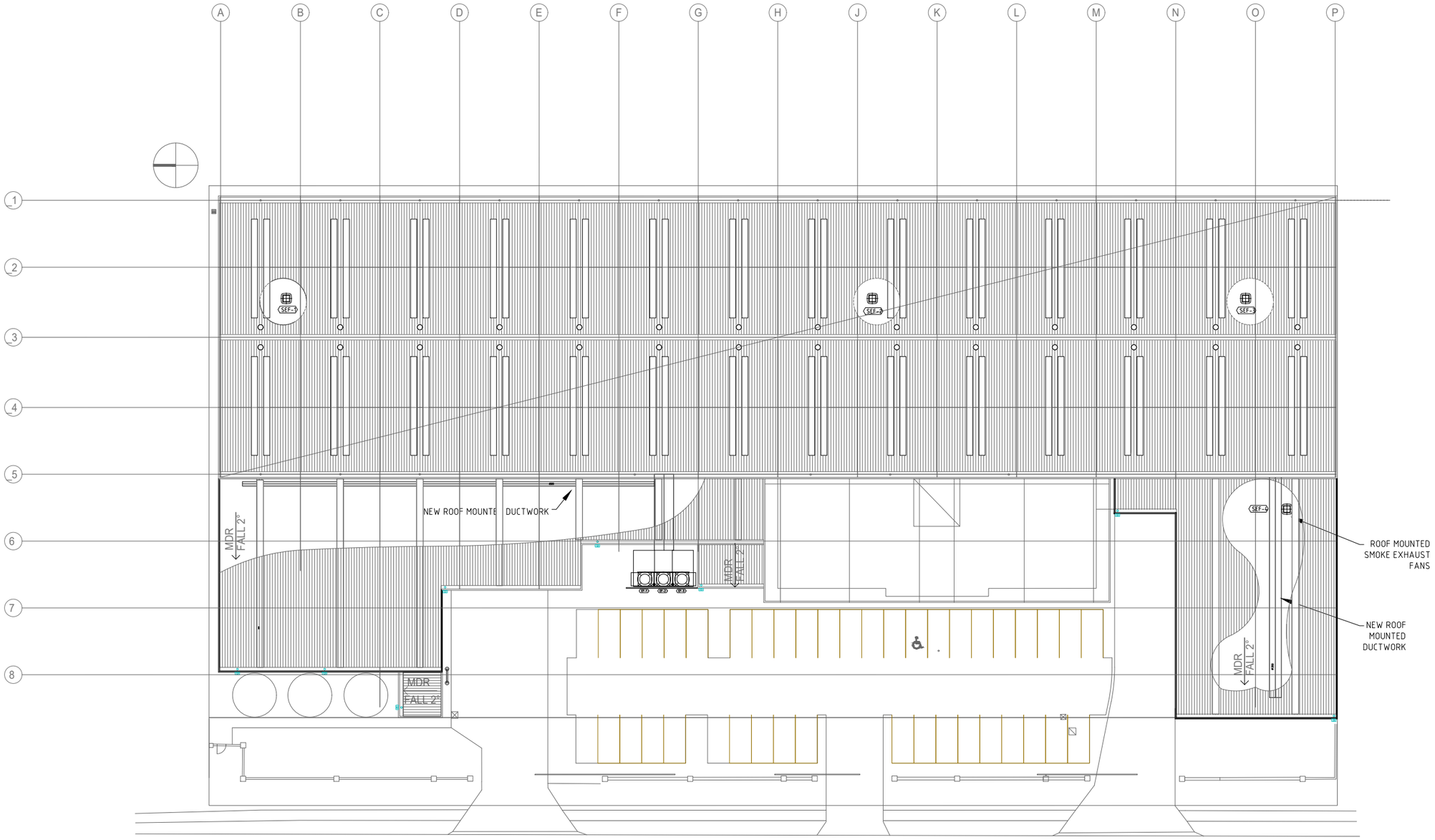
HI-QUALITY GROUP

CLIENT

N KEY PLAN

DRAWING TITLE:
MECHANICAL SERVICES
STAGE 2 - WASTE TREATMENT FACILITY
GROUND LEVEL VENTILATION LAYOUT
9 WHYALLA PL

STATE: NSW	REGION: PRESTON	
ENG: P.L	DRAWN: P.L	QA: P.L
PROJECT No: HVACA-HWQ-002		
CADREF No: M103		
SCALE 1:500	SHEET No. 4 OF 6	REV. P1



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P1	06/06/2021	P.L	CONCEPT HVAC	P.L

STRICTLY CONFIDENTIAL

PROJECT STAGE:

	SIGNATURE	DATE
☐ CD		
☐ DD		
☐ TD		
☐ IFC		

QUALITY RECORD :

HVAC Alliance
ABN 44 612 366 006

HI-QUALITY GROUP

CLIENT

N KEY PLAN

DRAWING TITLE:
MECHANICAL SERVICES
STAGE 2 - WASTE TREATMENT FACILITY
ROOF LEVEL VENTILATION LAYOUT
9 WHYALLA PL

STATE: NSW	REGION: PRESTON	
ENG: P.L	DRAWN: P.L	QA: P.L
PROJECT No: HVACA-HWQ-002		
CADREF No: M104		
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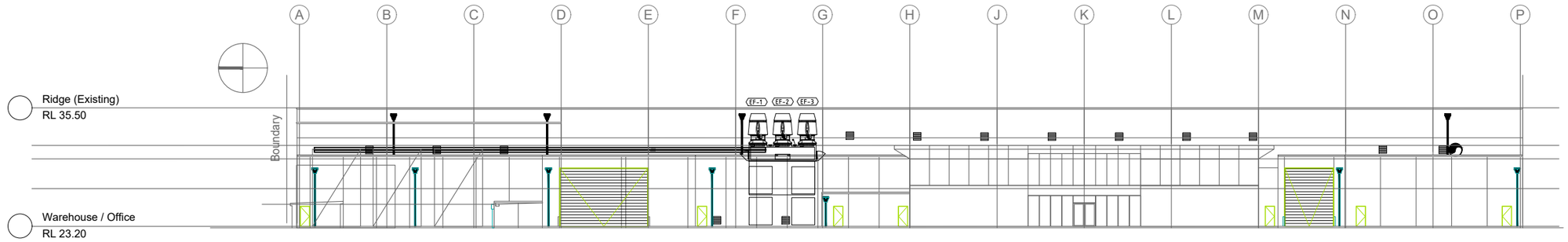
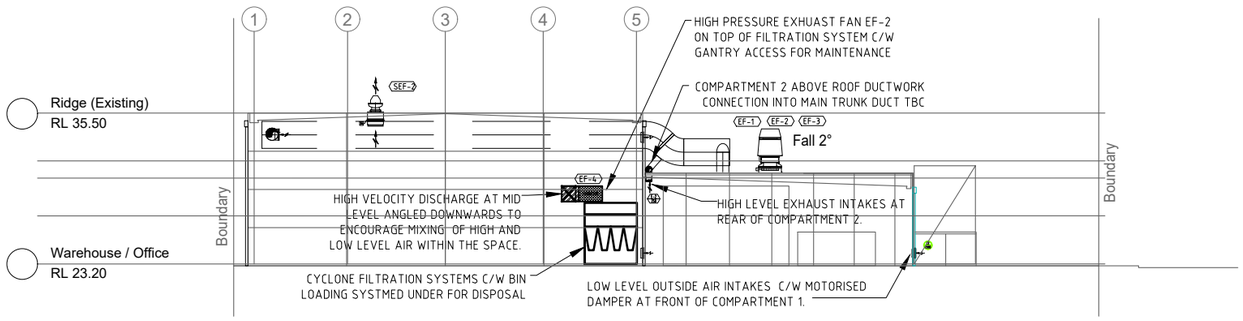
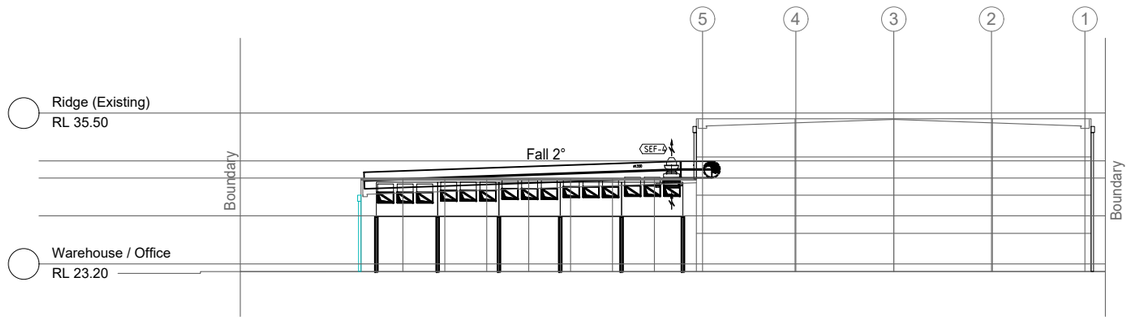
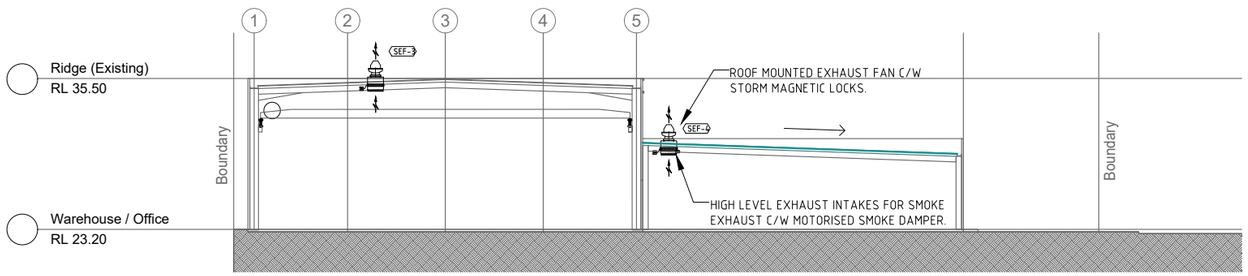


01 - West Elevation 1:500





02 - North Elevation 1:500



03 - South Elevation 1:500

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-				
-				
P1	06/06/2021	P.L	CONCEPT HVAC	P.L

STRICTLY CONFIDENTIAL

PROJECT STAGE:

	SIGNATURE	DATE
☐ CD		
☐ DD		
☐ TD		
☐ IFC		

QUALITY RECORD :

HVAC Alliance
ABN 44 612 366 006

HI-QUALITY GROUP

CLIENT

N KEY PLAN

DRAWING TITLE:
MECHANICAL SERVICES
STAGE 2 - WASTE TREATMENT FACILITY
ELEVATIONS & SECTIONS
9 WHYALLA PL

STATE: NSW		REGION: PRESTON	
ENG: P.L	DRAWN: P.L	QA: P.L	
PROJECT No: HVACA-HWQ-002			
CADREF No: M105			
SCALE 1:500	SHEET No. 6 OF 6		REV. P1

Appendix C

Baseline Air Quality

TECHNICAL MEMORANDUM

DATE 26 May 2021 **Project No.** 20142192-041-M-RevA

TO Dan Blair, Hi Quality

CC

FROM Cameron McNaugton **EMAIL** csmcnaughton@golder.com

HI QUALITY PRESTONS WASTE TREATEMENT FACILITY: BASELINE AIR QUALITY

This technical memo summarises Golder's assessment of baseline air quality for the proposed Hi Quality Prestons Waste Treatment Facility. This memo documents the following:

1) The source of baseline particulate matter (PM) data used for the baseline;

2) Analysis of the raw data's completeness and summary statistics;

3) Selection of the 3 years of baseline data for use in the assessment;

4) Description of gap filling techniques used to improve the representativeness of the data; and

5) Summary statistics for the final data set used for the assessment.

Data Source

Baseline air quality data were obtained from the NSW Environmental Protection Authority's ambient air quality monitoring station (AAQMS) located at Liverpool, NSW. These data include hourly $PM_{2.5}$ and PM_{10} observations from 1 January 2015 to 31 December 2020.

Raw Data Statistics

Table 1 summarizes the following raw data statistics for the Liverpool AAQMS data:

- Number (N) of available hourly data records for the year and the completeness of the data expressed as a percent of all hours in the year; i.e., percent complete.
- Annual mean, median, standard deviation (Stdev), minimum, maximum and 70^{th} percentile hourly concentrations.
- Number of data records with PM concentrations below zero (a non-physical quantity).
- Annual number of 24-hr particulate matter impact assessment criteria exceedances, based on:
  - 24-hr averages of the raw hourly data;
  - 24-hr average PM2.5 impact assessment criteria of 25 $\mu g/m^3$; and
  - 24-hr average PM10 impact assessment criteria of 50 $\mu g/m^3$.

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Selection of Baseline Years for Air Quality Modelling

Based on the results presented in Table 1, years 2016, 2017 and 2018 are recommended as the assessment years for air quality modelling. Reasons for selecting these years include the following:

- A consecutive 3-year period of data is required.
- Year 2015 was excluded because it is the oldest and has the lowest percent completeness for both $PM_{2.5}$ and PM_{10}.
- Years 2019 and 2020 were excluded due to the atypically large influence of bush fire smoke in those years.

Gap Filling and Conditioning

A continuous hourly record of $PM_{2.5}$ and PM_{10} data are required to accurately simulate potential impacts of the Project on air quality at hourly timescales. The raw data were gap-filled and conditioned as follows:

1) Missing hourly data in each year were gap-filled by assigning the 1-hr median value for that year (Table 1). Particulate matter concentrations are typically log-normally distributed so substitution using the median value is considered more representative than the mean.
2) Hourly data with negative $PM_{2.5}$ concentrations were assigned a value of 1.0 $\mu g/m^3$. Although the PM instruments have a reporting precision of 0.1 $\mu g/m^3$, measurement uncertainty is approximately +/-1.0 $\mu g/m^3$.
3) Hourly data with negative PM_{10} concentrations were assigned a value of 2.5 $\mu g/m^3$. The median PM_{10}: $PM_{2.5}$ ratio for the 5-year record is 2.2.

This approach increases 1-hr and 24-hour data completeness to 100%. This approach also introduces a small positive bias to the mean (but not the median) 24-hr average PM concentrations calculated from the 1-hr data. With respect to potential impacts from the Project, this is a conservative bias; i.e., it improves the representativeness of the air quality model predictions.

Summary Statistics

Table 2 summarizes the annual 1-hr $PM_{2.5}$ and PM_{10} statistics for the gap-filled data. Table 3 summarizes the 24-hr average $PM_{2.5}$ and PM_{10} statistics. Figure 1 includes a time series of 24-hr $PM_{2.5}$ and PM_{10} for years 2016, 2017 and 2018. These are the data that will be used as the 1-hr baseline $PM_{2.5}$ and PM_{10} concentrations in the assessment.

As indicated, the background air quality in the Liverpool area is generally good. However, there are between three and eight 24-hr $PM_{2.5}$ exceedances per year, and two to thirteen 24-hr PM_{10} exceedances per year.

Table 1: Raw 1-hr Liverpool PM data statistics.

Year	Size	N	Mean	Median	Stdev	Min	70th	Max	Percent Complete	Below Zero	24-hr PM Exceedances
		#	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	%	#	#
2015	$PM_{2.5}$	7909	8.5	7.1	7.7	-2.5	10	74	90%	497	2
	PM_{10}	8384	18	16	12	-8.9	22	198	96%	37	1
2016	$PM_{2.5}$	8044	8.8	7.3	8.2	-2.5	11	110	92%	543	4
	PM_{10}	8711	19	17	13	-10	24	181	99%	48	3
2017	$PM_{2.5}$	8009	8.9	7.3	8.5	-2.5	11	205	91%	449	5
	PM_{10}	8664	21	18	14	-10	24	257	99%	59	2
2018	$PM_{2.5}$	8369	10	8.3	8.8	-2.5	12	160	96%	199	8
	PM_{10}	8634	24	20	19	-9	28	481	99%	34	13
2019	$PM_{2.5}$	8313	13	8.5	22	-2.5	13	437	95%	237	32
	PM_{10}	8667	28	21	34	-8.5	29	730	99%	50	29
2020	$PM_{2.5}$	8397	9.1	6.8	10	-10	11	168	96%	707	9
	PM_{10}	8508	21	17	23	-9.4	23	830	97%	39	8

Table 2: Gap-filled and conditioned 1-hr Liverpool PM data statistics.

Year	Size	N	Mean	Median	Stdev	Min	70th	Max	Percent Complete
		#	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	%
2015	$PM_{2.5}$	8759	8.5	7.1	7.2	0.1	10	74	100%
	PM_{10}	8759	18	16	12	0.1	22	198	100%
2016	$PM_{2.5}$	8784	8.8	7.3	7.7	0.1	10	110	100%
	PM_{10}	8784	19	17	12	0.1	23	181	100%
2017	$PM_{2.5}$	8760	8.9	7.3	8.0	0.1	10	205	100%
	PM_{10}	8760	21	18	13	0.1	24	257	100%
2018	$PM_{2.5}$	8760	10	8.3	8.5	0.1	12	160	100%

Year	Size	N	Mean	Median	Stdev	Min	70th	Max	Percent Complete
		#	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	%
	PM_{10}	8760	24	20	19	0.1	28	481	100%
2019	$PM_{2.5}$	8760	13	8.5	21	0.1	12	437	100%
	PM_{10}	8760	28	21	34	0.1	29	730	100%
2020	$PM_{2.5}$	8784	9.2	6.8	10	0.1	10	168	100%
	PM_{10}	8784	21	17	23	0.1	23	830	100%

Table 3: Gap-filled and conditioned 24-hr Liverpool PM data statistics.

Year	Size	N	Mean	Median	Stdev	Min	70th	Max	24-hr PM Exceedances
		#	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	#
2015	$PM_{2.5}$	365	8.6	7.3	4.2	2.8	10	32	2
	PM_{10}	365	18	17	7.4	3.5	21	73	1
2016	$PM_{2.5}$	366	8.9	7.7	4.7	2.1	10	51	4
	PM_{10}	366	19	18	8	5.4	23	68	3
2017	$PM_{2.5}$	365	9.0	8.1	4.7	2.7	10	58	3
	PM_{10}	365	21	20	8	4.8	24	72	2
2018	$PM_{2.5}$	365	10	9.1	5.3	2.2	12	44	8
	PM_{10}	365	24	23	11	6.6	28	100	13
2019	$PM_{2.5}$	365	13	9.3	14	1.5	13	154	30
	PM_{10}	365	28	23	20	6.0	30	173	28
2020	$PM_{2.5}$	366	9.4	7.7	6.5	2.3	10	71	8
	PM_{10}	366	21	18	14	2.9	24	189	7

Figure 1: Time series of gap-filled and conditioned 24-hr PM2.5 and PM10 for 2016, 2017 and 2018 observed at Liverpool NSW.

Appendix D

Air Emissions Inventory

TECHNICAL MEMORANDUM

DATE 19 August 2021 **Project No.** 20142192-040-M-Rev0

TO Dan Blair, Hi Quality
CC
FROM Cameron McNaughton **EMAIL** csmcnaug@golder.com

AIR POLLUTANT EMISSIONS INVENTORY FROM HI QUALITY'S PROPOSED WASTE TREATMENT FACILITY IN PRESTONS, NSW

1.0 INTRODUCTION

Hi Quality Waste Treatment Services Pty Ltd (Hi Quality) retained Golder Associates Ltd. Pty. (Golder) to assist them with an Environmental Impact Statement (EIS) for their proposed Prestons Waste Treatment Facility (the Project) located at 9-13 Whyalla Place, Prestons, NSW, 2170.

The Planning Secretary's Environmental Assessment Requirements (SEARs) required the following issues be addressed, with respect to odour and other air emissions:

- A quantitative assessment of the potential air quality, dust and odour impacts of the development in accordance with relevant Environment Protection Authority guidelines
- The details of buildings and air handling systems and strong justification for any material handling, processing or stockpiling external to buildings
- A greenhouse gas assessment; and
- Details of proposed mitigation, management and monitoring measures.

In addition, the New South Wales Environment Protection Authority required:

- *Demonstrate that the HVAC system can mitigate all key pollutants and capture fugitive dust and vapours generated in the Waste Treatment Facility (including Asbestos).*
- *Proposed measures in place to manage odours from the storage of highly odorous organic chemicals (including mercaptans and acrylates), noting that the nearest sensitive receiver is <500m. Though the nearest residential receiver is 500m N across Hoxton Park Rd, a sensitive receptor includes a location where people work – thus clarification on the nearest sensitive receptor is required. Adjacent premises must be considered required when assessing project air impacts.*
- *Benchmark proposed air pollution control and mitigation measures against best available practice.*

This technical memorandum includes an analysis of contaminants potentially emitted from the Project and provides estimates of emission rates for a limited group of specific compounds. The goals of this analysis are as follows:

1) To identify key pollutants most likely to be emitted by the Project;
2) To review proposed emissions controls and evaluate their emissions removal efficiencies; and
3) To quantify emissions rates of key pollutants for the purpose of their inclusion in an air quality model that will be used to evaluate potential air quality impacts on sensitive receptors.

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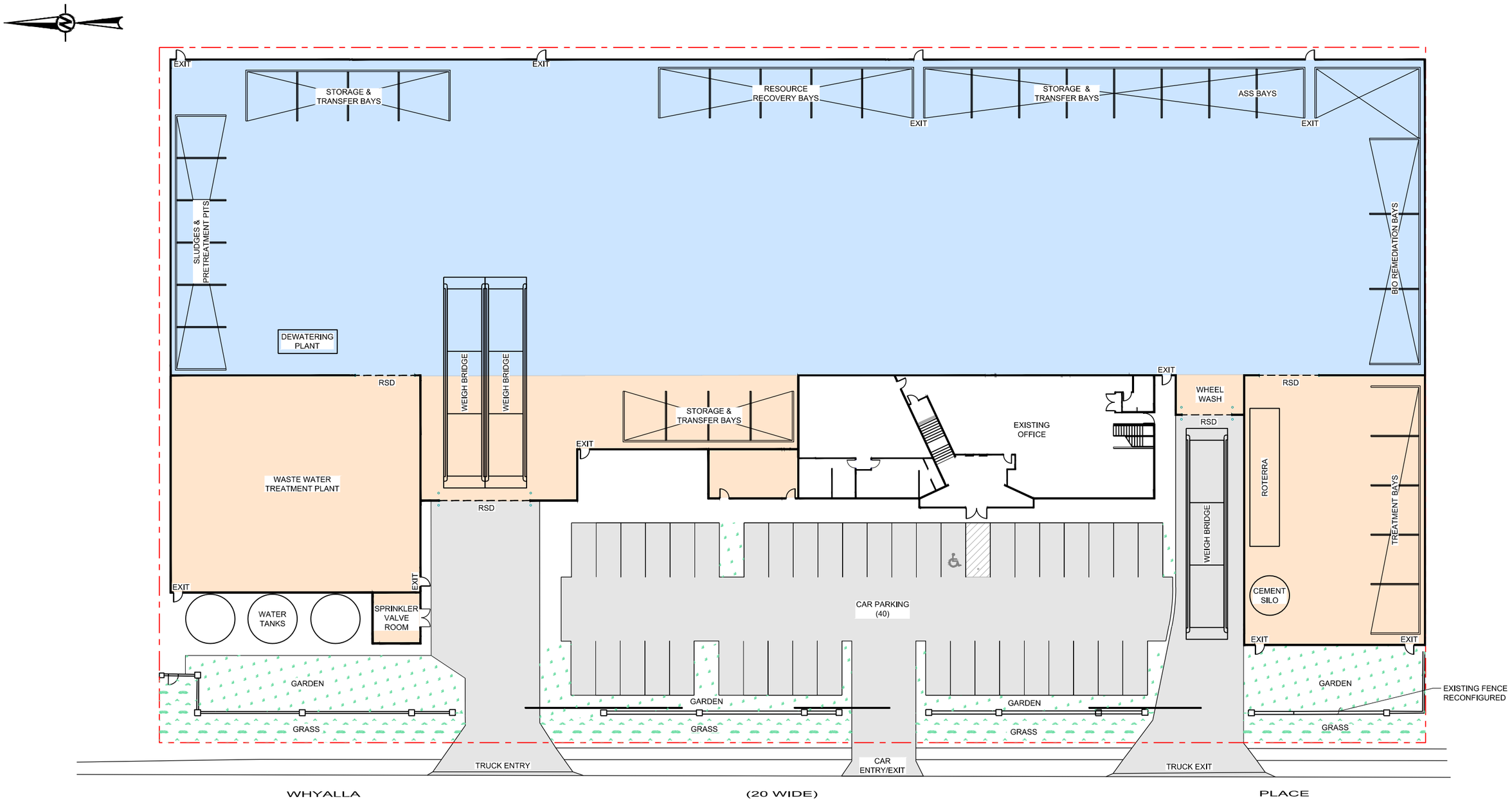

LEGEND

- WAREHOUSE - EXISTING
- WAREHOUSE - EXTENSION
- CONCRETE DRIVE
- GRASS
- GARDEN
- SITE BOUNDARY

NOTE(S)

RSD - ROLLER SHUTTER DOOR

REFERENCE(S)

BASE SURVEY TAKEN FROM DRG NO. 20209_DA 100_P7_SITE PLAN.

NOT FOR CONSTRUCTION

DRAFT

0 10 20

1:400 METRES

CLIENT
HI QUALITY

PROJECT
PRESTONS WASTE TREATMENT FACILITY

CONSULTANT

GOLDER

YYYY-MM-DD	2021-03-05
DESIGNED	TR
PREPARED	JRR
REVIEWED	JM
APPROVED	JM

TITLE
CONCEPTUAL LAYOUT

PROJECT NO.	CONTROL	REV.	FIGURE
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Prestons Waste Treatment Facility Waste Flows

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JM/TR/jm
20142192-011-M-RevC Waste Flow Chart

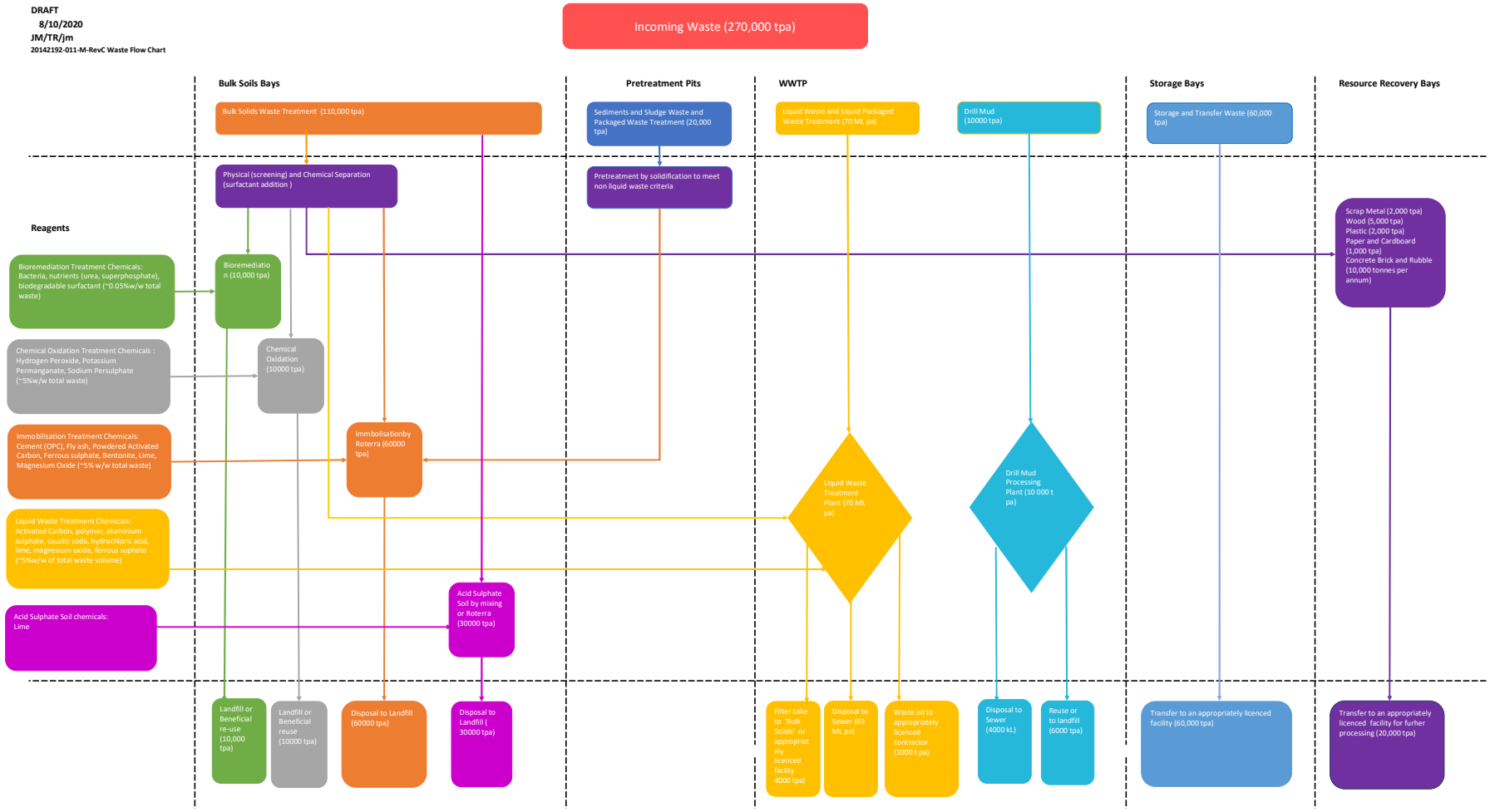

FIGURE 2

2.0 SCIENTIFIC APPROACH

2.1 Waste Type Identification

Figure 1 shows the building layout for the Project and Figure 2 summarizes the incoming waste streams. Up to 270,000 tonnes per annum (tpa) will be received at the Facility. Figure 3 details the proposed heating, ventilation and air conditioning (HVAC) layout for the Facility and divides the Facility into three Compartments. The wastes will generally be received/unloaded in Compartment 1 and then transferred to one of four receiving areas. The receiving areas and their locations include:

- Bulk Soil Bays in Compartment 3;
- Sediment and Sludge Pre-treatment Pits in Compartment 1;
- The wastewater treatment plant (WWTP) in Compartment 2; and
- Treatment Bays in Compartment 1.

There is an additional set of bays for recovered resources (Resource Recovery Bays in Compartment 1). Types of waste and the total annual mass or volume (in megalitres; ML) that will be received include:

- Bulk Solids (110,000 tpa);
- Sediment and Sludge Wastes and Packaged (solid) Wastes (20,000 tpa);
- Liquid Waste and Packaged (liquid) Wastes (70 ML);
- Drill mud (10,000 tpa) and
- Storage and Transfer Waste (60,000 tpa).

Specific waste types that will be treated at the Project, and their corresponding waste codes, are summarized in Table A1 in Appendix A. Wastes that will be stored or transferred only are summarized in Table A2. These wastes are grouped according to the following categories:

- Category A – Organics (non-halogenated);
- Category B – Halogenated including Brominated;
- Category C – Metals and Metalloids (excluding slag); and
- Category D – Other (inorganic, specialist waste streams).

It is impractical to develop compound-specific emissions profiles for each waste code. Therefore, waste types have been aggregated into three classes that broadly reflect their chemical composition. These waste classes are named and described as follows:

1) ***Dusty Wastes and/or Metals in Waste***: solid waste contaminated with fine dust and/or individual metals or solid waste generally high in metals.
2) ***Volatile Waste***: all liquid wastes, plus solid waste contaminated with volatile materials (e.g., halogenated and non-halogenated solvents).
3) ***Other Special Waste***: solid waste containing contaminants of a unique or specific composition.

47902.85m^2 @ 2ACH = 95805.7m^3/hr = 26,613L/s Exhaust from space at high level

Compartment 1 to be used for unloading, storage of product to be treated etc. minimal VOC's generated here but more significant vehicle exhaust issues. Only 1 treatment pit on far right of this space.I suggest wrapping area which will have a canopy in with Compartment 3. This space at 2ACH target = 94,654L/s ensuring high and low level make up air for scavenging fumes.

3569.5m^3/hr = 991.5L/s Exhaust min

high level make up air louvres @

ductwork to be installed over rooftop to avoid fire damper requirement

25,000/s Discharge off cyclone system @ 45 deg downwards centrally in warehouse to scavenge low level debris, VOC's etc and encourage mixing with high level make up air for recollection at rear of warehouse.

Filtration system discharging at top of unit through an attenuator Fan to have acoustic wrapping.

13 off intakes at high level in warehouse. Each located in boot horizontally installed in spiral ductwork(to keep balancing damper out of air stream).

fabric curtain sides from top of wall to underside of roof each side with front drop curtain set to 4.5m high (typical all southern bays)

25,000L/s exhaust rate from hood 25m^2 hood over each of the 5 pits

ductwork splitter into cyclone filtration unit.

4 off filter boxed stacked in 2 x 2 configuration for collection and treatment of the whole building air extraction quantity (circa 52,600L/s max, 39,000L/s min)

Tripple set of strobic air fans located on common discharge plenum off of filter boxes. safe access gantry required over filter boxes.

ductwork to be installed over rooftop of compartment 3 with fire damper requirement at high level entry to Compartment 1

motorise d damper (typical)

scale needs confirmation

Compartment 1 to be used for liquid waster treatment in a sealed machine. We are largely ventilating this space for AS1668.2 Vehicular movement & human comfort rather than toxic fumes, VOC's and Duct collections. I would assume very minimal VOC's generated here but more significant vehicle exhaust issues. **1ACH** target = **5870L/s**

Full height vented roller shutter doors (8000L/s each @ 12Pa maximum pressure drop)

Compartment 3 to be used for dumping and mixing superfine particles during immobilisation process. **5ACH** target = **16,218L/s**

LEGEND

- WAREHOUSE - EXISTING
- WAREHOUSE - EXTENSION
- CONCRETE DRIVE
- GRASS
- GARDEN
- SITE BOUNDARY

NOTE(S)

REFERENCE(S)

BASE SURVEY TAKEN FROM DRG NO. 20209_DA 100_P7_SITE PLAN.

NOT FOR CONSTRUCTION

DRAFT

0 10 20

1:400 METRES

For Review

[P5] 1/03/2021 12:13:54 PM

HVAC Alliance

ABN 44 612 366 006

HVAC SERVICES CONCEPT STAGE

FIGURE F003

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

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2.2 Contaminant Prioritization

Actual waste composition is unknown, and it is impractical to test each tonne of waste prior to treatment. Therefore, an approach is required to estimate which contaminants are likely to occur in the solid or liquid waste and then to focus analysis on the contaminants of highest concern.

A prioritized list of air emissions from waste were generated based on Hi Quality's experience at their Waste Treatment Facility in Queensland, and Golder's professional experience related to air emissions from waste handling and treatment. The prioritized list of emissions types for the Project include the following:

- Particulate matter (PM) emissions generated from solid waste handling and treatment, including:
  - Particulate matter nominally smaller than 2.5 micrometres in aerodynamic diameter ($PM_{2.5}$);
  - Particulate matter nominally smaller than 10.0 micrometres in aerodynamic diameter (PM_{10}); and
  - Total suspended particulate matter (TSP); and
  - Metals in dust, including wastes containing up to 5 wt% arsenic, chromium or lead.
- Volatile organic compounds (VOC), including:
  - Benzene, toluene, ethylbenzene and xylene (BTEX) compounds associated with wastes contaminated with hydrocarbons or non-halogenated industrial solvents.
  - Emissions of chlorinated compounds (e.g., trichloroethylene; TCE) from wastes contaminated with halogenated industrial solvents.
- Special waste types, such as the following:
  - Per- and Polyfluoroalkyl Substances (PFAS); and
  - Asbestos.

In our analysis we focus on evaluating contaminants estimated to be of highest concern that also have the highest probability of being emitted. After their emission, if maximum ground-level concentrations of these compounds are predicted to be compliant with their respective air quality criteria, then we assume that the emissions of other contaminants will also be compliant.

2.3 Emissions Factors

The subsections that follow document Golder's approach to estimating emissions for the prioritized list of emissions types.

2.3.1 Particulate and Metals Emissions Factors

Emissions of metals are assumed to be exclusively associated with emissions of particulate matter. Emissions of particulate matter occur due to the following processes:

1) Unloading of soil and solid waste inside Compartment 1;
2) Stockpiling of soil and solid waste prior to treatment in Compartment 3;
3) Mixing of waste with reagents and binders (Roterra Unit) in Compartment 3;
4) Stockpiling of treated waste in Compartment 3; and
5) Loadout of treated waste Compartment 1.

No mathematical relationships have been developed to specifically estimate particulate matter emissions from the handling/treatment of solid waste. The United States Environmental Protection Agency (EPA) has developed emissions factors (AP 42, Fifth Edition, Volume 1) for *Aggregate Handling and Storage Piles* (AP-42 Chapter 13.2.4). Equation 2.1 is used to estimate emissions from adding/removing material from aggregate stockpiles, including truck unloading and loadout to a truck using a front-end loader.

$$EF = k(0.0016)\left(\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}\right) \quad \text{Equation 2.1}$$

Where:

- EF = the emissions factor in kg of particulate matter per tonne of material handled (mg/kg);
- k = particle size multiplier, a dimensionless quantity with the following values:
  - k = 0.74 for TSP;
  - k = 0.35 for PM_{10};
  - k = 0.053 for $PM_{2.5}$;
- U = mean wind speed in meters per second (m/s);
- M = the material moisture content in percent (%).

Equation 2.1 is valid over the following range of conditions:

- materials with measured silt contents between 0.44 and 19%;
- materials with a moisture content between 0.25% and 4.8%; and
- over a range of wind speeds between 0.6 and 6.7 m/s.

Here we assume that Metals Waste and waste containing metals have the following properties:

1) a silt content of less than 19%;
2) a moisture content of 0.5% (a conservative assumption); and
3) are subject to a wind speed of 2.5 m/s (a conservative assumption for indoor waste-handling operations).

The PM emissions factors are used to generate dust emissions from the handling of solid wastes. To determine the emissions of metals, the PM emissions are then multiplied by the maximum expected weight percentage of metals found in the solid waste; i.e., solid waste containing up to 5 wt% of arsenic, chromium or lead.

2.3.2 Volatile Compound Emissions Factors

The Volatile Waste class includes liquid wastes containing mixtures of acids, bases, oil and water, as well as solid waste contaminated with volatile compounds (e.g., hydrocarbons, halogenated and non-halogenated solvents). Emissions of volatile compounds from these wastes can occur due to the following processes:

1) Bulk delivery of liquid and sludge waste into storage and treatment bays in Compartments 1 and 2;
2) Unloading and stockpiling of solid waste inside Compartments 1 and 3;

3) Stockpiling and loadout of treated waste in Compartment 1.

No mathematical relationships have been developed to specifically estimate emissions of volatile compounds from the handling/treatment of liquid or solid waste. The US EPA has developed AP42 guidance for a broad range of processes. These include the following chapters, and subheadings relevant to the Project:

- Chapter 4: Evaporation Loss Sources;
  - Chapter 4.6: Solvent Degreasing;
- Chapter 6: Organic Chemical Process Industry;
  - Chapter 6.4: Paint and Varnish;
  - Chapter 6.7: Printing Ink;
  - Chapter 6.13: Pharmaceuticals Production;
- Chapter 7.0: Liquid Storage Tanks; and
  - Organic Liquid Storage Tanks.

Each of these chapters were reviewed as part of this analysis, in addition to reviewing material available in the *Air Pollution Engineering Manual* (AWMA 2000). Based on this review, Golder employs the following approach to estimate emissions of volatile compounds from Volatile Waste at the Project.

1) The primary source of fugitive emissions of volatile compounds is assumed to occur during bulk delivery of the solid or liquid Volatile Waste.

2) Emissions during the bulk delivery of the Volatile Waste is parameterized using equations developed to estimate emissions from the transfer of petroleum liquids from tanker trucks into petroleum storage tanks. This method is stated as having a probable error of +/-30% (AWMA 2000).

3) The type/method of unloading is assumed to be “splash loading” using a “dedicated normal service”. This is the delivery method with the highest predicted emissions per unit of liquid(s) unloaded and therefore a conservative approach to estimating emissions.

4) Emissions of volatile compounds from solid waste (e.g., petroleum and solvents contaminated waste) are computed using the same equations as used for the handling of liquid wastes. This is a simplistic but necessary assumption due to a lack of well-developed theory or other guidance. This assumption is believed to be conservative for the following reasons:

    a. Volatile organic liquid wastes mixed with water will evaporate quickly as the compounds attempt to achieve a local equilibrium vapour pressure.

    b. Volatiles in solid waste will also evaporate, however this process will be inhibited by the presence of soil voids and solid organic compounds because many solvents have an octanol-water partitioning value (k_{ow}) that leads, preferentially, to solvent sorption onto carbon-rich surfaces (e.g., soil organic matter).

    c. By assuming solid Volatile Waste “splashes” onto the tipping floor, and assuming the volatiles are released as if escaping from a liquid with low organic carbon content (i.e., contaminated water) rather than semi-solid with some organic carbon content (i.e., contaminated soil), volatile compounds emissions will be more conservatively estimated.

AWMA (2000) provides total uncontrolled organic emission factors for a variety of petroleum liquids during splash loading. The emission factor for gasoline is used as the reference value for this analysis. The “splash loaded: dedicated normal service” emissions factors are highest for gasoline (1,430 mg/L transferred) as compared to crude oil (580 mg/L). The “dedicated normal service” emissions factor (1,430 mg/L of gasoline transferred) is higher than for tanker trucks equipped with vapour recovery systems (e.g., 980 mg/L of gasoline transferred).

The contaminant prioritization analysis for Volatile Waste indicates the following waste sources and compounds are those of highest concern:

- Benzene as a component of hydrocarbon contaminated water or soil;
- Benzene as a non-halogenated organic solvent; and
- Trichloroethylene (TCE) from wastes derived from either contaminated soils or the surface treatment of metals and plastics.

Emissions from benzene as a component of gasoline, benzene as a solvent, and TCE as a solvent are each considered separately, assuming the following:

- all hydrocarbons in soil are gasoline, the most volatile and commonly used hydrocarbon;
- all non-halogenated solvent residues in waste are benzene; and
- all halogenated solvent residues in waste are TCE.

The emissions of benzene and TCE will differ from emissions from gasoline because these compounds have different physicochemical properties, including molecular weight, density, and equilibrium vapour pressures. To account for this, the emissions factors for splash-loaded gasoline have been pro-rated for benzene and TCE using the ratio of the compound’s vapour pressure to the vapour pressure of gasoline. These modified emission factors are presented in Table 1.

Table 1: Estimated volatile compounds emissions factors for gasoline, benzene and trichloroethene.

Compound	Molecular Weight	Liquid Density	Vapour Pressure	VOC EF[1] Uncontrolled
	g/mol	g/cm^3	atm	mg/L
Gasoline	114	0.75	0.449	1,430
Benzene (in gasoline)	78.1	0.88	0.125	399
Benzene (as solvent)	78.1	0.88	0.125	399
Trichloroethylene (TCE)	131	1.46	0.076	242

g/mol = grams per mol; g/cm^3 = grams per cubic centimetre; atm = atmospheres; mg/L milligrams per L transferred

2.3.3 Special Compound Emissions

Special compounds potentially associated with waste being received at the Project include PFAS and Asbestos.

PFAS are contaminants of emerging concern due to their environmental persistence. PFAS may be found in solid or liquid waste. Since these compounds are typically only semi-volatile, PFAS found in liquid wastes are assumed to remain in the liquids. Therefore, we focus on PFAS air emissions assumed to be associated with particulate matter. For estimating PFAS emissions, we conservatively assume that the PFAS associated with PM occurs at the PFAS National Environmental Management Plan, Version 2.0 (NEMP, 2020) maximum permissible PFAS content of 50 mg/kg (0.005 wt%).

Volumes of waste potentially contaminated with asbestos are predicted to be less than 20,000 tpa. Since emissions control devices designed to capture and control fugitive dust emissions will also be highly effective in capturing fugitive asbestos fibres, asbestos emissions are not considered explicitly in our analysis.

2.4 Air Emissions Control

PM and VOC emissions from the Project will be mitigated using both engineering controls and management controls. The proposed emissions controls were developed collaboratively between Hi Quality, Golder and HVAC Alliance, a qualified heating, ventilation, and air conditioning (HVAC) sub-consultant.

2.4.1 Engineering Controls

Figure 3 summarizes the proposed HVAC system and details the locations where emissions are collected by overhead vents etc. Emissions are routed from their point of origin to emissions control devices and then to three strobic fans serving as exhaust stacks for all emissions from the Project.

The Project building is compartmentalised (1, 2 and 3) to improve the collection and mitigation of fugitive emissions in individual work areas. Key emissions activities and their relationship to the building compartments include the following:

1) PM and VOC emissions from unloading of untreated waste and loadout of treated wastes is assumed to occur exclusively in Compartment 1.

2) Compartment 1 is served by a series of overhead vents along the north wall. These are designed to draw contaminated air from near the emitting activities and route this air to the common inlet plenum for the air emissions control system.

3) Three-sided fabric curtains will be installed in relevant working areas to reduce the escape of fugitive dust and vapours during material handling and processing and to improve the collection efficiency of contaminated air by the HVAC system.

4) VOC emissions are potentially generated by the WWTP in Compartment 2 while treating hydrocarbon or solvent contaminated liquids. The WWTP is a sealed vessel so VOC capture efficiency is predicted to be high. VOC emissions captured in this area are routed directly to the common outlet plenum for the air emissions control system.

5) Raw water tanks are to be fitted with screw lock (or similar) inlet fittings to reduce spillage. Tank relief vents will include vapour recovery systems ducted to the HVAC system during product loading/unloading.

6) Potentially large volumes of fugitive dust will be generated when using the Roterra unit to treat bulk soils and sludge in Compartment 3. All emissions from Compartment 3 are routed directly to a dedicated filter-

cartridge based dust collector (Camfil Model GSX48; Appendix B). The dust collector has a manufacturer-stated PM removal efficiency of 99.99% for particles down to 0.5 micrometers in geometric diameter. The dust collector is located in Compartment 1 and will vent treated exhaust air directly into Compartment 1.

7) Compartments 1, 2 and 3 will have a small amount (<10%) of additional PM and VOC emissions from diesel combustion by mobile plant and haul trucks.

8) Emissions collected in Compartments 1 and 2 are routed to a common inlet plenum for the building's air emissions control system. This system includes the following components, listed in order of exhaust flow:

    a. Common inlet plenum serving Compartments 1 and 2;

    b. PM filter box;

    c. VOC and odour filter box; and

    d. Common outlet plenum;

    e. Three (3) strobic exhaust fans operating in parallel.

9) Fresh air is provided to each of the compartments by motorised dampers fitted behind weatherproof louvres located along the western wall of compartment 1 & 2 and the northern wall of compartment 3 (see Figure 3).

The PM filter box will be equipped with a G4-rated, 30/30 Dual 10 high capacity disposable carboard pre-filter and an F7-rated, Hi-Flo spun glass high-capacity filter. The PM removal efficiencies as a function of size for each filter type are summarized in Table 2. The combined removal efficiencies for the two filters are calculated as 75% for $PM_{2.5}$, 95% for PM_{10} and 97.5% for TSP. No additional PM removal is assumed to occur as air passes through the VOC molecular filters, which is a conservative assumption.

The VOC and odour filter box will be equipped with VG440 molecular filters filled with Camfil's LGS048 media. Compound specific removal efficiencies were not available for the LGS048 media. However, the carbon-based LGS048 media is tailored by the vendor for the removal of VOC's and odour.

This assessment uses the predicted removal efficiencies for a 50:50 mixture of activated carbon and Purafil CP. This is the media formulation currently in use at Hi Quality's Waste Treatment Facility in Yatala, Queensland. The use of Purafil CP type of media is to increase the removal efficiency of BTEX compounds and halogenated VOC's (e.g., TCE), as compared to the use of activated carbon only (see comparison in Table 3).

Table 2: Summary of estimated PM removal efficiencies for Project emissions control system.

d_g*	Filter Efficiency		
µm	**G7 (Pre-filter)**	**F7 (Main Filter)**	**Combined**
1.00	3%	62%	**63%**
2.50	15%	71%	**75%**
10.0	54%	90%	**95%**
30.0	75%**	95%**	**97.5%**

*removal efficiencies based on geometric diameter (d_g), not aerodynamic diameter (d_{ae}); i.e., removal is "greater than" indicated value. **assumption, no value given by manufacturer.

Table 3: Summary of estimated VOC removal efficiencies.

Type	Airflow-VC	PK/PM18
Media	Activated Carbon	**50:50 Carbon/Purafil CP**
Benzene	90%	**98%***
TCE	<90%	**98%**

*Manufacturer stated 99.5% removal of toluene ($C_5H_5CH_3$)

2.4.2 Management Controls

Management controls include policies and procedures designed to reduce the generation of PM and VOC emissions, especially fugitive emissions. Examples of proposed management controls include:

- No idling of mobile plant and haul trucks when not in use.
- Material loading/unloading and handling procedures designed to reduce fugitive dust emissions; e.g., high-speed roller-doors required to be closed during material loading/unloading and handling.
- Operation of emissions control devices according to their manufacturer's specifications.
- Regular preventive maintenance of emissions control devices according to their manufacturer's specifications.
- Wheel wash station at the Facility exit to reduce soil track-out and generation of fugitive dust outside the building envelope.
- Fogging suppression systems where deemed necessary in Compartment 3 treatment bays and will be installed in other areas if necessary.
- Compartment 3 manual on/off switches to focus air collection in the active 1 of 5 treatment bays being used for stockpiling treated waste discharged from the Roterra unit. These HVAC controls system will

allow a single stockpile bay hood to collect, and send for treatment, approximately 95% of the total air flow through the space.

- Fabric side curtains front drop curtain to 4 m on bioremediation treatment bays are designed to contain minor contaminant generation from handling and turning process.
- Overall the building compartments will be maintained at > -5 Pascals (Pa) while in 'daily treatment mode'. When in 'after hours mode', the building can exhaust air system from each compartment shall be reduced and associated outside air inlet dampers closed off to maintain > -5 Pa whilst saving energy.
- Safe minimum ventilation rates will be determined through design development and reviewed during commissioning. Where materials are dropped off outside of daily treatment times, the 'after hours mode' shall revert to 'daily treatment mode' for the duration of unloading activity. The truck leaving the facility will trigger a 1hr run on timer before reducing to "after hours mode'.

3.0 EMISSIONS INVENTORY RESULTS

3.1 Particulate Emissions Factors

Up to 110,000 tpa of bulk solid waste will be handled twice, as it is loaded and unloaded, in Compartment 1. Of this material, 60,000 tonnes is destined for immobilization using the Roterra unit housed in Compartment 3. An additional 30,000 tpa of acid sulfate soils and 10,000 tpa of soil waste treated via chemically oxididation will also be treated using the Roterra (See Figure 2). Therefore, the total amount of material handled/treated by the Roterra is therefore 100,000 tpa.

Table 4 summarizes the uncontrolled and controlled emissions factors for PM and the daily and annual uncontrolled emissions rates for Compartment 3. Contaminated air from Compartment 3 is treated using the 99.95% efficient dust collector that vents directly into Compartment 1.

Table 5 summarizes the uncontrolled and controlled emissions factors for PM and the daily and annual uncontrolled emissions rates for Compartment 1. This includes the emissions vented to Compartment 1 by the dust collector serving Compartment 3.

For the assessment, assumptions used to generate the emissions factors and rates presented in Tables 4 and 5 include the following:

- Fugitive dust in Compartment 1 is assumed to be generated from twice handling of 110,000 tpa of bulk solids at a maximum rate of 300 tonnes per hour (i.e., 150 + 150 tonnes per hour).
- Fugitive dust from handling 100,000 tpa of solids in the Roterra operating at a maximum rate of 150 tonnes per hour[1] is routed to Compartment 1 after treatment, conservatively[2] assuming only a 99.9% removal efficiency.
- An additional 10% PM emissions are added to fugitive dust emissions in Compartment 1 to account for diesel particulate emissions generated from mobile plant (e.g., front end loader) and haul trucks operating in the compartment.
- Annual and daily metals emissions rates are calculated assuming emissions occur 24-hrs per day, 7 days per week. In reality the Facility will receive waste 24-hrs/day but processing and dispatch operations will only occur between 7:00 am and 6:00 pm Monday to Saturday and 8 am to 6 pm Sundays

[1] Manufacturer's stated throughput is 50 to 75 m^3/hr, equivalent to 100 to 150 tonnes per hour for a bulk density of 2.0 tonnes/m^3.

[2] By a factor of 2: (1-0.9990)/(0.9995) = 2.

and Public Holidays. The 24-7 assumption is conservative because it represents a “worst case” scenario for daily (24-hr) air emissions.

3.2 Particulate Bound Metals Emissions Factors

Up to 100,000 tpa of solid waste is scheduled for treatment using the Roterra unit housed in Compartment 3. Some of these solids may contain up to 5 wt% arsenic, chromium or lead contaminated wastes. These metals have relatively high toxicity and are therefore those most important to effectively control. To conservatively assess metals emissions as a component of PM, we employ the following assumptions:

- Up to 60,000 tpa of the 100,000 tpa sent to the Roterra unit per year are assumed to contain a maximum of 5 wt% arsenic (20,000 tpa), chromium (20,000 tpa) or lead (20,000 tpa).
- This material is assumed to be handled twice, once in Compartment 1 during unloading, and again in Compartment 3 during treatment. Metals emissions post-treatment are assumed to be negligible.
- Up to 150 tonnes of waste can be handled and sent for treatment per hour and these activities are conservatively assumed to occur in the same hour; i.e., the maximum handling plus treatment rate of solid waste containing metals is 300 tpa.
- Annual and daily metals emissions rates are calculated assuming emissions occur 24-hrs per day, 7 days per week. In reality the Facility will receive waste 24-hrs/day but processing and dispatch operations will only occur between 7:00 am and 6:00 pm Monday to Saturday and 8 am to 6 pm Sundays and Public Holidays. The 24-7 assumption is conservative because it represents a “worst case” scenario for daily (24-hr) air emissions.

Tables 6 and 7 summarizing the PM emissions from handling and treatment of the solid wastes containing high metals in Compartment 3 and 1, respectively. These emissions are then converted into their equivalent 1-hr, 24-hr and annual emissions rates.

As shown in Table 6, the metals emissions from Compartment 3 into Compartment 1 are negligible due to the high efficiency of the dust collector. In Table 7, the emissions calculated for Compartment 1 include the Compartment 3 emissions vented from the dust collector into Compartment 1.

Note briefly:

- Assuming 150 tonnes per hour are being handled/treated in both compartments is a conservative assumption that maximizes the 1-hr and 24-hr emissions rates. In reality, handling rates and treatment times may be lower. This results in the same annual emissions, but lower hourly and daily emissions rates; i.e., the assessment is conservative over the 1-hr and 24-hr time frames.
- The metals emissions generated during the treatment of 50,000 tpa of waste containing metals should be considered as “total metals”, rather than being strictly viewed as actual emissions of a specific metal (i.e., As, Cr or Pb).

3.3 Particulate Bound PFAS Emissions

Per- and polyfluoroalkyl substances are contaminants of emerging concern due to their environmental persistence. The facility will store and/or transfer up to 10,000 tpa of PFAS contaminated soils but will treat up to 10,000 tpa of PFAS contaminated liquids.

Since these compounds are typically only semi-volatile, our assessment assumes that PFAS air emissions are associated primarily with particulate-bound PFAS found in bulk solids or soils.

We assume 10,000 tpa of PFAS contaminated solid waste is handled twice (20,000 tpa) in Compartment 1 at a maximum rate of 150 tonnes per hour. Since it is unlikely this waste will be unloaded, stored and loaded in the same day, the PFAS emissions calculations assume emissions only occur 12 hours per day.

We also conservatively assume that the PFAS content of PM generated from this solid waste contains the NEMP's (2020) maximum permissible PFAS content (i.e., 50 mg/kg or 0.005 wt%). This is also a conservative assumption. Results of these calculations are presented in Table 8.

Table 4: Summary of particulate matter emission factors and emissions rates from Compartment 3.

PM Size Class	Moisture Content	Wind Speed	PM Emissions Factor (Uncontrolled)	PM Control Efficiency	PM Emissions Factor (Controlled)	Waste Tonnage	PM Emissions Factor (Uncontrolled)		PM Emissions Factor (Controlled)	
	%	m/s	kg/tonne	%	kg/tonne	tonnes/yr	kg/day	kg/yr	kg/day	kg/yr
$PM_{2.5}$	0.50	2.5	7.0E-04	99.9%	6.97E-07	100,000	2.5	70	0.003	0.070
PM_{10}	0.50	2.5	4.6E-03	99.9%	4.61E-06	100,000	17	461	0.017	0.461
TSP	0.50	2.5	9.7E-03	99.9%	9.74E-06	100,000	35	974	0.035	0.974

Table 5: Summary of particulate matter emission factors and emissions rates from Compartment 1 (including Compartment 3 emissions).

PM Size Class	Moisture Content	Wind Speed	PM Emissions Factor (Uncontrolled)	PM Control Efficiency	PM Emissions Factor (Controlled)	Waste Tonnage	PM Emissions Factor (Uncontrolled)		PM Emissions Factor (Controlled)	
	%	m/s	kg/tonne	%	kg/tonne	tonnes/yr	kg/day	kg/yr	kg/day	kg/yr
$PM_{2.5}$	0.50	2.5	7.0E-04	75.0%	1.74E-04	242,000	7.5	238	1.26	42
PM_{10}	0.50	2.5	4.6E-03	95.0%	2.30E-04	242,000	50	1,575	1.67	56
TSP	0.50	2.5	9.7E-03	97.5%	2.43E-04	242,000	105	3,330	1.79	60

Table 6: Summary of 1-hr, 24-hr and annual particulate-bound As, Cr, and Pb emission rates for Compartment 3.

PM Size Class	Waste Tonnage	PM Emissions Factor (Uncontrolled)		PM Emissions Factor (Controlled)		PM Metals Content	Operating Hours/Day	Operating Days/Week	Maximum Processing Rate	1-hr Emission Rate	24-hr Emission Rate	Annual Emission Rate
	t/yr	kg/day	kg/yr	kg/day	kg/yr	wt%	hours	days	t/hr	g M/hr	g M/day	g M/yr
$PM_{2.5}$	60,000	2.5	42	0.003	0.042	5%	24	7	150	0.005	0.13	2.6
PM_{10}	60,000	17	276	0.017	0.276	5%	24	7	150	0.035	0.83	17
TSP	60,000	35	584	0.035	0.584	5%	24	7	150	0.073	1.8	37

Table 7: Summary of 1-hr, 24-hr and annual particulate-bound As, Cr, and Pb emission rates for Compartment 1 (including Compartment 3 emissions).

PM Size Class	Waste Tonnage	PM Emissions Factor (Uncontrolled)		PM Emissions Factor (Controlled)		PM Metals Content	Operating Hours/Day	Operating Days/Week	Maximum Processing Rate	1-hr Emission Rate	24-hr Emission Rate	Annual Emission Rate
	t/yr	kg/day	t/yr	kg/day	kg/yr	wt%	hours	days	t/hr	g M/hr	g M/day	g M/yr
$PM_{2.5}$	60,000	5.0	84	0.63	11	5%	24	7	150	1.3	32	662
PM_{10}	60,000	33	553	0.85	14	5%	24	7	150	1.8	42	888
TSP	60,000	70	1,168	0.91	15	5%	24	7	150	1.9	46	957

Table 8: Summary of 1-hr, 24-hr and annual particulate-bound PFAS emission rates for Compartment 1 (including Compartment 3 emissions).

PM Size Class	Waste Tonnage	PM Emissions Factor (Uncontrolled)		PM Emissions Factor (Controlled)		PFAS Content	Operating Hours/Day	Operating Days/Week	Maximum Processing Rate	1-hr Emission Rate	24-hr Emission Rate	Annual Emission Rate
	t/yr	kg/day	t/yr	kg/day	kg/yr	wt%	hours	days	t/hr	mg PFAS/hr	mg PFAS/day	mg PFAS/yr
$PM_{2.5}$	20,000	2.1	28	0.26	3.5	0.005%	12	7	150	1.3	16	220
PM_{10}	20,000	13.8	184	0.35	4.7	0.005%	12	7	150	1.7	21	290
TSP	20,000	29	389	0.38	5.1	0.005%	12	7	150	1.8	22	307

3.4 Volatile Compound Emissions Factors

Up to 70 ML of liquid waste and 10,000 tpa of drill mud are scheduled for treatment (Figure 2). Of this total, up to 20,000 tonnes (20,000,000 litres) of oil/water mixtures contaminated with up to 10% hydrocarbons are proposed for treatment at the Project. These deliveries are assumed to occur in 10,000 L batches and unloaded over a 1-hr period. In addition, the hydrocarbons are conservatively assumed to be composed entirely of gasoline, with a 0.0562 wt% benzene content[3].

Similarly, up to 1,000 tonnes per year (1,000,000 litres) of halogen and non-halogen solvent-contaminated waste is also proposed for storage and/or treatment at the Project. These deliveries are also conservatively assumed to be 10,000 L and unloaded over a 1-hr period. The solvent content of the waste is not to exceed 5% for organic and non-halogenated solvents (i.e., benzene) but may be up to 10% for halogenated contaminated wastes (e.g., TCE).

Table 9 summarizes the physicochemical properties of gasoline, benzene and TCE, as well as their uncontrolled emissions factors assuming “splash loading” with “dedicated normal service”. This is a conservative assumption as emissions using vapour recovery would lower these emissions by approximately one-third. The uncontrolled emissions factors for benzene and TCE are based on the uncontrolled EF for gasoline after pro-rating the benzene and TCE emissions by each compound’s vapour pressure. Table 10 also lists estimated control efficiencies for these compounds by the Project’s emissions control system. Table 10 summarizes the quantities of Volatile Waste being handled, the solvent content of the waste and the corresponding 1-hr, 24-hr and annual controlled emissions rates.

These emissions rates will be used as input to the air quality model and results assessed against the ambient air quality standards for benzene and TCE. Compliance of benzene and/or TCE with the relevant air quality criteria can be considered an indication that emissions of other solvents will also be compliant. This determination is considered conservative since wastes containing volatile materials are unlikely to be contaminated exclusively with benzene or TCE, and because these compounds are considered relatively toxic and are therefore the most important to control.

[3] https://www.sciencedirect.com/topics/earth-and-planetary-sciences/btex

Table 9: Summary of uncontrolled and controlled volatile compound emissions rates from Volatile Waste.

Compound	Molecular Weight	Liquid Density	Vapour Pressure	VOC EF[1] Uncontrolled	Vapour Control Efficiency	VOC EF Controlled
	g/mol	g/cm^3	atm	mg/L	%	mg/L
Gasoline (vapour)	114.2	0.75	0.449	1,430	98%	29
Benzene (in gasoline)	78.1	0.88	0.125	399	98%	8.0
Benzene (as solvent)	78.1	0.88	0.125	399	98%	8.0
TCE	131.4	1.46	0.076	242	98%	4.8

[1]assumes splash loading: dedicated normal service (dedicated vapour balance = 980 mg/L)

Table 10: Summary of controlled 1-hr, 24-hr and annual volatile compound emission rates for the Project.

Compound	Total Waste Volume Handled	Solvent Content of Waste	Solvent Volume Handled	Operating Hours/Day	Operating Days/Week	Maximum Material Handling Rate	Maximum Solvent Handling Rate	1-hr Emission Rate	24-hr Emission Rate	Annual Emission Rate
	kL/yr	%	kL/yr	hours	days	L/hr	L/hr	g/hr	g/day	kg/yr
Gasoline (vapour)	20,000	10%	2,000	10	6	10,000	1,000	29	286	57
Benzene (in gasoline)		0.06%	5.6	10	6		5.6	0.04	0.45	0.090
Benzene (as solvent)	1,000	5%	50	10	6	10,000	500	4.0	8.0	0.080
TCE	1,000	10%	100	10	6	10,000	1,000	4.8	9.7	0.097

4.0 DISCUSSION

There is no prescribed regulatory approach, or other guidance, associated with estimating emissions from the handling and treatment of contaminated solid and liquid wastes. Therefore, the approach to estimating emissions from these activities is subjective and based on the professional judgement of qualified persons.

The selection of emissions factors, and assumptions related to using a select group of compounds as proxies for all compounds is an over-simplification. However, these assumptions have been applied conservatively. For example, by assuming:

- Wastes are contaminated with a single metal up to 5 wt%;
- Volatile emissions from liquid waste use equations developed for loading of tanks with petroleum products, are stated as accurate to within approximately +/-30%, and employ the highest (i.e., most conservative) emissions factors for the most volatile petroleum product (i.e., gasoline).
- The volatility of solvents in solid waste containing organic matter would be equivalent to their volatility when mixed with water.
- PFAS contaminated soils contain the maximum permissible amount under the PFAS NEMP (2020); i.e., 50 mg/kg.

The accuracy of the emissions rates calculated using this approach cannot be quantitatively or independently verified. Their purpose is to provide conservative estimates for use in an air quality model of the Project's emissions. Where compliance is achieved by a relatively large margin (e.g., >10%) using the proposed level of emissions control efficiency, it is likely that emissions are compliant. Where compliance is not achieved, or achieved by a slim margin (e.g., <10%), Hi Quality should consider stack testing and ambient air quality monitoring to verify emissions estimates and the results of the air quality modelling.

5.0 REFERENCES

Air & Waste Management Association (AWMA), 2000. Air Pollution Engineering Manual, Second Edition. Edited by Wayne T. Davis. Wiley-Interscience, Hoboken, New Jersey.

PFAS National Environmental Management Plan Version 2.0 (NEMP), 2020. Heads of EPA Australia and New Zealand.

APPENDIX A

Waste Codes

Appendix A

Waste Code	Waste Description	Solids and Sludge Treatment Technology	Liquid Waste Treatment Technology	Potential Sources
CATEGORY A - Organics (Non Halogenated)				
J100	Mineral Oils	Bioremediation	Separation	TPH Contaminated soils and solids. Pure oils from various sources including machinery maintenance workshop wastes.
J160	Coal Derived Hydrocarbon Contaminated Soils (excludes DNAPL)	Enhanced Bioremediation or Chemical Oxidation	Separation	Gasworks or Gasworks impacted materials
J160	Coal Derived Hydrocarbon Contaminated Soils (includes residual free coal tars)	Enhanced Bioremediation and Immobilisation	Separation of NAPL	Gasworks or Gasworks impacted materials
N120	Soils contaminated with a hazardous substance	Chemical Oxidation Bioremediation Immobilisation	N/A	Soil residues, property development, site remediation, industrial waste, mining waste.
G100	Ethers	Immobilisation	Adsorption	Chemical manufacturer and by-products
N190	Filter cake	Immobilisation / Bioremediation / Chemical Oxidation	N/A	Residues from industrial and mining waste water treatment plants
G110	Organic solvents, other than halogenated solvents	Chemical Oxidation Bioremediation Immobilisation Storage Only	Chemical Oxidation / Adsorption	Solvent manufacture. By product from paint/pigment manufacture. Alcohol by products.
D340	Perchlorates	Bioremediation	Adsorption	Fertiliser manufacture, contaminated soils.
G160	Waste from the manufacture, formulation or use of organic solvents	Immobilisation / Chemical Oxidation / Bioremediation	Chemical Oxidation / Adsorption	Solvent manufacture. By product from paint/pigment manufacture. Alcohol by products.
N140	Fire debris and fire wash waters	Immobilisation / Chemical Oxidation / Bioremediation	Precipitation / Chemical Oxidation	Demolition waste and fire debris and wash waters
CATEGORY B - HALOGENATED including Brominated				
G150	Halogenated organic solvents - Residues from industrial waste treatment or disposal operations	Chemical Oxidation Bioremediation Immobilisation	Chemical Oxidation / Adsorption	Solvent manufacture wastes eg: paint/pigment & alcohol by products.
N205	Contaminated Soils Containing chlorinated Compounds	Chemical Oxidation Bioremediation (anearobic)	N/A	Solid Industrial waste treatment residues, Chemical manufacturing. Contaminated soils from redevelopment
M160	Organo halogen compounds—other than substances referred to in this Table or Table 2	Immobilisation / Chemical Oxidation / Bioremediation	Precipitation / Chemical Oxidation	Manfacturing (various), contaminated site remediation
M160	Oxidising agents	Immobilisation / Chemical Oxidation / Bioremediation	Precipitation / Chemical Oxidation	Manfacturing (various), contaminated site remediation
M100	Waste substances and articles containing or contaminated with polychlorinated biphenyls, polychlorinated napthalenes, polychlorinated terphenyls and/or polybrominated biphenyls	Immobilisation Chemical Oxidation	Precipitation / Chemical Oxidation	Manfacturing (various), contaminated site remediation
CATEGORY C - Metals & Metalloids (excludes solid waste slags derived from metal processing industries)				
D130	Arsenic, arsenic compounds (requires valency assessment)	Immobilisation	Precipitation	Soil residues, property development, timber treatment residues, industrial waste, mining waste
D170	Antimony and antinomy compounds	Immobilisation	Precipitation	Electrical processing factories, flame retardant
D290	Barium compounds (excluding barium sulphate)	Immobilisation	Precipitation	Soil residues, property development, industrial waste, mining waste

D160	Beryllium and beryllium compounds	Immobilisation	Precipitation	Soil residues, property development, industrial waste, mining waste
D310	Boron and boron compounds	Immobilisation	Precipitation	Soil residues, property development, timber treatment residues, industrial waste, mining waste
D150	Cadmium and cadmium compounds	Immobilisation	Precipitation	Soil residues, property development, industrial waste, mining waste
D140	Chromium compounds (hexavalent and trivalent)	Immobilisation	Precipitation	Soil residues, property development, timber treatment residues, industrial waste, mining waste
D190	Copper compounds	Immobilisation	Precipitation	Copper refinery residues. Soil residues, property development, timber treatment residues, industrial waste, mining waste
N150	Fly ash	Immobilisation	N/A	Power stations
A100	Waste from surface treatment of metals & plastics	Immobilisation	Precipitation / Neutralisation	Galvanisers, electroplating industry, plastics manufacturing
D220	Lead; lead compounds	Immobilisation	Precipitation	Lead refinery waste. Soil residues, property development, service station remediation, industrial waste, mining waste
D120	Mercury; mercury compounds	Immobilisation	Precipitation	Soil residues, property development, demolition waste from chlor alkali plants, industrial waste, mining waste
D100	Metal Carbonyls	Immobilisation	Precipitation / Adsorption	Nickel refineries, steel mill, chemical manufacture
D210	Nickel, nickel compounds	Immobilisation	Precipitation	Nickel refinery waste. Soil residues, property development, industrial waste, mining waste
D300	Non-toxic salts	Immobilisation	N/A	Industrial, manufacturing and mining by-products
H110	Organic phosphorous compounds	Immobilisation	Precipitation	Industrial waste, mining waste, fertiliser manufacture.
M250	Surface active agents (Surfactants)	Immobilisation / Bioremediation / Storage	Chemical Oxidation / Adsorption	Detergent manufacture. NON PFAS fire fighting foam.
D360	Phosphorus compounds	Immobilisation	Precipitation	Industrial waste, mining waste, fertiliser manufacture.
D240	Selenium and selenium compounds	Immobilisation	Precipitation	Contaminated soils
D250	Tellurium and tellurium compounds	Immobilisation	Precipitation	Contaminated soils
D180	Thallium and thallium compounds	Immobilisation	Precipitation	Industrial by-products, Contaminated soils
H170	Waste from the manufacture, formulation or use of wood preserving chemicals	Immobilisation / Chemical Oxidation / Bioremediation	Precipitation / Chemical Oxidation	Soil residues, Timber treatment plants, chemical manufacturing plants
D270	Vanadium compounds	Immobilisation	Precipitation	Vanadium pentoxide Catalysts from fertiliser manufacture or petroleum processing. Contaminated soils.

D230	Zinc compounds	Immobilisation	Precipitation	Soil residues, property development, industrial waste, mining waste
CATEGORY D - OTHER (inorganic, specialist waste streams)				
C100	Basic (alkaline) solutions or bases (alkalis) in solid form	Dissolve and treat as liquid	Dissolve / Neutralise	Industrial waste, Mining Waste
B100	Acidic solutions or acids in solid form	Solids would be dissolved	Dissolve / Neutralise	Industrial waste, Mining Waste
T100	Chemical waste arising from a research and development or teaching activity	Immobilisation	Precipitation / Adsorption / Chemical Oxidation	Laboratory wastes from industry, schools, university, government organisation
D350	Chlorates	Immobilisation / Storage	Adsorption	Disinfection by products from water treatment
N160	Encapsulated, chemically-fixed, solidified or polymerised wastes	Immobilisation	N/A	Waste from treatment facilities
M220	Isocyanate compounds	Storage / Immobilisation	N/A	Polymer manufacturing
R120	Waste pharmapheudicals, drugs and medicines	Storage	Storage	Waste mineral oils unfit for their original intended use
J120	Oil and water mixtures or emulsions, or hydrocarbon and water mixtures or emulsions	N/A	Separation / Adsorption	Petroleum refineries, workshops, petrol stations, rolling mills and from edible oil and soap factories
M230	Triethylamine catalysts for setting foundry sands	Immobilisation	N/A	Foundries
E100	Waste containing peroxides other than hydrogen peroxide	Immobilisation	Precipitation / Adsorption	Industrial waste, Mining Waste
H100	Waste from the manufacture, formulation or use of biocides or phytopharmaceuticals	Immobilisation / Chemical Oxidation / Bioremediation	Chemical Oxidation / Adsorption	Biocide manufacture. Cooling tower decommissioning.
F100	Waste from the manufacture, formulation or use of inks, dyes, pigments, paints, lacquers or varnish	Immobilisation / Chemical Oxidation / Bioremediation	Chemical Oxidation / Adsorption	Solvent manufacture. By product from paint/pigment manufacture. Alcohol by products.
T120	Waste from the manufacture, formulation or use of photographic chemicals or processing materials	Immobilisation / Chemical Oxidation / Bioremediation	Precipitation / Chemical Oxidation	Photograph developers. Product destruction.
F110	Waste from the manufacture, formulation or use of resins, latex, plasticisers, glues or other adhesives	Immobilisation / Chemical Oxidation / Bioremediation	Precipitation / Chemical Oxidation / Adsorption	Chemical manufacturers, resin, latex and adhesive manufacturing.
R140	Waste from the manufacture or preparation of pharmaceutical products	Immobilisation / Chemical Oxidation / Bioremediation	Precipitation / Chemical Oxidation	Pharmaceutical manufacturing. Product destruction.
N220	Contaminated Soils Containing Asbestos	Immobilisation	N/A	Contaminated soils derived from redevelopment / remediation programs

N220	Pre Packaged Asbestos Waste Prepared for Disposal	Storage & Disposal Only	N/A	Demolition Wastes
A100	Waste resulting from surface treatment of metals and plastics	Immobilisation / Chemical Oxidation / Bioremediation	Precipitation / Chemical Oxidation	Electroplaters, galvanisers, plastis manufacturers
A110	Waste from heat treatment and tempering operations containing cyanide	Immobilisation / Chemical Oxidation / Bioremediation	Precipitation / Chemical Oxidation	Manfacturing (various), contaminated site remediation
E100	Waste containing peroxides other than hydrogen peroxide	Immobilisation	Immobilisation	Manfacturing (various), contaminated site remediation
D110	Inorganic fluorine compounds excluding calcium fluoride	Immobilisation	Immobilisation	Manfacturing (various), contaminated site remediation
N100	Containers and drums that are contaminated with residues of substances referred to in this list	Immobilisation / Chemical Oxidation / Bioremediation	Precipitation / Chemical Oxidation	Manfacturing (various), contaminated site remediation
D200	Cobalt compounds	Immobilisation	Precipitation	Manfacturing (various), contaminated site remediation
D330	Inorganic sulfides	Immobilisation	Precipitation / Chemical Oxidation	Manfacturing (various), contaminated site remediation
G110	Organic solvents excluding halogenated solvents	Immobilisation / Chemical Oxidation / Bioremediation	Precipitation / Chemical Oxidation	Manfacturing (various), contaminated site remediation
N230	Ceramic-based fibres with physico-chemical characteristics similar to those of asbestos	Immobilisation / Chemical Oxidation / Bioremediation	Precipitation / Chemical Oxidation	Manfacturing (various), contaminated site remediation
M150	Phenols, phenol compounds including chlorophenols	Immobilisation / Chemical Oxidation / Bioremediation	Precipitation / Chemical Oxidation	Manfacturing (various), contaminated site remediation
M270	Per-and poly fluoroalkyl (PFAS) contaminated materials including waste PFAS-containing prodcts and contaminated containers (Soils & Liquid Streams)	Immobilisation (Proprietary Stabilisation Products)	Adsorption (Activated carbon, ion exchange)	Airports, defence sites, Manfacturing (various), contaminated site remediation

APPENDIX A
Table A2 : Waste Codes - Storage Only no Treatment

Waste Code	Waste Description	Solids and Sludge Treatment Technology	Waste Water Treatment Technology	Potential Sources
A130	Cyanides (inorganic)	Storage Only	Storage Only	Transformers
M210	Cyanides (organic)	Storage Only	Storage Only	Transformers
M100	Material containing polychlorinated biphenyls ((PCB's), polychlorinated naphthalene’s (PCN's), polychlorinated terphenyls (PCT's) and/or polybrominated biphenyls (PBB's)	Storage Only	Storage Only	Transformers
M260	Highly odorous organic chemicals (including mercaptans and acrylates)	Storage Only	Storage Only	
M180	Polychlorinated dibenzo-p-dioxin (any congener) Reactive Chemicals	Immobilisation / Chemical Oxidation / Bioremediation	Precipitation / Chemical Oxidation	Manfacturing (various), contaminated site remediation

APPENDIX B

Air Emissions Control

Video link: Camfil APC Plant Tour

Preston HWQ February 28, 2021

Prepared for:

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QUOTATION

APC20-4091 Rev B: (1) GSX48

GOLD SERIES® X-Flo Dust Collector

The GSX utilizes Gold Cone X-Flo cartridge technology to deliver clean air and long life while utilizing the smallest floor space of any dust collector available today.

Enhanced performance features with ease of installation and service make the Gold Series the ultimate choice for cleaning the work environment of irritating dust and fumes.

Gold Cone® X-Flo Filters

- Gold Cone X-Flo filters have an even greater capacity than traditional or other cone filter capacity due to the newly patent pending inner cone of filtration media.
- The inner cone provides uniform dispersion of back-pulsed air and opens up more usable space for airflow in the dust collector; now extending into the clean air plenum featuring patent pending technology, pulse cleaning is improved even further.
- Multiple filter media options and pleat spacings are available to best suit your specific application and dust.
- All Camfil APC eXtreme filter media offerings deliver a minimum of 99.99% separation efficiency down to 0.5 micron by weight.

GSX Housing

- GSX modules are constructed of 4.5 mm steel.
- Door, hopper, inlet and panels are all of 3.1 mm steel.
- Most other dust collectors on the market are only 2.5 mm or thinner.
- Hoppers have standard 254 mm discharges, unless otherwise specified herein.

High Entry Inlet

- Camfil APC's high cross flow inlet reduces interstitial velocities traditionally associated with low entry hopper inlets.
- Re-engineered staggered angle baffles installed in the inlet protect the filters from incoming dust and separates the larger dust particles directly into the hopper, reducing the load on the filters.

Powder Paint Finish

- Baked on, durable Axalta® powder coat (TGIC-free) polyester paint. All carbon steel components are 5-stage acid washed prior to powder coating for maximum adhesion of the paint. Unless otherwise specified, internal frames will be black.
- For improved weather/corrosion resistance for outside installations we recommend using the zero zinc edge primer which is available on request.

Automatic Filter Cleaning

- Filters are automatically back-flush cleaned with periodic pulses of compressed air.
- Vertical design of the Camfil APC cartridges provides more efficient pulsing of dust, thus eliminating uneven dust loading associated with horizontally mounted cartridges.
- Powerful cleaning system delivers 100% more cleaning energy than horizontal filter designs and includes: 152 mm diameter compressed air header, nozzled purge pipes, diaphragms, and remote pilot valves in an IP65 enclosure. Diaphragms are factory plumbed to the solenoids.

Filter Access

- Redesigned quick-open access door(s) to super-fast cartridge change-out system that does not require entry into the collector.
- Cam-operated clamp bars provide easy filter clamping and sealing.
- Most competitive units use a laborious threaded handle system for door removal, in which knobs can be lost and threads can bind.

Support Leg Structure

- 1370 mm clearance under the hopper discharge flange
- Designed for seismic and wind load as per IBC2012E

GSX48

Rating: 130560 m³/h @ 3.0 kPa Pstat

Quantity:	1	**Media Area:**	1672 m²
Paint Color:	Camfil Green	**Application/Process:**	Fugitive dust
Estimated Height:	6147 mm	**Dust Type:**	Fly ash
Cartridges:	48	**Operating Temperature:**	Not provided by customer
A/C Ratio:	78.1 m³/m²/h		

GSX48 BASE COLLECTOR TOTAL: AUD211,116

Staggered Angle Inlet Baffle **Incl. Above**

- Three rows of staggered angled baffles installed inside the inlet box to protect the filters from incoming dust and to separate the larger dust particles, which fall directly into the hopper, reducing the load on the filters.

	**Compressed Air Regulator with Gauge**	**Incl. Above**

- 1" NPT Filter/Regulator combination with oil filled pressure gauge and shut off valve. Owner should set pressure regulator to 90 PSI for optimum filter cleaning.

HemiPleat® Cartridges – eXtreme Synthetic **(48)** **Incl. Above**

- This revolutionary pleat allows 100% of the filter media to remain open for dust capture and improved airflow
- Open pleats allow for optimal pulse cleaning
- Utilizes eXtreme Synthetic media
- eXtreme Synthetic is a proprietary triple layer of spun bond polyester washable filter media for excellent dust release and minimum MERV 15 efficiency.
- Cartridge Model No. FLTR-GCX-XS-375

GSX Controller **Incl. Above**

- The GSX controller provides a graphical user interface to control the pulse cleaning of the filters and both analog and digital display of the pressure drop across the filters. Controls are mounted in a NEMA 4 X enclosure (water tight and chemical resistant), and requires 110/220 v, single phase, 50/60 Hz power. GSX controllers regulate the automatic pulsing of the filters based on the differential pressure of the filters, so it only pulses when the filters are dirty, saving compressed air. The user can change multiple timing, cleaning, and alarm settings through the digital graphic interface. GSX controller is field wired by the user to the solenoids that are factory mounted to the dust collector.
- Included with your Camfil product is a smart sensor called GoldLink. A single data point will be sent to Camfil's customer database via data signal encrypted SSL/TLS once daily. This smart technology enables the collection of real-time data that will aid the owner in reducing potential downtime.

Large Pyramid Hopper(s) Option **Incl. Above**

- This optional design reduces the number of dust discharge points for a given model. Support leg height adjustment is included to accommodate any increase in this hopper's height.
- This hopper arrangement has 2 discharge points.

Increase Leg Length - 500 mm **Incl. Above**

- Standard hopper clearance is 54 inches. This adder increases the clearance by 500 mm.

Heavy Duty Cast 10x10 (254 mm) HDX Airlock, NFPA 69 Compliant **(2)** **Incl. Above**

- HDX square flanged drop-thru rotary airlock/feeder w/cast iron housing and headplates
- 8-Vane mild steel open end rotor w/beveled edges on vane tips and ends
- Material displacement 10 Liter/Rev.
- Design allowance for 21° C
- Standard graphite impregnated aramid fiber packing
- 1HP standard TEFC motor 190/380V/3Ph/60Hz
- Chain drive at 13 RPM, enclosed drive guard, base and mounting
- Designed & documented to comply with NFPA 69 – section 12.2.4.2 – standards
- The standard model is suitable for handling products up to a temperature of 57°C

- Flanged outlet guard
- Painted black, unless otherwise specified
- Estimated weight: 193 kg

Bulka bag supports - BB038804	**(2)**	**Incl. Above**

Fanset suitable for a duty of 90000m3/hr @ 2.5kpa Static Pressure	**Incl. Above**

- Price includes:
- MOTOR DETAIL WEG W21 : 110kW; 4 pole; Frame : D315S/M. (SIZED FOR D.O.L. OR AUTO TRANSFORMER START)
- ELECTRICAL SUPPLY : 415-3-50Hz
- CONSTRUCTION MATERIALS Grade 250 Casing. Corten (USA) Impeller. EN3B/CS1030 Shaft.
- EXTERNAL FINISH Standard enamel (Dulux Luxol 4QD or similar) 1 Coat + 1 Coat GOZP
- INTERNAL FINISH GOZP 1 coat of primer only
- Outlet Silencer

Please note: Camfil APC requires 25% down payment for any order exceeding $100,000.

The customer assumes the responsibility for contacting their insurance underwriter and advising Camfil APC in regard to specific application requirements and if additional fire protection and safety equipment may be required. The buyer is also cautioned to adhere to prescribed CE, National and Local codes and regulations applicable to industrial ventilation systems, which Camfil APC equipment may be applied on.
The Gold Series collectors are intended for non-explosive dust. The validation that the dust is non-explosive is the responsibility of the customer. If this is in doubt we recommend that the dust is tested by an accredited laboratory. If the customer wishes to change the usage of the collector, Camfil APC must be consulted for advice if this is not done the CE marking of the unit is invalidated.
Quoted price is valid for 30 days from quoted date. Sales tax not included. Price quoted is for cash, check, money order, or bank transfer only. Credit card purchases require a 3% pricing adjustment that includes credit card fees.

Grand Total: AUD211,116

About Camfil APC

Camfil Air Pollution Control (APC) is one of the top dust collector manufacturers worldwide. Their goals are to make factories safer and more productive and to ship collectors fast while still giving you, the customer, what you want. They're focused on being the most customer friendly company in the air pollution control business and are dedicated to making the best dust collector in the business from an end user operation and maintenance viewpoint.

Video link: Take a tour of the Camfil APC factory

If Camfil APC is favored with an order, please address purchase order to: Camfil APC C/O (Camfil representative)

Excludes:
-GST
-Delivery
-Mechanical Installation
-Electrical Connection
-Compressed Air Requirements
-Fan and Silencer
-Motor Starter
-In general anything not included in the scope of supply

ADDITIONAL NOTES:
*Camfil Australia's Terms & Conditions apply to this quotation
*GST to be added
*Quotation valid for 60 days

Please do not hesitate to contact me to discuss this quotation or any for any further information.

Regards,

Jeremy Shaw
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Camfil APC
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TWELVE YEAR
LIMITED WARRANTY

camfil
AIR POLLUTION CONTROL

3505 South Airport Road
Jonesboro, AR 72401
Phone: 800-479-6801
Fax: 870-933-8381
www.camfilapc.com

Camfil Air Pollution Control (Camfil APC) warrants to the original purchaser that the major structural components of the dust collector will be free from defects in materials and workmanship for twelve (12) years from the date of shipment, if properly installed, maintained and operated under normal conditions. Camfil APC warrants all Camfil APC manufactured items, and any non-Camfil APC manufactured components included with purchase order to Camfil APC, for a period of 12 months. Camfil APC warrants Camfil APC built filter elements to be free from defects in materials and workmanship for eighteen (18) months from date of shipment. Camfil APC does not warrant damages which are due to corrosion, abrasion, normal wear and tear, product modification or product misapplication. After Camfil APC has been given adequate opportunity to remedy any defects in material or workmanship, Camfil APC retains the sole option to accept return of the goods, with freight paid by the purchaser, and to refund the purchase price for the goods after confirming the goods are returned undamaged and in usable condition. Such a refund will be the full extent of Camfil APC's liability. Camfil APC shall not be liable for any other costs, expenses or damages, whether direct, indirect, special, incidental, consequential or otherwise. The terms of this warranty may be modified only by a special warranty document signed by the APC Vice President Americas of Camfil. There exists no other representations, warranties or guarantees except as stated in this paragraph. All other warranties, including merchantability and fitness for a particular purpose, whether express or implied, are hereby expressly excluded and disclaimed.

FAILURE TO USE GENUINE CAMFIL APC REPLACEMENT PARTS WILL VOID THIS WARRANTY.

Graeme Bell
APC Vice President Americas
Camfil APC

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CAMFIL AIR POLLUTION CONTROL (APC) TERMS AND CONDITIONS

1. Controlling Terms and Conditions: These Terms and Conditions and Camfil's quote and/or order acknowledgement shall constitute the entire agreement between the parties pertaining to the subject matter hereof, and shall supersede all prior or contemporaneous oral or written negotiations, agreements, understanding or representations with respect thereto. These Terms and Conditions shall supersede any conflicting provision contained in any purchase order of Buyer. Unless otherwise agreed in writing, nothing contained in any purchase order of Buyer shall in any way modify or add any provision to these Terms and Conditions. These Terms and Conditions may not be amended or any provision hereof waived in any way except by an instrument in writing signed by both parties. IN THE EVENT THAT CAMFIL'S QUOTE IS DEEMED AN OFFER, ACCEPTANCE BY BUYER OF SUCH OFFER IS EXPRESSLY LIMITED TO THE TERMS CONTAINED HEREIN. ISSUANCE BY BUYER OF A PURCHASE ORDER SHALL BE DEEMED AN ACCEPTANCE OF THESE TERMS AND CONDITIONS. IN THE EVENT THAT CAMFIL'S ORDER ACKNOWLEDGMENT IS DEEMED AN ACCEPTANCE OF BUYER'S PURCHASE ORDER, SUCH ACCEPTANCE BY SELLER OF BUYER'S PURCHASE ORDER IS EXPRESSLY MADE CONDITIONAL ON ASSENT TO ANY ADDITIONAL AND DIFFERENT TERMS CONTAINED HEREIN. FAILURE BY BUYER TO SPECIFICALLY OBJECT TO THESE TERMS AND CONDITIONS IN WRITING WITHIN TWENTY (20) DAYS OF RECEIPT SHALL CONSTITUTE AN ACCEPTANCE HEREOF.

2. Price: Unless otherwise separately and expressly set forth herein.

(a) Prices shall be as set forth in Seller's quote or order acknowledgment, and do not include transportation charges, insurance, export or special packaging, markings or any compliance testing such as special environmental, vibration, life cycle, extreme temperature, etc.

(b) Prices do not include inspection charges for inspection performed, at the request of Buyer, by outside individuals, entities, or agents.

(c) Prices shall be subject to an additional charge to cover any existing or future sales, use, consumption, transportation, license fee, tariff, or other tax, which may be applicable, and all duties, imports, and similar levies, except where Buyer properly furnishes appropriate certificate of exemption therefrom. These additional charges may be invoiced separately by Seller.

3. Payment Terms:

(a) Terms are Net Cash prior to shipment except where satisfactory open account credit is established, in which case terms are Net Thirty (30) days from date of invoice. Seller reserves the right, in seller's sole discretion, to revoke any credit extended. Invoices will be issued upon shipment. Buyer agrees to pay the lessor on one and one-half percent (1 1/2%) per month or the maximum rate legally permitted assessed against the unpaid balance from date of invoice until date of payment.

(b) Buyer grants Seller a purchase money security interest in the products sold to Buyer, and all proceeds thereof, as security for Buyers obligations. Buyer shall execute and cause to be filed all instruments or documents necessary to perfect any such interest, including a financing statement on Form UCC-1.

(c) Seller may withhold shipments of any other products ordered by Buyer until the full amount owed to Seller is paid or otherwise settled.

4. Warranties:

(a) Camfil warrants to the original purchaser that the major structural components of dust, mist, and fume collectors will be free from defects in materials and workmanship for twelve (12) years from the date of shipment, if properly installed, maintained and operated under normal conditions. Camfil warrants all Camfil manufactured items, and any non-Camfil manufactured components included with purchase order to Camfil, for a period of twelve (12) months from the date of shipment. Camfil warrants Camfil built filter elements to be free from defects in materials and workmanship for eighteen (18) months from date of shipment. Camfil warrants that all products sold will conform to Seller's specification, drawings, samples or other descriptions stated in or incorporated by referenced in Seller's quote or order confirmation.

(b) The above warranty does not apply to products which are (a) repaired, modified or altered by any party other than Seller; (b) used in conjunction with equipment not provided or authorized by Seller; (c) subjected to unusual physical, thermal, or electrical stress, abrasion, corrosion, improper installation, misuse, abuse, accident or negligence in use, storage, transportation or handling, alteration, or tampering, or (d) considered a consumable item or an item requiring repair or replacement due to normal wear and tear. On-site warranty repair is not covered under the forgoing warranty.

(c) After Camfil has been given adequate opportunity to remedy any defects in material or workmanship, Camfil retains in its sole discretion, the option to accept return of the products, with freight paid by the purchaser, and to refund the purchase price for the products after confirming the products are defective or nonconforming to Camfil's specifications. Such a refund will be the full extent of Camfil's. Camfil shall not be liable for any other costs, expenses or damages, whether direct, indirect, special, incidental, consequential or otherwise. The terms of this warranty may be modified only by a special warranty document signed by the APC Vice President Americas of Camfil.

(d) THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES. EXCEPT AS EXPRESSLY PROVIDED HEREIN, SELLER MAKES NO WARRANTIES, EITHER EXPRESS OR IMPLIED, EITHER IN FACT OR BY OPERATION OF LAW, STATUTORY OR OTHERWISE, REGARDING THE PRODUCTS. SELLER EXPRESSLY DISCLAIMS ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE FOR THE PRODUCTS. THE OBLIGATIONS OF SELLER SET FORTH IN THIS SECTION SHALL BE SELLER'S SOLE LIABILITY, AND BUYER'S SOLE REMEDY, FOR BREACH OF THE FOREGOING WARRANTY. Representations and warranties made by any person including distributors, dealers and representatives of Seller which are inconsistent or in conflict with the terms of this warranty shall not be binding on Camfil unless reduced to writing and approved by an expressly authorized officer. **FAILURE TO USE GENUINE CAMFIL APC REPLACEMENT PARTS WILL VOID SELLER'S WARRANTY.**

(e) Seller warrants that neither the use alone, nor the sale in the form in which the products were delivered by Buyer, will infringe the claims of any United States patent. Buyer shall at its own expense, defend and hold Seller harmless from any claim of any nature whatsoever arising out of any warranty or representation extended to others except to the extent specifically authorized in writing by Seller.

5. Seller's Liability: **Seller's liability for defective products is limited to either repair, replacement or refund of the purchase price of the defective products at Seller's election, provided the defective products are returned to Seller, at Seller's request, transportation charges prepaid by Buyer. Products shall not be returned to seller without Seller's permission. Under no circumstances (whether or not foreseeable) shall Seller be obligated for consequential, special, incidental or other damages, losses or expenses in connection with or by reason of any breach; Seller's liability is limited to the purchase price of the products. The remedies expressed in these terms and conditions are exclusive.** No claims for defective products (whether due to latent or patent defects) may be made except in writing, provided claims for patent defects are received by Seller within fifteen (15) days from the date of delivery and claims for latent defects are received by Seller within one year from the date of delivery. In the event any other default is claimed, notice shall be promptly given to Seller.

6. Excuse: Seller shall not be in default by reason of any failure in performance of its obligations under any written agreement (including any failure to make progress in the prosecution of the work thereunder which endangers performance) if such failure arises out of causes beyond the control (whether caused directly or indirectly), of the Seller. Such causes may include, but are not restricted to: Acts of God or of the public enemy; war, acts of any Government (including specifically but not exclusively any orders, rules, or regulations issued by any official or agency of any such Government) in either its sovereign or contractual capacity; riots; fires; floods; epidemics; quarantine restrictions; embargoes; strikes; labor difficulties; unusually severe weather; shortages in labor, breakage of equipment, fuel, materials and supplies, or any combination thereof.

7. Shipment, Risk of Loss and Damage: All shipments shall be F.O.B. Seller's plant unless otherwise specified. In the absence of specific instructions, Seller may select the carrier and delivery date. Risk of loss shall pass to Buyer upon delivery of the products to the carrier or delivery service or on the date in which payment is due, whichever occurs first. Products held for Buyer or stored for Buyer shall be at Buyer's risk and expense. Payment for any shipment of products postponed at Buyer's request and approved by Seller shall be due from the date previously specified in the order for shipment or from the date notice is given that the products are ready for shipment, whichever is later. In the event of such postponement, title shall pass to buyer as of the date the products are ready for shipment. Seller shall not be liable for any delays of delivery (provided Seller timely delivers the products to the carrier as described above). Claims against Seller for shortage or damage must be made in writing within fourteen (14) days after receipt by Buyer of the products shipped. All costs of inspection and testing shall be borne by Buyer.

Camfil may ship all of the products at one time or in portions from time to time within the time of shipment. This contract shall be deemed separable as to delivery and acceptance of the products sold. Buyer may not refuse to accept any lot or portion of the products shipped hereunder on the grounds that there has been a failure to ship any other lot or that products in any other lot were nonconforming. Any such default by Seller will not substantially impair the value of this contract as a whole and will not constitute a breach of the contract as a whole.

8. Taxes: In addition to all other amounts due Seller, Buyer shall pay or reimburse Seller the amount of any sales, use, excise, property or other federal, state or local taxes, duties, tariffs or other assessments (other than any tax based solely upon Seller's net income) and related interest which Seller is at any time obligated to pay or collect in connection with or arising out of transactions between the Seller and the Buyer. If Buyer claims a tax exemption, Buyer must provide Seller with a valid tax exemption certificate prior to shipment of any product.

9. Delivery: Each delivery shall be deemed to be a separate sale and payment will be made on partial deliveries. Unless otherwise agreed to in writing Seller shall have the right to specify time of delivery whenever Buyers fails to express a specific delivery date.

10. Tools: Unless otherwise, expressly and separately provided, Seller shall retain title to and possession of any models, patterns, dies, mold, jigs, fixtures and tools made for or obtained for the furnishing of an order.

11. Proprietary Rights: Not withstanding anything to the contrary contained in any request for quotation, quotation, purchase order, written agreement, or other document, or any purchase order or contract which may result there from, or in any plans, specifications, drawings, schedules or tables, contained in or incorporated therein by reference or otherwise, under no circumstances will:

(a) Buyers have access to any portion of Seller's facilities deemed to be proprietary by Seller;

(b) Buyer have access to any proprietary data or information;

(c) Buyer have any right or rights in or to proprietary data or information;

(d) Seller be deemed to grant a license to or any right in any patent, applications for patent, proprietary data or information.

Seller shall not be bound by any provision under any prime or other contract under which the Buyer may utilize products sold by Seller. Proprietary data or information as used herein, means any data providing information concerning Seller's trade secrets such as may be contained in, but not limited to any formula or device or compilation of information such as Seller's manufacturing methods or processes treatment and chemical composition of materials, plant layout and tooling.

12. Waiver: No waiver of any provision of these Terms and Conditions shall be valid or binding on any party unless agreed to in writing by the party to be charged. The failure of either party to enforce at any time any of the provisions of these Terms and Conditions, or the failure to require at any time performance by the other party of any of the provisions of these Terms and Conditions, shall in no way be construed to be a present or future waiver of such provisions, nor in any way affect the validity of either party to enforce each and every such provision thereafter.

13. Referenced Specifications: Seller shall not be required to perform nor comply with any specifications which are not delivered to Seller at Seller's home office address, 3505 South Airport Road, Jonesboro, Arkansas 72401, or any specifications which may be incorporated by reference unless such specifications are separately and specifically assented to in writing by Seller in its quote or order acceptance.

14. Attorneys' Fees: In the event of any action, suit or proceeding relating to the subject matter hereof, the prevailing party shall be entitled, in addition to any other rights and remedies it may have, to recover its reasonable attorneys' fees and related costs from the non-prevailing party.

15. Termination and Suspension: Any termination or suspension of Buyer's obligation to purchase products ordered from Seller, shall be by written notice to Seller specifying the extent to which performance of the work is terminated or suspended. Seller shall stop work and Buyer shall pay Seller: (1) full payment for products completed and/or (2) termination or suspension charges on the percentage of completion basis for products not completed, but not to exceed the total order price.

16. Governing Law, Jurisdiction and Venue: These Terms and Conditions shall be construed under and according to the laws of the State of Arkansas without regard to its conflict of law provisions. The parties agree that jurisdiction and venue for any actions relating to these Terms and Conditions will be in the state or federal courts located in the County of Craighead, State of Arkansas. Each party hereby irrevocably submits to the exclusive jurisdiction of the state and federal courts sitting in County of Craighead, State of Craighead, for the adjudication of any dispute hereunder or in connection herewith and hereby irrevocably waives, and agrees not to assert in any suit, action or proceeding, any claim that it is not personally subject to the jurisdiction of any such court, or that such suit, action or proceeding is improper.

17. Headings: The headings herein are for convenience only. They form no part of this Agreement and are in no way intended to alter or affect the meaning of this Agreement.

18. Severability: The invalidity in whole or in part of any of provisions of these Terms and Conditions shall not affect the validity or enforceability of any of its other provisions. The parties agree to renegotiate in good faith any term held invalid and to be bound by the mutually agreed substitute provision in order to give the most approximate effect intended by the parties.

19. Final Acceptance. Buyer agrees, within 10 days of completion of delivery and any installation or training provided by Seller, to review the installation and performance of the products as well as all materials related to training and operation. Buyer shall complete the Certification of Acceptance attached hereto as Attachment 1, certifying that Buyer has approved the installation and performance of the products and that Buyer has reviewed and understands all applicable training and operation materials. The Certification of Acceptance shall be deemed accepted by Buyer if not delivered to Seller within thirty (30) days of Completion unless Buyer has delivered written notice objecting with specificity to the installation or performance by such date. In the event that any agreed upon performance test is not met, Buyer's sole remedy will be repair or replacement of the part of product responsible and in no event shall Seller's liability for any and all liability related to failure to meet such test exceed the purchase price of the products or the portion of the purchase price attributable to any part(s) of the products in respect to which such claim is made.

APPENDIX C

Important Information regarding this Report

The document ("Report") to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd ("Golder") subject to the important limitations and other qualifications set out below.

This Report constitutes or is part of services ("Services") provided by Golder to its client ("Client") under and subject to a contract between Golder and its Client ("Contract"). The contents of this page are not intended to and do not alter Golder's obligations (including any limits on those obligations) to its Client under the Contract.

This Report is provided for use solely by Golder's Client and persons acting on the Client's behalf, such as its professional advisers. Golder is responsible only to its Client for this Report. Golder has no responsibility to any other person who relies or makes decisions based upon this Report or who makes any other use of this Report. Golder accepts no responsibility for any loss or damage suffered by any person other than its Client as a result of any reliance upon any part of this Report, decisions made based upon this Report or any other use of it.

This Report has been prepared in the context of the circumstances and purposes referred to in, or derived from, the Contract and Golder accepts no responsibility for use of the Report, in whole or in part, in any other context or circumstance or for any other purpose.

The scope of Golder's Services and the period of time they relate to are determined by the Contract and are subject to restrictions and limitations set out in the Contract. If a service or other work is not expressly referred to in this Report, do not assume that it has been provided or performed. If a matter is not addressed in this Report, do not assume that any determination has been made by Golder in regards to it.

At any location relevant to the Services conditions may exist which were not detected by Golder, in particular due to the specific scope of the investigation Golder has been engaged to undertake. Conditions can only be verified at the exact location of any tests undertaken. Variations in conditions may occur between tested locations and there may be conditions which have not been revealed by the investigation and which have not therefore been taken into account in this Report.

Golder accepts no responsibility for and makes no representation as to the accuracy or completeness of the information provided to it by or on behalf of the Client or sourced from any third party. Golder has assumed that such information is correct unless otherwise stated and no responsibility is accepted by Golder for incomplete or inaccurate data supplied by its Client or any other person for whom Golder is not responsible. Golder has not taken account of matters that may have existed when the Report was prepared but which were only later disclosed to Golder.

Having regard to the matters referred to in the previous paragraphs on this page in particular, carrying out the Services has allowed Golder to form no more than an opinion as to the actual conditions at any relevant location. That opinion is necessarily constrained by the extent of the information collected by Golder or otherwise made available to Golder. Further, the passage of time may affect the accuracy, applicability or usefulness of the opinions, assessments or other information in this Report. This Report is based upon the information and other circumstances that existed and were known to Golder when the Services were performed and this Report was prepared. Golder has not considered the effect of any possible future developments including physical changes to any relevant location or changes to any laws or regulations relevant to such location.

Where permitted by the Contract, Golder may have retained subconsultants affiliated with Golder to provide some or all of the Services. However, it is Golder which remains solely responsible for the Services and there is no legal recourse against any of Golder's affiliated companies or the employees, officers or directors of any of them.

By date, or revision, the Report supersedes any prior report or other document issued by Golder dealing with any matter that is addressed in the Report.

Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification

Appendix E

Isopleth

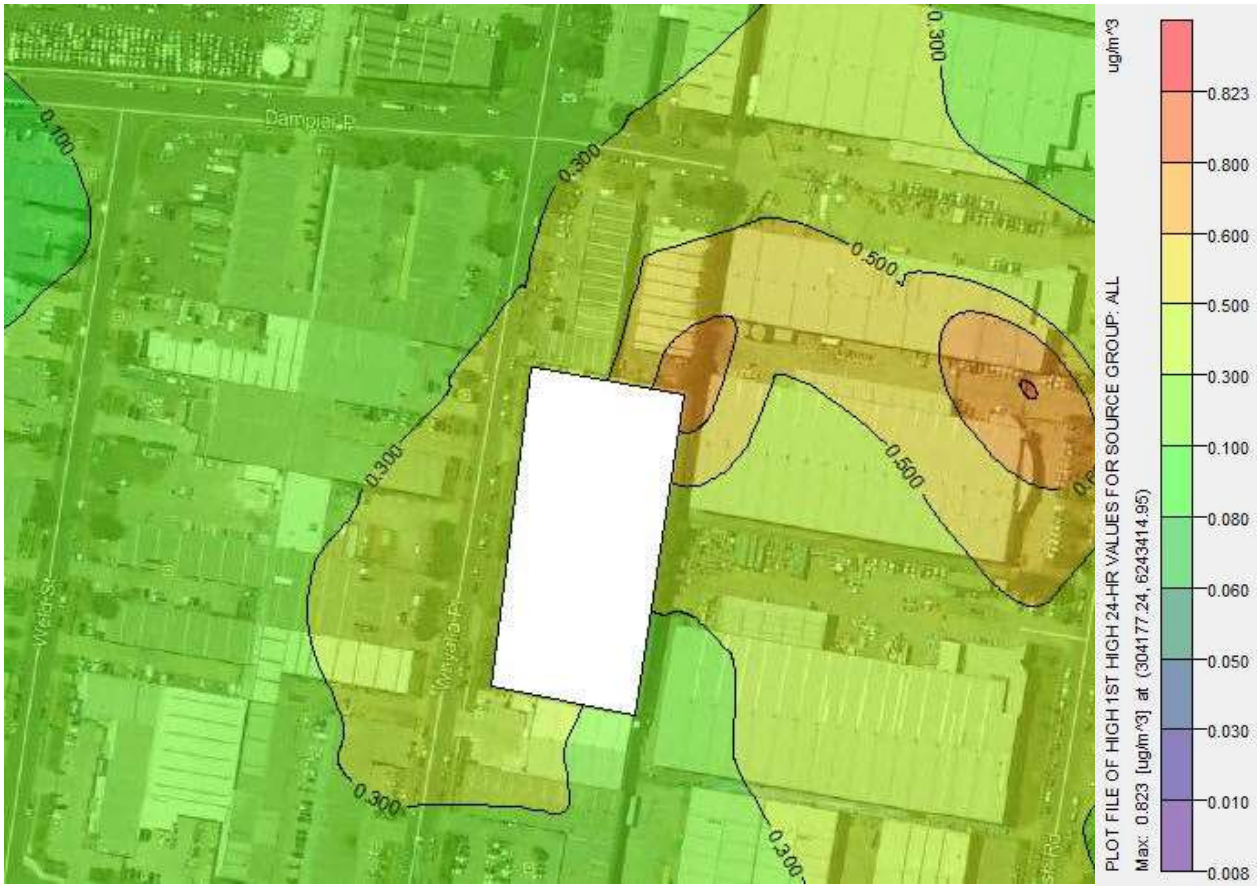


Figure E-1: Near field 24-hour $PM_{2.5}$ results (2019).

Figure E-2: Model domain 24-hour $PM_{2.5}$ results (2019).

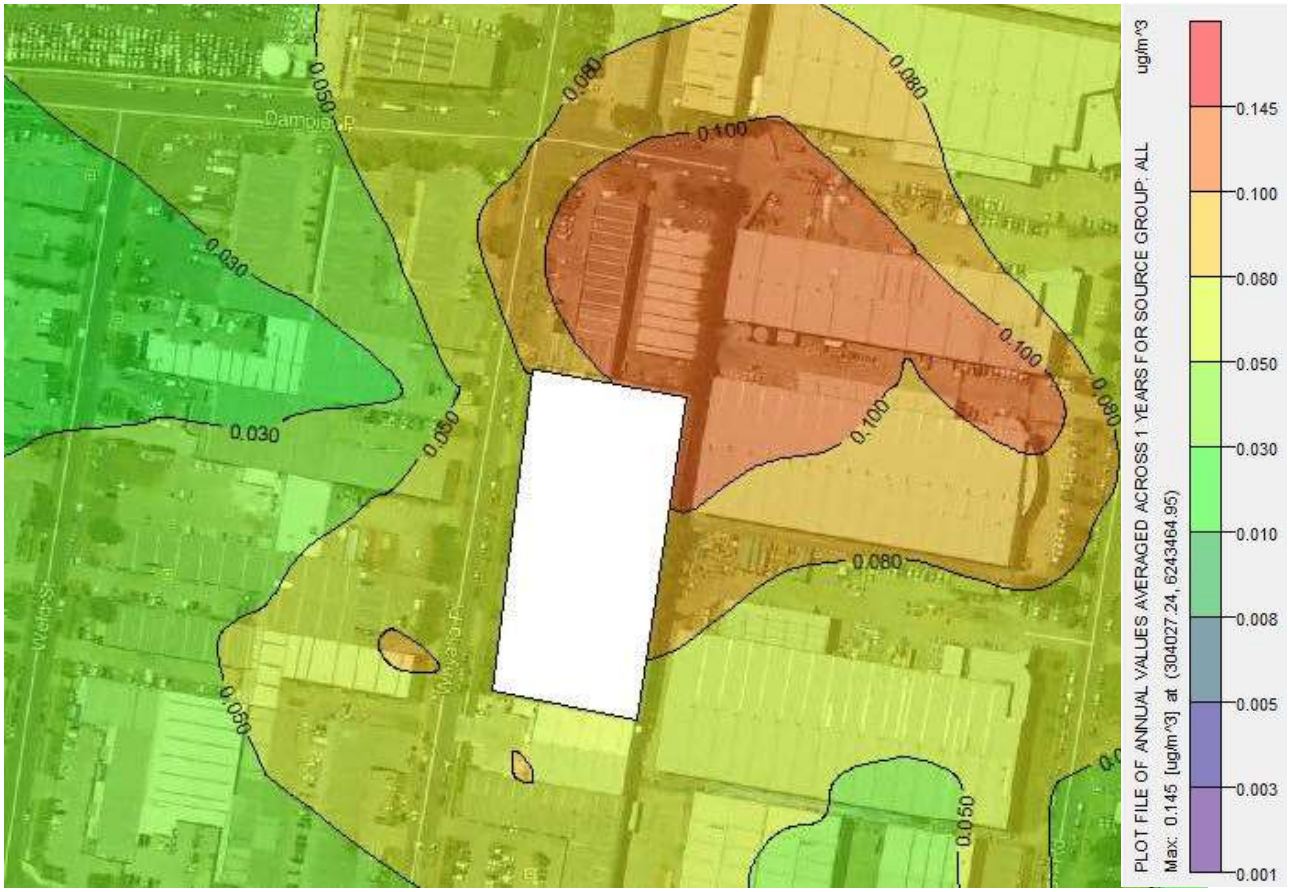


Figure E-3: Near field annual $PM_{2.5}$ results (2019).

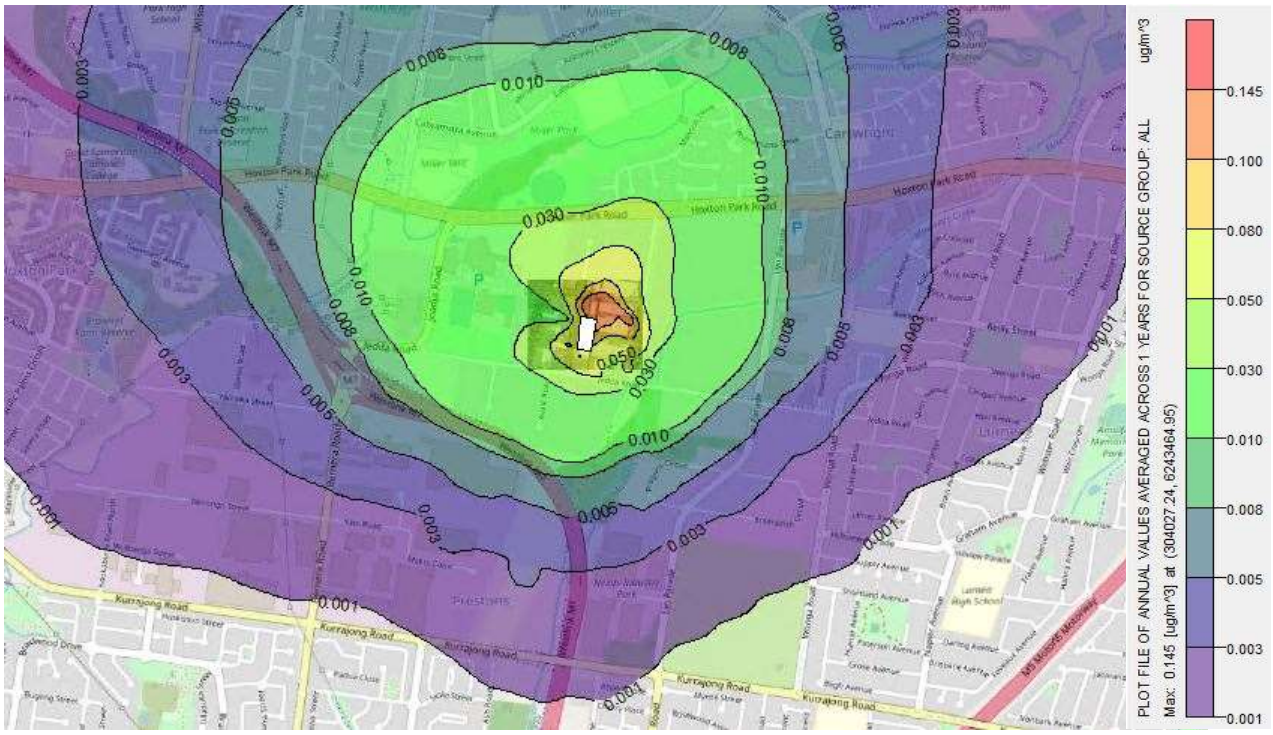


Figure E-4: Model domain annual $PM_{2.5}$ results (2019)

Figure E-5: Near field 24-hour PM_{10} results (2019).

Figure E-6: Model domain 24-hour PM_{10} results (2019).

Figure E-7: Near field annual PM_{10} results (2019).

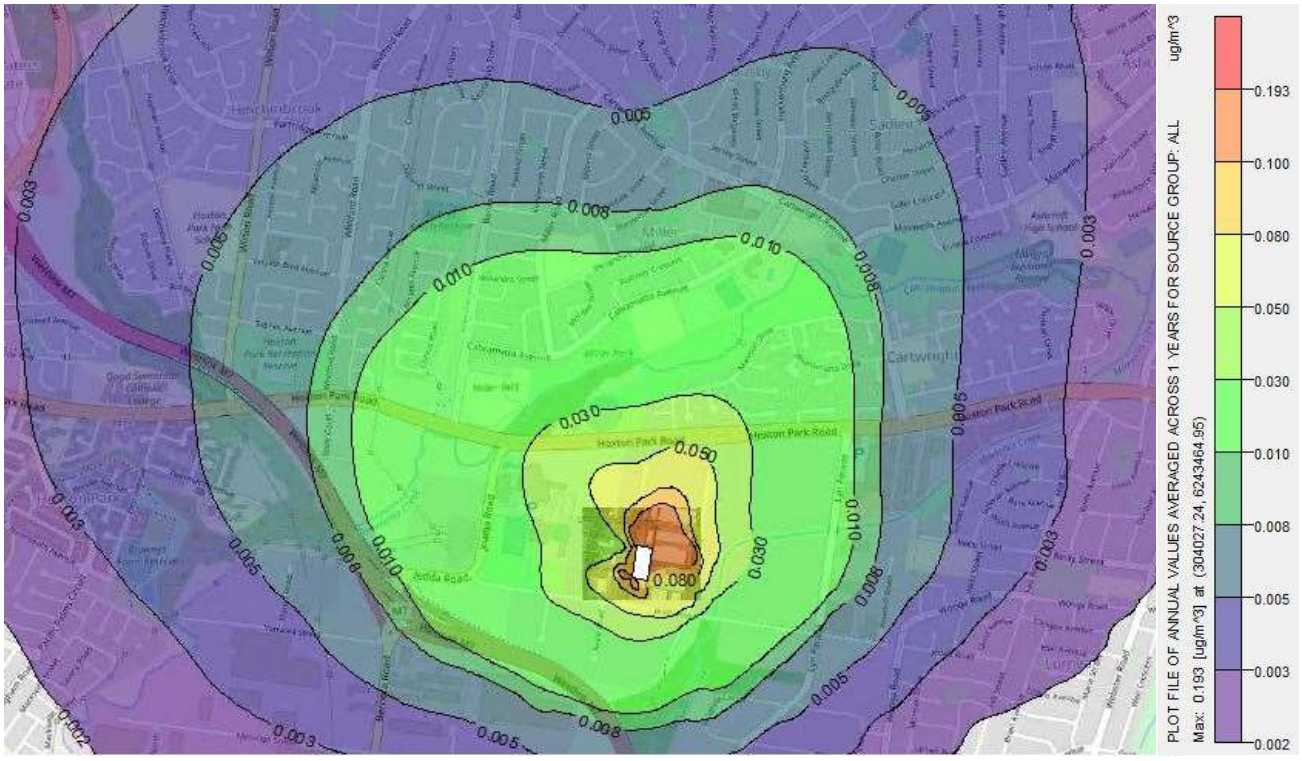
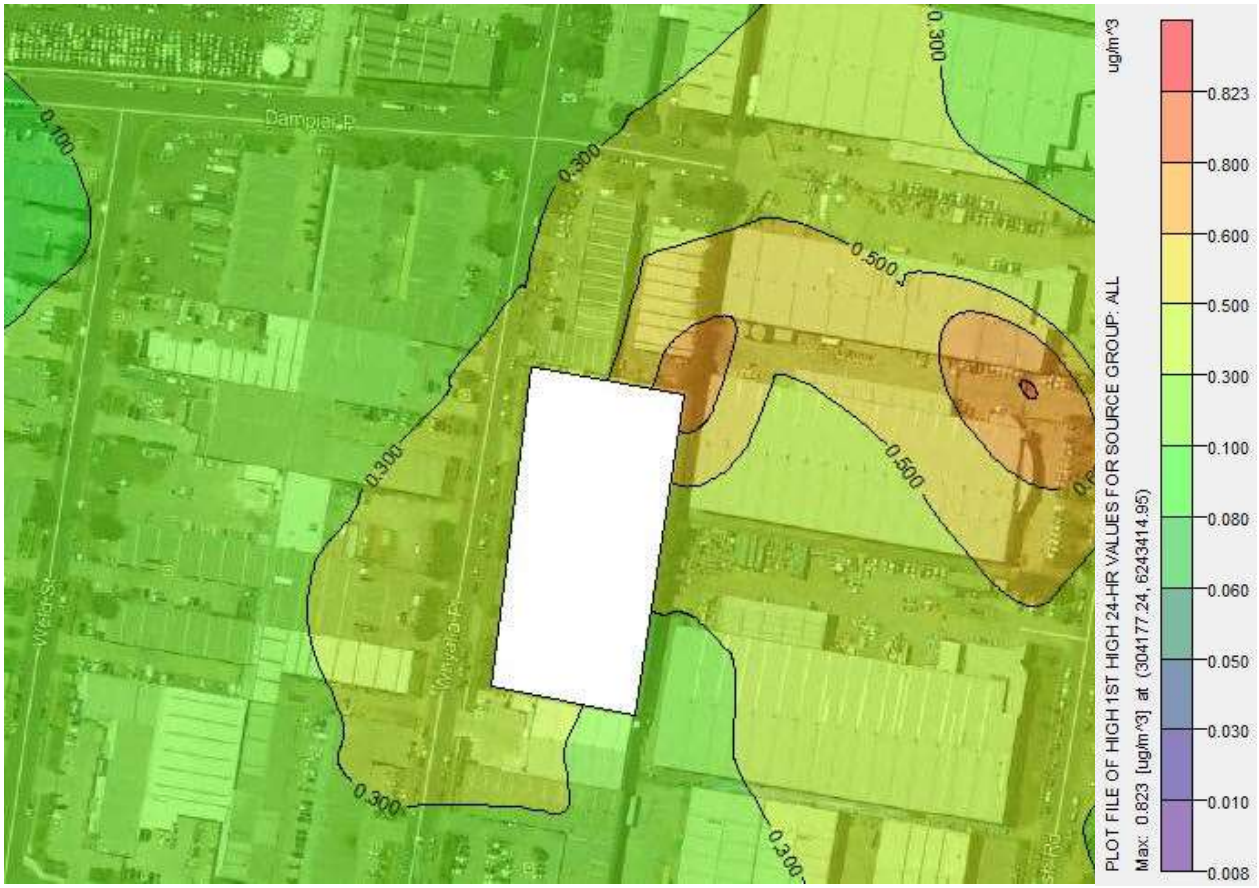


Figure E-8: Model domain annual PM_{10} results (2019).

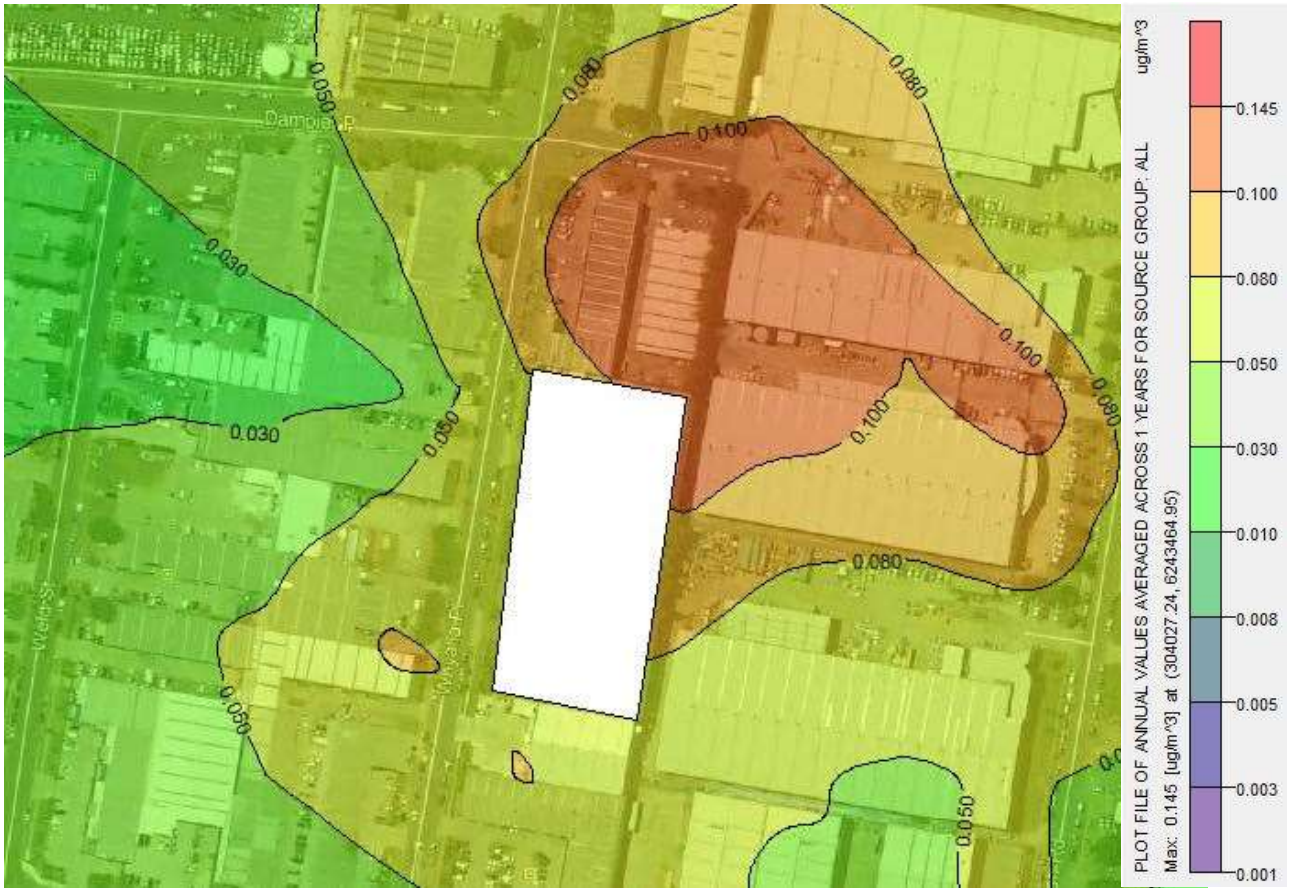
Figure E-9: Near field annual TSP results (2019).

Figure E-10: Model domain annual TSP results (2019).

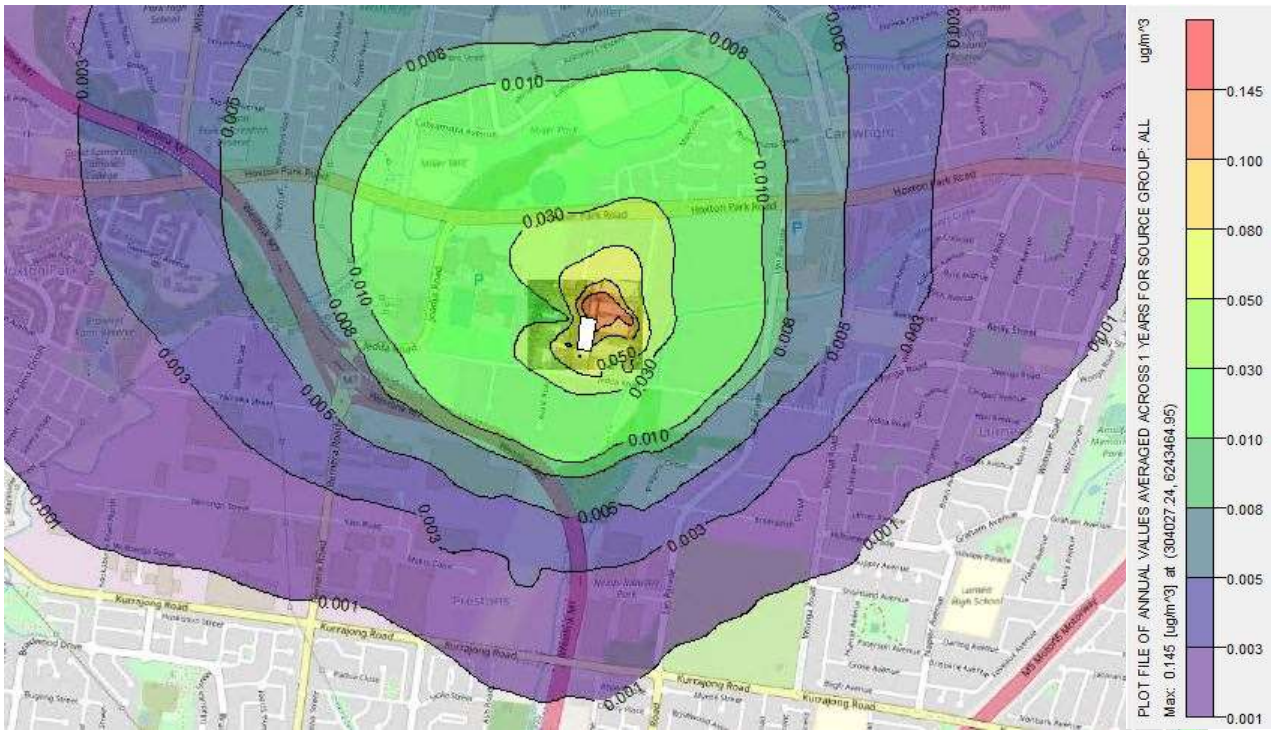


Plant boundary: 24-hour PM2.5 results (2019)

Model domain boundary: 24-hour PM2.5 results (2019)



Plant boundary: Annual PM2.5 results (2019)

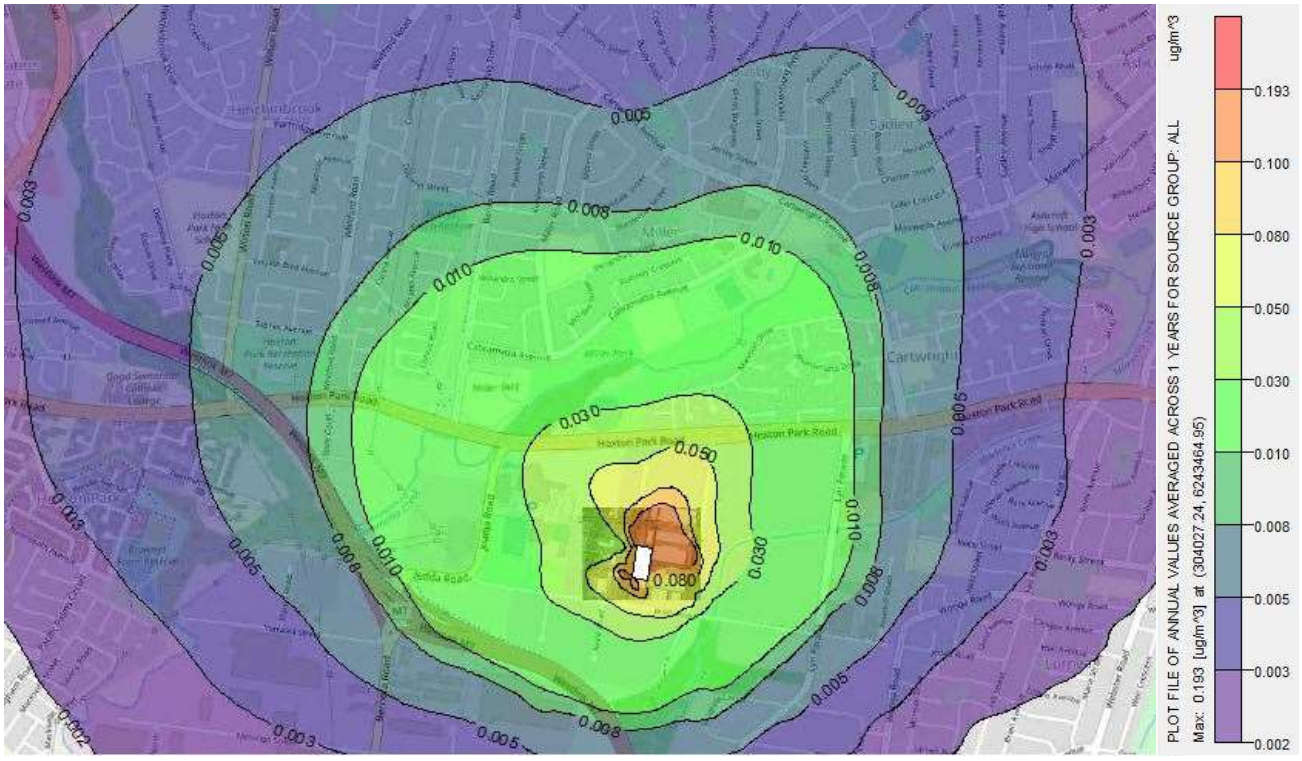


Model domain boundary: Annual PM2.5 results (2019)

Plant boundary: 24-hour PM10 results (2019)

Model domain boundary: 24-hour PM10 results (2019)

Plant boundary: Annual PM10 results (2019)



Model domain boundary: Annual PM10 results (2019)

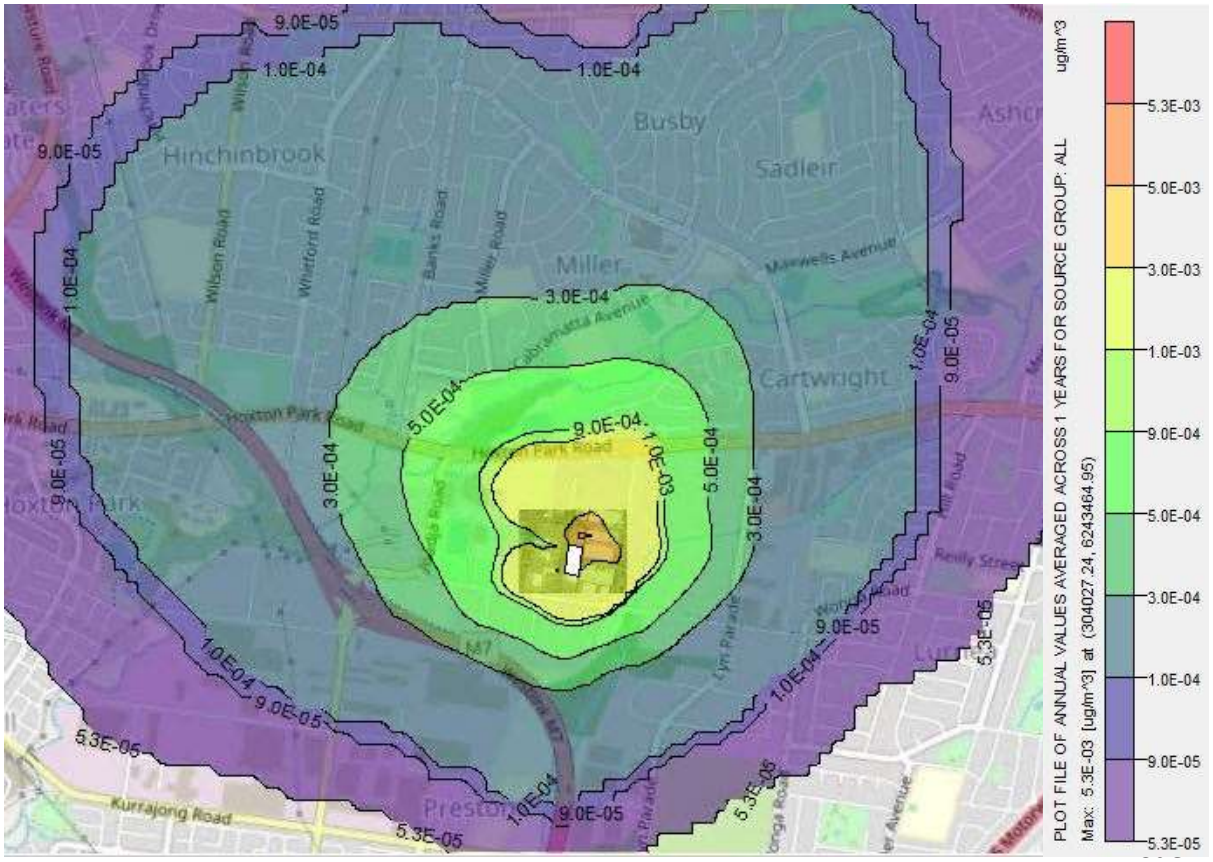
Plant boundary: Annual TSP results (2019)

Model domain boundary: Annual TSP results (2019)

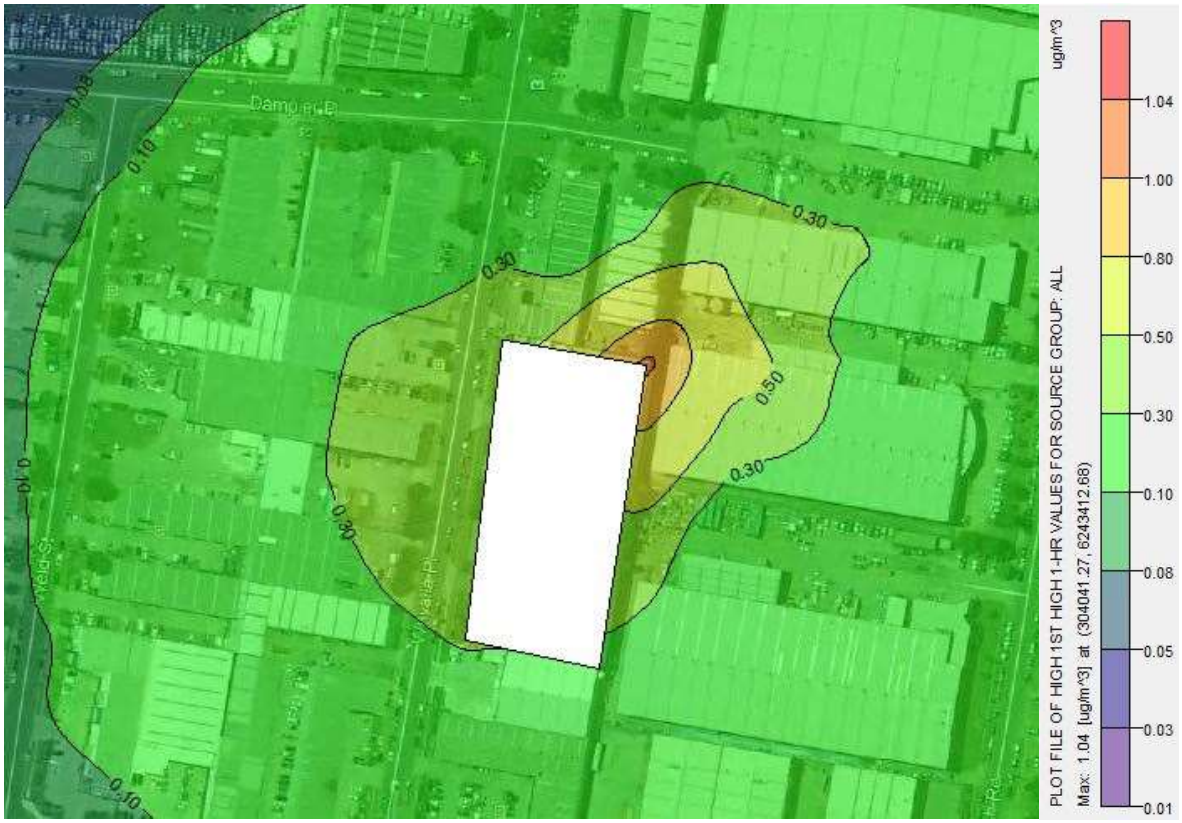
Plant boundary: 1-hour Arsenic and Chromium results (2019)

Model domain boundary: 1-hour Arsenic and Chromium results (2019)

Plant boundary: Annual Lead results (2019)



domain boundary: Annual Lead results (2019)



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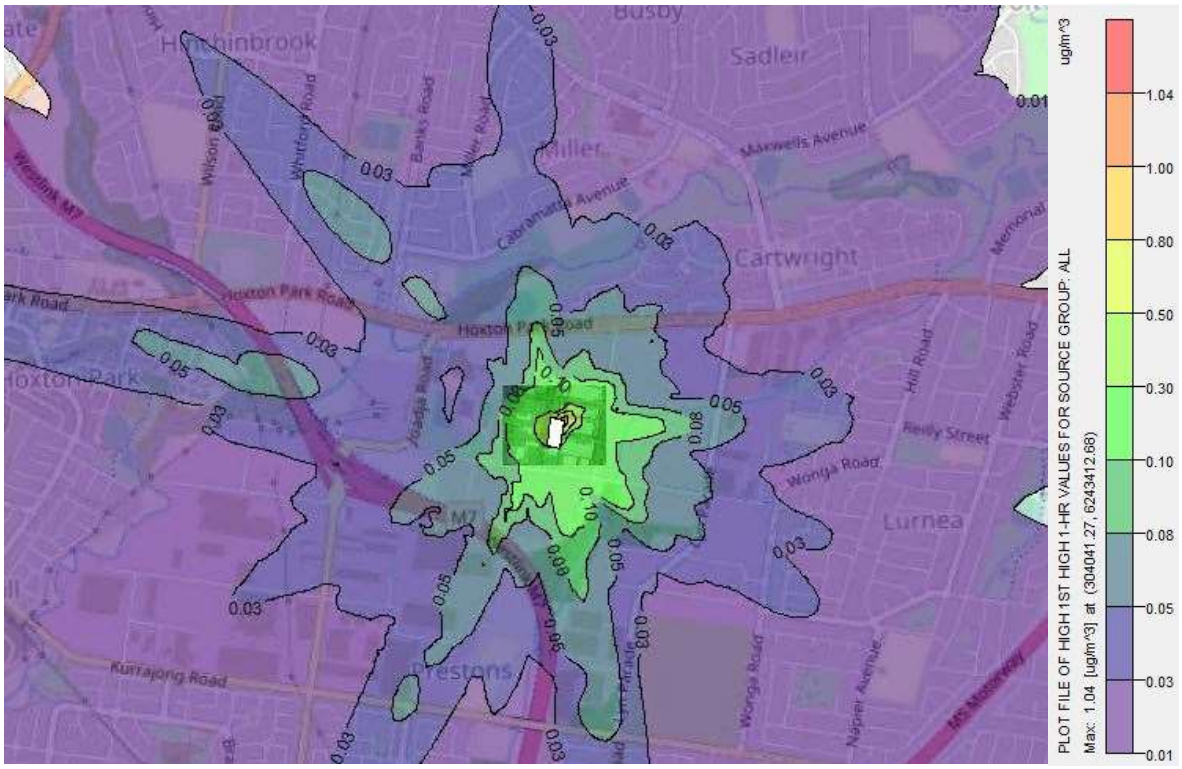

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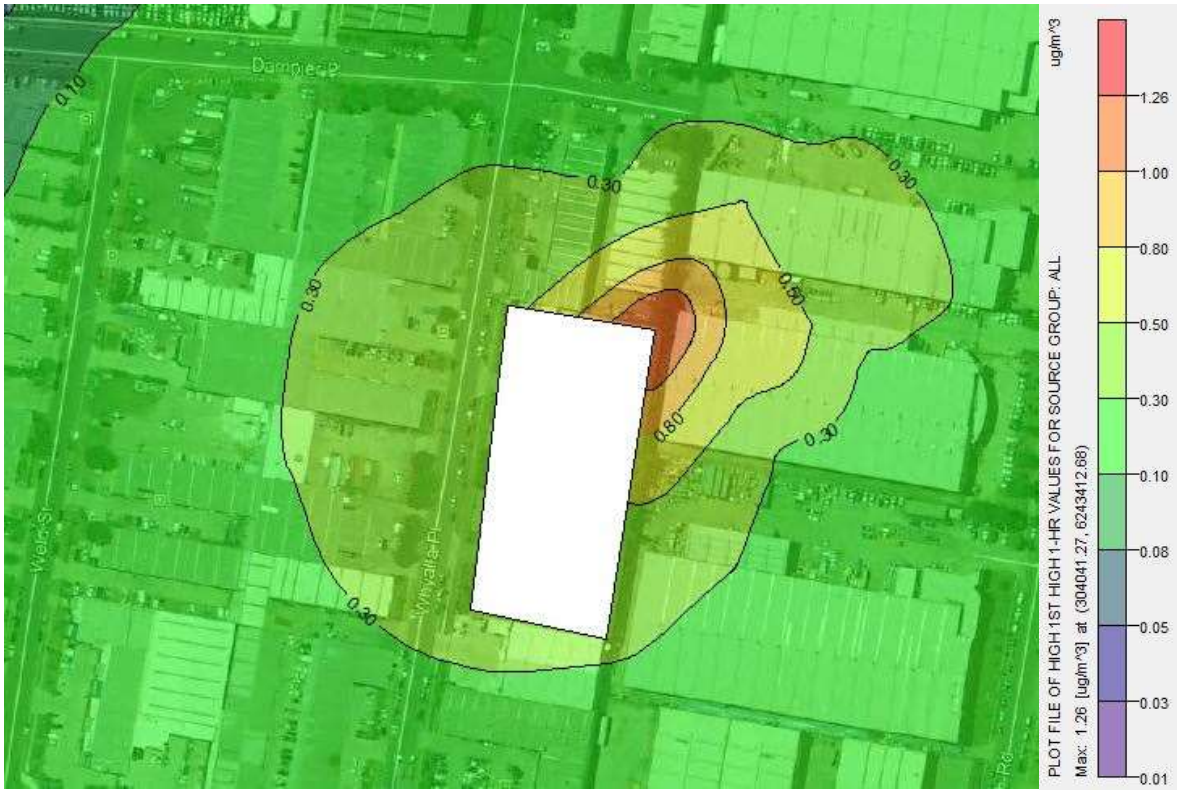

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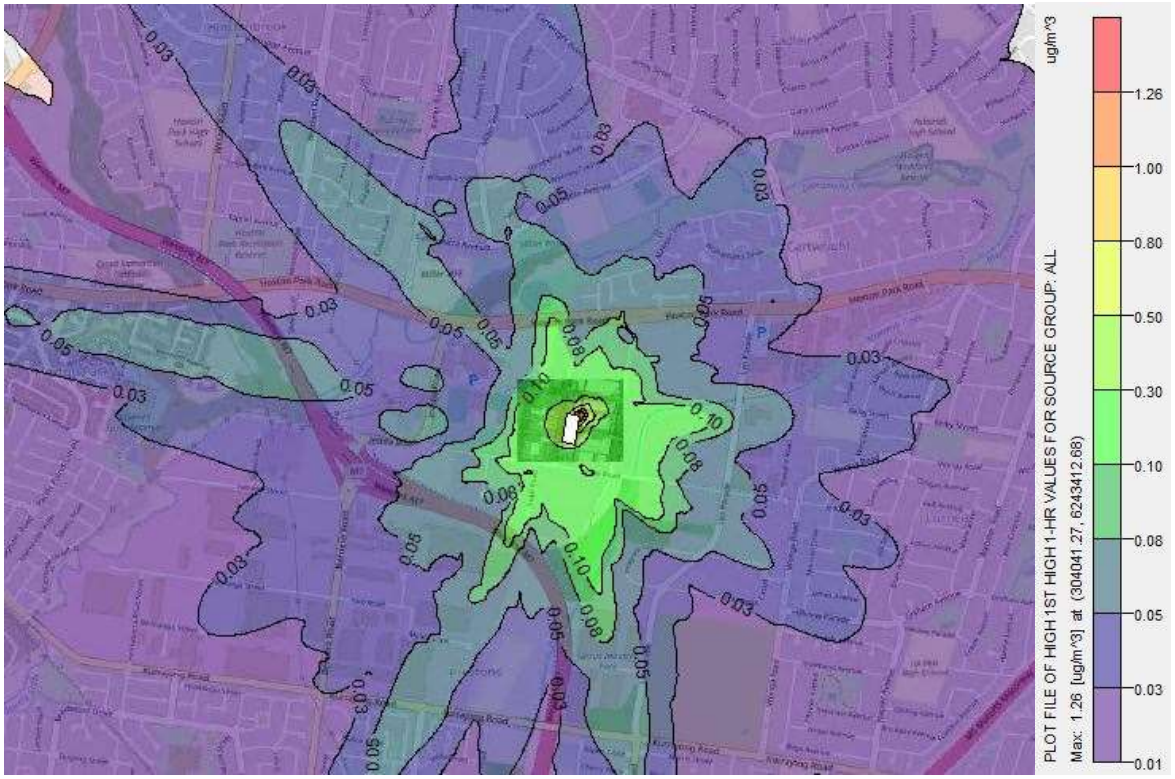

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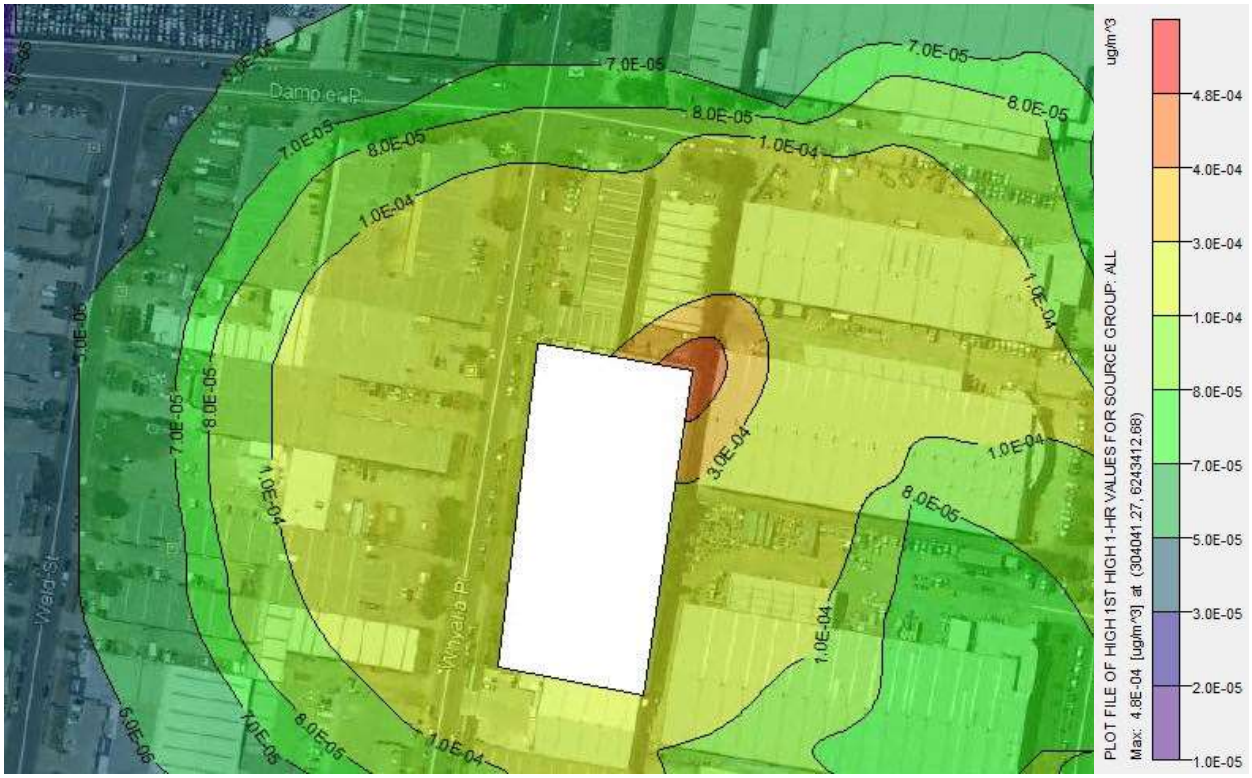
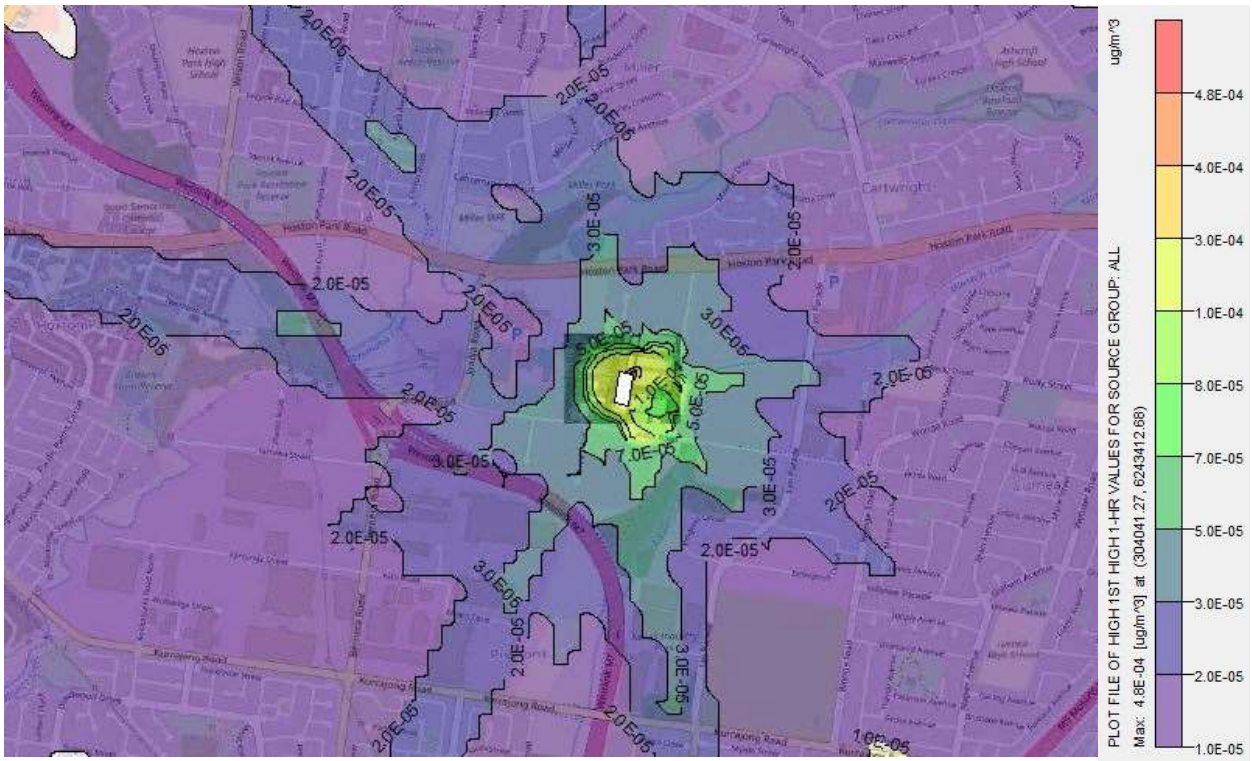


Plant boundary: 1-hour PFAS results (2019)



Model domain boundary: 1-hour PFAS results (2019)

Appendix F

Important Information Relating to this Report

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