ELF MUSHROOMS and
ELF FARM SUPPLIES PTY LTD

MUSHROOM INDUSTRY EXPANSION

in

WESTERN SYDNEY

Environmental Assessment
Volume 2



Perram &
Partners

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ELF FARM SUPPLIES PTY LTD

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Environmental Assessment
Volume 2 of 2
Appendices J to U

Report 121R3

December 2010

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MUSHROOM FARM NOISE ASSESSMENT

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1.0 INTRODUCTION

Atkins Acoustics was engaged by Perram & Partners on behalf of Elf Mushrooms to prepare a construction and operational noise assessment for the development of a new mushroom growing facility at Londonderry. The site is bounded by The Northern Road to the east and existing rural allotments to the north, south and west (*Figure 1*).

This report presents the results, findings and recommendations of the construction and operational noise assessment. The methodology adopted for the assessment included:

- site inspections;
- measurement and assessment of existing ambient noise levels at representative noise receiver locations;
- establishment of noise assessment goals in accordance with *DECCW,* Industrial Noise Policy *(INP)*, Noise Guide for Local Government *(NGLG)*, Draft Construction Noise Guideline (*CNG*) and the Environmental Criteria for Road Traffic Noise *(ECRTN);*
- prediction and assessment of construction noise;
- prediction and assessment of operational noise;
- prediction and assessment of road traffic noise; and
- recommendation of noise controls, where required.

The information presented in this report has been prepared for the investigation described herein, and is not intended for use in any other context or for any other purpose.

Figure 1: Site Location *(Reference GoogleEARTH 2009)*



2.0 THE PROPOSAL

2.1 The Site

The subject site is located on the western side of The Northern Road at Londonderry (*Figure 1*). The site is roughly rectangular in shape with a total area of 22.66 hectares and identified as Lot 138 DP 752037, Londonderry.

The development site is currently used for casual grazing and accommodates a residential dwelling setback approximately fifty-two (52) metres from The Northern Road frontage. In the past the site has been operated as a piggery.

The adjacent land use to the east on the opposite side of The Northern Road is Castlereagh Nature Reserve. Adjacent the southern boundary of the site is a residential dwelling (1 Thomas Road *unformed*) and motor vehicle storage / wreckers. West of the site are four (4) rural properties (2, 8-16, 18-20 and 26 Timothy Road) abutting the site with residential dwellings in the order of 470m from the proposed main building of the mushroom farm. To the north are a number of rural properties (493, 503, 505 & 509 The Northern Road) with residential dwellings in the order of 120-200m from the proposed main building.

2.2 Overview of Proposal

The mushroom farm would be developed in five (5) stages. Stage 1 would represent greater than half of the total development and consist of 18 growing rooms, common ancillary areas including packing and loading, plant room, administration, workshop, staff amenities, stores and wastewater management. It is anticipated that Stage 1 would have the capacity to produce approximately 85 tonnes of mushrooms per week. Stage 1 development is proposed to incorporate a spent compost processing facility that would convert spent compost to a fine-grained nutrient rich top dressing material for lawns and turfed playing fields. The spent compost area has been located to the western end of the proposed main building to minimise any potential noise impacts.

Following Stage 1, a childcare facility is proposed on the northern-east corner of the site when needed for employees. Details for the childcare centre are not available at this stage of the development, however the childcare centre would require separate approval and noise assessment.

A further four (4) stages are envisaged for the future development of the site and would bring the total number of growing rooms to fifty (50) with additional ancillary equipment. It is envisaged that these works could commence approximately five (5) years after the completion and commissioning of Stage 1. Notwithstanding the proposed staged development, this assessment has considered the full completed development of the site as represented by Stage 5.

A graphical representation of the proposed staged development and layout of the proposed mushroom farm is presented in *Figure 2*. As part of the development a landscaped earth mound in the order of two point five (2.5) metres high is proposed on the eastern (The Northern Road) and northern site boundaries. The main mushroom growing building is to be constructed with a FFL of 38.5RL with an eave height of 9.8m above FFL and a ridge height of 11.9m above FFL.

Figure 2: Proposed Site Layout



2.2.1 Plant and Equipment

The plant and equipment used at the facility would consist of a range of fixed and mobile equipment. In terms of mobile plant, it is anticipated that a front-end loader/s, telescopic loader, mobile blender (spent substrate processing) and head-filling machine would be required. For mushroom dispatch, shelf filling/loading activities and peat transfer diesel or electric forklifts would be utilised.

Fixed plant and equipment would include chillers, compressors, boiler, steam generator and air handling units (AHU).

2.2.2 Traffic Generation

In terms of truck movements, the following numbers have been projected for each facet of the farm operations:

Phase 3 Substrate	up to 6 trucks/day (24/week)
Spent Substrate	4 trucks/day (8-12/week)
Product Dispatch	4 refrigerated semi trailer trucks/day (28/week)
Cardboard Delivery	1 truck/day (2/week)
Casing Material (peat)	1 truck/day (5-6/week)

In addition to the truck numbers presented above there is projected to be up to eighty-three (83) cars taking into account a typical usage scenario of one (1) vehicle per two (2) employees. The truck numbers presented above relate to the number of vehicles, however vehicles would enter and exit the site accordingly in terms of vehicle *movements* the numbers presented above would be doubled. The proposed hours of operation for the facility are twenty-four (24) hours, seven (7) days a week.

Utilising the projected vehicle numbers broken down into a typical maximum hourly generation, the following day and night truck *movements* are envisaged:

Day (7.00am to 10.00pm)	10 trucks (*20 movements*)
Night (10.00pm to 7.00am)	4 trucks (*8 movements*)

2.3 Site Development (Construction)

Construction of the proposal would require a number of construction stages including bulk earthworks/drainage, hardstand/building slab preparation, building erection and fit out/commissioning.

2.3.1 Bulk Earthworks/Drainage

Preliminary works associated with the development of the site would involve initial site stripping of existing isolated trees and shrubs on the proposed building site. Remnant native vegetation is generally located on the western and south-western portion of the site and would not be disturbed by the proposed construction works.

Following initial site stripping, it is proposed to import fill material to develop a level pad for the construction of the finished hardstand and base for the buildings at RL38.5. Accordingly there would be up to 1750mm fill to the existing ground levels for the main building and 2250mm maximum for spent compost store.

2.3.2 Hardstand, Building Erection & Fit out

The main civil and construction works include roads, concrete pours for hardstand and building slab foundations, erection of steel and building panels and installation of plant and equipment. The main noise generating activities would be associated with the concrete works. For these works the following plant has been considered:

- concrete trucks/pumps
- cranes

The building erection would be conducted with cranes, scissor lifts and associated minor plant and equipment. It is expected that noise for these activities would be significantly less than the bulk earthworks and compaction and concrete works. For noise assessment purposes the following schedule of plant and equipment has been considered:

- trucks
- cranes

2.4 Construction Hours

The main earthworks and building construction would be undertaken between:

- 7.00am to 6.00pm - Monday to Friday
- 8.00am to 1.00pm - Saturday.

Works associated with the building fit out and plant commissioning could be undertaken twenty-four (24) hours, seven (7) days a week where noise is inaudible at residential premises and subject to DoP conditions.

The envisaged duration of the construction works and commissioning is approximately fourteen to eighteen (14-18) months for Stage 1 with subsequent stages taking a further three to four (3-4) months each. Construction hours are for 'standard' hours in accordance with the procedures of the *ICNG*, outside these hours suitable justification needs to be provided and noise assessment goals typically more stringent.

3.0 LOCAL ENVIRONS

Site measurements and inspections confirmed that the noise environment at potentially sensitive noise receivers is typically controlled by road traffic on The Northern Road, local domestic activities and natural elements (insects, birds, cows and breeze in trees, etc.).

3.1 Noise Assessment Locations

The nearest potentially affected residential dwellings are located to the north (493, 503, 505 & 509 The Northern Road) south (1 Thomas Road *unformed*) and west (2, 8-16, 18-20 and 26 Timothy Road) of the development. The closest residential dwellings are located approximately 120-200m to the north, adjacent to the southern site boundary and approximately 180m to main building and 470m west of the main building. *Table 1* and *Figure 3* identifies the receiver locations selected to represent the closest dwelling within each of the receiver 'areas'.

Table 1: Assessment Locations

Reference	Description	Location
R1	493 The Northern Road	North
R2	509 The Northern Road	North
R3	1 Thomas Road	South
R4	8-16 Timothy Road	West

Figure 3: Reference Assessment Locations ***(Reference: GoogleEARTH 2009)***



3.2 Local Meteorology

For the purpose of noise assessment data for *Mulgrave 2008-2009* was provided by PAE Holmes (*data generated from raw meteorological data recorded at Elf Farms Supplies, Mulgrave)* is considered representative for the site and was adopted for the assessment.

3.2.1 Stability Classifications (Temperature Inversions)

Table 2 shows the frequency of occurrence of the different stability classes for night hours (6pm to 7am – *INP Section 5.2*) during Winter.

Table 2: Frequency of occurrence of stability classes (Mulgrave 2001-2002)

Stability Class	Percentage Frequency of Occurrence
A	0.0
B	0.0
C	0.0
D	35.8
E	36.2
F	28
Total	**100**

Holmes data show that F stability class conditions (temperature inversions) are not a feature of the area. Referenced to the requirements of the *DECCW, INP* the effected of temperature inversions have not been considered in the noise assessment.

3.2.2 Prevailing Wind Data

Wind data was compiled into annual and seasonal roses *(Holmes)* for day, evening and night assessment periods (*Appendix 2*). A review of the data has shown that wind effects are a feature of the area and require assessment referenced to the *DECCW, INP*. Specifically north-north-east wind during the day (autumn and winter), south-west winds in the evening (autumn) and south-south-west winds and north-east winds at night (summer and winter respectively).

3.2.3 Review

The *INP* recommends that wind effects be considered when it is a feature of the area. Where winds blow in the direction from the source to the receiver at speeds up to 3m/s for more than 30% of the time in any season, wind is considered to be a feature of the area and noise level predictions must be made under these conditions.

Hence meteorological effects considered for operational noise modelling include:

- North-north-east wind (Day): 22.5º at 3m/s
- South-west wind (Evening): 225.5º at 3m/s
- South-south-west wind (Night): 202.5º at 3m/s
- North-east wind (Night): 45º at 3m/s

4.0 EXISTING AMBIENT NOISE LEVELS

For the purpose of assessing noise impacts from the proposal and establish project specific noise assessment goals, the ambient noise environment was monitored from Thursday 12 March 2009 to Friday 20 March 2009.

The reference monitoring locations selected (*Table 1*) and shown on *Figure 1* were:

- *M1* East portion of site (approx. 52m to CL of The Northern Road)
- *M2* Central portion of site
- *M3* West portion of site

Site observations during installation of the monitoring equipment confirmed that the background noise was generally controlled by road traffic on The Northern Road. During night-time hours it is anticipated that background noise levels would be influenced by traffic, domestic activities and natural elements. For noise assessment purposes, the residential assessment locations were considered as receiver 'areas' for the purpose of developing noise goals.

The noise monitoring instrumentation consisted of RTA Technology environmental noise loggers. The loggers were set to A-weighting, fast response and programmed to calculate and record statistical noise levels at every 15-minute interval. The instruments were calibrated before and after the measurements using a Bruel & Kjaer sound level calibrator Type 4230 and no significant drift was detected.

Table 3 presents a summary of the measurement results with a graphical presentation presented in *Appendix 1*.

Table 3: Measured RBL and L_{Aeq} Noise Levels

dB(A) re: 20 × 10^{-6} Pa

Date	Assessment Background Level L_{A90}			Equivalent Continuous Level L_{Aeq}		
	Day	**Evening**	**Night**	**Day**	**Evening**	**Night**
Reference Location M1: East						
Thu 12/3/09	-	43	32	-	65	55
Fri 13/3/09	44	40	33	59	63	53
Sat 14/3/09	44	44	34	57	66	53
Sun 15/3/09	42	43	35	56	66	56
Mon 16/3/09	41	44	36	59	58	58
Tue 17/3/09	43	42	32	59	62	55
Wed 18/3/09	44	41	33	59	65	56
Thu 19/3/09	44	*47*	33	59	64	56
RBL	**44**	**43**	**33**			
Ambient L_{Aeq}				**58**	**64**	**56**
Reference Location M2: Central						
Thu 12/3/09	-	42	38	-	64	49
Fri 13/3/09	38	41	38	58	63	45
Sat 14/3/09	39	*batt*	*batt*	49	*batt*	*batt*
RBL	**39**	**42**	**38**			
RBL*	**39**	**42**	**33**			
Ambient L_{Aeq}				**55**	**64**	**47**
Ambient L_{Aeq}*				**52**	**64**	**47**
Reference Location M3: West						
Thu 12/3/09	-	38	31	-	64	41
Fri 13/3/09	34	36	32	42	62	40
Sat 14/3/09	37	39	37	43	63	43
Sun 15/3/09	37	*43*	*45*	44	65	49
Mon 16/3/09	34	40	37	44	48	47
Tue 17/3/09	33	40	32	44	47	43
Wed 18/3/09	36	39	34	44	67	44
Thu 19/3/09	35	40	33	44	65	44
RBL	**35**	**39**	**33**			
Ambient L_{Aeq}				**43**	**64**	**45**

* Represent extrapolated noise levels (M1 & M3) due to battery failure and extraneous noise at M2
Noise levels in *Italics* excluded

batt – Battery failure on this monitoring location

NOTE: *Daytime: (7.00am to 6.00pm Monday to Saturday, 8.00am to 6.00pm Sunday and Public Holidays)*
Evening: (6.00pm to 10.00pm)
Night: (10.00pm to 7.00am Monday to Saturday, 10.00pm to 8.00am Sunday and Public Holidays)

A battery failure occurred at noise monitoring location M2. Accordingly noise levels measured at M2 and interpolation of data from M1 and M3 have been utilised to establish L_{A90} and L_{Aeq} levels for M2.

Inspections and ambient noise level measurements confirmed road traffic controls the L_{Aeq} noise levels at Location M1. For locations M2 and M3 the ambient L_{Aeq} noise levels are influenced by natural elements and domestic activities. There are no existing industries in the vicinity of the development site or in the vicinity of the residential receivers, accordingly this assessment has utilised the intrusive (+5dB(A)) noise goal for reference assessment locations R1 and R4. For reference assessment locations R2 and R3 the assessment has also considered the INP amenity goal taking into account the level of existing traffic noise.

5.0 ENVIRONMENTAL NOISE ASSESSMENT GOALS

The development site is located within the Penrith City Council (*PCC*) LGA. From a review of *PCC Development Control Plan 2006*, Council has no specific noise policy for assessing noise from industry or development generated traffic. *PCC* currently has a *Draft DCP 2008* on exhibition that provides additional guidance for assessment of noise and vibration. With respect to noise, the *Draft DCP 2008* refers to the intrusive goals referenced in the *INP*.

With this understanding we have referenced the DECCW, Interim Construction Noise Guideline *(ICNG)*, Industrial Noise Policy *(INP),* Noise Guide for Local Government (*NGLG*) and the Environmental Criteria for Road Traffic Noise *(ECRTN)* to develop project specific noise goals for site and traffic noise during construction and operation.

5.1 DECCW, Interim Construction Noise Guideline (*ICNG*)

The *DECCW* released the *Interim Construction Noise Guideline* in July 2009 following an extension period of review of a Draft version of the guideline issued in August 2008. The *Interim Construction Noise Guideline (ICNG)* was developed by the *DECCW* in response to concerns raised with respect to construction noise impacts and the practicability and feasibility of achieving stringent numeric noise levels established from procedures developed for permanent industrial noise sources. In accordance with the *DECCW* procedures, and practicability and feasibility concerns with respect to assessing and controlling construction noise impacts, the objectives of the *ICNG* guideline have been considered.

The main objectives of the *ICNG* are to:

- identify and minimise noise from construction sites,
- focus on applying all 'feasible and reasonable' work practices to minimise construction noise impacts, and

- provide flexibility in selecting site-specific feasible and reasonable work practices in order to minimise noise impacts.

For residential properties exposed to construction noise, the *ICNG* recommends that the $L_{Aeq,15min}$ noise levels should not exceed the rating background noise level (RBL) by more than 10dB(A) for standard hours, and 5dB(A) outside the recommended hours.

For works outside the recommended standard hours, the *DECCW* recommends that:

- all feasible and reasonable work practices should be applied with the aim to meet the recommended noise levels; and
- where feasible and reasonable work practices have been applied and the noise levels exceed the recommended levels, the proponent should consult with the community.

The *DECCW* recognises that no single approach can minimise noise from all types of construction. The level of effort and the sophistication of methods to minimise construction noise are guided by factors such as the practicality of reducing noise exposure, duration of the works and extent of the noise.

5.1.1 Recommended Standard Hours for Construction

The *ICNG* recommends the following standard hours for construction works:

- 7:00am – 6:00pm, Monday to Friday;
- 8:00am – 1:00pm, Saturday;
- No work on Sundays or Public Holidays

For construction outside the recommended standard hours, the *ICNG* recommends that prior approval(s) would be required.

5.1.2 Construction Noise Assessment Goals

A summary of the adopted construction noise goals are presented in *Table 4*.

Table 4: Construction Noise Assessment Goals – DECCW:ICNG
dB(A) re 20 × 10^{-6} Pa

Reference Assessment Location	Rating Background L_{A90} Noise Level (RBL)	Noise Assessment Goal ($L_{Aeq,15min}$)
	Day	Day
R1	39	49
R2	44	54
R3	44	54
R4	35	45

Note: Construction noise goals for standard hours of 7.00am to 6.00pm Monday to Friday and 8.00am to 1.00pm Saturday

5.3 DECCW, Industrial Noise Policy (Operational Noise)

The objectives of the *INP* are to protect the community from intrusive noise and preserve amenity. For assessment of intrusive noise, the *INP* recommends that the $L_{Aeq,15min}$ source noise should not exceed the existing L_{A90} Rating Background Level *(RBL)* by more than 5dB(A). The assessment goal for preservation of amenity requires noise levels with the introduction of new sources to be within the acceptable levels for the locality and land-use. *Table 5* present a summary of the *INP* acceptable and recommended maximum amenity assessment goals.

Table 5: INP Amenity Goals

Receiver Description	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended Maximum
Residence (1)	Suburban	Day	55	60
		Evening	45	50
		Night	40	45

NOTE: Daytime: (7.00am to 6.00pm Monday to Saturday, 8.00am to 6.00pm Sunday and Public Holidays)
Evening: (6.00pm to 10.00pm)
Night: (10.00pm to 7.00am Monday to Saturday, 10.00pm to 8.00am Sunday and Public Holidays)

(1) In assessing noise levels at residences, the noise is assessed at the most affected point on or within the residential property boundary or, if this is more than 30 m from the residence, at the most-affected point within 30m of the residence.

From the *INP* procedures, *Table 6* presents the calculated *RBL's*, the ambient L_{Aeq} noise levels, the intrusive and amenity noise goals and the project specific noise assessment goals. The operation of the mushroom farm would include delivery of substrate and loading of growing rooms within the early morning period (5-7am). Accordingly in addition to the normal day, evening and night periods this assessment has considered the fringe period of 5-7am. A review of the ambient noise measurements confirmed L_{A90} noise levels of 43dB(A) (M1), 41dB(A) (M2) and 40dB(A) (M3) respectively.

Table 6: Operational Noise Assessment Goals
dB(A) re: 20 x 10^{-6} Pa

Period [1]	INP Amenity L_{Aeq} Noise Level	Existing RBL	Existing L_{Aeq} Noise Level	Intrusive Criterion L_{Aeq} Noise Level	Amenity Criterion L_{Aeq} Noise Level	Project Assessment Goals L_{Aeq} Noise Level
Reference Location R1 – 493 Northern Road *						
5-7am	40	41	50	46	n/a	**44***
Day	55	39	52	44		**44**
Evening	45	42	64	47		**44***
Night	40	33	47	38		**38**
Reference Location R2: 509 Northern Road						
5-7am	40	42	60	47	50	**47**
Day	55	44	58	49	48	**48**
Evening	45	43	64	48	54	**48**
Night	40	33	56	38	46	**38**
Reference Location R3– 1 Thomas Road						
5-7am	40	42	60	47	50	**47**
Day	55	44	58	49	48	**48**
Evening	45	43	64	48	54	**48**
Night	40	33	56	38	46	**38**
Reference Location R4 –8-16 Timothy Road*						
5-7am	40	39	48	44	n/a	**40***
Day	55	35	43	40		**40**
Evening	45	39	64	44		**40***
Night	40	33	45	38		**38**

NOTE: Daytime : 7.00am to 6.00pm Monday to Saturday, 8.00am to 6.00pm Sunday and Public Holidays.
Evening : 6.00pm to 10.00pm.
Night : 10.00pm to 7.00am Monday to Saturday, 10.00pm to 8.00am Sunday and Public Holidays.
* Application Notes – NSW Industrial Noise Policy: RBL levels for evening should be no higher than day, and night RBL no higher than evening or day

The principles underpinning the establishment of noise assessment goals are that the goals are best regarded as planning tools, *"They are not mandatory, and an application for a noise-producing development is not determined purely on the basis of compliance or otherwise with the noise criteria. Numerous factors need to be taken into account in the determination. These include economic consequences, other environmental effects and the social worth of the development. The criteria help to determine consent/licence conditions because they provide information on the likely effect of any environmental noise associated with the development." (INP, Section 1.4.1)*

5.3.1 DECCW, Noise Guide for Local Government (Night-time Disturbance)

It is proposed to operate the mushroom growing facility twenty-four (24) hours a day, seven (7) days a week. Site design and growing processes have been refined to minimise potential for disturbance during night-time hours, particularly with respect to scheduling substrate delivery between 5.00am to 7.00am when ambient background noise levels begin to increase, rather than throughout the night. It is also proposed to dispatch product at night. To avoid disturbance during night-time hours, the *NGLG* recommends that the $L_{A1,1min}$ noise levels when assessed outside a bedroom window, should not exceed the background L_{A90} noise level by more than 15dB(A).

In accordance with the *NGLG* assessment procedures and the background RBL measurement results, intermittent noise levels from site activities during the night-time (10.00pm to 7.00am) and fringe (5.00am to 7.00am) period should not exceed:

Location R1:	5-7am	54dB(A) (L_{A90} 39 +15dB(A))
	10pm-5am	48dB(A) (L_{A90} 33 +15dB(A))
Location R2 & R3:	5-7am	57dB(A) (L_{A90} 42 +15dB(A))
	10pm-5am	48dB(A) (L_{A90} 33 +15dB(A))
Location R4:	5-7am	50dB(A) (L_{A90} 35 +15dB(A))
	10pm-5am	48dB(A) (L_{A90} 33 +15dB(A))

5.4 DECCW, Environmental Criteria for Road Traffic Noise (ECRTN)

The *ECRTN* recommends that the traffic noise from land use developments with the potential to create additional road traffic on arterial roads (including The Northern Road), where feasible and reasonable should be limited to $L_{Aeq,15hr}$ 60dB(A) (day) and $L_{Aeq,9hr}$ 55dB(A) (night). Where existing traffic noise levels exceed the recommended level, traffic noise resulting from the proposal should not increase the existing traffic noise levels by more than 2dB(A). In assessing traffic noise at residential dwellings, the noise is measured or assessed at 1m from the exposed building facade and a height of 1.5m above floor level.

6.0 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

The main construction activities envisaged include hardstand and foundation preparation, drainage, concrete works, erection of buildings and installation of plant and equipment.

Considering the distances to residential dwellings are greater than 100m, ground vibration from filling and compaction activities and other on-site plant is not considered to be an issue and not been assessed any further in this report.

6.1 Noise Assessment Locations

Potentially affected residential properties to the envisaged construction activities are identified in *Table 1* and *Figure 3*.

6.2 Construction Noise

The main plant and equipment of acoustical significance envisaged during site preparation and construction includes compactor, trucks, concrete trucks and cranes. A summary of typical plant and equipment for construction works is listed in *Table 7*.

Table 7: Construction Plant & Equipment

Item	Description	Purpose
1	Dozers D9 or equivalent	Site establishment, filling
2	Compactor/s	Compacting fill material
3	Cranes	Concrete hardstand & building erection
4	Trucks	Filling, on-site transport of material
5	Water Cart	Filling of site
6	Concrete trucks/pumps	Concrete hardstand
7	Generator/s	Site power

For noise modelling and assessment purposes *Table 8* presents a summary of equipment sound power levels established from field measurements and manufacturers specifications and reference to AS2436-1981.

Table 8: Plant/Equipment Sound Power Levels
L_{Aeq} re: 10^{-12} Watts

Plant Description	Sound Power Level								
	dB(A)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Dozers	112	108	115	112	108	109	103	95	87
Compactors	110	107	110	105	107	105	104	96	94
Cranes	106	90	98	98	102	101	100	97	88
Trucks	109	104	105	102	104	103	103	98	93
Water Cart	105	100	101	98	100	99	99	94	89
Concrete trucks/pumps	112	107	108	105	107	106	106	101	96
Generators	97	94	93	90	92	91	91	86	81

6.2.1 Construction Noise Modelling

Noise from the compaction, hardstand/concrete pouring, building erection and fit out activities have been predicted taking into account of noise attenuation due to distance separation and potential site shielding where relevant.

The construction stages selected to represent a range of scenarios that are representative of the envisaged site activities. The scenarios modelled include:

Scenario 1a *Bulk earthworks (east portion)*: 1 x dozer, 1 x compactor, 1 x 30t dump truck and 1 x water cart. *Total Lw 116dB(A)*

Scenario 1b *Bulk earthworks (west portion)*: 1 x dozer, 1 x compactor, 1 x 30t dump truck and 1 x water cart. *Total Lw 116dB(A)*

Scenario 2a *Concrete hardstand (east)*: 2 x concrete trucks/pumps, 2 x cranes. *Total Lw 116dB(A)*

Scenario 2b *Concrete hardstand (west)*: 2 x concrete trucks/pumps, 2 x cranes. *Total Lw 116dB(A)*

Scenario 3a *Building erection (east)*: 2 x cranes, 2 x trucks and 1 x generators. *Total Lw 114dB(A)*

Scenario 3b *Building erection (west)*: 2 x cranes, 2 x trucks and 1 x generators. *Total Lw 114dB(A)*

Table 9 presents a summary of the predicted noise levels for each scenario.

Table 9: Predicted Construction Noise Levels

Reference Location	Description	Assessment Goal L_{Aeq}	Predicted Sound Pressure Level L_{Aeq}	Compliance
Scenario 1a: Bulk earthworks (east portion)				
R1	493 The Northern Road	49	49	√
R2	509 The Northern Road	54	62	x
R3	1 Thomas Road	54	63	x
R4	8-16 Timothy Road	45	63	x
Scenario 1b: Bulk earthworks (west portion)				
R1	493 The Northern Road	49	56	x
R2	509 The Northern Road	54	57	x
R3	1 Thomas Road	54	53	√
R4	8-16 Timothy Road	45	55	x
Scenario 2a: Concrete Hardstand (east)				
R1	493 The Northern Road	49	49	√
R2	509 The Northern Road	54	62	x
R3	1 Thomas Road	54	64	x
R4	8-16 Timothy Road	45	63	x
Scenario 2b: Concrete Hardstand (west)				
R1	493 The Northern Road	49	57	x
R2	509 The Northern Road	54	57	x
R3	1 Thomas Road	54	53	√
R4	8-16 Timothy Road	45	56	x

Table 9: Predicted Construction Noise Levels (cont.)

Reference Location	Description	Assessment Goal L_{Aeq}	Predicted Sound Pressure Level L_{Aeq}	Compliance
Scenario 3a: Building Erection (east)				
R1	493 The Northern Road	49	47	√
R2	509 The Northern Road	54	60	x
R3	1 Thomas Road	54	61	x
R4	8-16 Timothy Road	45	61	x
Scenario 3b: Building Erection (west)				
R1	493 The Northern Road	49	55	x
R2	509 The Northern Road	54	55	x
R3	1 Thomas Road	54	51	√
R4	8-16 Timothy Road	45	54	x

In terms on internal fit-out and commissioning, noise levels are expected to be more than 8-10dB(A) lower than the results presented in *Table 9* comply with construction noise goals and unlikely to result in significant noise impacts on residential properties.

6.2.2 Construction Noise Assessment

The noise modelling results (*Table* 9) show that the construction noise goals may be exceeded at various stages of the main construction activities in the absence of any additional noise controls and considering continuous operation of the referenced plant and equipment. The development of the northern boundary acoustic mound early in the construction program, could reduce construction noise levels at residential receivers to the north (R2 & R3) by 5-8dB(A) whilst with 50% plant operation predicted noise levels would be a additional 3dB(A) lower. To further minimise potential noise exposure during construction activities, the following controls should be considered:

- development of the northern acoustic mound as soon as practical in the construction program;

- adoption of Best Management Practice (BMP) and Best Available Technology Economically Achievable (BATEA) practices as encouraged by the *DECCW*;
- site inductions and personnel/contractor training in correct use of plant and equipment;
- selection of plant and equipment to take into account acoustic performance where practical;
- reduce operating speeds of equipment where practical and switch off idle plant when not in active use;
- review construction layouts and trucks access arrangements to allow for forward travel throughout the site and minimise reversing or manoeuvring where possible;
- inspection / maintenance / repair program for mobile mechanical plant;
- ensure that construction activities are conducted within the standard hours*:
    - 7.00am to 6.00pm Monday to Friday
    - 8.00am to 1.00pm Saturday;

    * unless under special circumstances (*ICNG Section 2.3*)
- review use of mobile plant sirens / alarms and alter work practices where practical, or replace with broad band or level varying alarms/sirens;
- a contact telephone number would be provided to the immediate neighbours so that information can be received or compliant made in relation to noise. A log of complaints would be maintained and actioned by the contractor.

7.0 OPERATIONAL NOISE ASSESSMENT

Operational noise from the mushroom farm activities including both mobile (FEL, trucks, blenders, head filling machines) and fixed mechanical plant (compressors, condensers, chillers and boilers) has been predicted with the *ENM* environmental noise computer model. The computer model takes account of noise attenuation due to increase in distance, ground effect, atmospheric absorption, shielding from intervening structures and topography. Atmospheric conditions assumed for the noise modelling included calm conditions with 15°C air temperature and 70% relative humidity. Additional weather conditions considered in the operational noise assessment included:

- North-north-east wind (Day): 22.5º at 3m/s
- South-west wind (Evening): 225.5º at 3m/s
- South-south-west wind (Night): 202.5º at 3m/s
- North-east wind (Night): 45º at 3m/s

Table 10 presents a summary of the external plant/equipment sound power levels adopted for the noise modelling. Sound power levels and octave band spectrum presented have been established from site attended noise audits of the plant and equipment at a similar facility (Glossodia), audits of equipment (Mulgrave Substrate Plant) and manufacturer data.

Table 10: Plant/Equipment Sound Power Levels
L_{Aeq} re: 10^{-12} Watts

Plant Description	Sound Power Level								
	dB(A)	63	125	250	500	1k	2k	4k	8k
Truck (moving)	101	98	102	101	97	94	94	91	80
Truck (idle)	91	88	92	91	87	84	84	81	70
Refrigerated Truck (SB310 refrig. unit)	93	90	94	93	89	86	86	83	72
JCB Telescopic Handler	105	109	99	99	100	101	99	95	93
Nufab Compost Turner	93	93	94	93	90	88	84	80	75

Table 10: Plant/Equipment Sound Power Levels (cont.)
L_{Aeq} re: 10^{-12} Watts

Plant Description	Sound Power Level								
	dB(A)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Head Filling Activities (truck engine, filling machine & peat loading)	103	113	107	95	100	94	96	92	85
Cooling Towers x2 (each) (AquaCool MSS 187LS3)	99	91	87	88	90	95	93	87	84
Compressors x 5 (total) (PowerPax TT400)	93	82	82	85	85	89	86	79	83
Steam Generator (ST302l)	99	89	89	94	94	96	93	87	82
Humidification Boiler (Saacke SR1000/PAG10A)	90	104	101	94	85	79	76	72	64
Plant Room (space averaged) [1]	95	84	84	87	87	91	88	81	85
North Air Intake [2]	85	74	74	77	77	81	78	71	75
Roof Air Discharge [2]	85	74	74	77	77	81	78	71	75
AHU Ridge Vents [3]	63	66	62	60	61	59	51	46	40

Note: 1 All fixed plant in purpose designed plant room resulting in space averaged SPL of 95dB(A)
2 Noise attenuation incorporated into plant room to result in source noise level of Lw85dB(A) for intake / discharge
3 AHU would be installed wholly within roof space. Source noise level based on Lw57 at discharge for AHU connected via ducted vents comprising a total of 74 vents, adjusted for 18 ridge top source points. AHU are ducted and could incorporate insulated ducting if required prior to discharge to meet specified limits.

Fixed mechanical plant presented in *Table 10* are for noise assessment purposes only as final selections have not been confirmed. Albeit, the plant selected are based on audit measurements and manufacturer data of similar plant and equipment required.

Activities during night-time hours would typically comprise dispatch of picked mushrooms via refrigerated truck from central southern loading dock. It is also proposed to supply fresh substrate and head filling of growing rooms between 5.00am to 7.00am with the continuous operation of the fixed plant and equipment. Winching out (utilising electric driven winching equipment) of spent substrate would be conducted during daytime hours.

The proposed facility would operate twenty-four (24) hours a day, seven (7) days a week. Accordingly, night-time intermittent activities need to be considered to assess potential sleep disturbance. To provide an assessment of night-time intermittent

activities the assessment has considered a worse case of airbrake release and the sound power level presented in *Table 11*. Audit measurements have confirmed sound power levels of $L_{A1,1min}$ 116dB(A).

Table 11: Night-time Intermittent Noise Source
$L_{A1,1min}$ re: 10^{-12} Watts

Plant Description	Sound Power Level									
	dB(A)	63	125	250	500	1k	2k	4k	8k	16k
Airbrake Release	116	99	94	94	97	108	109	111	111	107

7.1 Noise Modelling

The noise modelling results summarised in *Tables 12-15*, represent the calculated noise levels from site operations and fixed mechanical plant. In terms of onsite trucks for dispatch and substrate delivery, the noise model has considered two (2) trucks within a fifteen (15) minute assessment period. For substrate delivery and subsequent growing room head filling operations the noise model has considered six (6) representative locations comprising the eastern, central and western portions of the northern and southern facades to provide a range of predicted noise levels.

Considering the envisaged activities, for the assessment of site operations over a fifteen (15) minute assessment period ($L_{Aeq,15min}$), different scenarios were considered for day/evening and night operations as follows:

5-7am *Head Filling Activities including**
Trailer mounted engine for moving floor of trailer
Conveyor system
Head filling machine
Forktruck (peat loading)
2 x truck movements/15min through site to loading area
All fixed mechanical plant

* *Model considered six (6) representative locations along northern and southern facades.*

Day	*1 x Nufab Compost Turner working spent substrate pile***
	*1 x Telescopic Handler at spent substrate pile***
	All fixed mechanical plant
	1 x Refrigerated Truck at dispatch
	2 x truck movements/15min through site to loading area
	*** considered three (3) locations on substrate pile: north, central & south)*
Evening	*All fixed mechanical plant*
Night	*1 x Refrigerated Truck at dispatch*
	2 x truck movemenst/15min through site to loading area
	All fixed mechanical plant

The noise modelling utilised envisaged activities presented above with the simultaneous operation of fixed mechanical plant.

Table 12: Predicted Operational Noise Levels (5-7am)
$L_{Aeq(15min)}$ dB(A) re: 20 x 10^{-6} Pa

Reference Location	Description	Predicted $L_{Aeq,15min}$ Noise Level	Assessment $L_{Aeq,15min}$ Goal (5-7am)	Compliance
Operational Noise – Calm (Headfilling SE + Fixed)				
R1	493 The Northern Road	27	44	√
R2	509 The Northern Road	27	47	√
R3	1 Thomas Road	44	47	√
R4	8-16 Timothy Road	26	40	√
Operational Noise – Calm (Headfilling SC + Fixed)				
R1	493 The Northern Road	27	44	√
R2	509 The Northern Road	27	47	√
R3	1 Thomas Road	43	47	√
R4	8-16 Timothy Road	28	40	√
Operational Noise – Calm (Headfilling SW + Fixed)				
R1	493 The Northern Road	26	44	√
R2	509 The Northern Road	27	47	√
R3	1 Thomas Road	42	47	√
R4	8-16 Timothy Road	31	40	√

Table 12: Predicted Operational Noise Levels (5-7am) cont.

$L_{Aeq(15min)}$ dB(A) re: 20 x 10^{-6} Pa

Reference Location	Description	Predicted $L_{Aeq,15min}$ Noise Level	Assessment $L_{Aeq,15min}$ Goal (5-7am)	Compliance
Operational Noise – Calm (Headfilling NW + Fixed)				
R1	493 The Northern Road	35	44	√
R2	509 The Northern Road	31	47	√
R3	1 Thomas Road	37	47	√
R4	8-16 Timothy Road	31	40	√
Operational Noise – Calm (Headfilling NC + Fixed)				
R1	493 The Northern Road	39	44	√
R2	509 The Northern Road	34	47	√
R3	1 Thomas Road	37	47	√
R4	8-16 Timothy Road	22	40	√
Operational Noise – Calm (Headfilling NE + Fixed)				
R1	493 The Northern Road	41	44	√
R2	509 The Northern Road	37	47	√
R3	1 Thomas Road	37	47	√
R4	8-16 Timothy Road	21	40	√
Operational Noise – SSW Wind (Headfilling SE + Fixed)				
R1	493 The Northern Road	34	44	√
R2	509 The Northern Road	31	47	√
R3	1 Thomas Road	42	47	√
R4	8-16 Timothy Road	24	40	√
Operational Noise – SSW Wind (Headfilling SC + Fixed)				
R1	493 The Northern Road	34	44	√
R2	509 The Northern Road	31	47	√
R3	1 Thomas Road	41	47	√
R4	8-16 Timothy Road	26	40	√
Operational Noise – SSW Wind (Headfilling SW + Fixed)				
R1	493 The Northern Road	33	44	√
R2	509 The Northern Road	31	47	√
R3	1 Thomas Road	39	47	√
R4	8-16 Timothy Road	29	40	√

Table 12: Predicted Operational Noise Levels (5-7am) cont.

$L_{Aeq(15min)}$ dB(A) re: 20 x 10^{-6} Pa

Reference Location	Description	Predicted $L_{Aeq,15min}$ Noise Level	Assessment $L_{Aeq,15min}$ Goal (5-7am)	Compliance
Operational Noise – SSW Wind (Headfilling NW + Fixed)				
R1	493 The Northern Road	39	44	√
R2	509 The Northern Road	35	47	√
R3	1 Thomas Road	35	47	√
R4	8-16 Timothy Road	29	40	√
Operational Noise – SSW Wind (Headfilling NC + Fixed)				
R1	493 The Northern Road	42	44	√
R2	509 The Northern Road	37	47	√
R3	1 Thomas Road	35	47	√
R4	8-16 Timothy Road	20	40	√
Operational Noise – SSW Wind (Headfilling NE + Fixed)				
R1	493 The Northern Road	44	44	-
R2	509 The Northern Road	40	47	√
R3	1 Thomas Road	35	47	√
R4	8-16 Timothy Road	20	40	√
Operational Noise – NE Wind (Headfilling SE + Fixed)				
R1	493 The Northern Road	24	44	√
R2	509 The Northern Road	24	47	√
R3	1 Thomas Road	44	47	√
R4	8-16 Timothy Road	33	40	√
Operational Noise – NE Wind (Headfilling SC + Fixed)				
R1	493 The Northern Road	24	44	√
R2	509 The Northern Road	24	47	√
R3	1 Thomas Road	44	47	√
R4	8-16 Timothy Road	34	40	√
Operational Noise – NE Wind (Headfilling SW + Fixed)				
R1	493 The Northern Road	23	44	√
R2	509 The Northern Road	24	47	√
R3	1 Thomas Road	42	47	√
R4	8-16 Timothy Road	36	40	√

Table 12: Predicted Operational Noise Levels (5-7am) cont.

$L_{Aeq(15min)}$ dB(A) re: 20 x 10^{-6} Pa

Reference Location	Description	Predicted $L_{Aeq,15min}$ Noise Level	Assessment $L_{Aeq,15min}$ Goal (5-7am)	Compliance
Operational Noise – NE Wind (Headfilling NW + Fixed)				
R1	493 The Northern Road	32	44	√
R2	509 The Northern Road	28	47	√
R3	1 Thomas Road	37	47	√
R4	8-16 Timothy Road	36	40	√
Operational Noise – NE Wind (Headfilling NC + Fixed)				
R1	493 The Northern Road	36	44	√
R2	509 The Northern Road	31	47	√
R3	1 Thomas Road	37	47	√
R4	8-16 Timothy Road	27	40	√
Operational Noise – NE Wind (Headfilling NE + Fixed)				
R1	493 The Northern Road	39	44	√
R2	509 The Northern Road	35	47	√
R3	1 Thomas Road	37	47	√
R4	8-16 Timothy Road	27	40	√

Table 13: Predicted Operational Noise Levels (Day)

$L_{Aeq(15min)}$ dB(A) re: 20 x 10^{-6} Pa

Reference Location	Description	Predicted $L_{Aeq,15min}$ Noise Level	Assessment $L_{Aeq,15min}$ Goal (Day)	Compliance
Operational Noise – Calm (Spent Substrate Operations N + Fixed + Trucks)				
R1	493 The Northern Road	27	44	√
R2	509 The Northern Road	27	48	√
R3	1 Thomas Road	37	48	√
R4	8-16 Timothy Road	34	40	√
Operational Noise – Calm (Spent Substrate Operations C + Fixed + Trucks)				
R1	493 The Northern Road	27	44	√
R2	509 The Northern Road	27	48	√
R3	1 Thomas Road	42	48	√
R4	8-16 Timothy Road	35	40	√

Table 13: Predicted Operational Noise Levels (Day) cont.

$L_{Aeq(15min)}$ dB(A) re: 20 x 10^{-6} Pa

Reference Location	Description	Predicted $L_{Aeq,15min}$ Noise Level	Assessment $L_{Aeq,15min}$ Goal (Day)	Compliance
Operational Noise – Calm (Spent Substrate Operations S + Fixed + Trucks)				
R1	493 The Northern Road	28	44	√
R2	509 The Northern Road	27	48	√
R3	1 Thomas Road	43	48	√
R4	8-16 Timothy Road	37	40	√
Operational Noise – NNE Wind (Spent Substrate Operations N + Fixed + Trucks)				
R1	493 The Northern Road	23	44	√
R2	509 The Northern Road	24	48	√
R3	1 Thomas Road	38	48	√
R4	8-16 Timothy Road	39	40	√
Operational Noise – NNE Wind (Spent Substrate Operations C + Fixed + Trucks)				
R1	493 The Northern Road	23	44	√
R2	509 The Northern Road	24	48	√
R3	1 Thomas Road	43	48	√
R4	8-16 Timothy Road	38	40	√
Operational Noise – NNE Wind (Spent Substrate Operations S + Fixed + Trucks)				
R1	493 The Northern Road	24	44	√
R2	509 The Northern Road	25	48	√
R3	1 Thomas Road	44	48	√
R4	8-16 Timothy Road	37	40	√

Table 14: Predicted Operational Noise Levels (Evening)

$L_{Aeq(15min)}$ dB(A) re: 20 x 10^{-6} Pa

Reference Location	Description	Predicted $L_{Aeq,15min}$ Noise Level	Assessment $L_{Aeq,15min}$ Goal (Evening)	Compliance
Operational Noise – Calm (Fixed Plant)				
R1	493 The Northern Road	24	44	√
R2	509 The Northern Road	24	48	√
R3	1 Thomas Road	22	48	√
R4	8-16 Timothy Road	5	40	√

Table 14: Predicted Operational Noise Levels (Evening) cont.
$L_{Aeq(15min)}$ dB(A) re: 20 x 10^{-6} Pa

Reference Location	Description	Predicted $L_{Aeq,15min}$ Noise Level	Assessment $L_{Aeq,15min}$ Goal (Evening)	Compliance
Operational Noise – SW Wind (Fixed Plant)				
R1	493 The Northern Road	27	44	√
R2	509 The Northern Road	27	48	√
R3	1 Thomas Road	18	48	√
R4	8-16 Timothy Road	2	40	√

Table 15: Predicted Operational Noise Levels (Night)
$L_{Aeq(15min)}$ dB(A) re: 20 x 10^{-6} Pa

Reference Location	Description	Predicted $L_{Aeq,15min}$ Noise Level	Assessment $L_{Aeq,15min}$ Goal (Night)	Compliance
Operational Noise – Calm (Truck Movement, Refrigerated Truck + Fixed Plant)				
R1	493 The Northern Road	26	38	√
R2	509 The Northern Road	26	38	√
R3	1 Thomas Road	37	38	√
R4	8-16 Timothy Road	21	38	√
Operational Noise – NE Wind (Truck Movement, Refrigerated Truck + Fixed Plant)				
R1	493 The Northern Road	23	38	√
R2	509 The Northern Road	23	38	√
R3	1 Thomas Road	37	38	√
R4	8-16 Timothy Road	27	38	√
Operational Noise – SSW Wind (Truck Movement, Refrigerated Truck + Fixed Plant)				
R1	493 The Northern Road	33	38	√
R2	509 The Northern Road	31	38	√
R3	1 Thomas Road	35	38	√
R4	8-16 Timothy Road	19	38	√

The modelling scenarios represent a range of activities, situations and noise levels likely to be emitted from the site activities. The modelling assumed plant and equipment operating simultaneously and typical operations consistent for 5-7am morning fringe period, day, evening and night operations. Whilst these situations would not occur all of the time, the noise modelling represents the likely worst-case operating scenarios.

In terms of intermittent activities during night-time hours, the modelling considered the noise level presented in *Table 11* and considered truck exhaust brake release at six (6) representative locations along the northern and southern facades and at the loading dock. *Table 16* presents the range of predicted $L_{A1,1min}$ noise levels and assessment goals for reference receiver locations.

Table 16: Predicted Intermittent Noise Levels
$L_{A1, 1min}$ dB(A) re: 20 x 10^{-6} Pa

Reference Location	Description	Predicted $L_{A1,1min}$ Noise Level	Assessment $L_{A1,1min}$ Goal (5-7am/Night)	Compliance
Intermittent Noise – 5 to 7am along northern and southern side of main building				
R1	493 The Northern Road	30-48	54	√
R2	509 The Northern Road	28-46	57	√
R3	1 Thomas Road	31-51	57	√
R4	8-16 Timothy Road	23-41	50	√
Intermittent Noise – 10pm to 5am for loading dock				
R1	493 The Northern Road	31	48	√
R2	509 The Northern Road	29	48	√
R3	1 Thomas Road	49	48	+1
R4	8-16 Timothy Road	39	48	√

7.2 Assessment

The noise predictions show that during calm and adverse meteorological conditions the predicted operational (L_{Aeq}) noise levels during 5-7am fringe morning, day, evening and night operating scenarios (*Tables 12-15*) are predicted to satisfy the recommended assessment goals at all reference receiver locations.

A review of the noise modelling has identified that compliance under some operating and meteorological conditions is marginal and typically controlled by headfilling activities. Observations during site audits at Glossodia confirmed that the principle noise source was the motor driving the moving trailer floor. Acoustic controls could be readily adapted to the trailer motor to provide noise reductions in the order of 2-4dB(A) to further reduce noise from the Londonderry proposal.

In terms of night-time intermittent activities, the predicted (L_{A1}) noise levels (*Table 16*) generally satisfy the recommended assessment goals. A minor (1dB(A)) technical exceedance of the night-time intermittent goal ($L_{A1,1min}$ 48dB(A)) was identified for R3. It is noted that the predicted level of 49dB(A) is less than existing L_{Amax} and L_{A1} noise levels (*Appendix 1*) presently experienced by this residence from vehicles on The Northern Road. It is envisaged that up to four (4) trucks/night would enter/depart the site during night-time hours associated with dispatch of harvested mushrooms.

Referenced to the *Environmental Criteria for Road Traffic Noise (ECRTN),* maximum internal levels below 50-55dB(A) within a residential dwelling are unlikely to cause awakening reactions and one or two noise events per night with maximum internal noise levels of 65-70dB(A) are not likely to affect health or wellbeing. Considering the predicted external level of 49dB(A) and a nominal reduction across a building façade with open windows of 8-10dB(A) an internal maximum noise level of 39-41dB(A) is well within the range of noise levels recommended by the *ECRTN*. Accordingly maximum noise levels of 49dB(A) from the site are unlikely to result in significant noise impacts.

The predicted maximum noise level could be reduced with consideration of a number of amelioration measures including: controlling airbrake noise emission to L_{Amax} 115dB(A) or less, site shielding to reference location R3 and/or secondary noise controls to exposed bedroom windows of the residence.

7.3 Road Traffic Noise

The road traffic noise assessment has been based on traffic projections reported by Halcrow MWT (Doc. CTLCXY201-v06), data provided by Elf Mushrooms and existing traffic volumes on The Northern Road recorded by The Centre for Excellence (CFE) between 13 May 2009 and 19 May 2009. The CFE data confirmed that existing daily traffic volumes on The Northern Road (bi-directional) are in the order of 9,156 vehicles.

Considering the existing and projected traffic data recorded, the modelling and assessment of road traffic noise adopted the following vehicle counts and compositions. For calculation purposes the 50th percentile speed recorded for The Northern Road was 82km/h.

Table 17: Existing Traffic Volumes (Daily)

Description	Traffic Volumes			Heavy Vehicle Percentage (%)
	Light	Heavy	Total	
The Northern Road				
- Day	7282	791	8073	12
- Night	956	126	1082	10

Existing traffic noise levels measured at a reference distance of 52m from the centre-line of The Northern Road in free field conditions confirmed levels of $L_{Aeq,15hr}$ 60.7dB(A) and $L_{Aeq,9hr}$ 55.6dB(A) (63.2dB(A) and 58.1dB(A) façade corrected respectively).

Based on the existing traffic data (*Table 17*) and the CORTN modelling procedures, *Table 18* presents a summary of predicted existing road traffic noise levels at a reference distance of ten (10) metres from the edge of the road. It is noted that the CORTN procedures were utilised to determine the change in road traffic noise levels, rather than definitive noise levels.

Table 18: Predicted Existing Traffic Noise Levels @ 10m
L_{Aeq} dB(A) re: 20 x 10^{-6} Pa

Description	Predicted Traffic Noise Levels L_{Aeq}	
	Day $L_{Aeq,15hr}$	Night $L_{Aeq,9hr}$
The Northern Road	70.6	64.5

The predicted road traffic noise levels in the absence of the proposed mushroom farm at a reference distance of ten (10) metres show that the *ECRTN* baseline goals ($L_{Aeq,15hr}$ 60dB(A) and $L_{Aeq,9hr}$ 55dB(A)) are exceeded.

Elf Mushrooms provided projected maximum hourly light and heavy vehicle numbers for the operation of the facility at proposed capacity as follows:

Day 83 cars (165 trips - shift change) & 10 trucks (20 trips)

Night 83 cars (165 trips - shift change) & 4 trucks (8 trips)

Considering adopted traffic volumes and assuming a 50% traffic split north / south on The Northern Road, *Table 19* presents a summary of the adopted hourly vehicle numbers incorporating the proposed development.

Table 19: Vehicle Volumes + Mushroom Farm (Hourly)

Description	Traffic Volumes			Heavy Vehicle Percentage (%)
	Light	Heavy	Total	
The Northern Road				
- Day	568	63	631	10.0
- Night	189	18	207	8.7

Based on the traffic volumes summarised in *Table 19* and CORTN modelling procedures, *Table 20* presents a summary of the predicted future road traffic noise levels at a reference distance of ten (10) metres from the edge of the road.

Table 20: Predicted Future Traffic Noise Levels @ 10m with Mushroom Farm
L_{Aeq} dB(A) re: 20 x 10^{-6} Pa

Description	Predicted Traffic Noise Levels L_{Aeq}	
	Day $L_{Aeq,15hr}$	Night $L_{Aeq,9hr}$
The Northern Road	71.4 (+0.8)	66.4 (+1.9)

Predicted increase in noise levels shown in () brackets

The predicted future road traffic noise levels incorporating the operation of the mushroom growing facility at a reference distance of ten (10) metres from the edge of The Northern Road show that the recommended *ECRTN* baseline goals $L_{Aeq,15hr}$ 60dB(A) and $L_{Aeq,9hr}$ 55dB(A) are exceeded. Calculations show that the proposal would not result in an increase to the existing traffic noise levels by more than 2dB(A). The predictions consider a worse case traffic generation scenario, and actual volumes are expected to be lower.

7.4 Operational Noise Control Recommendations and Management

The results of the noise modelling have shown that predicted noise levels from the proposed mushroom farm satisfy the recommended assessment goals under calm meteorological conditions. To mitigate potential noise impacts under adverse conditions, the following control measures have been adopted and considered in the noise modelling. Prior to construction all noise control measures should be reviewed and assessed in accordance with Development Approval Conditions.

- Site layout generally in accordance with *Figure 2*;
- Finished site levels approximately RL38.5 with main growing building height of approximately six point eight to eight point nine (9.8-11.9) metres above finished hardstand level;
- Chillers, condensers, boiler, pumps and all other fixed and mobile mechanical plant selected to satisfy the referenced acoustic performance (*Table 10*).
- Details of all mechanical plant and equipment shall be subject to detailed review by Acoustic Consultant prior to final specification;
- Walls and roof of plantroom to provide a minimum acoustic performance of Rw45 and Rw36 respectively. Final details subject to review prior to final specification;
- Intake and discharge shafts for plantroom shall incorporate noise attenuation to achieve the acoustic performance referenced in *Table 10*. Final details subject to review prior to final specification;
- Plantroom to incorporate absorptive treatment (min NRC 0.70). Plantroom will require acoustic input prior to final specification;
- Building roof cladding consisting of sheet metal (min. 0.42BMT) over fibreglass building blanket and medium duty thermofoil or similar AND insulated colorbond sandwich panel (ceiling) for growing rooms providing a nominal installed noise reduction in the order of 28dB(A) (Rw34 or greater). Final details subject to detailed review by Acoustic Consultant prior to final specification;

- Construction of an earth mound along the northern and eastern portions of the site of a height of not less than two point five (2.5) metres above finished hardstand level (approx. RL41) as per *Figure 2*;
- Trailer motors for moving floor substrate trucks to incorporate acoustic enclosures and residential grade mufflers to provide a minimum 3dB(A) noise reduction and result in a sound power level in the order of Lw100dB(A);
- Airbrake release discharge noise levels reduced to Lw115dB(A) or less;
- Truck speed on the site access roads less than 20kph; and,
- Mobile plant and plant alarms fitted with low level or broadband 'quacker' alarms or equivalent in lieu of sirens/reversing beepers.

8.0 CONCLUSION

Elf Mushrooms (*ELF*) proposes to develop an existing 'greenfield' site at Londonderry to accommodate a mushroom growing farm. The subject site is located on the western side of The Northern Road at Londonderry (*Figure 1*). The site is roughly rectangular in shape with a total area of 22.66 hectares and identified as Lot 138 DP 752037, Londonderry.

Atkins Acoustics was engaged by Perram & Partners on behalf of Elf Mushrooms to prepare a construction and operation noise assessment for the proposal.

Site inspections and noise measurements confirmed that the noise environment at potential exposed receiver locations is subjected to noise from road traffic on The Northern Road, domestic activities and natural elements.

The nearest potentially affected residential dwellings are located to the north (493, 503, 505 & 509 The Northern Road) south (1 Thomas Road *unformed*) and west (2, 8-16, 18-20 and 26 Timothy Road) of the development. The closest residential dwellings are located approximately 120-200m to the west, adjacent southern site boundary and approximately 180m to proposed building and 470m west of the proposal. *Table 1* and *Figure 3* identifies the receiver locations selected for noise assessment.

Goals for the assessing noise from the proposal have been developed from procedures documented in the DECCW, Industrial Noise Policy (*INP*), Interim Construction Noise Guideline *(CNG)*, Industrial Noise Policy *(INP),* Noise Guide for Local Government *(NGLG)* and the Environmental Criteria for Road Traffic Noise *(ECRTN)*.

Construction noise modelling for the proposal has shown that the recommended construction noise goals are generally satisfied at the reference receiver locations.

Noise modelling for the operating scenarios for 5-7am morning fringe, day, evening and night represents a range of activities, situations and noise levels likely to be emitted from the site and with all plant and equipment operating simultaneously. Whilst these situations will not occur all of the time, the noise modelling represents worst-case operating scenarios. The noise predictions conducted in accordance with *INP* procedures show that during calm and adverse meteorological conditions the predicted operational noise levels for all scenarios assessed satisfy the recommended project assessment goals. Where predicted noise levels have been identified as marginally compliant, additional noise control measures have been recommended to further reduce noise levels.

Noise modelling for envisaged night-time activities truck (airbrake release) has shown that the intermittent noise would generally satisfy the *NGLG* disturbance goals and significantly less than the levels presented in the *ECRTN*. The assessment has shown that a technical exceedance (1dB(A)) of the *NGLG* goal can be controlled through a review of truck airbrake release systems.

The results and findings presented in this report assume that effective noise mitigation controls (*Section 7.4*) are incorporated into the design, operation and management of the proposed facility.

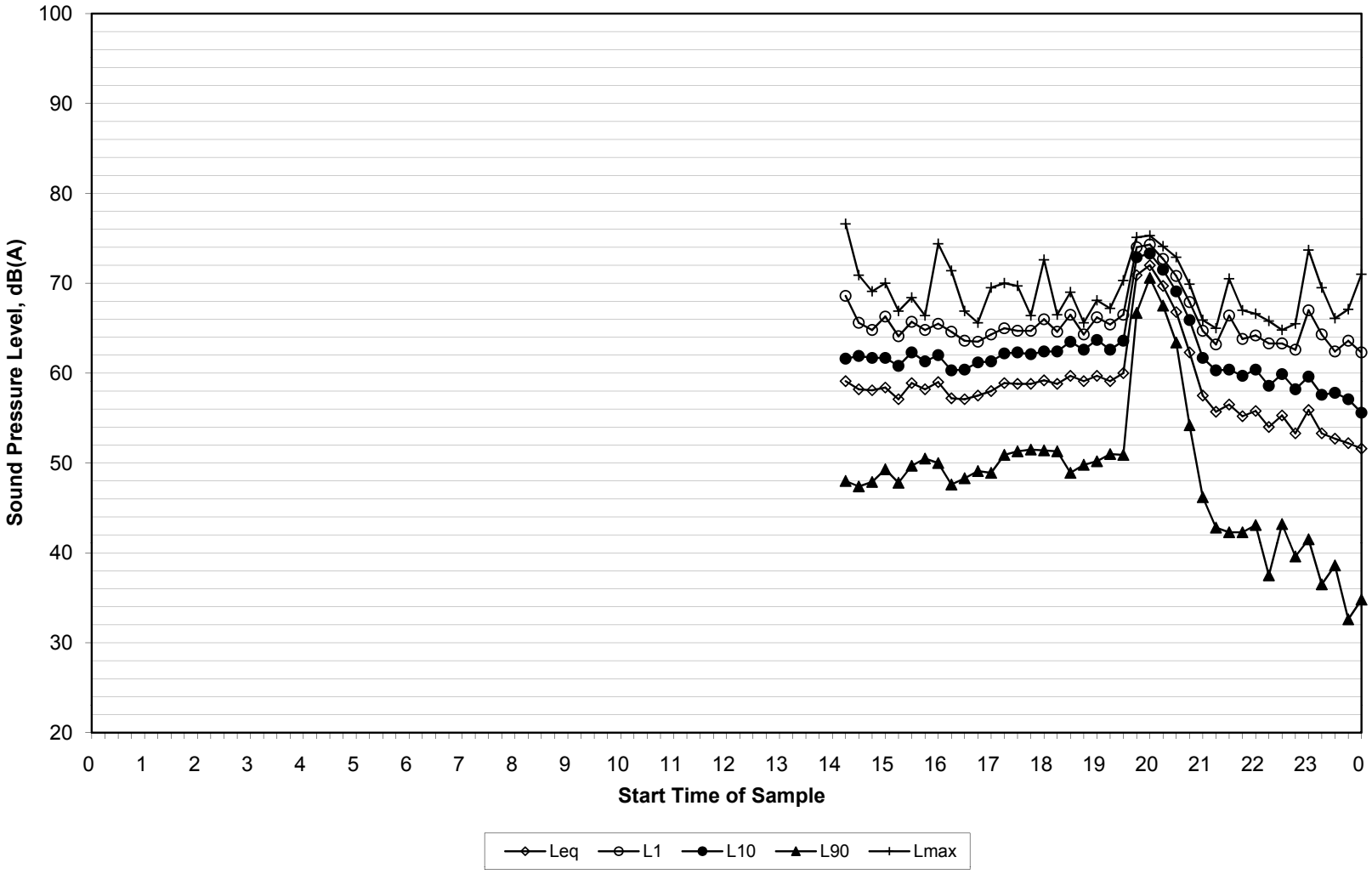
Predicted road traffic noise levels in the absence of the facility at a reference distance of ten (10) metres from the edge of the road show that the recommended *ECRTN* baseline goals ($L_{Aeq,15hr}$ 60dB(A) and $L_{Aeq,9hr}$ 55dB(A)) are exceeded. The predicted road traffic noise levels incorporating the mushroom growing facility show that the proposal would not increase the existing traffic noise levels on The Northern Road by more than 2dB(A) and satisfy the *ECRTN* assessment goals.

Should the development be approved, this assessment has demonstrated that noise impacts can be controlled to satisfy the project design goals recommended by the DECCW and are unlikely to give rise to significant noise impacts.

APPENDIX 1: AMBIENT NOISE MEASUREMENT RESULTS

Ambient Sound Pressure Levels

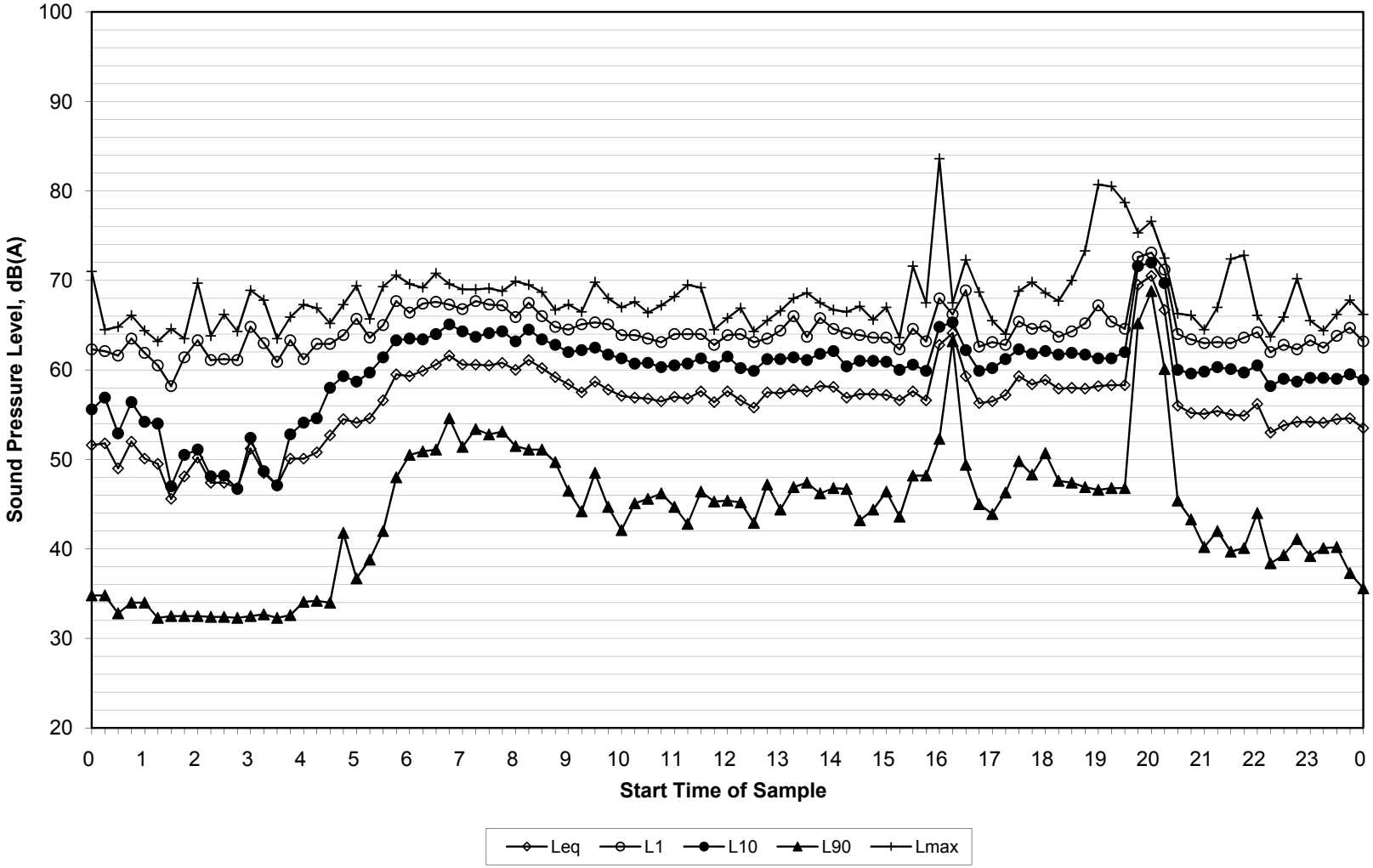
Thursday, 12 March 2009



Location 1 - 521 Northern Road (east)
Front - approx. 52m to Cl of Northern Road

Ambient Sound Pressure Levels

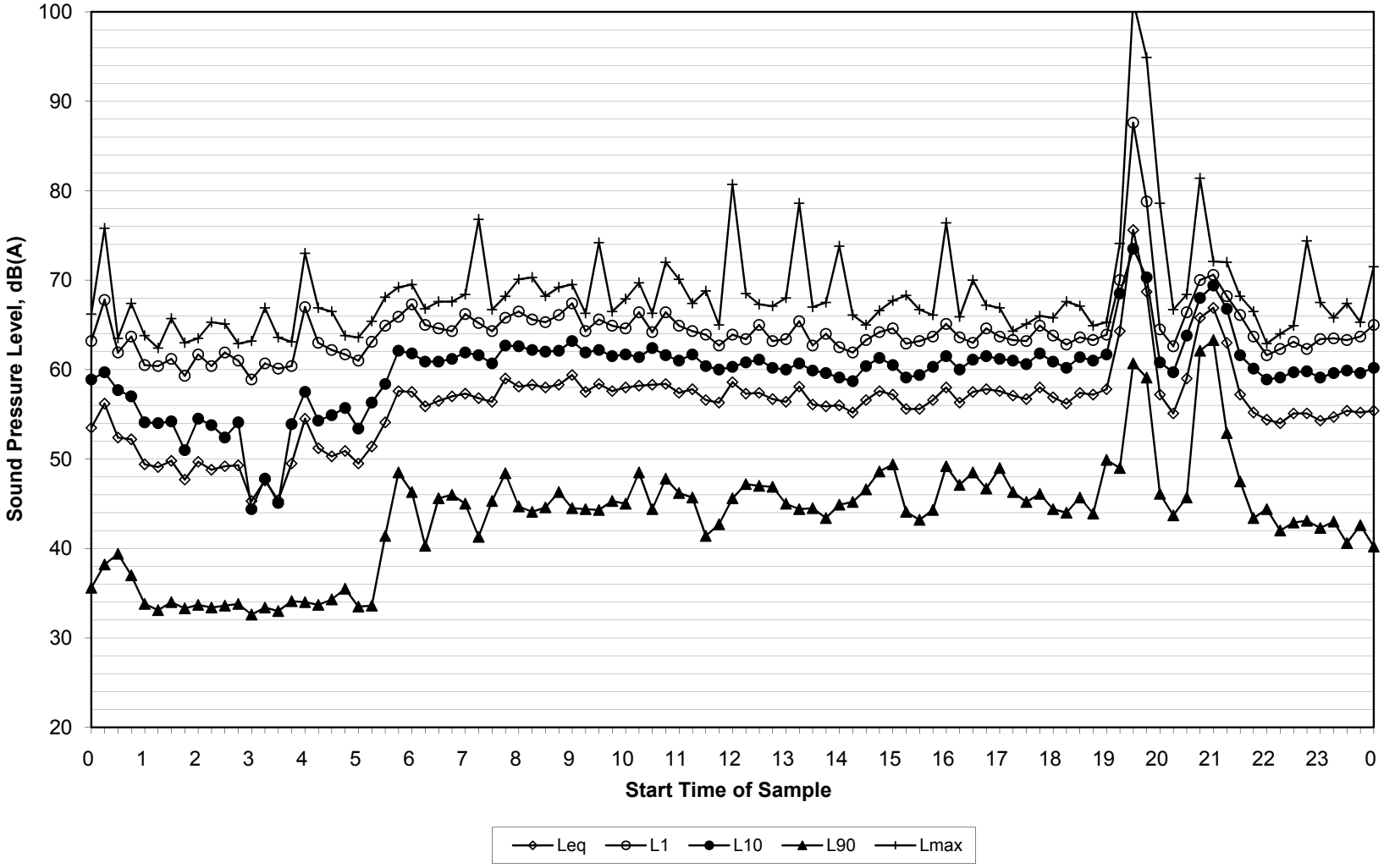
Friday, 13 March 2009



Location 1 - 521 Northern Road (east)
Front - approx. 52m to Cl of Northern Road

Ambient Sound Pressure Levels

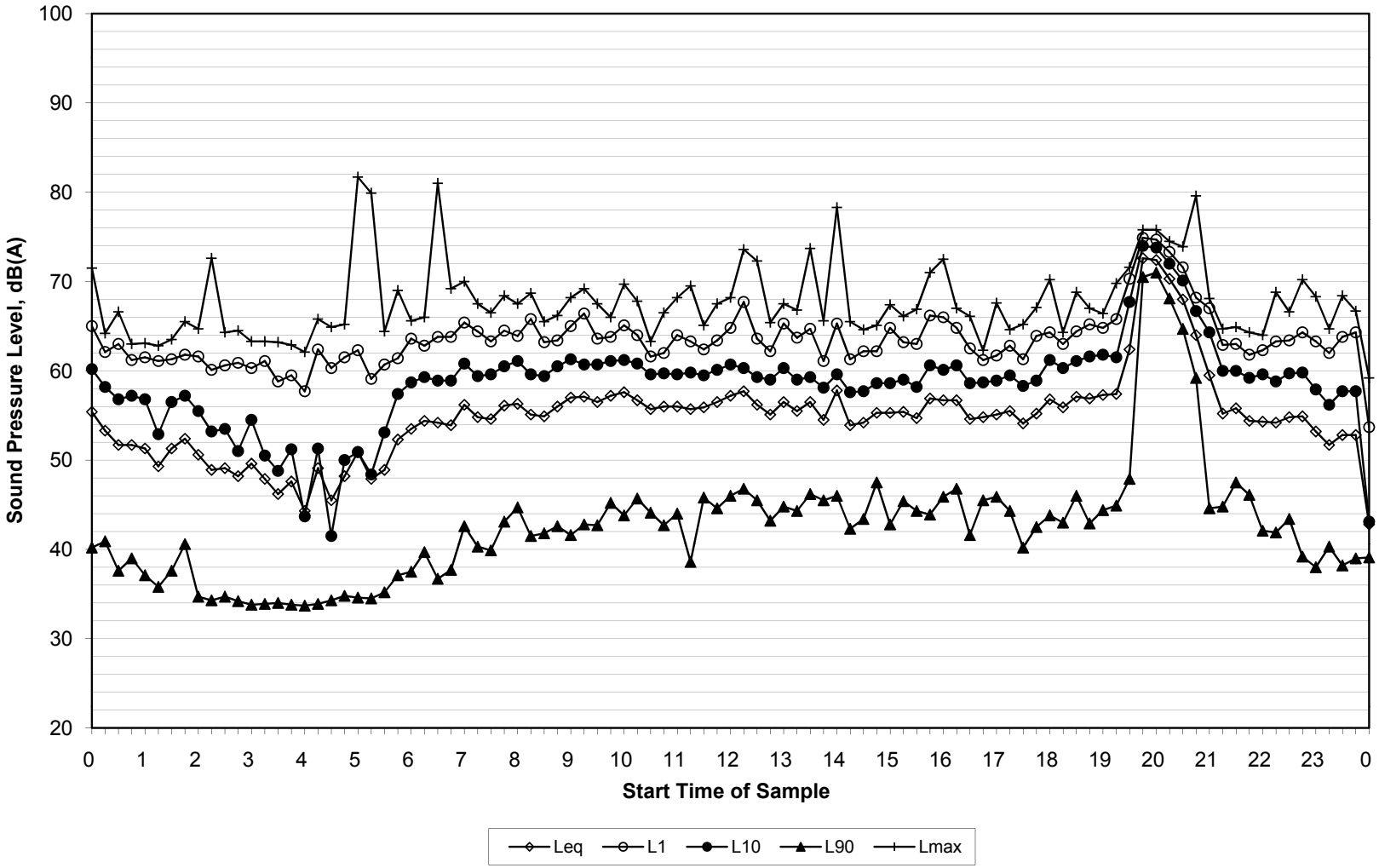
Saturday, 14 March 2009



Location 1 - 521 Northern Road (east)
Front - approx. 52m to Cl of Northern Road

Ambient Sound Pressure Levels

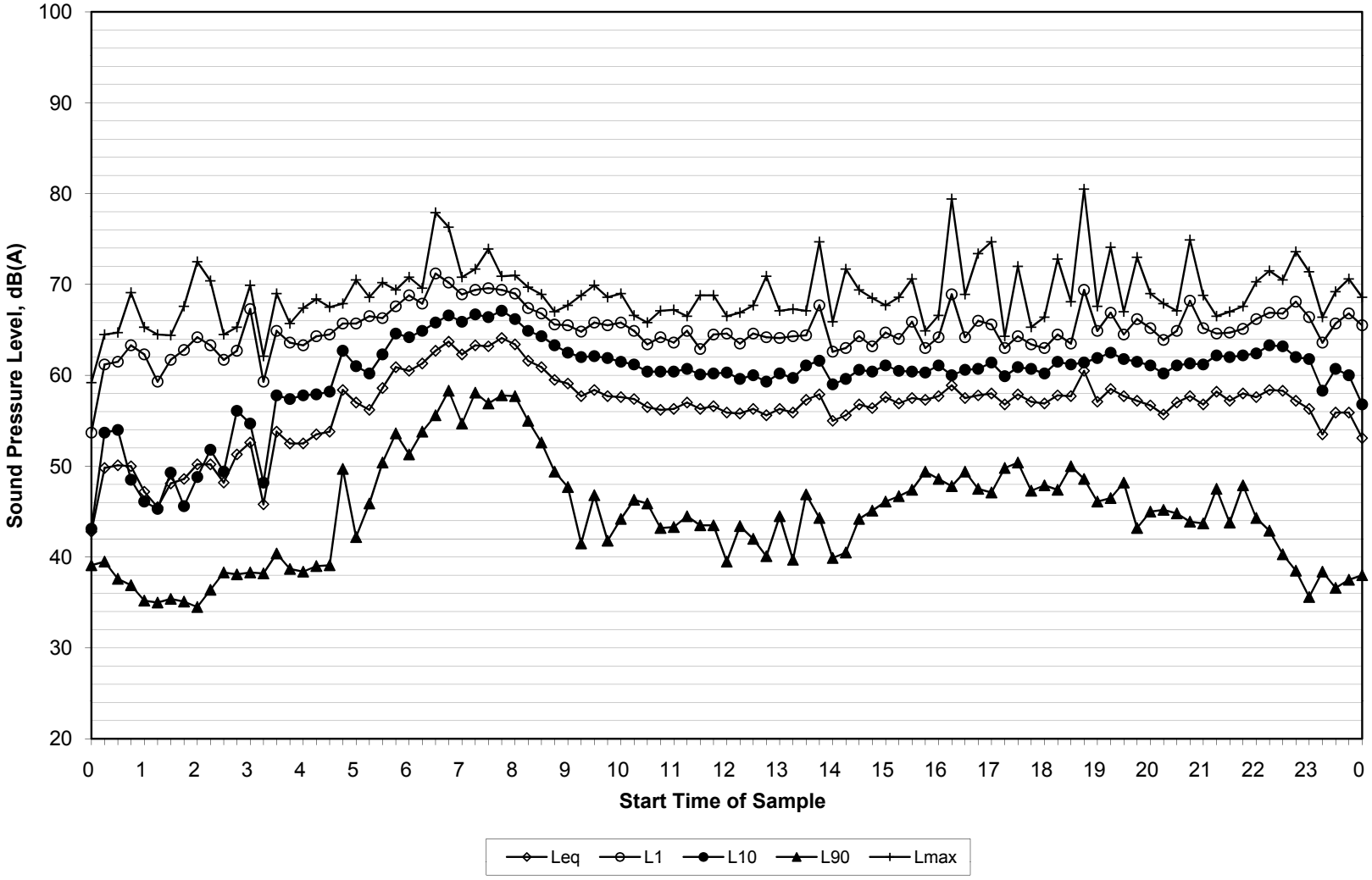
Sunday, 15 March 2009



Location 1 - 521 Northern Road (east)
Front - approx. 52m to Cl of Northern Road

Ambient Sound Pressure Levels

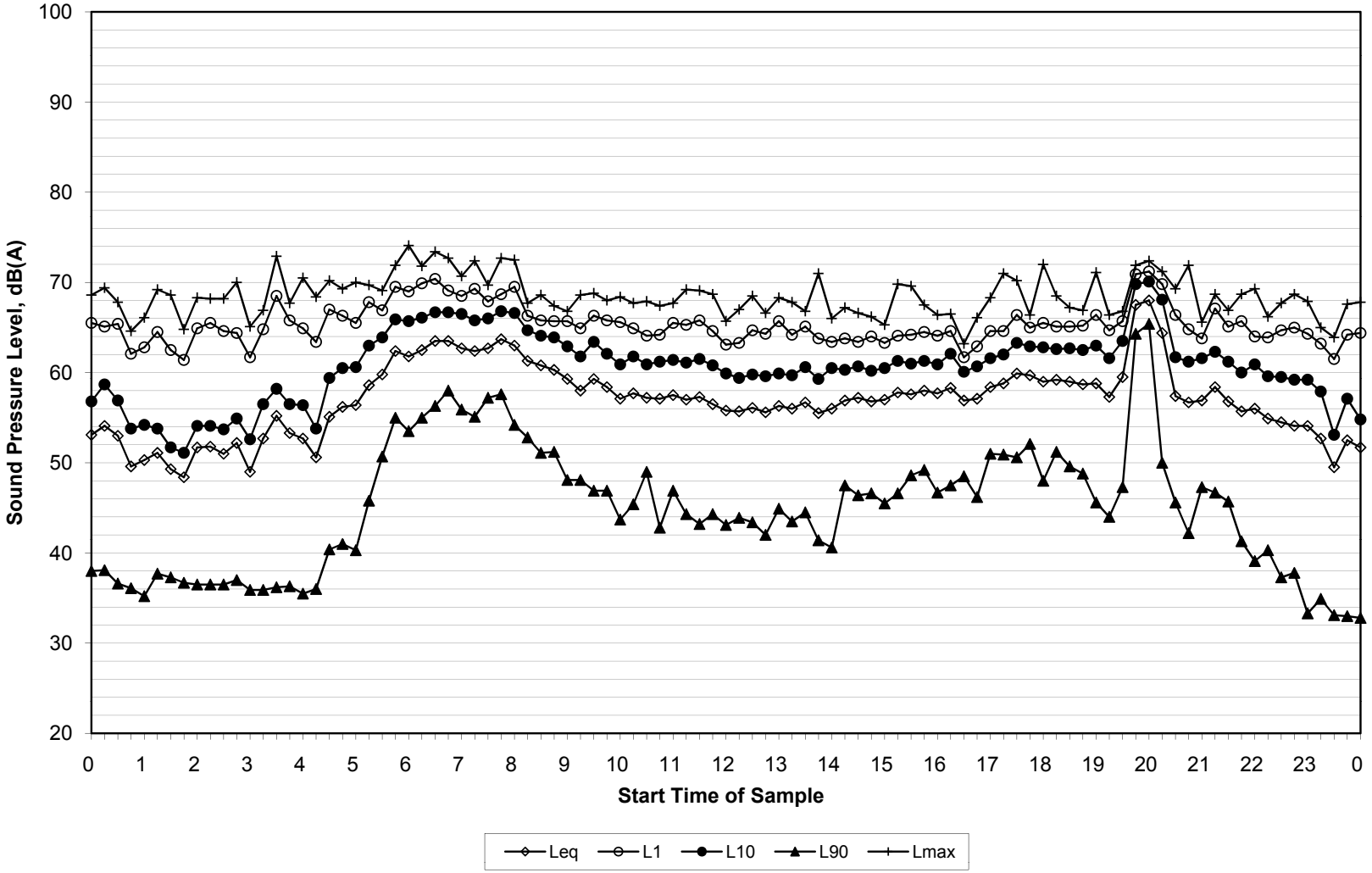
Monday, 16 March 2009



Location 1 - 521 Northern Road (east)
Front - approx. 52m to Cl of Northern Road

Ambient Sound Pressure Levels

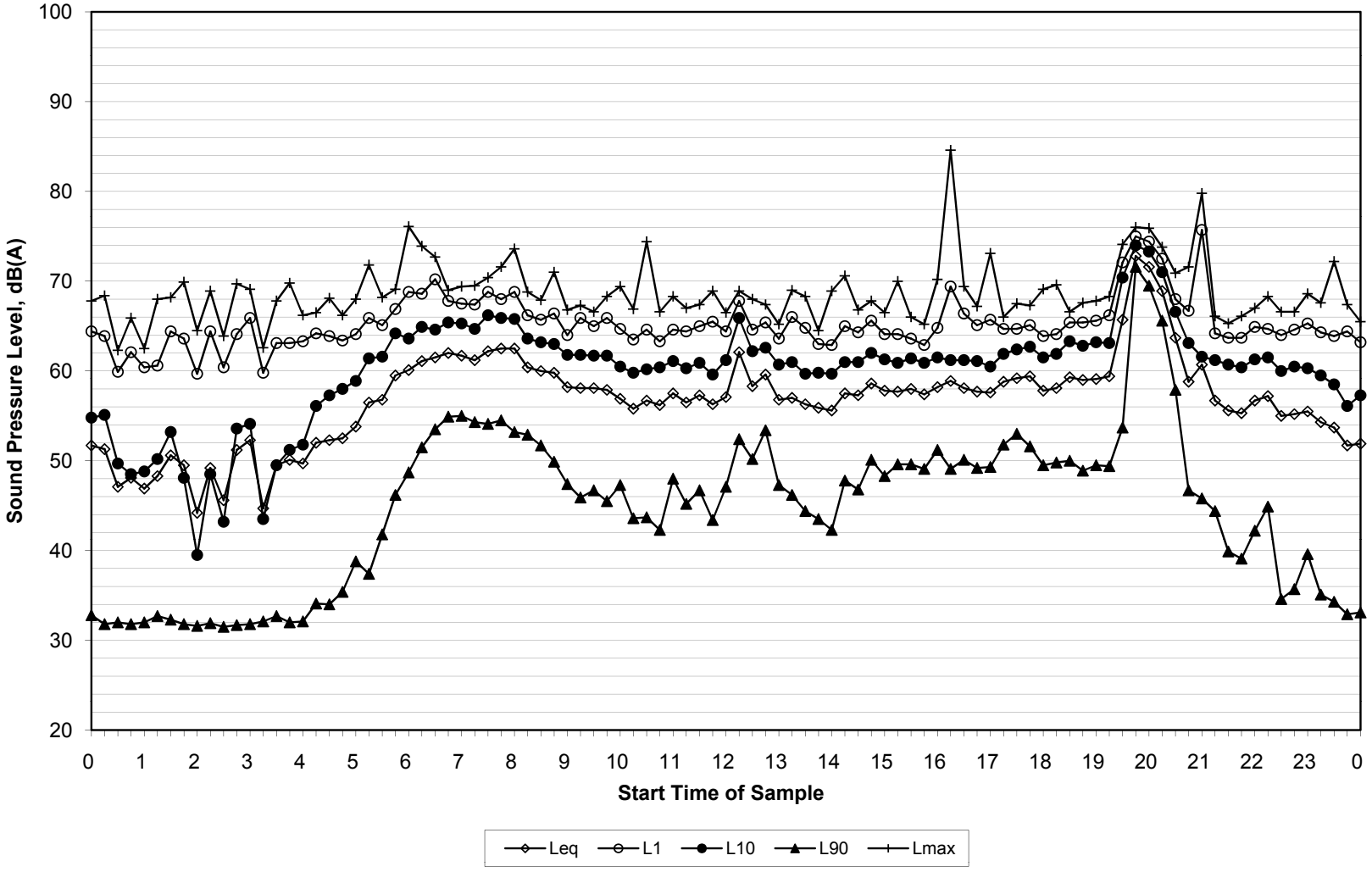
Tuesday, 17 March 2009



Location 1 - 521 Northern Road (east)
Front - approx. 52m to Cl of Northern Road

Ambient Sound Pressure Levels

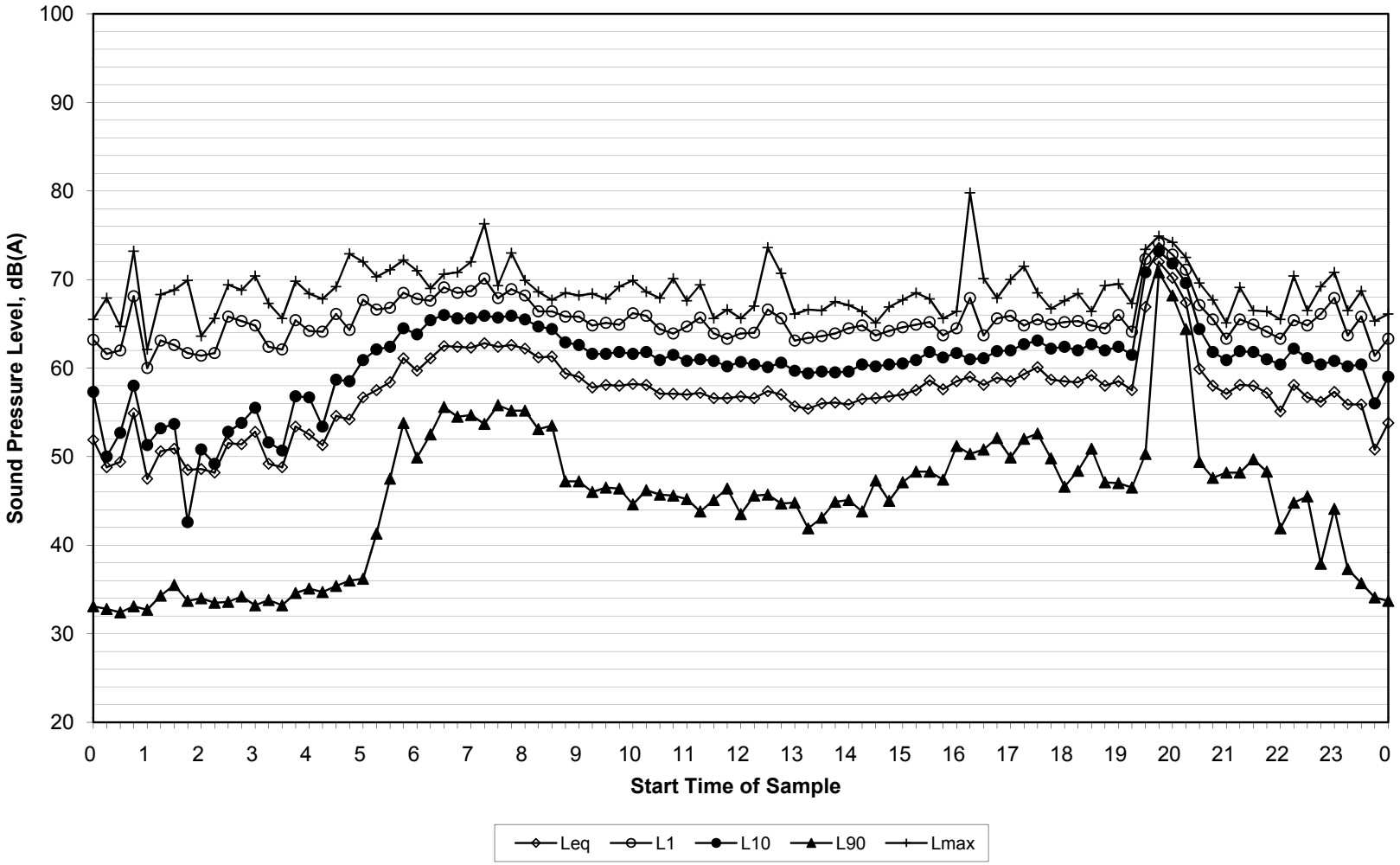
Wednesday, 18 March 2009



Location 1 - 521 Northern Road (east)
Front - approx. 52m to Cl of Northern Road

Ambient Sound Pressure Levels

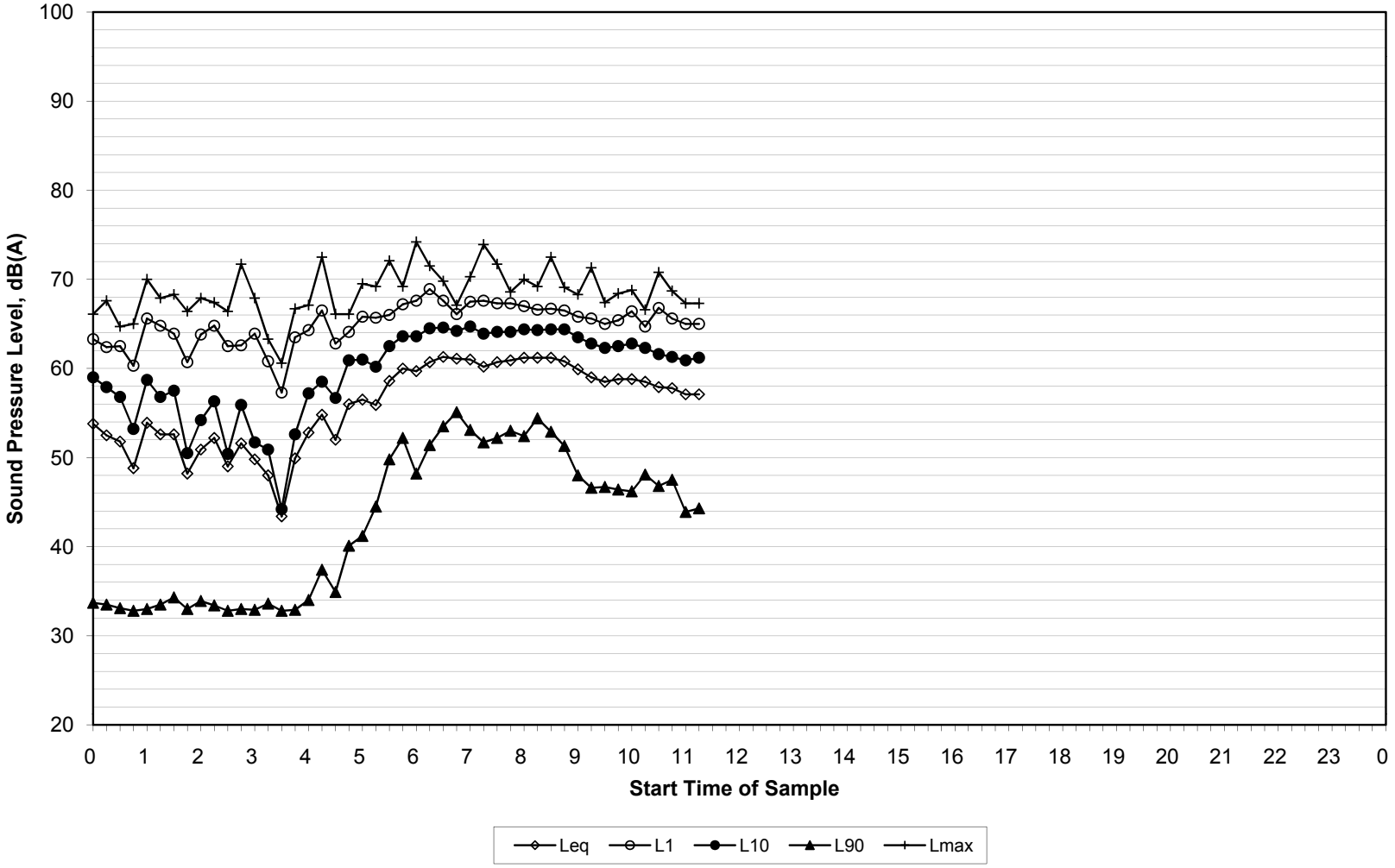
Thursday, 19 March 2009



Location 1 - 521 Northern Road (east)
Front - approx. 52m to Cl of Northern Road

Ambient Sound Pressure Levels

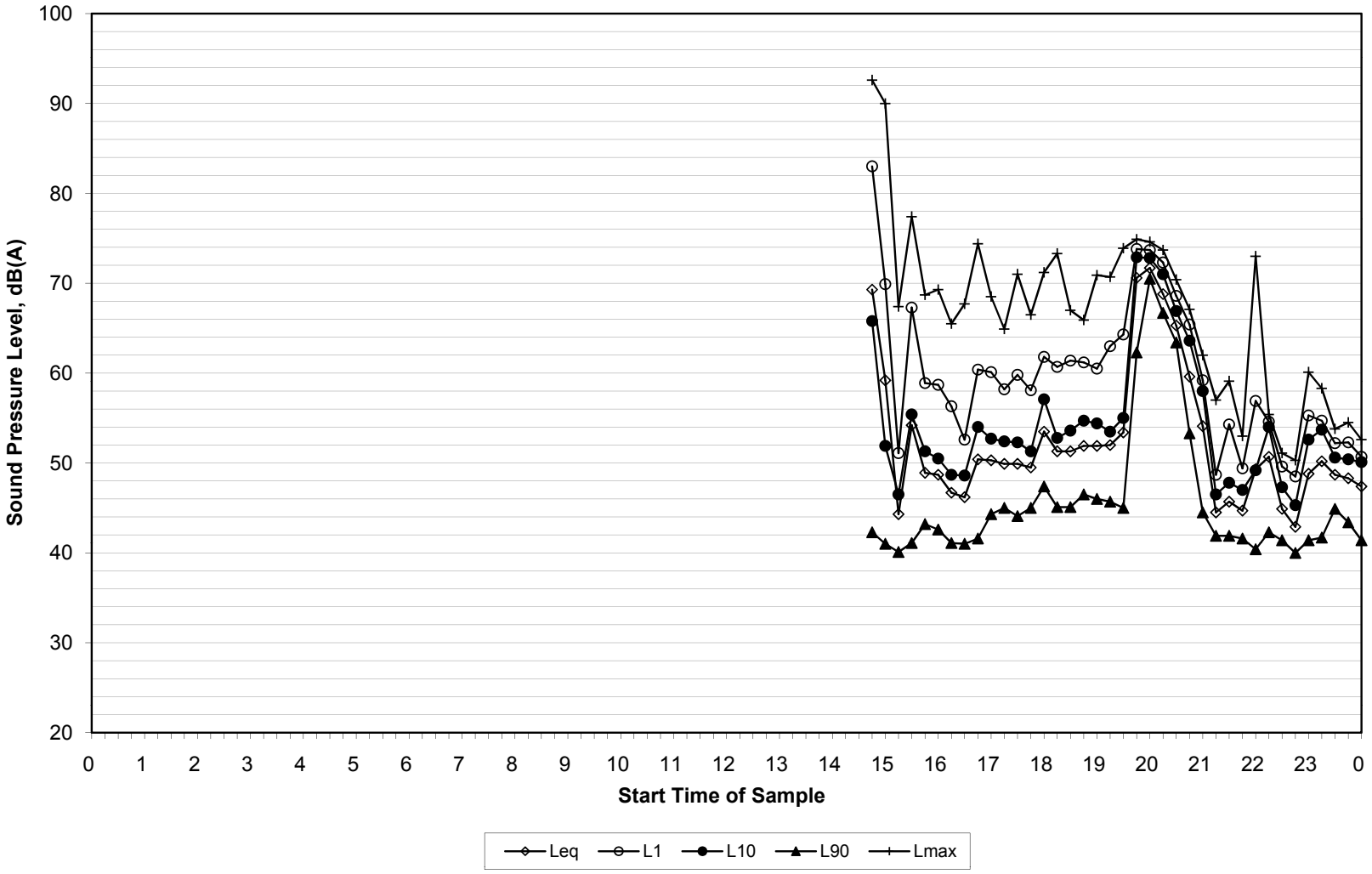
Friday, 20 March 2009



Location 1 - 521 Northern Road (east)
Front - approx. 52m to Cl of Northern Road

Ambient Sound Pressure Levels

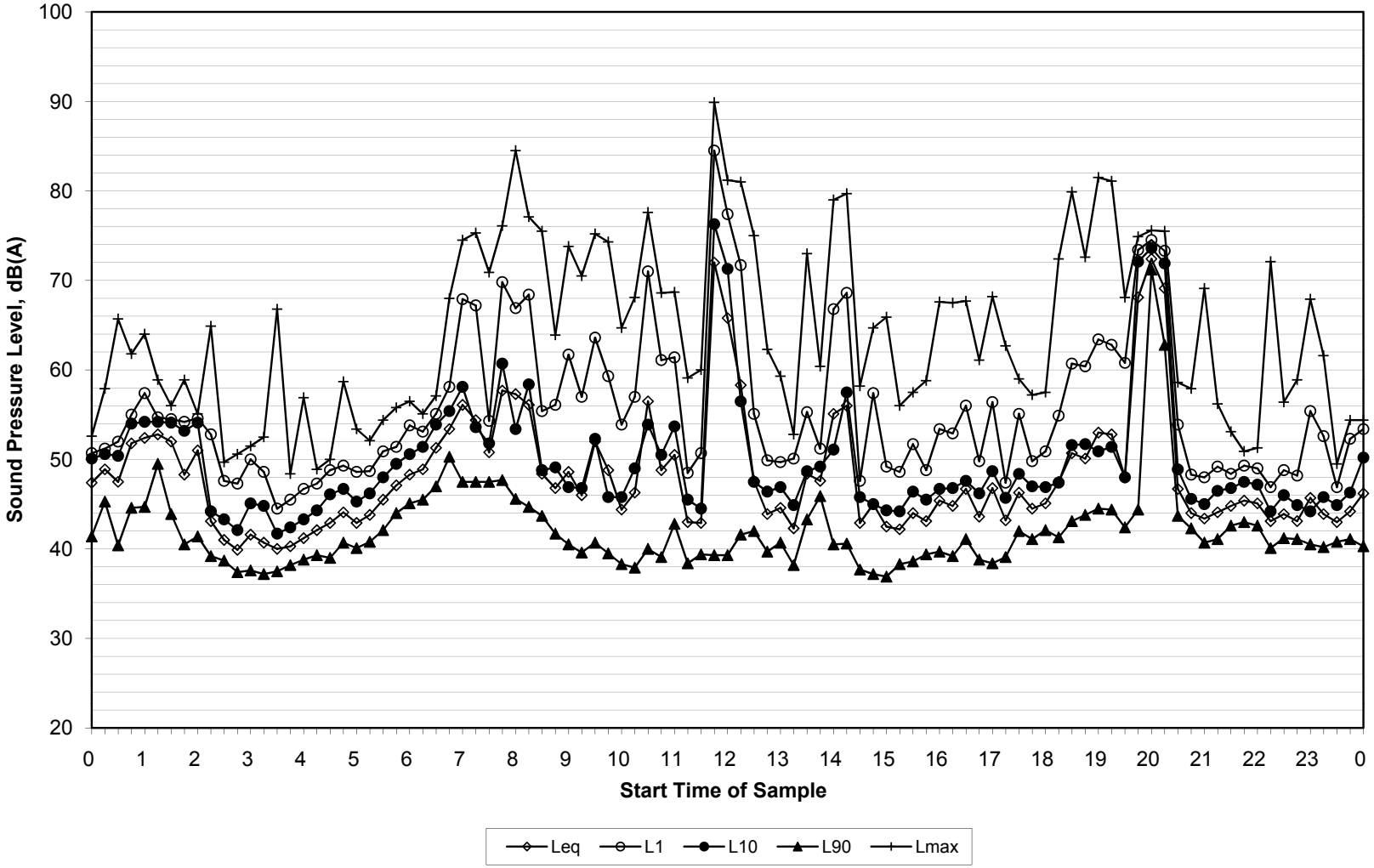
Thursday, 12 March 2009



Location 2 - 521 Northern Road (north)
Central portion of site

Ambient Sound Pressure Levels

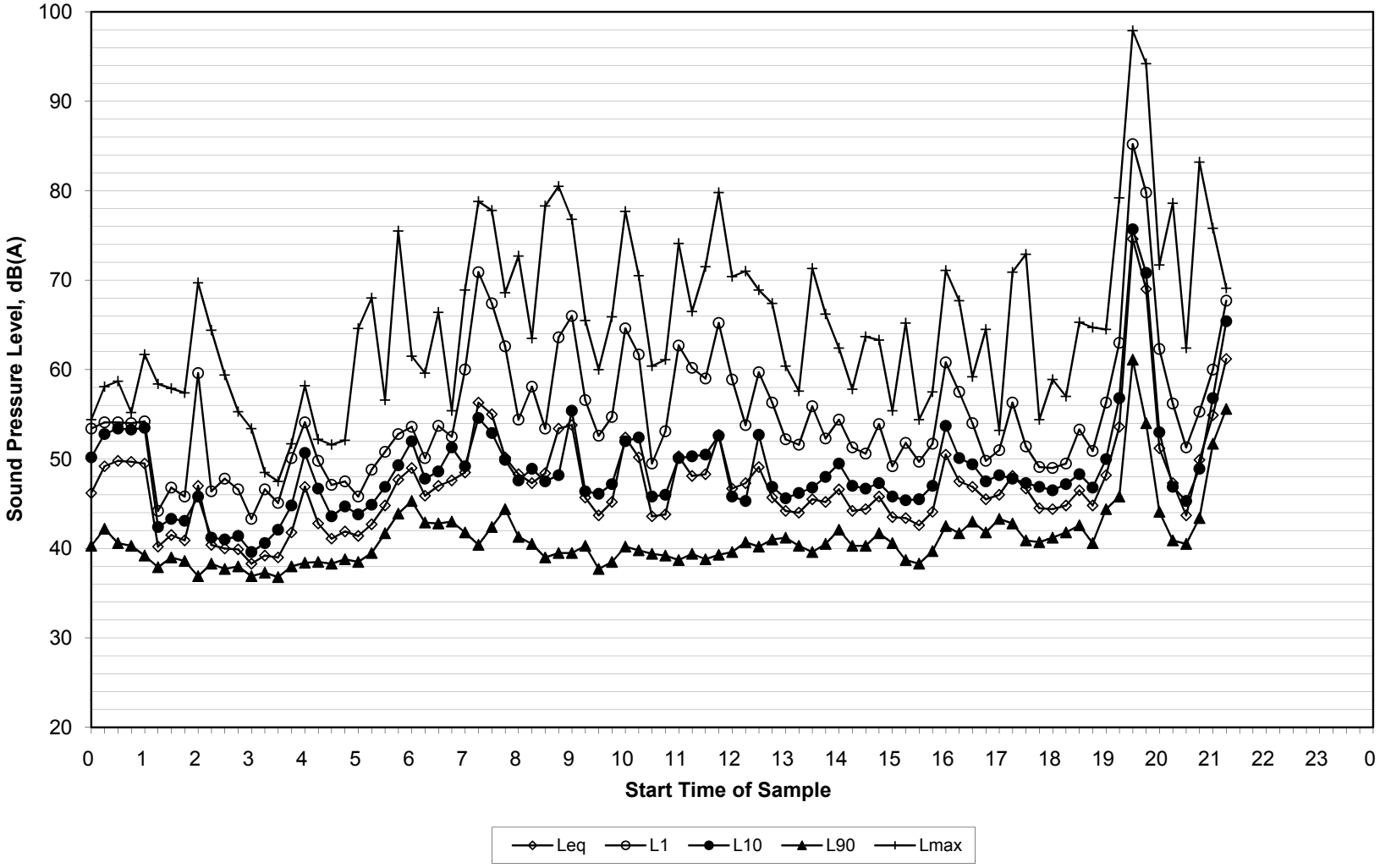
Friday, 13 March 2009



Location 2 - 521 Northern Road (north)
Central portion of site

Ambient Sound Pressure Levels

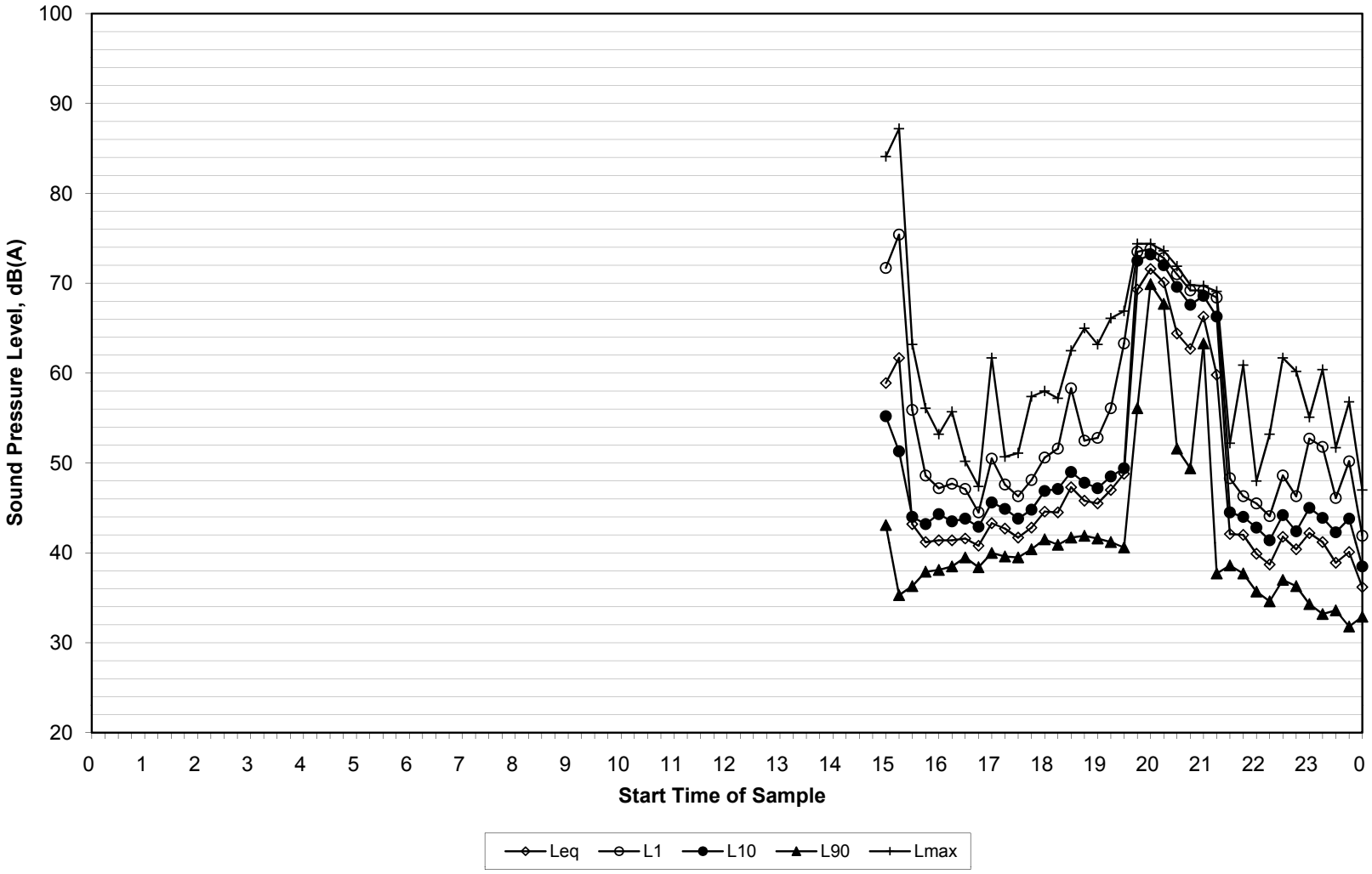
Saturday, 14 March 2009



Location 2 - 521 Northern Road (north)
Central portion of site

Ambient Sound Pressure Levels

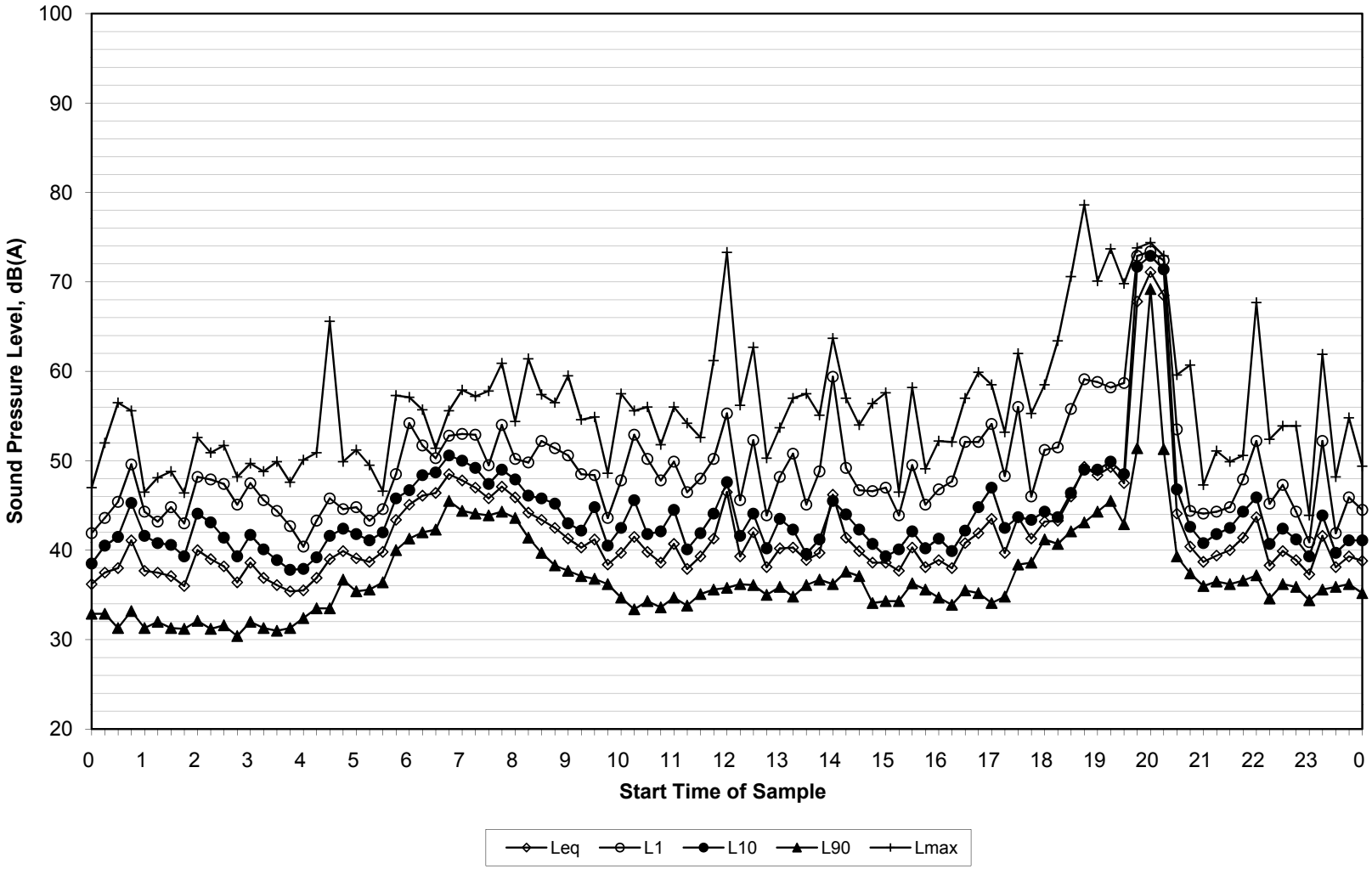
Thursday, 12 March 2009



Location 3 - 521 Northern Road (west)
Rear portion of site

Ambient Sound Pressure Levels

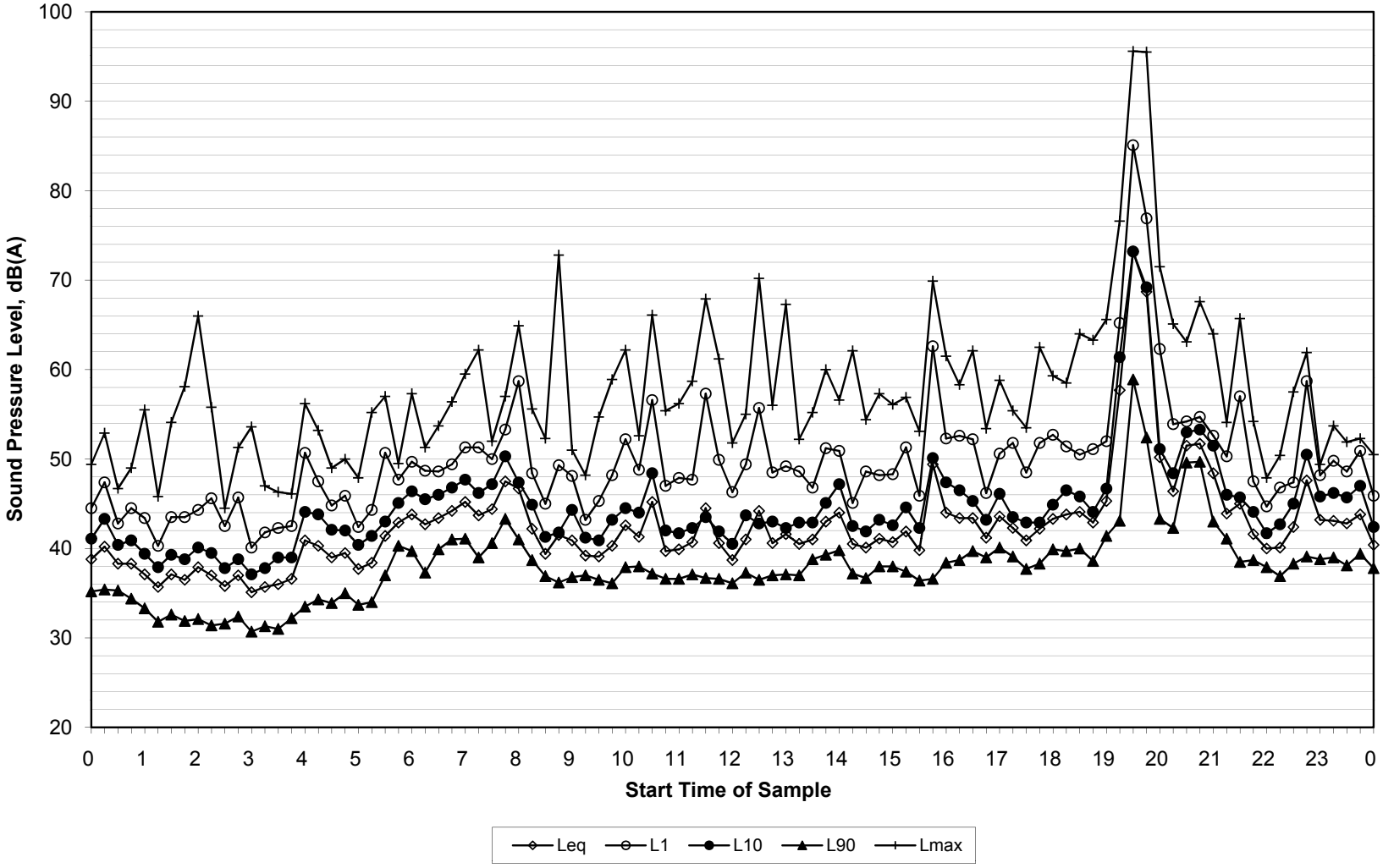
Friday, 13 March 2009



Location 3 - 521 Northern Road (west)
Rear portion of site

Ambient Sound Pressure Levels

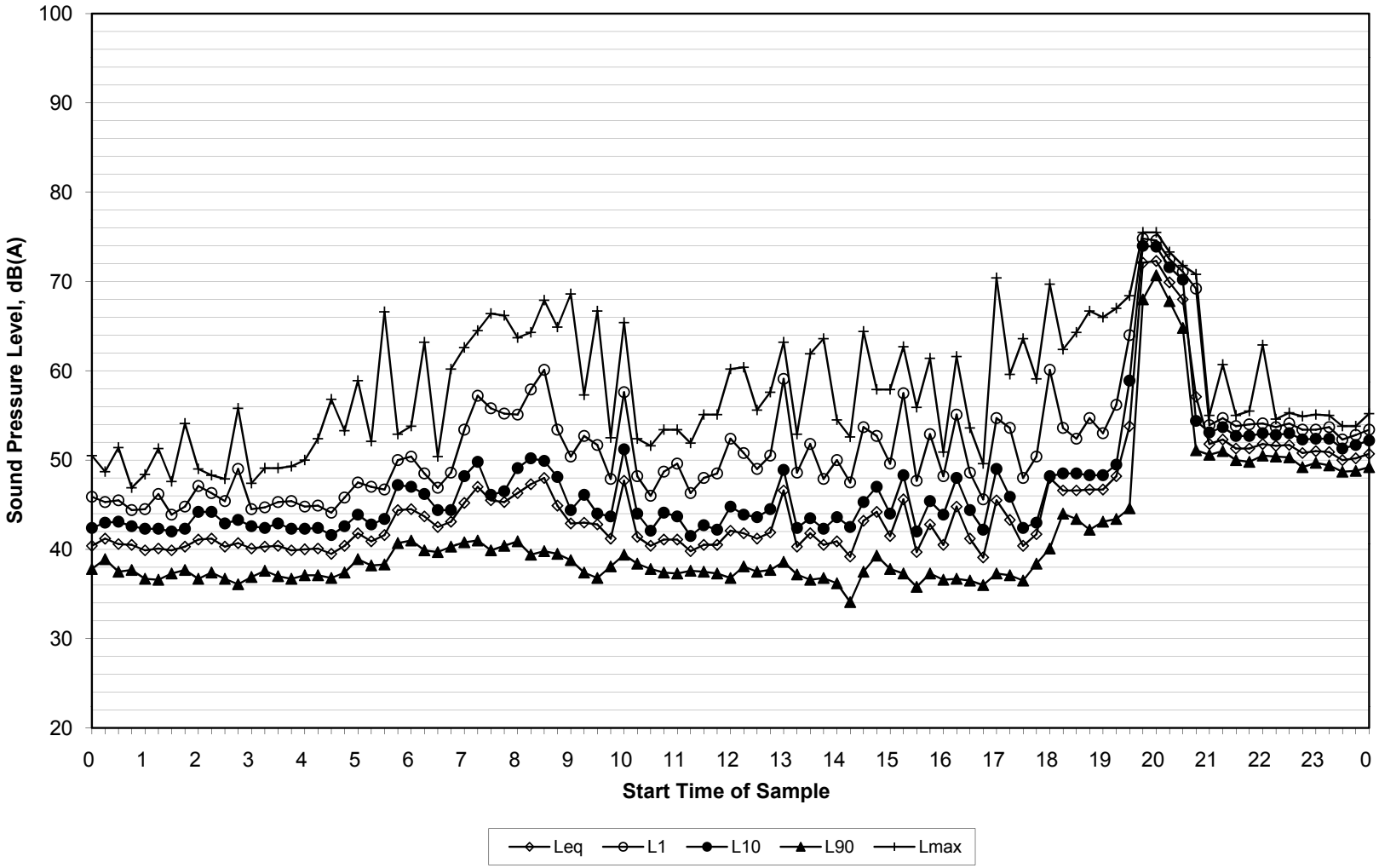
Saturday, 14 March 2009



Location 3 - 521 Northern Road (west)
Rear portion of site

Ambient Sound Pressure Levels

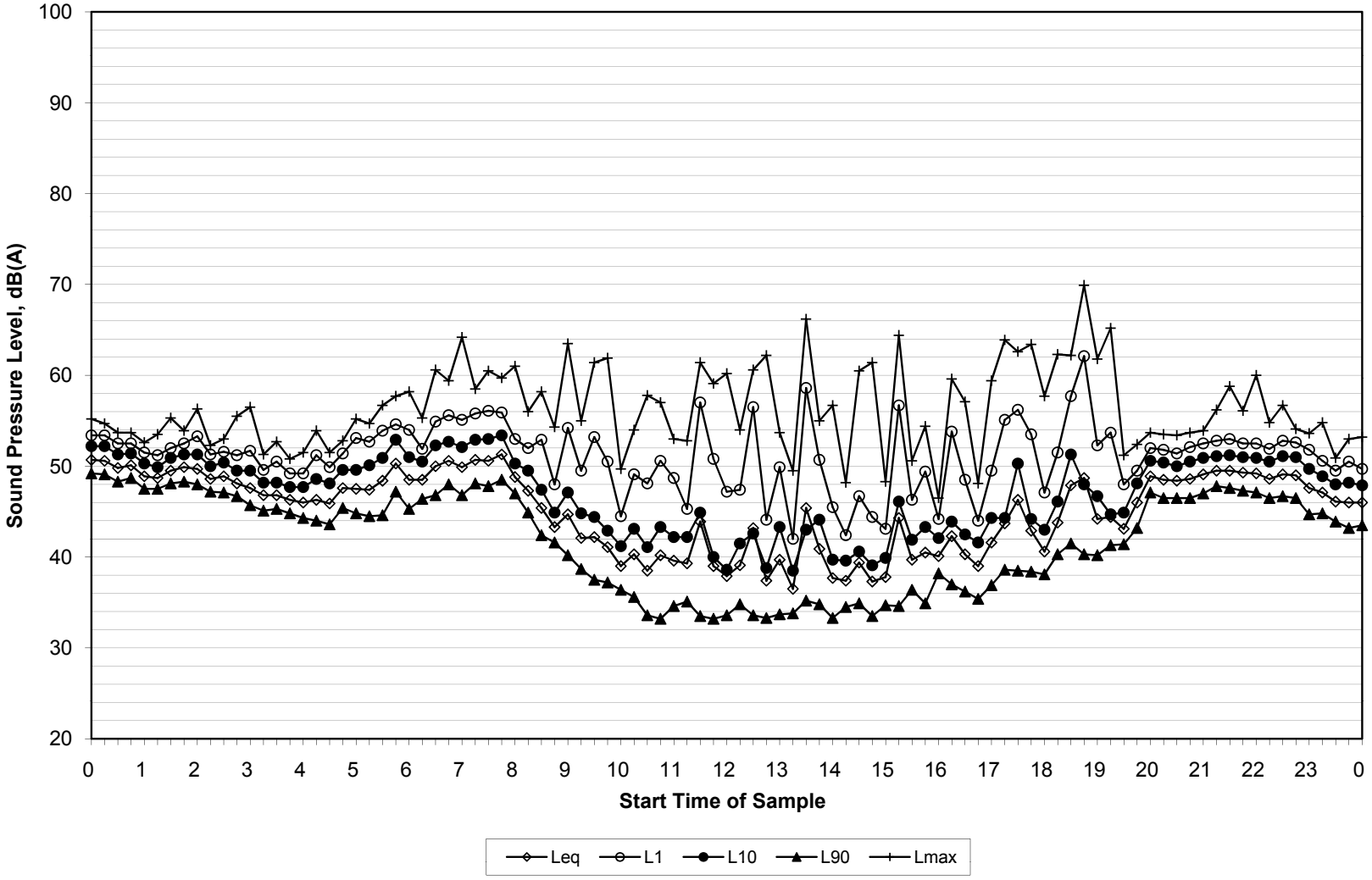
Sunday, 15 March 2009



Location 3 - 521 Northern Road (west)
Rear portion of site

Ambient Sound Pressure Levels

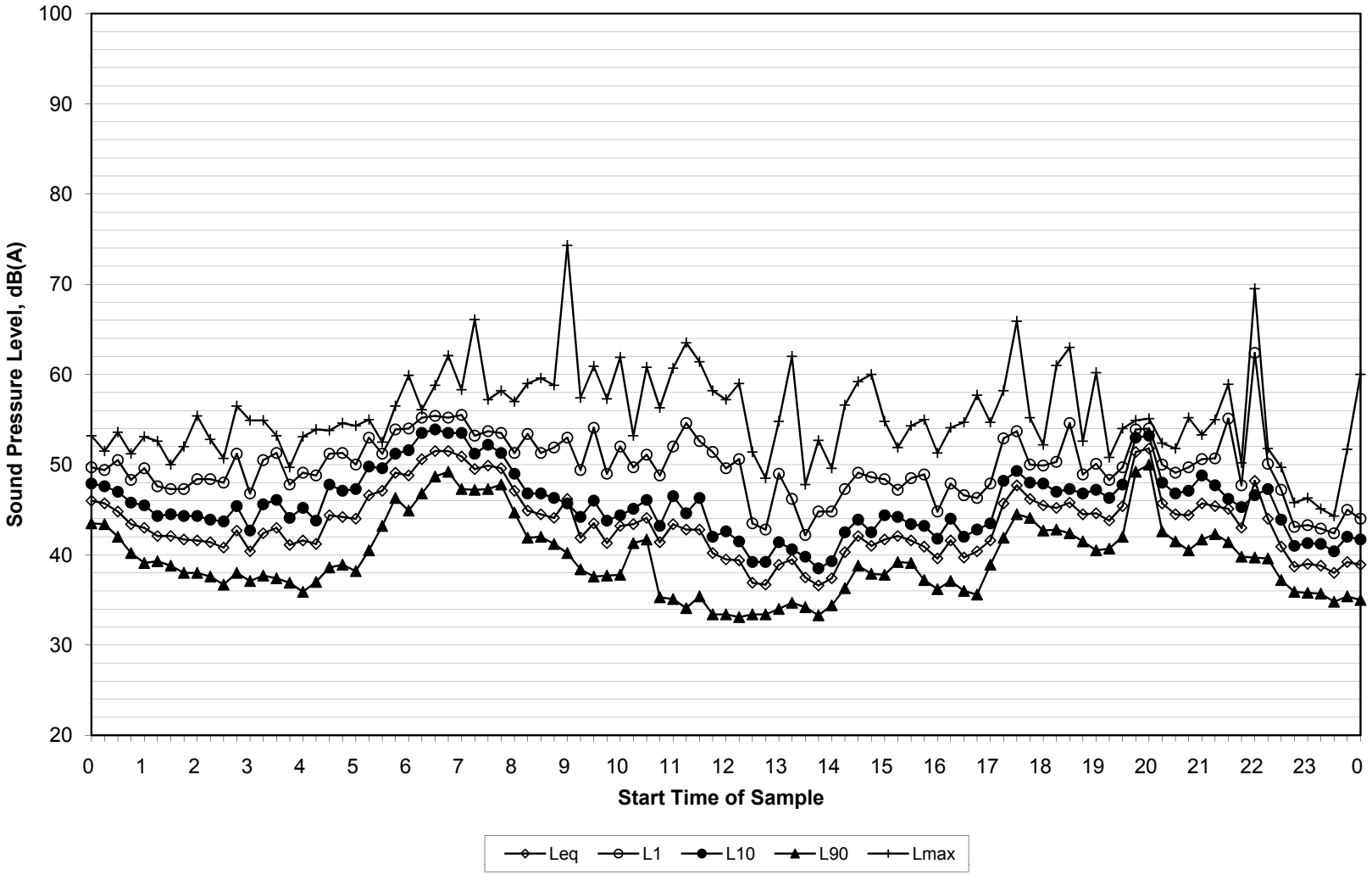
Monday, 16 March 2009



Location 3 - 521 Northern Road (west)
Rear portion of site

Ambient Sound Pressure Levels

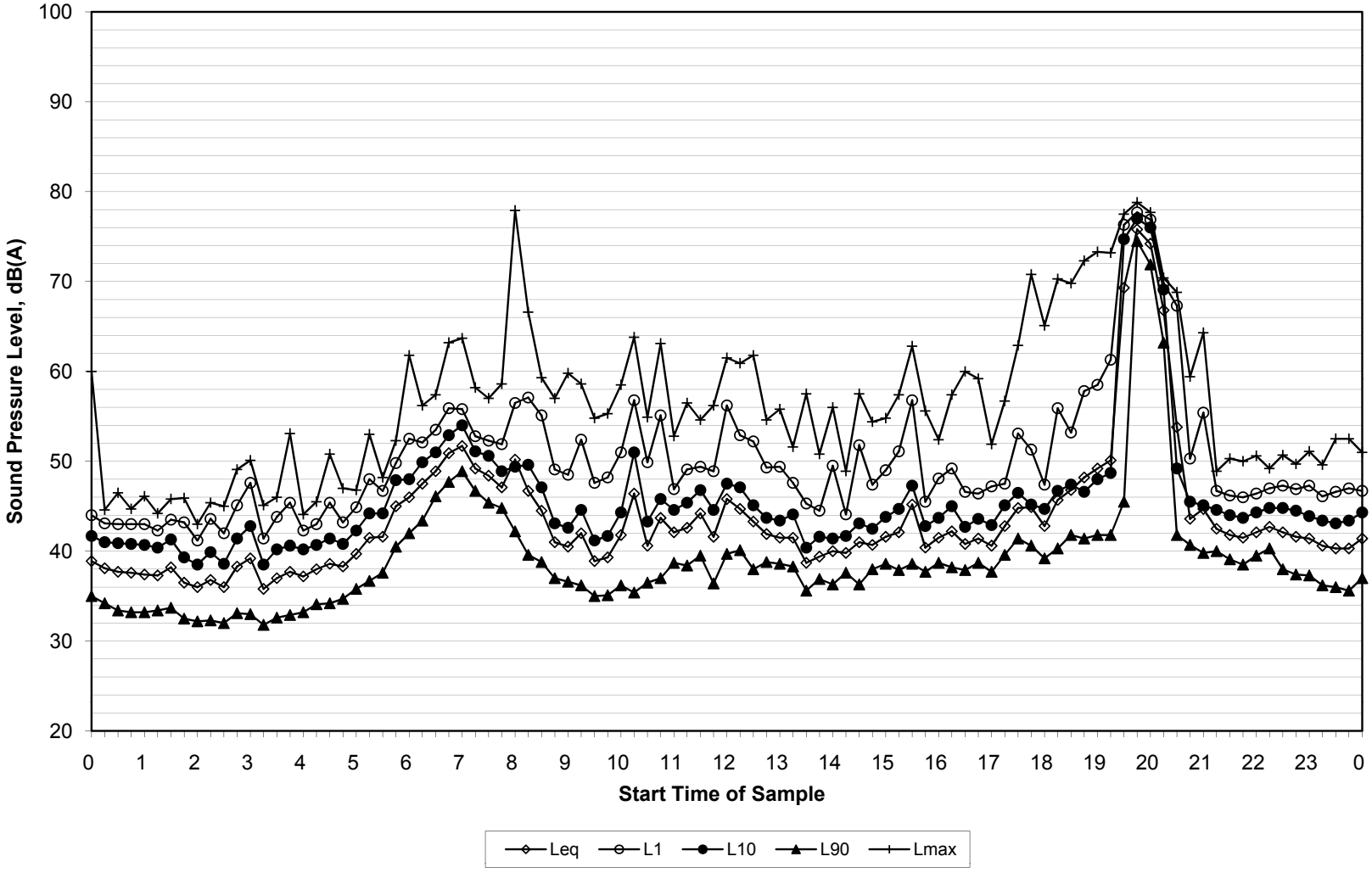
Tuesday, 17 March 2009



Location 3 - 521 Northern Road (west)
Rear portion of site

Ambient Sound Pressure Levels

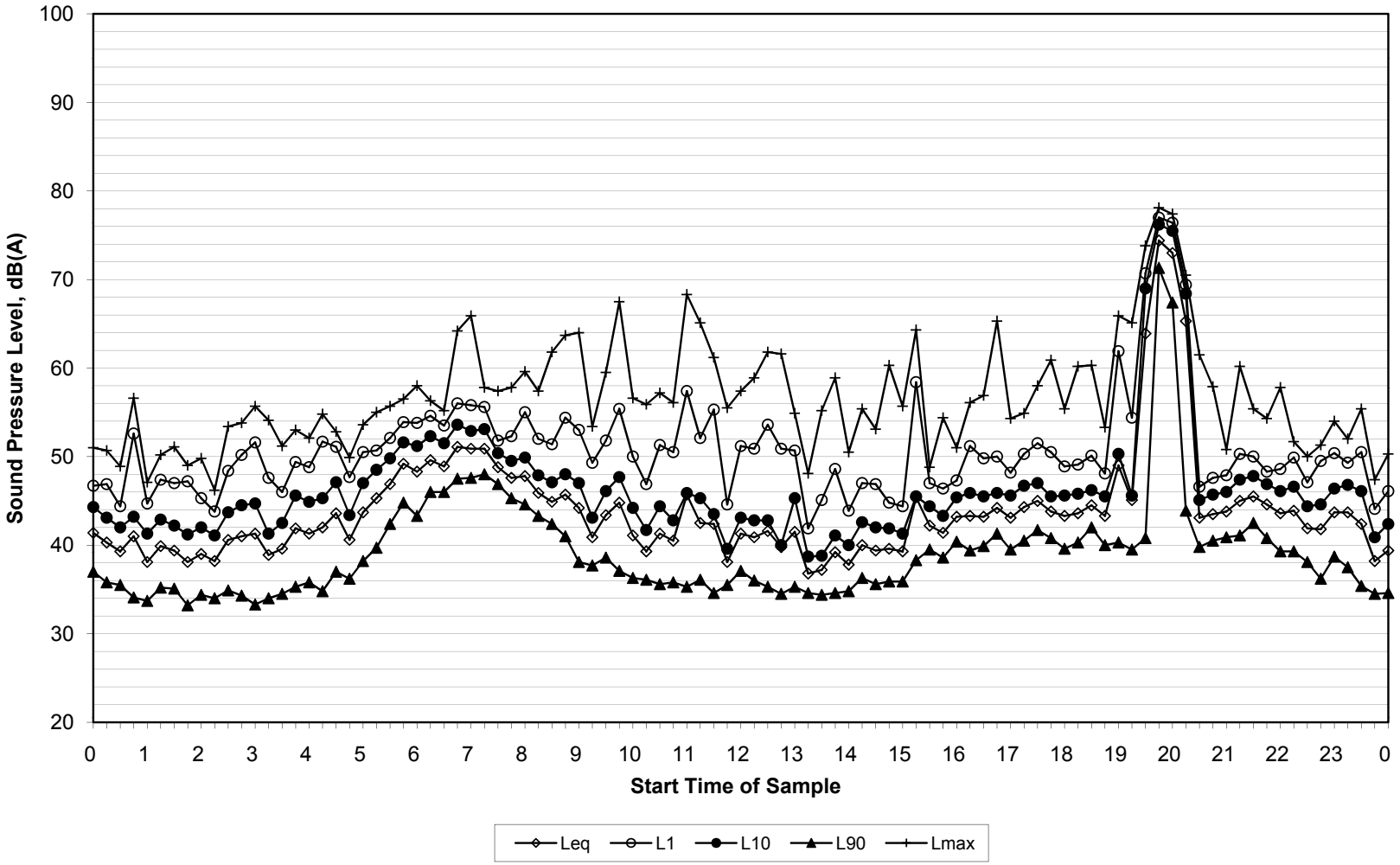
Wednesday, 18 March 2009



Location 3 - 521 Northern Road (west)
Rear portion of site

Ambient Sound Pressure Levels

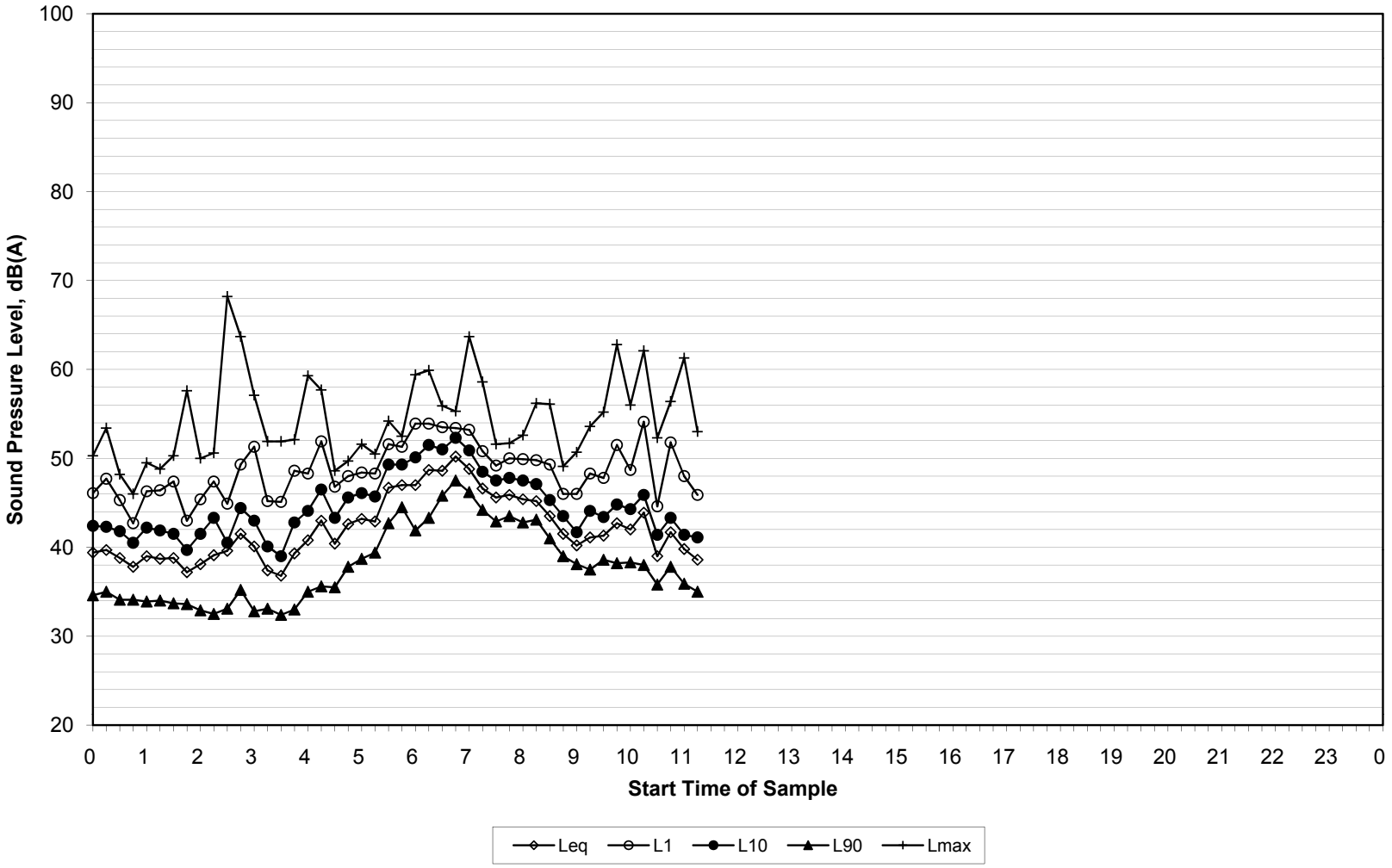
Thursday, 19 March 2009



Location 3 - 521 Northern Road (west)
Rear portion of site

Ambient Sound Pressure Levels

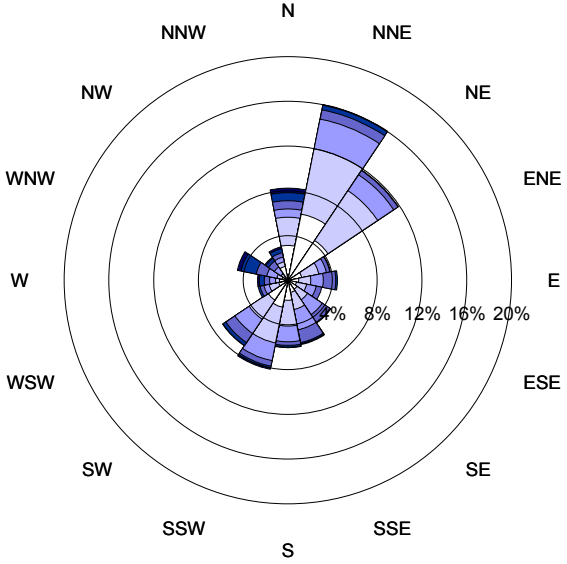
Friday, 20 March 2009



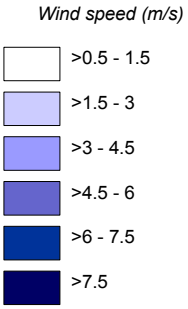
Location 3 - 521 Northern Road (west)
Rear portion of site

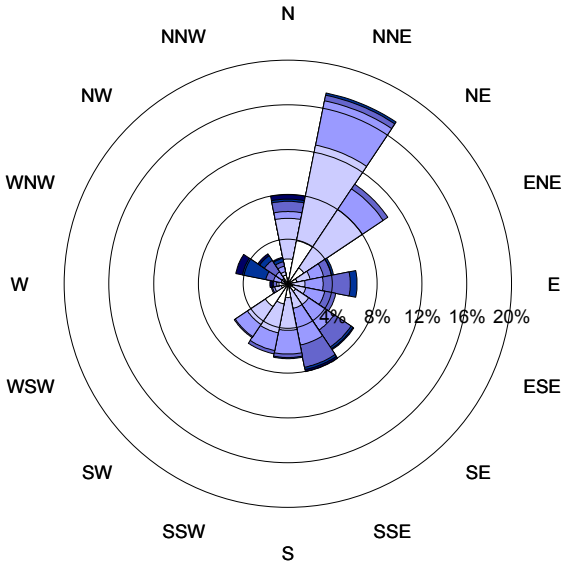
APPENDIX 2: WIND ROSES - MULGRAVE

Annual and seasonal windroses for Mulgrave (Day, April 2008 - March 2009)

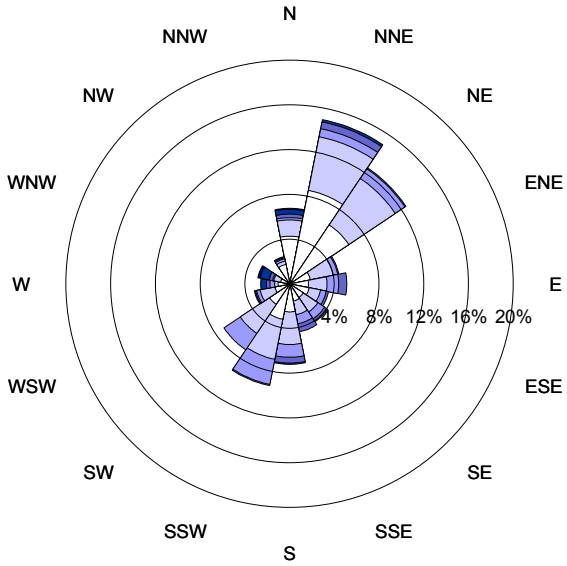


Annual
Calms = 5.4%

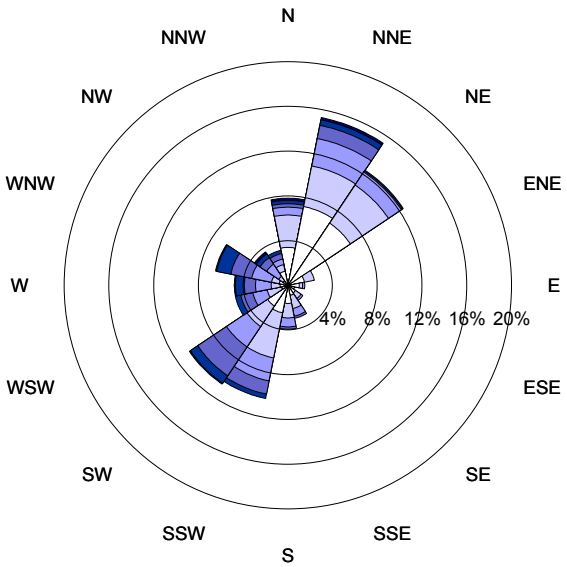




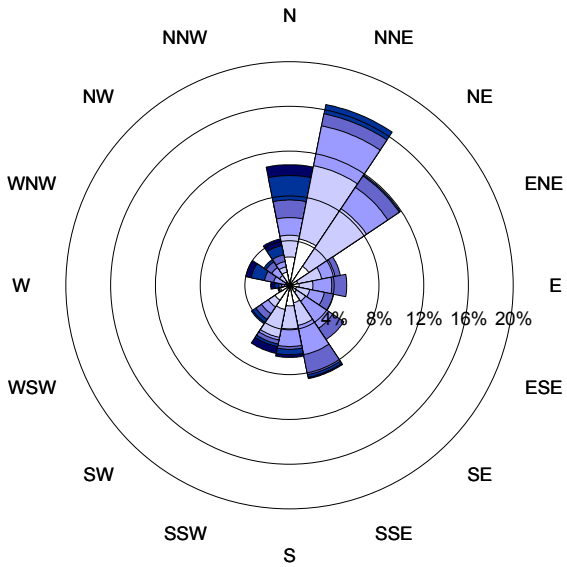
Summer
Calms = 1.8%



Autumn
Calms = 9.3%

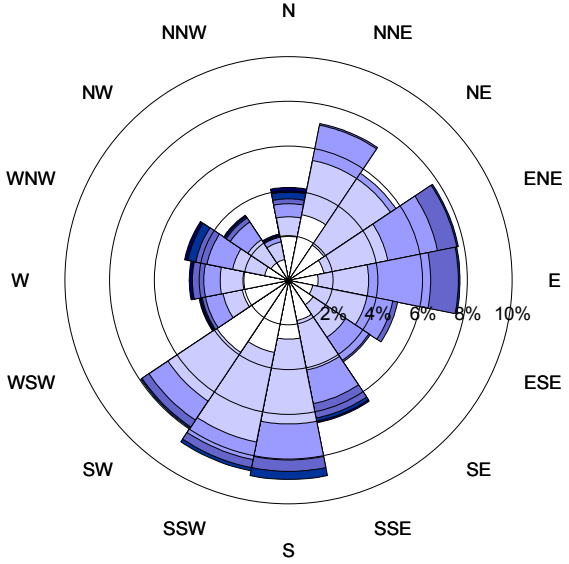


Winter
Calms = 7.7%

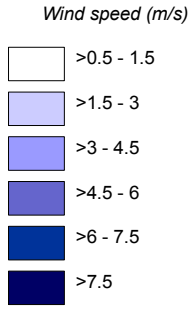


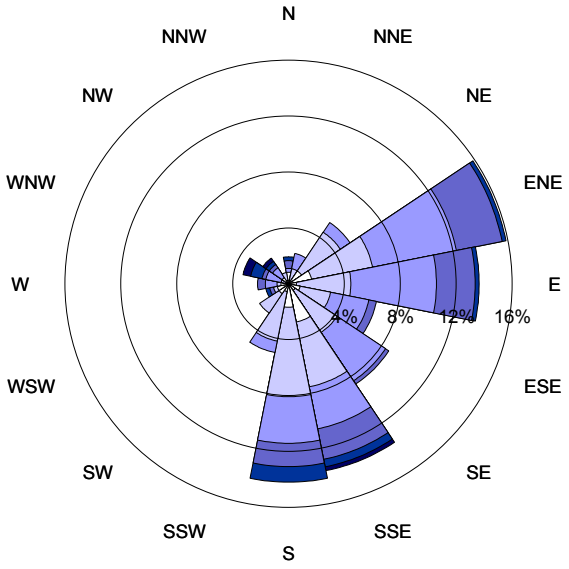
Spring
Calms = 2.3%

Annual and seasonal windroses for Mulgrave (Evening, April 2008 - March 2009)

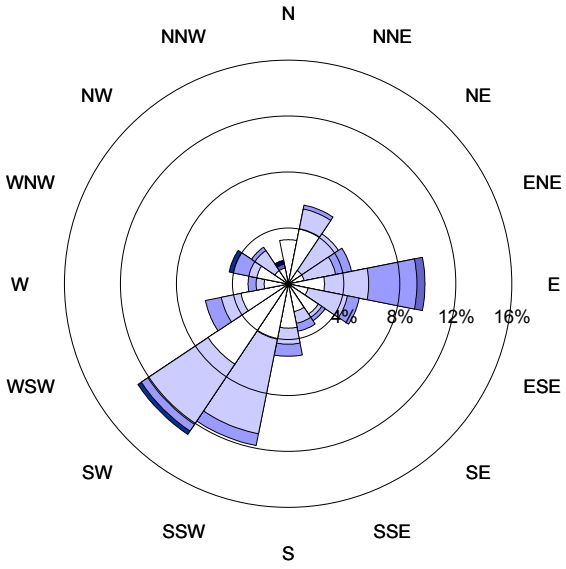


Annual
Calms = 7.4%

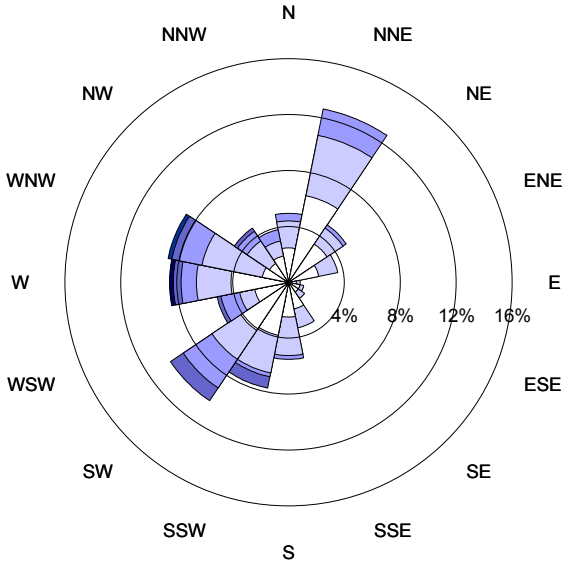




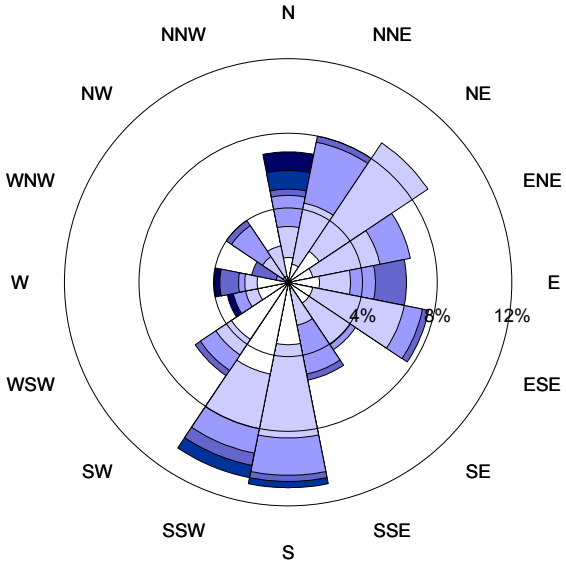
Summer
Calms = 0.6%



Autumn
Calms = 12.6%

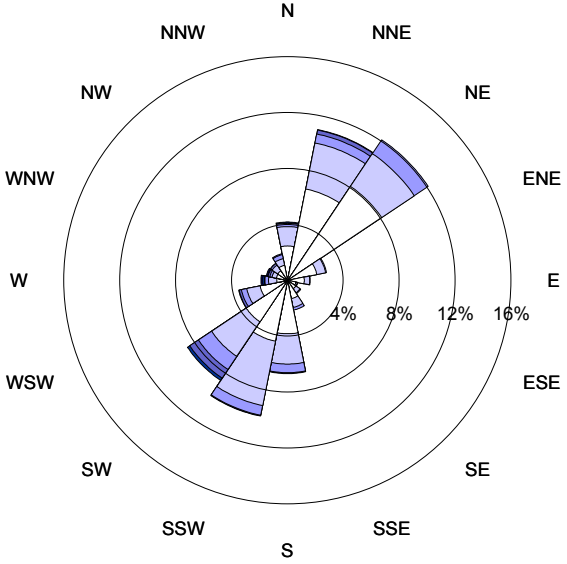


Winter
Calms = 12.9%

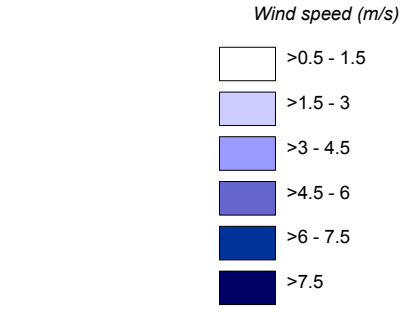


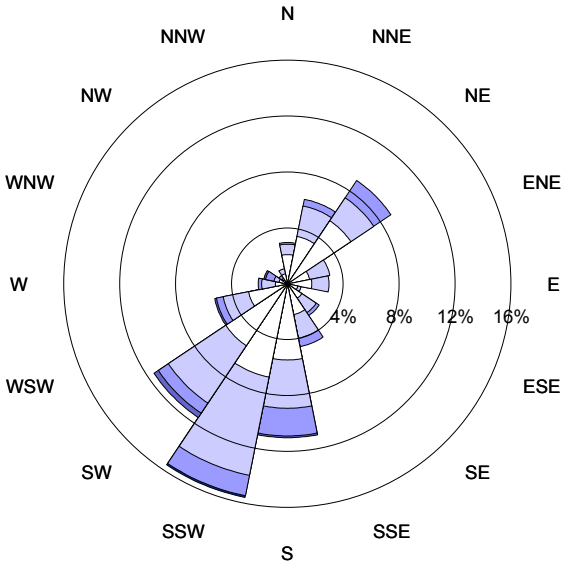
Spring
Calms = 2.7%

Annual and seasonal windroses for Mulgrave (Night, April 2008 - March 2009)

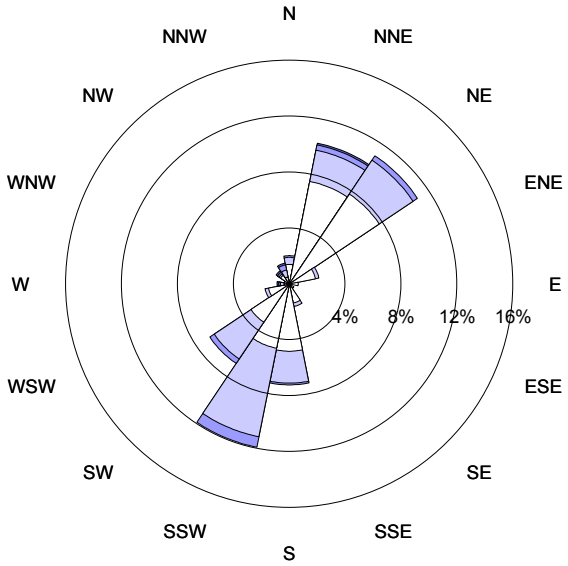


Annual
Calms = 28.7%

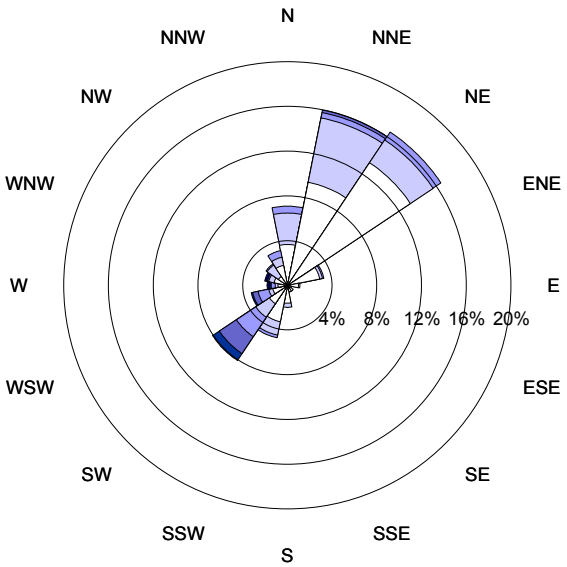




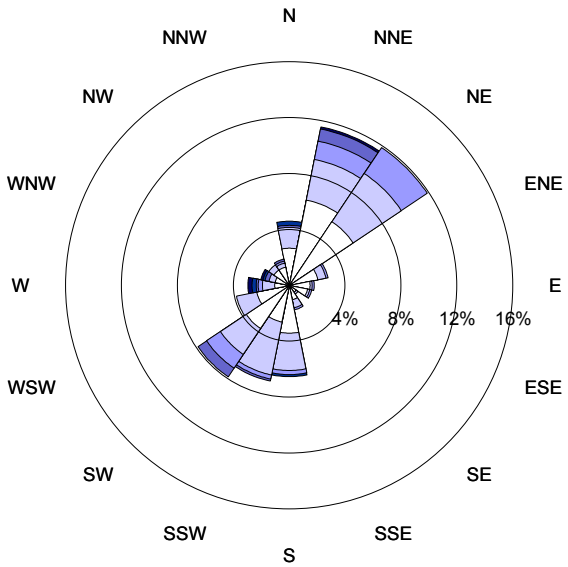
Summer
Calms = 18.6%



Autumn
Calms = 40.1%



Winter
Calms = 27.0%



Spring
Calms = 29.3%

Appendix K

MUSHROOM FARM AIR QUALITY ASSESSMENT

AIR QUALITY ASSESSMENT

PROPOSED MUSHROOM FARM, LONDONDERRY

Elf Mushrooms

Job No: **2966**

11 November 2010

A PEL Company

PROJECT TITLE:	PROPOSED MUSHROOM FARM, LONDONDERRY
JOB NUMBER:	**2966**
PREPARED FOR:	Perram and Partners on behalf of Elf Mushrooms
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1 INTRODUCTION

This report has been prepared by PAEHolmes on behalf of Perram & Partners who in turn are acting for Elf Mushrooms. It presents an assessment of the odour impacts for the proposed operation of a new mushroom farm at Londonderry, NSW.

The report comprises the following components:

- A description of the project;
- Discussion of air quality issues related to the project;
- A description of local dispersion conditions at the site;
- A description of modelling parameters;
- Results of dispersion modelling of the odour emissions; and
- Greenhouse gas assessment.

The dispersion modelling was undertaken using the CALPUFF model, in accordance with the NSW Department of Environment, Climate Change and Water (NSW DECCW) "*Approved methods for the modelling and assessment of air pollutants in NSW*" (herein referred to as the Approved Methods) (**NSW DEC, 2005**) and the NSW DECCW document "*Technical Framework: Assessment and management of odours from stationary sources in NSW*" (herein referred to as the framework) (**NSW DEC, 2006**). A Level 3 odour impact assessment was undertaken.

2 PROJECT DESCRIPTION

The current Elf Mushroom farm in Vineyard, NSW, has reached capacity and Elf Mushrooms is planning to establish a new mushroom farm in Londonderry. This proposed development is intended to occur in conjunction with the proposed expansion of the existing Mulgrave substrate plant operated by Elf Farm Supplies. Mushroom substrate produced at Mulgrave will be used at the Londonderry site. Spent compost will be further processed on site and used as soil conditioner.

The proposed mushroom farm site is located in Londonderry approximately; 10 km south west of Windsor and 10 km west-southwest of the existing farm in Vineyard (see **Figure 1**). The site has some residential properties to the northeast and south; and directly to the east of the site is the Castlereagh Nature Reserve.

The terrain surrounding the Londonderry farm site is relatively flat; the nearest sensitive receptor is approximately 200 m to the northeast (see **Figure 1**).

2.1 Proposed development

Figure 2 presents a site layout for the proposed mushroom farm at Londonderry. This farm is expected to more than double the current capacity of the existing facility at Vineyard. The site will be located on a 25 hectare rural site on The Northern Road. The construction of this new farm will occur in multiple stages; the first stage will establish the farm and have a weekly production of 85 tonnes of fresh mushrooms, employing 115 people. The later stages will see the weekly production of mushrooms increase by about 25 tonnes, in conjunction with the closure of the Elf Mushrooms Vineyard facility. Employees will be offered employment at the new Londonderry facility.

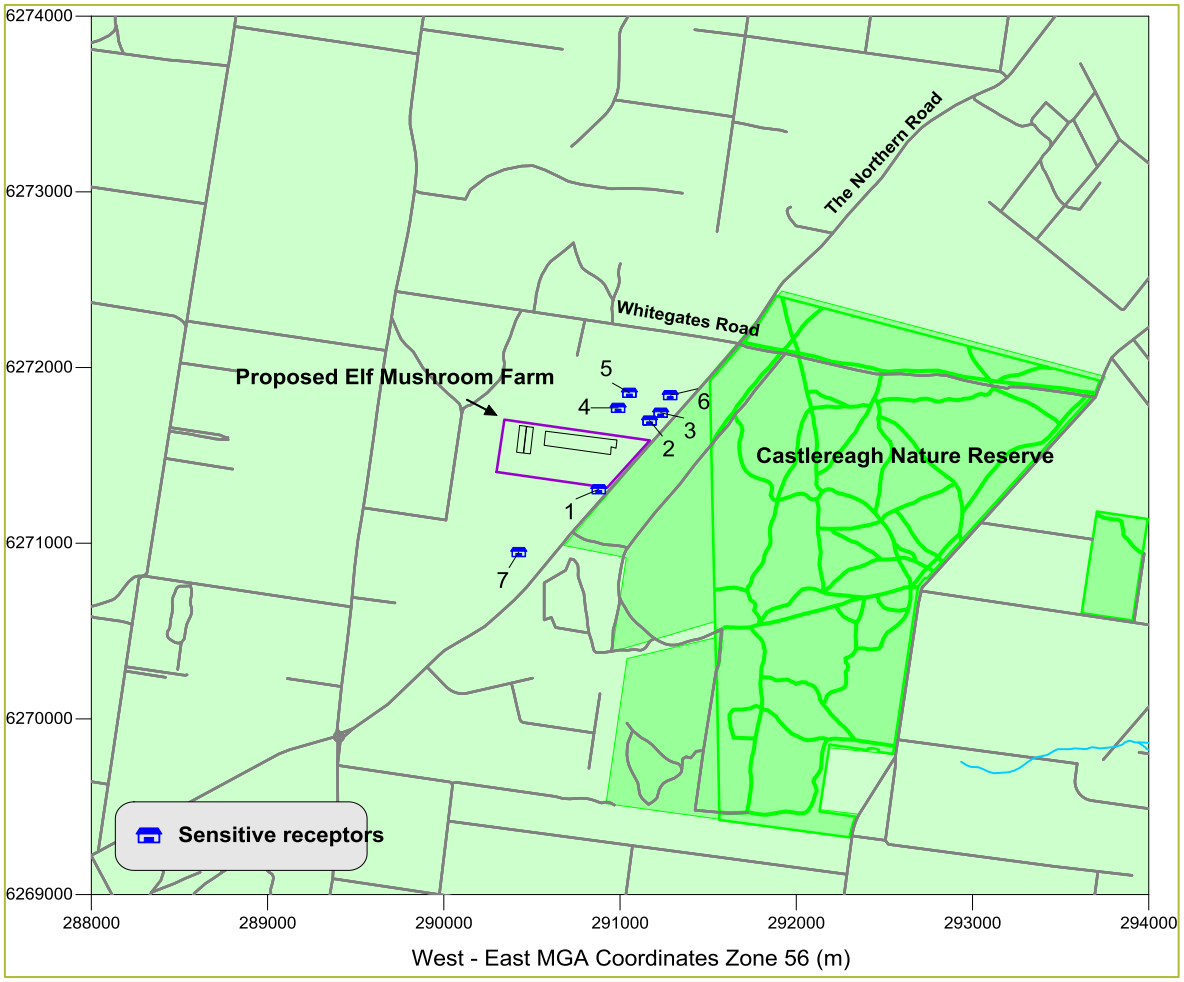


Figure 1: Location of proposed new Elf Mushrooms Farm, Londonderry NSW

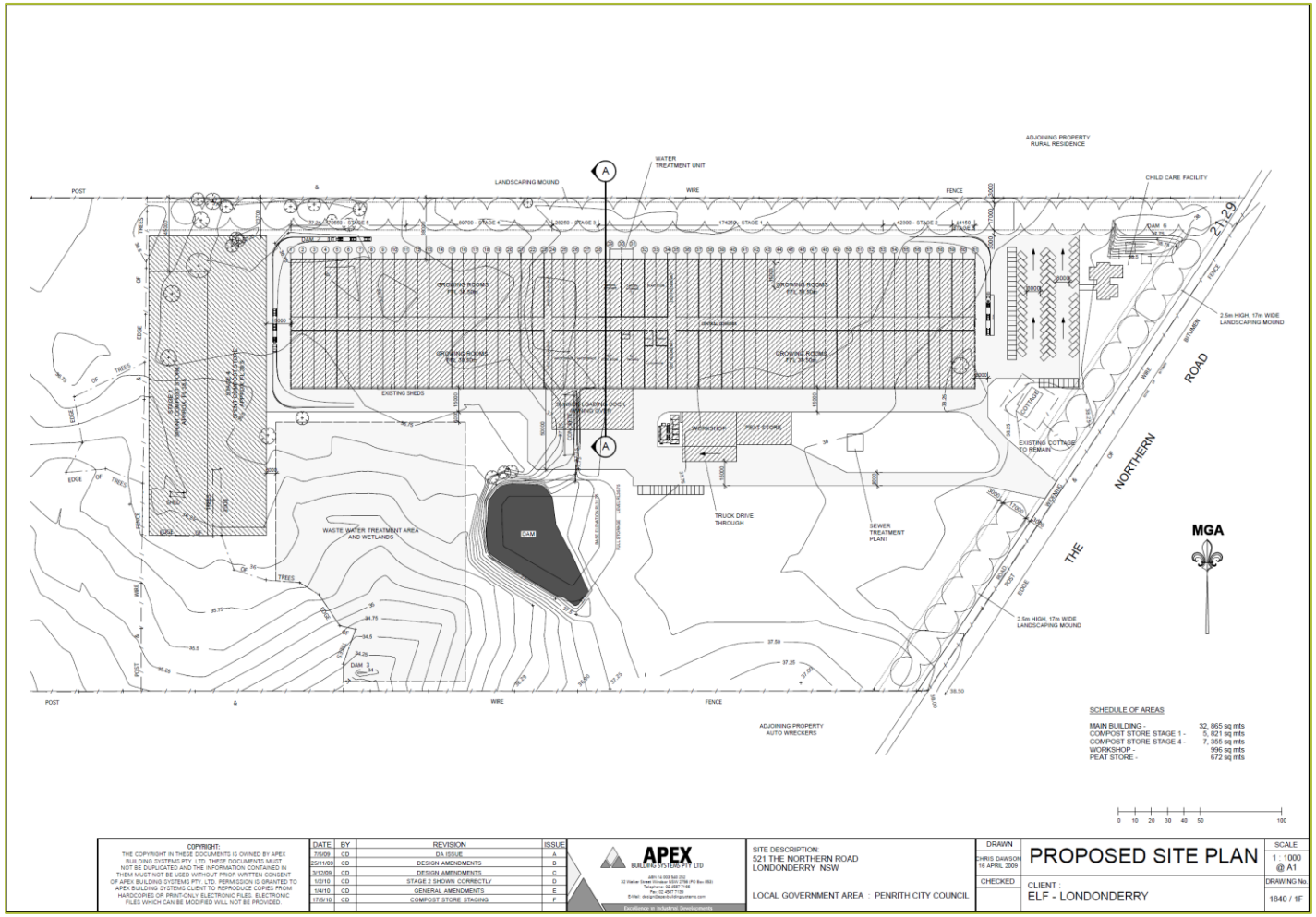


Figure 2: Site layout

3 DISCUSSION OF AIR QUALITY ISSUES

3.1 Measuring odour concentration

There are no instrument-based methods that can measure an odour response in the same way as the human nose. Therefore "dynamic olfactometry" is typically used as the basis of odour management by regulatory authorities.

Dynamic olfactometry is the measurement of odour by presenting a sample of odorous air to a panel of people with decreasing quantities of clean odour-free air. The panellists then note when the smell becomes detectable. The correlations between the known dilution ratios and the panellists' responses are then used to calculate the number of dilutions of the original sample required to achieve the odour detection threshold. The units for odour measurement using dynamic olfactometry are "odour units" (ou) which are dimensionless and are effectively "dilutions to threshold".

Olfactometry can involve a "forced choice" end point where panellists identify from multiple sniffing ports the one where odour is detected, regardless of whether they are sure they can detect odour. There is also a "yes/no" or "free choice" endpoint where panellists are required to say whether or not they can detect odour from one sniffing port. Forced choice olfactometry generally detects lower odour levels than yes/no olfactometry and is the preferred method for use in Australia.

In both cases, odorous air is presented to the panellists in increasing concentrations. For the forced-choice method, where there are multiple ports for each panellist, the concentration is increased until all panellists consistently distinguish the port with the sample from the blanks. For a yes/no olfactometer (which has only one sniffing port) one method used is to increase the concentration of odour in the sample until all panellists respond. The sample is then shut off and once all panellists cease to respond, the sample is introduced again at random dilutions and the panellists are asked whether they can detect the odour.

During the 1990s significant research was undertaken in Europe to refine the olfactometry method. This led to considerable improvements in panellist management and standardisation and, importantly, clear criteria for repeatability and reproducibility of results.

The draft Committé Européen de Normalisation (CEN) odour measurement standard (**CEN, 1996)** is a performance based standard with strict criteria for repeatability and reproducibility. The Australian standard (introduced in September 2001) (**Standards Australia, 2001**) is based upon the CEN standard.

As with all sensory methods of identification there is variability between individuals. Consequently the results of odour measurements depend on the way in which the panel is selected and the way in which the panel responses are interpreted.

Relevant odour data has been obtained from testing conducted during the current operations of the substrate plant and from the existing Vineyard mushroom farm to establish predicted odour emission values.

3.2 Odour performance criteria

3.2.1 Introduction

The determination of air quality goals for odour and their use in the assessment of odour impacts is recognised as a difficult topic in air pollution science. The topic has received

considerable attention in recent years and the procedures for assessing odour impacts using dispersion models have been refined considerably. There is still considerable debate in the scientific community about appropriate odour goals as determined by dispersion modelling.

The DECCW has developed odour goals and the way in which they should be applied with dispersion models to assess the likelihood of nuisance impact arising from the emission of odour.

There are two factors that need to be considered:

1. what "level of exposure" to odour is considered acceptable to meet current community standards in NSW and
2. how can dispersion models be used to determine if a source of odour meets the goals which are based on this acceptable level of exposure

The term "level of exposure" has been used to reflect the fact that odour impacts are determined by several factors the most important of which are:

- the **F**requency of the exposure
- the **I**ntensity of the odour
- the **D**uration of the odour episodes and
- the **O**ffensiveness of the odour (the so-called FIDO factor)

In determining the offensiveness of an odour it needs to be recognised that for most odours the context in which an odour is perceived is also relevant. Some odours, for example the smell of sewage, hydrogen sulfide, butyric acid, landfill gas etc., are likely to be judged offensive regardless of the context in which they occur. Other odours such as the smell of jet fuel may be acceptable at an airport, but not in a house, and diesel exhaust may be acceptable near a busy road, but not in a restaurant.

In summary, whether or not an individual considers an odour to be a nuisance will depend on the FIDO factors outlined above and although it is possible to derive formulae for assessing odour annoyance in a community, the response of any individual to an odour is still unpredictable. Odour goals need to take account of these factors.

3.2.2 Complex mixtures of odorous air pollutants

The DECCW Approved Methods include ground-level concentration (glc) criterion for complex mixtures of odorous air pollutants. They have been refined by the DECCW to take account of population density in the area. **Table 3.1** lists the odour glc criterion to be exceeded not more than 1% of the time, for different population densities.

The difference between odour goals is based on considerations of risk of odour impact rather than differences in odour acceptability between urban and rural areas. For a given odour level there will be a wide range of responses in the population exposed to the odour. In a densely populated area there will therefore be a greater risk that some individuals within the community will find the odour unacceptable than in a sparsely populated area.

The Londonderry site can be considered semi-rural due to the relatively isolated population of the surrounding area. Therefore, as shown in **Table 3.1**, an impact assessment criterion between 4-5 odour units should be applicable.

Table 3.1: Odour Performance Criteria for the Assessment of Odour

Population of affected community	glc criterion for complex mixtures of odorous air pollutants (ou)
≤ ~2	7
~10	6
~30	5
~125	4
~500	3
Urban (2000) and/or schools and hospitals	2

3.2.3 Peak-to-mean ratios

It is common practice to use dispersion models to determine compliance with odour goals. This introduces a complication because Gaussian dispersion models are only able to directly predict concentrations over an averaging period of 3-minutes or greater. The human nose, however, responds to odours over periods of the order of a second or so. During a 3-minute period, odour levels can fluctuate significantly above and below the mean depending on the nature of the source.

To determine more rigorously the ratio between the one-second peak concentrations and three-minute and longer period average concentrations (referred to as the peak-to-mean ratio) that might be predicted by a Gaussian dispersion model, the DECCW commissioned a study by **Katestone Scientific Pty Ltd (1995, 1998)**. This study recommended peak-to-mean ratios for a range of circumstances. The ratio is also dependent on atmospheric stability (discussed in **Section 4.2**) and the distance from the source. For area sources in the near field, as applies in this case, the peak to-mean ratio is 2.5 for neutral conditions (stability class A-D) and 2.3 for stable conditions (stability class E-F). For this assessment we have conservatively assumed a peak-to-mean ratio of 2.5 for all stability classes. For point sources in the far field, there are range of peak-to-mean ratios, depending on the height of the stack and whether the source is wake-affected or not. In this case, a conservative approach has been taken, and the values for a surface wake-free point in the far-field have been applied, that, the peak to-mean ratio is 4 for stability classes A to C, and 7 for stability classes D to F. A summary of the factors is provided in **Appendix A**.

The DECCW Approved Methods take account of this peaking factor and the goals shown in **Table 3.1** are based on nose-response time.

4 APPROACH TO ASSESSMENT

4.1 Dispersion Modelling Methodology

The air dispersion modelling conducted for this assessment has been based on an advanced modelling system using the models TAPM and CALMET/CALPUFF (see **Figure 3**). This system substantially overcomes the basic limitations of the steady-state Gaussian plume models such as AUSPLUME. These limitations are most severe in very light winds, in coastal environments, and where terrain affects atmospheric flow.

The modelling system works as follows:

- TAPM is a prognostic meteorological model that generates gridded three-dimensional meteorological data for each hour of the model run period.
- CALMET, the meteorological pre-processor for the dispersion model CALPUFF, calculates fine resolution three-dimensional meteorological data based upon observed ground and upper level meteorological data, as well as observed or modelled upper air data generated for example by TAPM.
- CALPUFF then calculates the dispersion of plumes within this three-dimensional meteorological field.

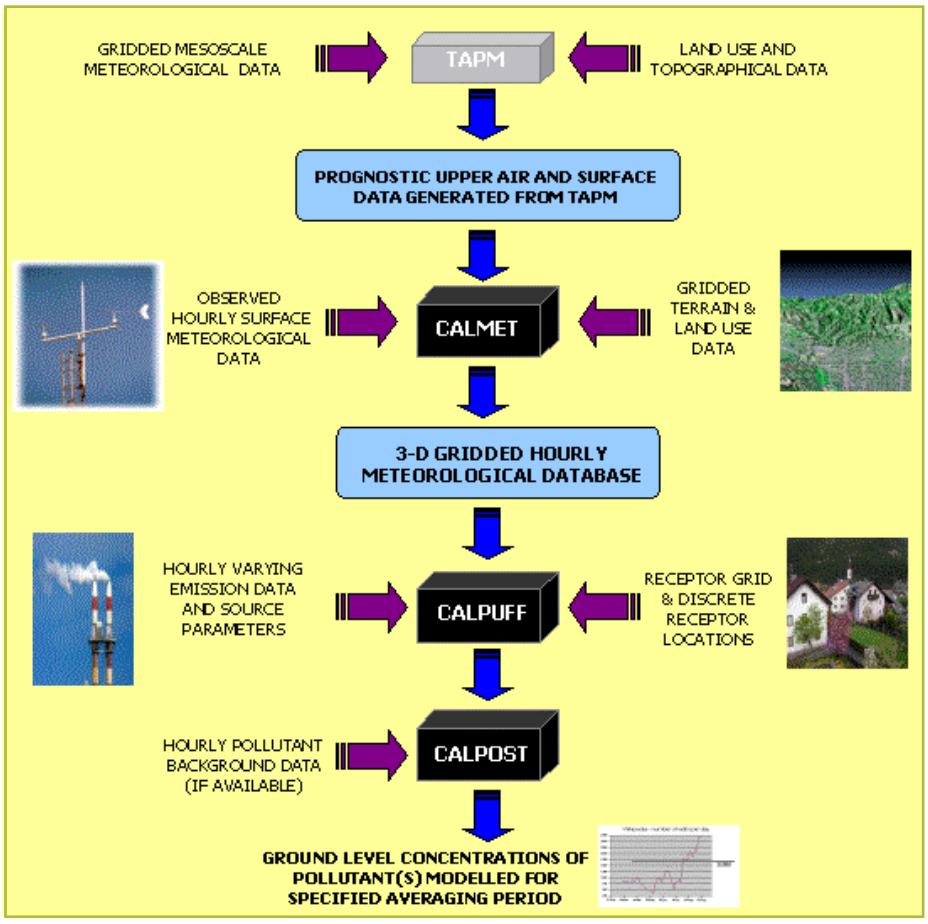


Figure 3: Modelling Methodology Used in this Study

4.1.1 TAPM

The Air Pollution Model, or TAPM, is a three dimensional meteorological and air pollution model developed by the CSIRO Division of Atmospheric Research. Detailed description of the TAPM model and its performance is provided elsewhere. The Technical Paper by **Hurley (2005)** describes technical details of the model equations, parameterisations, and numerical methods. A summary of some verification studies using TAPM is also given in **Hurley *et al*. (2005)**.

TAPM solves the fundamental fluid dynamics and scalar transport equations to predict meteorology and (optionally) pollutant concentrations. It consists of coupled prognostic meteorological and air pollution concentration components. The model predicts airflow important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of larger scale meteorology provided by synoptic analyses.

Observed surface meteorological data collected from the on-site weather station at Elf Farm Supplies was merged into TAPM. Surface meteorological data and 3-D prognostic data were generated over the study region using TAPM. The TAPM-generated data and observed surface meteorological data were then entered into the CALMET diagnostic meteorological model, which is discussed below.

4.1.2 CALMET

CALMET is a meteorological pre-processor that includes a wind field generator containing objective analysis and parameterised treatments of slope flows, terrain effects and terrain blocking effects. The pre-processor produces fields of wind components, air temperature, relative humidity, mixing height and other micro-meteorological variables to produce the three-dimensional meteorological fields that are used in the CALPUFF dispersion model.

The hourly observed data supplemented with TAPM-generated data for the period of analysis were used as input to the CALMET pre-processor to create a fine resolution, three-dimensional meteorological field for input into the dispersion model. CALMET uses the meteorological inputs in combination with land use and geophysical information for the modelling domain to predict girded meteorological fields for the region.

Terrain data have been sourced from the Shuttle Terrain Mission dataset. The spatial resolution of these data is 100 m.

Meteorological information collected on-site at the Elf Farm Supplies facility in Mulgrave, Sydney Airport AMO, Richmond RAAF and TAPM-generated surface information were used as input into the CALMET model. TAPM surface information was only included when no observed data from the other meteorological stations were available. These data comprised 0.15% of the total data points input, therefore should not influence the model output.

The 3-D prognostic data derived from TAPM simulations were used in the CALMET modelling as no measured upper air data is available for the site.

A summary of the data and parameters used for the meteorological component of this study are shown in **Table 4.1**.

Table 4.1: Meteorological parameters used for CALMET

TAPM (v 4.0)	
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Number of grid points	25 x 25 x 25
Year of analysis	April 2008 – March 2009
Centre of analysis	"Elf Farm Supplies", Mulgrave (30°37' S, 150°49' E)
CALMET (v. 6.326)	
Meteorological gird domain	20 km x 20 km
Meteorological grid resolution	0.2 km
TERRAD	10 km
IEXTRP	-4
BIAS (NZ)	-1,-0.5,-0.25,0,0,0,0
R1	5 km
R2	5 km
RMAX1	10 km
RMAX2	10 km
Surface meteorological stations	"Elf Farm Supplies" on-site station -Wind speed -Wind direction -Temperature Sydney Airport AMO (Bureau of Meteorology, Station Number 066037) -Cloud cover -Cloud height Richmond RAAF (Bureau of Meteorology, Station Number 067105) -Wind speed -Wind direction -Temperature -Relative Humidity -Pressure TAPM -Wind speed -Wind direction -Relative humidity -Pressure

The CALMET generated meteorological data were analysed in detail to confirm local meteorology and has been presented in the following sections.

Figure 4 presents the wind vectors from CALMET output for an hour of the modelling period. The figure shows the distribution of winds and influence of land use and terrain within the modelling domain. For example, winds from the northwest shows katabatic winds flow from the mountain range towards the Mulgrave site in an easterly direction. The flows are then directed southwards along the shallow floodplain region directly adjacent to the Mulgrave site.

Winds from other directions and hours have also been analysed and can be provided upon request.

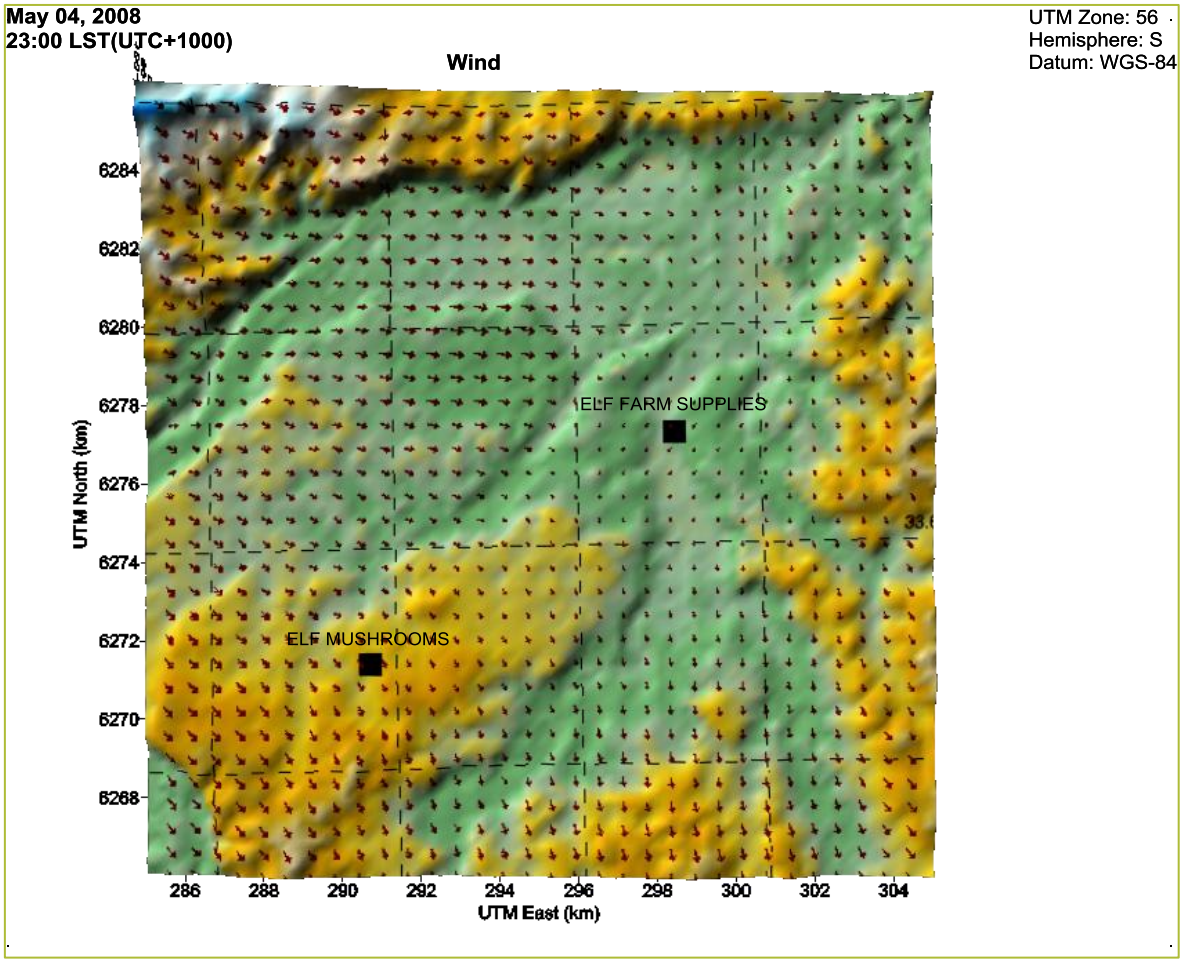


Figure 4: CALMET Wind Vectors – 4th May 2008, 23:00

The method used in the CALMET modelling was a 'Hybrid mode' approach that incorporated measured hourly surface data in combination with a TAPM generated 3-D input field. This method was used in light of recent guidance notes provided by TRC Atmospheric Studies Group (**TRC, 2010**) on the preferred methodologies for running CALMET.

When this method is compared with previous methodologies using an 'Observations only' approach that inputs TAPM derived upper air data from a discrete location within the modelling domain as opposed to using the 3-D input, it was found that there were little to no difference between the data extracted at the site. This may be attributed to the absence of significant terrain features within the CALMET modelling domain that may have affected the predictions between the modelling methodologies.

4.1.3 CALPUFF

CALPUFF (**Scire *et al.*, 2000a**) is a multi-layer, multi-species, non-steady state puff dispersion model that can simulate the effects of time and space varying meteorological conditions on pollutant transport, transformation and removal. The model contains algorithms for near-source effects such as building downwash, partial plume penetration, sub-grid scale interactions as well as longer-range effects such as pollutant removal, chemical transformation, vertical wind shear and coastal interaction effects. The model employs dispersion equations based on a Gaussian distribution of pollutants across the puff and takes into account the complex arrangement of emissions from point, area, volume, and line sources.

As with any air dispersion model, CALPUFF requires inputs in three major areas:

- Emission rates and source details.
- Meteorology.
- Terrain and surface details, as well as specification of specific receptor locations.

CALPUFF is a DECCW approved model, and has been used in many studies in New South Wales, Queensland and other parts of Australia.

5 METEOROLOGICAL DATA USED IN ASSESSMENT

5.1 Wind

Windroses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points – N, NNE, NE, etc. The bar at the top of each wind rose diagram represents winds blowing from the north (i.e. northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the colour of the bar sections correspond to wind speed categories, the lighter colour representing the lightest winds.

The diurnal wind roses based on a CALMET extract are shown in **Figure 5**.

On an annual basis winds from the north-northeast are most predominant with a good proportion of winds from the northeast. In autumn, winds blow predominantly from north-northeast and are similar to the annual windrose. In summer winds from the north-northeast, northeast, south and south-southwest are most significant. Winter winds predominantly occur from the north-northeast. In spring, the dominant wind directions are from the north-northeast and northeast.

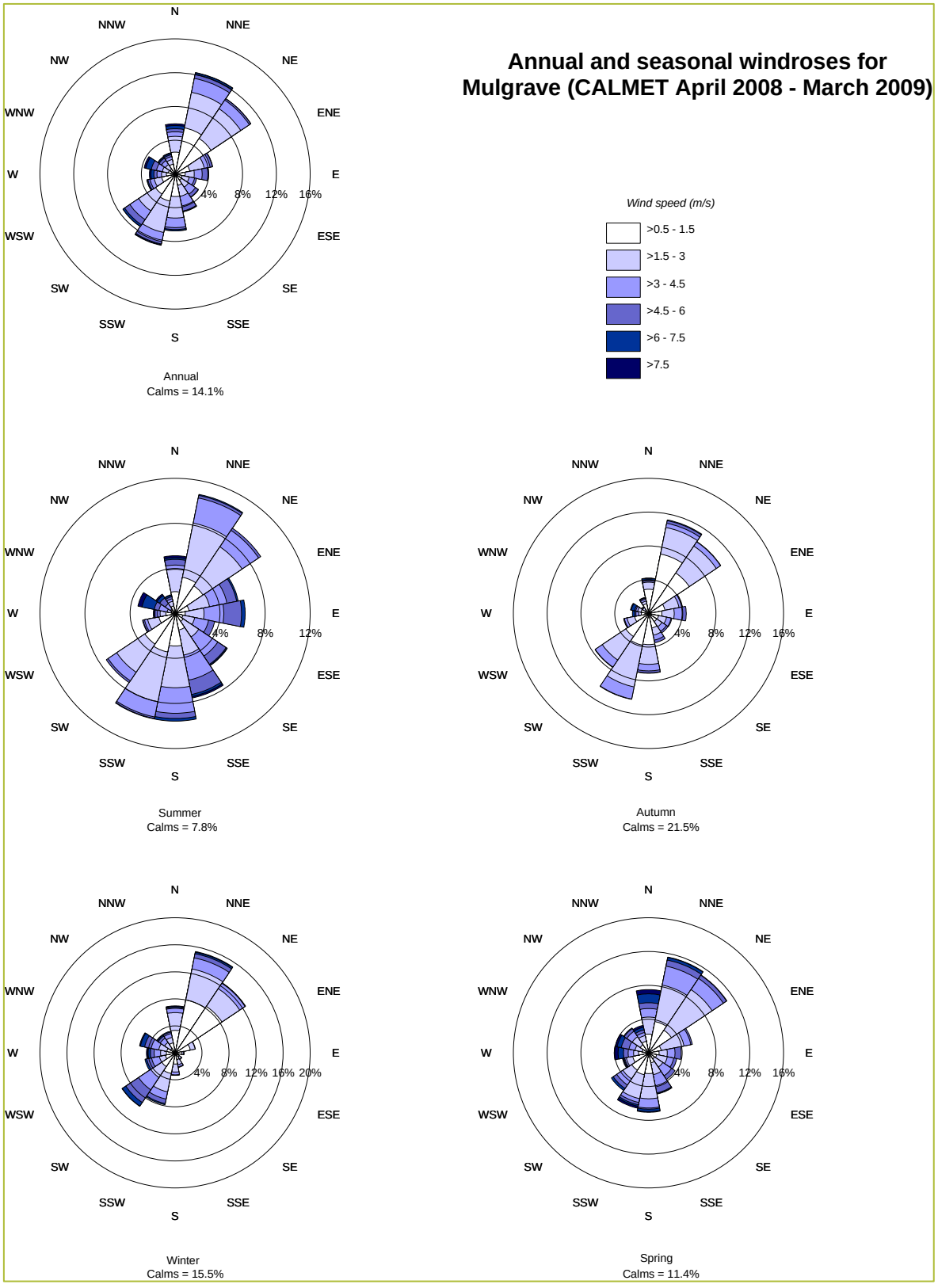


Figure 5: Annual and seasonal windroses

The frequency distribution of hourly averaged wind speed values is shown in **Figure 6**. Light wind speeds (up to 2 m/s) are relatively frequent and occur approximately 58.1% of the time. Strong winds (greater than 6 m/s) occur approximately 14% of the time.

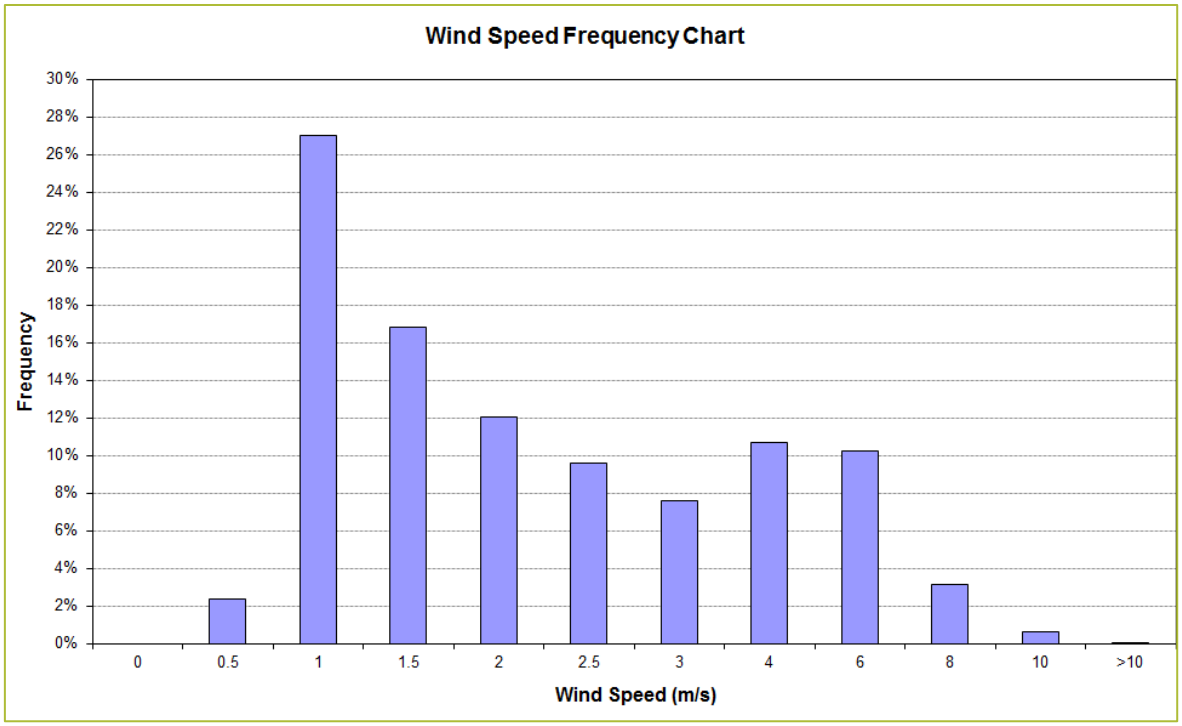


Figure 6: Wind Speed Distribution for April 2008 to March 2009

5.2 Stability

Atmospheric turbulence is an important factor in plume dispersion. Turbulence acts to increase the cross-sectional area of the plume due to random motions, thus diluting or diffusing a plume. As turbulence increases, the rate of plume dilution or diffusion increases. Weak turbulence limits plume diffusion and is a critical factor in causing high plume concentrations downwind of a source, particularly when combined with very low wind speeds.

Turbulence is related to the vertical temperature gradient, the condition of which determines what is known as stability, or thermal stability. For traditional dispersion modelling using Gaussian plume models, categories of atmospheric stability are used in conjunction with other meteorological data to describe atmospheric conditions and thus dispersion.

The most well-known stability classification is the Pasquill-Gifford scheme[a], which denotes stability classes from A to F. Class A is described as highly unstable and occurs in association with strong surface heating and light winds, leading to intense convective turbulence and much enhanced plume dilution.

At the other extreme, class F denotes very stable conditions associated with strong temperature inversions and light winds, which commonly occur under clear skies at night and in the early morning. Under these conditions plumes can remain relatively undiluted for considerable distances downwind.

[a] A more accurate turbulence scheme within CALPUFF, based on micrometeorological parameters, was used for modelling.

Intermediate stability classes grade from moderately unstable (B), through neutral (D) to slightly stable (E). Whilst classes A and F are strongly associated with clear skies, class D is linked to windy and/or cloudy weather, and short periods around sunset and sunrise when surface heating or cooling is small.

As a general rule, unstable (or convective) conditions dominate during the daytime and stable flows are dominant at night. This diurnal pattern is most pronounced when there is relatively little cloud cover and light to moderate winds.

The frequency distribution of estimated stability classes in the meteorological file is presented in **Figure 7**. The data show a total of 48.4% of hours with either E or F stability class.

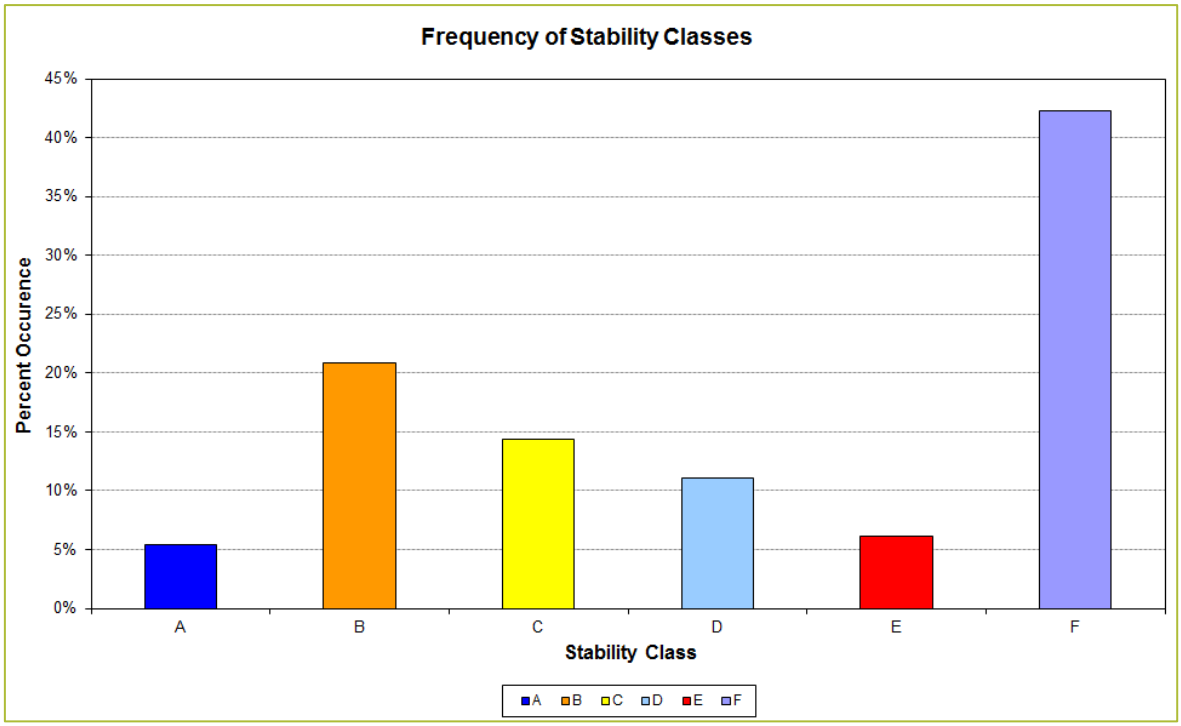


Figure 7: Frequency Distribution of Estimated Stability Classes

5.3 Local Climate

This section describes the general climate in the study area to give a more complete picture of the local meteorology.

Table 5.1 presents the temperature, humidity and rainfall data for the closest Bureau of Meteorology site which is located at Richmond RAAF (067105); approximately 9 km north-west of the site. Also presented are monthly averages of maximum and minimum temperatures, 9am and 3pm temperatures and humidity. Rainfall data consist of mean monthly rainfall and the average number of rain days per month.

The annual average maximum and minimum temperatures experienced are 24.1°C and 11.0°C. July is the coldest month, with an average minimum temperature of 3.5°C. January is the hottest month, with an average maximum temperature of 30.1°C.

Rainfall data show that February is on average the wettest month, with a mean rainfall reading of 128.7 mm, over 8.3 rain days. July is the driest month with an average rainfall of 31.7 mm, over an average of 4.1 rain days. The average annual rainfall is 726.7 mm and the average number of rain days annually is 72.6.

Table 5.1: Temperature, humidity and rainfall data for Richmond RAAF

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
9 am Mean Temperatures (°C) and Relative Humidity (%)													
Dry-bulb	22.1	21.3	19.1	17.0	13.1	10.1	8.9	11.4	15.4	18.3	19.2	20.9	16.4
Humidity	72	78	80	76	81	82	80	70	63	58	68	68	73
3 pm Mean Temperatures (°C) and Relative Humidity (%)													
Dry-bulb	28.5	27.4	25.8	23.0	19.6	17.0	16.6	18.7	21.5	23.5	25.2	27.5	22.9
Humidity	47	52	52	49	53	53	47	39	38	40	46	44	47
Daily Maximum Temperature (°C)													
Mean	30.1	29.1	26.8	24.0	20.6	18.0	17.5	19.8	22.7	25.1	26.6	28.7	24.1
Daily Minimum Temperature (°C)													
Mean	17.5	17.7	15.5	11.4	7.9	4.9	3.5	4.4	8.1	11.0	13.9	15.9	11.0
Rainfall (mm)													
Mean	70.7	128.7	67.5	43.8	56.2	46.0	31.7	33.3	50.0	55.3	83.3	62.1	726.7
Rain days (Number)													
Mean	7.6	8.3	7.8	5.5	5.9	5.1	4.1	3.6	4.8	5.8	7.9	6.2	72.6

Station Number 067105, Latitude: -33.60 South, Longitude: 150.78 East, Elevation: 19 m
Source: **Bureau of Meteorology, 2010**

6 ESTIMATE OF EMISSIONS

The main source of odorous emissions from the proposed mushroom farm will be the stockpile of spent mushroom compost. Additional potential sources of odour have also been identified as the on-site sewage treatment facility and the waste water treatment application.

Odour emissions from area sources are probably the most difficult to measure for a variety of reasons. Firstly the source is often heterogeneous. For example in the case of compost, there will be different odour emission rates from different sections of the compost. Secondly, unlike stack emissions, it is difficult to measure the volumetric flow of the odour. This clearly adds another level of complexity to odour assessments.

6.1 Spent Compost

Odour testing was conducted by Stephenson Environmental Management Australia (SEMA) on spent compost at the existing Elf Mushrooms farm at Vineyard; the results are summarised in **Table 6.1** and presented in **Appendix B.**

Table 6.1: Odour testing results for Spent Compost

Spent Compost	Odour concentration (ou)	Specific Odour Emission Rate (ou.m/s)
Fresh	1,020	0.655
One day	236	0.152
Six weeks	731	0.469

The construction of the farm will take place over multiple stages. The first stages will have a spent compost stockpile area of approximately 6,352 m^2. Later stages will see the total stockpile area increased to 14,337 m^2.

Spent compost is left to dry in the stockpile area for a six week period. The stockpiles are covered by a roof to ensure they are kept dry and will be turned every three days to enhance the drying process.

To model the impact from this source we have considered the entire stockpile area and applied the maximum specific emission rate of 0.655 ou.m/s.

6.2 Sewage Treatment Facility

The proposed on-site sewage treatment facility will be designed to service sewage generated from the on-site toilet facilities for approximately 150 employees.

As the design of this facility has not yet been finalised it is difficult to provide an estimate of the potential impact likely to be generated from this facility. As a conservative approach we have taken measured odour emissions from a sewage recycling facility that utilises raw sewage from the trunk mains. This information was obtained from a previous odour assessment by **PAEHolmes (2009)**. Odour sampling was collected by The Odour Unit Pty Ltd from an existing recycled water facility located at Pennant Hills Golf Course, the results of the odour monitoring are presented in **Appendix B**.

The source of odour from this facility would be from the screens used to remove inorganic material larger than 3mm in size from the flow prior to treatment of the liquid flow. The screens are entirely enclosed; however, there are three pump locations where fugitive odour emissions can escape.

The design of the facility was assumed to be similar to the design of the facility assessed in the PAEHolmes report. The odour emissions from the proposed on-site sewage treatment facility is expected to be much less than modelled as the amount of sewage processed will be significantly less. A summary of the modelling parameters for this facility is presented below in **Table 6.2**.

Table 6.2: Sewage Treatment facility modelling inputs

Source	Odour Concentration (ou)	Stack height (m)	Exit Velocity (m/s)	Diameter (m)	Area (m^2)	Odour emission rate[(a)] ($ou.m^3/s$)
Point 1	856	4.5	0.5	0.11	0.010	4.1
Point 2	856	4.5	0.5	0.08	0.005	2.2
Point 3	856	4.5	0.5	0.08	0.005	2.2
Total odour emissions						8.5

[(a)]Odour emission rate = odour concentration (ou) * exit velocity (m/s) * area (m^2)

6.3 Waste Water Treatment Facility

Waste water generated from activities taking place on-site will be recycled through the natural filtration functions in wetlands. This design will remove any sediment and pollutants in the water, all water passing through will be completely reused in the cooling towers, stream generator and for toilet flushing. All the treated water will be reused within the property and not allowed to enter downstream ecosystems.

There was no readily available odour data to use to represent the potential odour generated from this activity. To estimate the potential odour emissions from this source we have conservatively assumed emission rates for tertiary treatment at a sewerage treatment facility.

A report by **SKM** on the **Woodford Island Sewage Treatment Plant (2009),** estimated a specific odour emission rate of 0.44 ou.m/s for the tertiary treatment based on the average odour emissions from the Sydney Water Corporation odour database. This odour emission rate is likely to be an overestimation of the actual odour generated from this source.

The wetlands are proposed to cover a total area of approximately 488 m^2, for the purposes of this assessment we have modelled the entire area emitting at a rate of 0.44 $ou.m^2/s$.

7 APPROACH TO ASSESSMENT

Table 7.1 below outlines the emission rates used in this study.

Table 7.1: Emissions used in modelling

Source	Type	Units	Stages 1-3	Stages 4-5
Compost 1	Area	$ou.m^3/s$	4,161	-
Compost 2	Area	$ou.m^3/s$	-	9,391
Waste water recycling	Area	$ou.m^3/s$	215	215
P1	Point	$ou.m^3/s$	4.1	4.1
P2	Point	$ou.m^3/s$	2.2	2.2
P3	Point	$ou.m^3/s$	2.2	2.2

Note: Some numbers may not exact due to rounding.

While odour emission rates may increase during turning of the stockpile, this will be done during day-time hours when dispersion conditions are favourable.

The modelling has been performed using the CALMET meteorological information as described in **Section 5** with the odour emission information from above. The way in which the model has been used in this study has been to predict the 1-hour average odour levels (expressed in odour units) over a set of gridded receptors and discrete receptors placed at nearby residences.

A summary of the parameters used in the CALPUFF modelling are presented in **Table 7.2** below.

Table 7.2: Summary of CALPUFF parameters used for this study

CALPUFF (v 6.263)						
Year of analysis	April 2008 to March 2009					
Computational grid domain	20 km x 20 km					
Computational grid resolution	0.2 km					
Area sources						
	Compost 1			**Compost 2**		
	Easting (m)	Northing (m)		Easting (m)	Northing (m)	
Dimensions of Stockpile	290494	6271633		290497	6271653	
	290529	6271628		290570	6271643	
	290506	6271474		290545	6271469	
	290471	6271479		290471	6271479	
Waste water recycling	Easting (m)	Northing (m)				
	290549	6271534				
	290666	6271517				
	290645	6271369				
	290540	6271441				
Point Sources						
Source ID	**Easting (m)**	**Northing (m)**	**Stack height (m)**	**Stack diameter (m)**	**Exit velocity (m/s)**	**Exit temperature (K)**
P1	290906	6271470	4.5	0.11	0.5	293
P2	290906	6271470	4.5	0.8	0.5	293
P3	290907	6271470	4.5	0.8	0.5	293

Plots of the odour levels at the 99th percentile 1-hour average have been generated, showing the extent to which odours are predicted to occur for 99% of the time. These allow for direct comparison with the DECCW's odour assessment criteria and are presented in **Section 7**.

8 ASSESSMENT OF IMPACTS

The predicted 99th percentile 1-hour average odour contours form the proposed mushroom farm at Londonderry is presented in **Figure 8** and **Figure 9**.

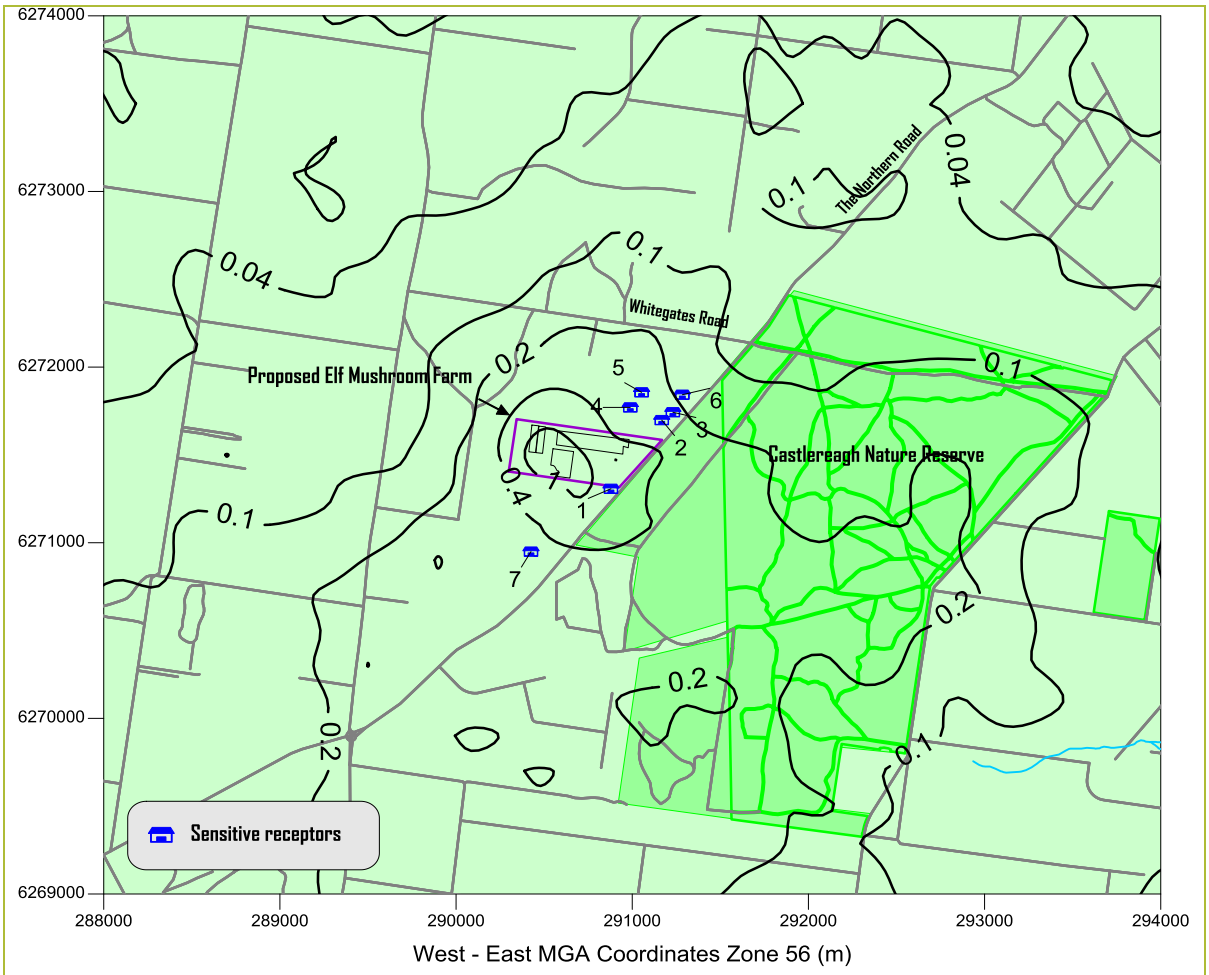
The predicted 99th percentile 1-hour average odour concentrations at nearby sensitive receptors are provided in **Table 8.1** below.

Table 8.1: Predicted 99th percentile 1-hour average odour concentration for sensitive receptors

Sensitive receptor ID	Easting (m)	Northing (m)	Predicted 99th percentile (ou)	
			Stages 1-3	**Stages 4-5**
1	290879	6271308	0.6	0.9
2	291168	6271699	0.2	0.4
3	291231	6271743	0.2	0.3
4	290989	6271771	0.3	0.4
5	291053	6271857	0.2	0.3
6	291285	6271843	0.2	0.2
7	290425	6270950	0.4	0.6

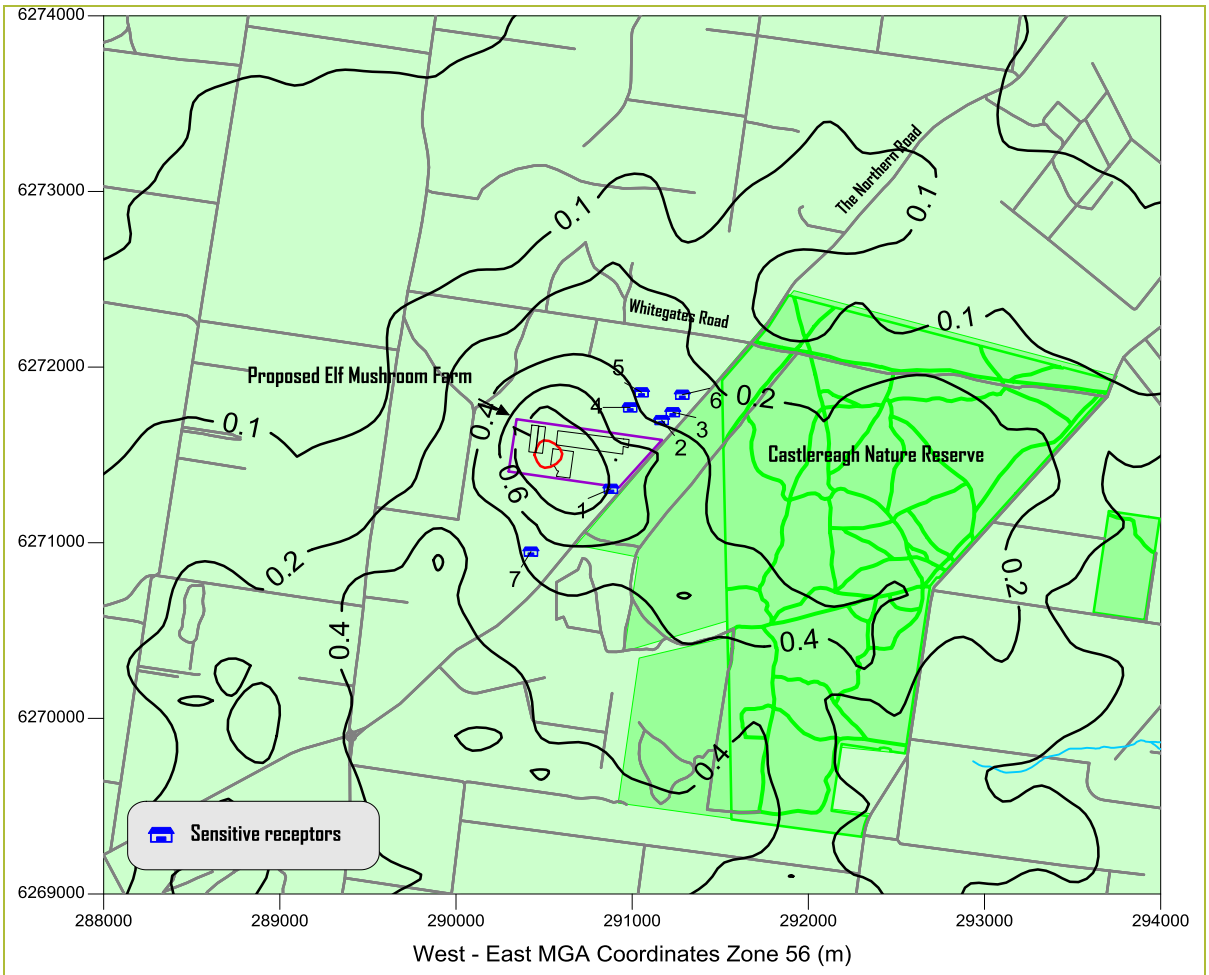
The model results show that the most stringent DECCW odour criteria, 2 odour units, does not extend beyond the site boundary or into any residential areas, suggesting that adverse odour impacts would not be observed.

This assessment has taken a very conservative approach to modelling the predicted odour for the proposed farm at Londonderry. As discussed above in **Section 6**, the modelling has considered that the entire stockpile area will be utilised for spent compost; the emission rate used for the compost was taken as the maximum recorded in the odour testing. The emission rates used for the sewage treatment facility were obtained from a facility that is designed to process much large quantities of raw sewage. The emissions from the waste water treatment facility were substituted with emission rates used for a tertiary treatment in a sewage treatment facility.



Species:	Location:	Scenario:	Percentile:	Averaging Time:
Odour	Londonderry	Stage 1 to 3	99th	1-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF v6.326	OU	DECCW = 2 OU (shown as a red line)	2008-2009 CALMET-Generated	P Henschke

Figure 8: Predicted 99th percentile 1-hour average odour concentration for proposed Londonderry mushroom farm (Stages 1-3)



Species:	Location:	Scenario:	Percentile:	Averaging Time:
Odour	Londonderry	Stage 4 to 5	99th	1-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF v6.326	OU	DECCW = 2 OU (shown as a red line)	2008-2009 CALMET-Generated	P Henschke

Figure 9: Predicted 99th percentile 1-hour average odour concentration for proposed Londonderry mushroom farm (Stages 4-5)

9 GREENHOUSE GAS ASSESSMENT

9.1 International Framework

9.1.1 Intergovernmental Panel on Climate Change (IPCC)

The Intergovernmental Panel on Climate Change (IPCC) is a panel established in 1988 by the World Meteorological Organisation (WMO) and the United Nations Environment Programme (UNEP), to provide independent scientific advice on climate change. The panel was asked to prepare, based on available scientific information, a report on all aspects relevant to climate change and its impacts and to formulate realistic response strategies. This first assessment report of the IPCC served as the basis for negotiating the United Nations Framework Convention on Climate Change (UNFCCC).

Since the UNFCCC has entered into force, the IPCC remains the pivotal source for its scientific, technical and socio-economic information.

The stated aims of the IPCC are to assess scientific information relevant to:

- Human-induced climate change;
- The impacts of human-induced climate change; and
- Options for adaptation and mitigation.

The fourth IPCC assessment report was released in 2007 (**IPCC, 2007**). IPCC reports are widely cited in climate change debates and policies, and are generally regarded as authoritative.

9.1.2 United Nations Framework Convention on Climate Change (UNFCCC)

The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognises that the climate system is a shared resource, the stability of which can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The Convention enjoys near universal membership, with 183 countries (Parties) having ratified the contained treaty, the Kyoto Protocol – see **Section 9.1.2.1**. Australia ratified the Kyoto Protocol in December 2007.

Under the UNFCCC, governments:

- Gather and share information on greenhouse gas emissions, national policies and best practices;
- Launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries; and
- Cooperate in preparing for adaptation to the impacts of climate change.

9.1.2.1 Kyoto Protocol

The Kyoto Protocol entered into force on 16 February 2005. The Kyoto Protocol builds upon the UNFCC by committing Annex I Parties to individual, legally-binding targets to limit or reduce their GHG emissions for the following gases:

- Carbon dioxide (CO_2);
- Methane (CH_4)
- Nitrous oxide (N_2O);

- Hydrofluorocarbons (HFCs);
- Perfluorocarbons (PFCs); and
- Sulfur hexafluoride (SF_6)

The emission reduction targets are calculated based on a Party's domestic emission greenhouse inventories (which include the sectors land use change and forestry clearing, transportation, stationary energy, etc). Domestic inventories require approval by the Kyoto Enforcement Branch. The Kyoto Protocol requires developed countries to meet national targets for greenhouse gas emissions over a five year period between 2008 and 2012.

To achieve their targets, Annex I Parties must put in place *domestic policies and measures.* The Kyoto Protocol provides an indicative list of policies and measures that might help mitigate climate change and promote sustainable development.

Under the Kyoto Protocol, developed countries can use a number of flexible mechanisms to assist in meeting their targets. These are trading-based market mechanisms which include:

- Joint Implementation (JI) – where developed countries invest in GHG emission reduction projects in other developed countries; and
- Clean Development Mechanism (CDM) – where developed countries invest in GHG emission reduction projects in developing countries.

Annex I countries that fail to meet their emissions reduction targets during the 2008-2012 period may be liable for a 30 percent penalty, to be made up in the post 2012 commitment period.

9.2 Australian Context

9.2.1 Australia and the Kyoto Protocol

The Kyoto Protocol is an international agreement under the United Nations Framework on Climate Change (UNFCC) that was agreed in 1997. As of October 2009 it has been ratified by 187 countries. Australia ratified the protocol in December 2007.

The aim of the Protocol is to reduce global greenhouse gas emissions by requiring developed countries to meet national targets for greenhouse gas emissions over the five year period from 2008 to 2012. Australia's annual target is 108% of the 1990 emissions.

Countries are required to take on a range of monitoring and reporting commitments, which are designed to ensure they remain on track to meet their obligations and to measure the overall success of the Protocol. Australia is in the process of developing a Carbon Pollution Reduction Scheme to ensure compliance with its Kyoto targets and successive international agreements to constrain greenhouse emissions.

9.2.1.1 National Greenhouse and Energy Reporting Act

The *National Greenhouse and Energy Reporting (NGER) Act 2007* was passed in September 2007. The NGER Act establishes a mandatory corporate reporting system for greenhouse gas emissions, energy consumption and production. The NGER scheme consolidates existing greenhouse reporting schemes.

The NGER Act is underpinned by a number of legislative instruments that provide greater detail about obligations, which in conjunction with the NGER Act, form the National Greenhouse and Energy Reporting System, as follows:

- The National Greenhouse and Energy Reporting Regulations 2008;
- The National Greenhouse and Energy Reporting (Measurement) Determination 2008; and

NGER is seen as an important first step in the establishment of a domestic emissions trading scheme. This intention is explicitly stated in the objectives for the NGER scheme, as follows:

- Establish a baseline of emissions for participants in a future Australian emissions trading scheme;
- Inform the Australian public;
- Meet international reporting obligations;
- Assist policy formulation of all Australian governments while avoiding duplication of similar reporting requirements.

Companies must register and report if they emit greenhouse emissions or produce/consume energy at or above the following trigger thresholds:

- If they own facilities that emit greater than 25kt greenhouse emissions (expressed as CO_2-e) or produce/consume greater than 100 TJ of energy;
- If the corporate group emits greater than 125kt of greenhouse emissions (expressed as CO_2-e) or produce/consume greater than 500TJ of energy.

A project is required to report to the NGER system if it will emit greater than 25kt of greenhouse emissions. As such, the Project would not be subject to the reporting under the system based on initial estimates (see **Section 9.5**).

9.2.1.2 Carbon Pollution Reduction Scheme

A green paper detailing Australia's plans to implement a domestic emissions trading scheme was released on the 16 July 2008 (**DCC, 2008a**). A subsequent white paper was released in December 2008 (**DCC, 2008b**) with the intent that a Carbon Pollution Reduction Scheme (CPRS) would commence in July 2010. Due to the global financial crisis, the start date was deferred to July 2011. Legislation was introduced to Parliament in May 2009, and again in November 2009 but has been voted down in the senate.

The proposed CPRS is a 'cap and trade' emissions trading mechanism scheme whereby emitters of greenhouse gases greater than 25,000t carbon dioxide-equivalent (CO_2-e) are required to purchase a permit for every tonne of greenhouse gas that they emit. As such, should the CPRS come into being, the Project may be subject to the scheme (see **Section 9.5**).

9.3 Greenhouse Gas Inventories

Greenhouse gas inventories are calculated according to a number of different methods. The procedures specified under the Kyoto Protocol United Nations Framework Convention on Climate Change are the most common.

From the point of view of the proposed development, CO_2, CH_4 and N_2O would be the most significant gases for the project which would be formed and released during the combustion of fuel. It would be liberated when fuels are burnt in diesel and natural gas powered equipment and in the generation of the electrical energy that will be used at the site.

Inventories of greenhouse gas emissions can be calculated using published emission factors. Different gases have different greenhouse warming effects (referred to as warming potentials) and emission factors take into account the global warming potentials of the gases created during combustion.

The estimated emissions are referred to in terms of CO_2-equivalent (CO_2-e) emission by applying the relevant global warming potential.

9.4 Greenhouse emission calculation methodology

9.4.1 Introduction

The following equation (**DCC, 2009**) was used to estimate the greenhouse gas emissions from fuel usage:

$$GHG\ Emissions\ (tCO_2 - e) = \frac{Q \times EC \times EF}{1000} \qquad \text{Equation 1}$$

Where:

Q = quantity of fuel in tonnes or thousands of litres

EC = energy content of the fuel in GJ/tonne or GJ/kL

EF = relevant emission factor in kg CO_2-e/GJ

To calculate emissions from electricity usage, the following equation was used:

$$GHG\ Emissions\ (tCO_2 - e) = Q \times \frac{EF}{1000} \qquad \text{Equation 2}$$

Where:

Q = electricity consumed in GJ

EF = relevant emission factor in kg CO_2-e/GJ

To calculate emissions from Natural gas usage, the following equation was used:

$$GHG\ Emissions\ (tCO_2 - e) = \frac{Q \times EC \times EF}{1000} \qquad \text{Equation 3}$$

Where:

Q = natural gas consumed in GJ

EC = energy content factor in GJ/m^3

EF = relevant emission factor in kg CO_2-e/GJ

To calculate emissions from fuel used for transport purposes, the following equation was used;

$$GHG\ Emissions\ (tCO_2 - e) = \frac{Q \times EC \times EF}{1000} \qquad \text{Equation 4}$$

Where:

Q = the quantity of fuel used in kilolitres

EC = energy content factor in GJ/m^3

EF = relevant emission factor in kg CO_2-e/GJ

9.4.2 Emission factors

Data provided in the National Greenhouse Accounts (NGA) Factors, published by the Department of Climate Change (**DCC, 2009**) were used. DCC defines three 'scopes' (or emission categories):

- Scope 1 covers direct emissions from sources within the project boundary such as fuel combustion and manufacturing processes;
- Scope 2 covers indirect emissions from the consumption of purchased electricity, steam or heat produced by another organisation; and
- Scope 3 includes all other indirect emissions that are a consequence of the organisations activities but are not from sources owned or controlled by the organisations, for example, delivery of diesel fuel and electrical energy, etc.

For the purposes of this assessment, a full fuel cycle emission factor (that is the sum of scope 1, scope 2 and 3 emission factors, where applicable) has been used.

It should also be noted that some Scope 3 emissions have not been considered in this assessment as the information is not available.

Table 9.1 provides a summary of the emission factors used.

Table 9.1: Summary of emission factors for greenhouse gas assessment

Type of Fuels and Electricity	Emission factor		Scope	Source
Diesel - Non-transport activities	69.5	kg CO_2-e/GJ	1	Table 3 (**DCC, 2009**)
	5.3	kg CO_2-e/GJ	3	Table 38 (**DCC, 2009**)
Diesel – Energy content factor	38.6	kg CO_2-e/GJ	-	Table 3 (**DCC, 2009**)
Diesel – Transport activities	69.9	kg CO_2-e/GJ	1	Table 4 (**DCC, 2009**)
	5.3	kg CO_2-e/GJ	3	Table 38 (**DCC, 2009**)
Diesel – Energy content factor	38.6	kg CO_2-e/GJ	-	Table 3 (**DCC, 2009**)
Electricity	0.89	kg CO_2-e/kWh	2	Table 39 (**DCC, 2009**)
	0.18	kg CO_2-e/kWh	3	Table 3 (**DCC, 2009**)
Natural Gas	51.33	kg CO_2-e/GJ	1	Table 2 (**DCC, 2009**)
	16.4	kg CO_2-e/GJ	3	Table 37 (**DCC, 2009**)
Natural Gas – Energy content factor	25.3	kg CO_2-e/GJ	-	Table 2 (**DCC, 2009**)

9.4.3 Diesel, electricity and natural gas usage

Based on information provided by the proponent, **Table 9.2** presents a summary of annual diesel, electricity and natural gas usage for the site operating at full capacity.

Table 9.2: Summary of annual diesel, electricity and natural gas usage

Fuel Type	Annual Usage
Diesel (kl)	30
Electricity (kWh)	4,500,000
Natural Gas (GJ)	21,500

Source: Elf Mushrooms

9.4.4 Diesel usage for Transport of product off-site

There will also be diesel consumed from the transport of the product mushrooms and spent substrate to customers. The numbers of deliveries per year for the site operating at full capacity have been provided by the proponent and summarised in **Table 9.3** below.

It should be noted that product mushrooms are sold on-site to White Prince Mushrooms before transport off-site. The emissions generated from this activity have been included in the Scope 3 emissions for this site.

Table 9.3: Summary of outgoing product deliveries per year

	Annual deliveries
Outgoing Mushrooms	1,456
Outgoing Spent substrate	624

Source: Elf Mushrooms

The annual diesel usage has been calculated using the assumption that an average return distance of 100 km per load and an average fuel consumption of articulated trucks being 54.6 litres per 100 kilometres (**ABS, 2007**). The annual fuel usage to transport the product is calculated from following equation ((No. of deliveries) * 100 [km/trip] * 0.546 [L/km]) and presented below in **Table 9.4**.

Table 9.4: Summary of annual diesel usage for transport

	Annual fuel usage (kl)
Outgoing Mushrooms	79
Outgoing Spent substrate	34

9.5 Greenhouse gas emissions results

Based on the fuel, electricity and natural gas usage presented in **Section 8.4.3** and emissions from fuel usage of transport in **Section 8.4.4**, the annual CO_2-e emissions for the site when operating at full capacity are summarised in **Table 8.5**.

Table 9.5: Summary of estimated CO_2-e emissions (t CO_2-e/y)

Source	Scope 1	Scope 2	Scope 3	TOTAL (t CO2-e)
Diesel (Stationary)	80	-	6	86
Diesel (Transport)	92	-	237	329
Electricity	-	4,005	810	4,815
Natural Gas	544	-	353	897
Total	**716**	**4,005**	**1,406**	**6,127**

Note: some figures not exact due to rounding

When the Project is operating at full capacity, it has been estimated that the development would release approximately 0.006 Mt/y CO_2-e. The annual greenhouse emissions in NSW for 2008 were 164.7 Mt (**DCC, 2010**). Therefore, the proposed development represents approximately 0.004% of the total NSW greenhouse gas emissions.

In 2007, Australia's total greenhouse gas emissions were estimated at 581.9 Mt CO_2-e (**DCC, 2010**). When comparing emissions for the Project operating at full capacity, the predicted increase is 0.001% of total 2008 Australian emissions.

9.6 Energy Efficiency and GHG Emission Reduction Measures

The facility will implement an energy efficiency program to look at ways to reduce the overall impact of greenhouse gas emissions from its operation. This will be achieved by focusing on each of the processes that take place at the facility and review how these can be improved. Aspects of this energy efficiency program can include:

- Improving energy use and efficiency; and
- Raising awareness amongst stakeholders, employees and clients.

This program will be revised as required to respond to new information, technologies and policies as they evolve.

10 CONSTRUCTION IMPACTS

The construction process for the proposed development at the new mushroom farm in Londonderry will temporarily generate dust.

Development will involve construction of a number of buildings and related infrastructure. The impact due to these activities is difficult to accurately quantify due to the time frame over which they will occur. However the total amount of dust generated from such activities is predicted to be minor.

To ensure dust generation is controlled, the site has dust management plans which will be utilised to help reduce any off-site impacts from these activities.

The major dust emissions likely to occur are identified as vehicles travelling on-site and from wind erosion of exposed areas. Mitigation measures to control dust from these sources include:

- Maintaining active road surfaces;
- Limit vehicle speeds;
- Rehabilitate completed sections of the site.

11 CONCLUSIONS

This study has assessed the worst-case air quality impacts due to the proposed development of a new mushroom farm at Londonderry. A Level 3 assessment of odour, based on measured odour emissions data, combined with computer-based dispersion modelling, was used to determine the air quality impacts on areas in the vicinity of the site.

Results from the dispersion modelling indicate that the predicted ground-level odour concentrations are unlikely to exceed applicable assessment criteria for the proposed development at Londonderry.

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" Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for inclusion into the 'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, Australia'", TRC Environmental Corporation, 650 Suffolk Street, Wannalancit Mills, Lowell, MA 01854, June 2010

APPENDIX A

Peak to Mean Ratio

A.1 PEAK-TO-MEAN RATIOS

The following table shows recommended factors for estimating peak concentrations from different source types, stabilities and distances.

Source Type	Pasquill-Gifford stability class	Near field P/M60*	Far field P/M60
Area	A, B, C, D	2.5	2.3
	E, F	2.3	1.9
Line	A-F	6	6
Surface point	A, B, C	12	4
	D, E, F	25	7
Tall wake-free point	A, B, C	17	3
	D, E, F	35	6
Wake-affected point	A-F	2.3	2.3
Volume	A-F	2.3	2.3

*Ratio of peak 1-second average concentrations

APPENDIX B

Odour Testing Results

B.1.1 Odour measurements on Spent Compost

Stephenson
Environmental Management Australia

ODOUR EMISSION SURVEY - SPENT COMPOST

ELF MUSHROOMS

VINEYARD, NSW

PROJECT NO.:	4095/S14154/08
REVISION:	A
DATE OF SURVEY:	JUNE 2008
DATE OF ISSUE:	JUNE 2008
DATE OF RE-ISSUE:	SEPTEMBER 2009

P W STEPHENSON

M BRECKO

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1 INTRODUCTION

Stephenson Environmental Management Australia (SEMA) was requested by Elf Mushrooms to conduct an odour emission survey at their mushroom farm located at Vineyard, New South Wales (NSW).

The objectives of the survey were to:

- Determine odour concentrations from spent compost
- Determine the odour emission rates from the spent compost.

Odour emission testing was undertaken on 17 June 2008.

2 EMISSION TEST RESULTS

2.1 INTRODUCTION

The results of the emission tests are presented in Table 2-1. SEMA completed the odour sampling. SEMA is NATA accredited for the odour sampling, NATA accreditation number 15043.

Odour Research Laboratories Australia (ORLA) performed the odour analysis. ORLA is a division of Peter W Stephenson & Associates Pty Ltd and is NATA accredited to AS4323.3 for odour analysis, accreditation number 15043. ORLA is the only NATA accredited odour analysis laboratory in New South Wales.

The Certificates of Analysis, Olfactometer Test Report No. 4077/ORLA/08 is presented in Appendix A of this report.

The odour emission sampling and olfactometric analysis was conducted in accordance with Australian Standard (AS) 4323.3. Refer Section 4 of this report for further detail.

2.2 ODOUR RESULTS

Table 2-1 summarises the odour concentration and Surface Odour Emission Rates (SOER) for the three samples collected from the spent compost.

The SOER for samples was calculated using the following formula:

SOER = Sweep Gas Velocity (m/s) x odour concentration (ou)

Sweep Gas Velocity = velocity of Zero Nitrogen Gas supplied to equilibrium flux hood.
Sweep Gas Rate is 5L/min & Velocity is $6.42 * 10^{-4}$ m/s
Odour Concentration = As per Table 2-1

TABLE 2-1 ODOUR EMISSION RESULTS

Date	Location	Concentration (ou)	SOER (ou. m/s)
17/6/08	Fresh – Spent Compost	1,020	0.655
17/6/08	One Day Old Spent Compost	236	0.152
17/6/08	6 Weeks Old Spent Compost	731	0.469

Key:
ou = odour units
ou. m/s = odour units metres per second

3 CONCLUSIONS

SEMA conducted an odour survey of spent compost at Elf Mushrooms mushroom farm. Table 3-1 summarises the results of the odour survey.

TABLE 3-1 ODOUR SURVEY RESULTS

Date	Location	Concentration (ou)	SOER (ou. m/s)
17/6/08	Fresh – Spent Compost	1,020	0.655
17/6/08	One Day Old Spent Compost	236	0.152
17/6/08	6 Weeks Old Spent Compost	731	0.469

Key:
ou = odour units
ou. m/s = odour units metres per second

4 TEST METHODS

4.1 ODOUR

(Standards Association of Australia AS4323.3 and DECC NSW OM-7)

Samples were collected in 30L Nalophane sampling bags which are enclosed in airtight plastic containers.

Odorous gas for analysis was drawn through a Teflon (PTFE) sample probe. The gas then passes through a Teflon (PTFE) tube connected to the Nalophane sampling bag. The sampling pump is connected to the airtight plastic container to provide a sample gas flow-rate of approximately 0.5 – 1.5 litres per minute. After the required volume has been sampled, the pump is stopped and the bag sealed with a stainless steel valve.

Using a triangular forced choice olfactometer, the Nalophane bag of odour sample was dynamically diluted to various concentrations with dry odour free air.

The diluted sample was then presented to a panel of screened panellists as one of these airflows. The panellists then recorded if they could detect any odour and from which flow. The other two flows were discharging odour free air.

The odour is always presented to the panellists in ascending concentration; that is, from lower to higher concentration. The panellists are required at each dilution level to give a response as to what they are smelling from the flows (forced choice methodology). The response options for the panellists are:

'Guess'	Unable to determine which air flow contains the diluted odours
'Inkle'	Thinks that one of the flows may be different from the other two flows
'Detect' or 'Certain'	Is confident that one of the airflows smells different from the other two flows. Not necessarily able to say what the smell is.
'Recognise'	Thinks that one of the flows may be different from the other two flows and is able to: ▪ Assign a 'hedonic tone' (pleasantness scale number) to the odour ranging from –10 to 10 and/or ▪ Able to assign a character to the odour, as in 'it smells like …' *Note: that the Recognise level concentration and Hedonic Tone and Odour descriptors are obtained with the diluted odour, panellists are not exposed to the full strength odour.*

The percentage panel response and dilution levels used were then entered into a computer programme to determine the 50% panel response. This dilution level corresponds to the odour concentration of the sample.

Sampling and dilution lines are constructed from teflon, stainless or glass to prevent contamination of the sample.

The sampling and the dilution procedures used were in accordance with DEC NSW Methods OM-7 and OM-8 which are based on Standards Association of Australia, AS4323.3.

4.1.1 ODOUR PANEL SELECTION

Odour panellists must meet certain criteria to qualify as and remain panellists. Their average sensitivity to n-Butanol must be between 20 and 80 parts per billion (ppb) and their variability in response to n-Butanol must be within a certain range.

Panellists are tested against n-Butanol before every panel session to ensure they are in compliance.

Panellists should not suffer from respiratory complaints, nor should they eat or smoke or drink anything but water during the half hour preceding or during the test period and their person and clothing should be odour free and have not been exposed to an odorous environment before testing.

4.1.2 ODOUR TERMINOLOGY

The odour level is expressed in odour units and for mixed odours is analogous to concentration expressed in parts per billion. The odour detection level is defined as the ratio of *the volume that a sample of odorous gas would occupy when diluted to the threshold of detection of that odour* to *the volume of the sample*. In simpler terms, the ratio indicated the number of dilutions necessary to reduce the odour to its threshold of detection or odour detection threshold. This ratio is expressed in odour units or number of dilutions to detection threshold. For example, a value of 2,000 odour units would mean the volume of the initial sample of odorous gas would need to be diluted 2,000 times before the odour would just be detectable to the average human nose, that is, at the odour detection threshold.

4.2 EXHAUST GAS VELOCITY

(DECC NSW TM-2 and USEPA Method 12)

Velocity profiles were obtained across the stack utilising an Airflow Developments Ltd. S-type pitot tube and inclined manometer.

4.3 EXHAUST GAS TEMPERATURE

(DECC NSW TM- 2, 3 & 4 and USEPA Methods 2, 3 & 4)

The exhaust gas temperature was measured using a Digital thermometer (0-1200°C) connected to a chromel/alumel (K-type) thermocouple probe.

4.4 ACCURACY (FLOW MEASUREMENT)

All results are quoted on a dry basis.

Appendix C of (British Standard) 893 presents a range of accuracies for various parts of the isokinetic sampling procedure including pressure, velocity, temperature and particulate sampling. At best, an accuracy of ± 10% can be expected.

4.5 EXHAUST GAS MOISTURE CONTENT

(DECC NSW TM-22)

Moisture from the stack was collected in accordance with DECC NSW TM-22 sampling train. The collected moisture was weighed and calculated to a percentage of stack gas.

APPENDIX A – CERTIFICATES OF ANALYSIS

Odour Research Laboratories Australia

A Division of Peter W. Stephenson & Associates Pty Ltd
ACN 002 600 526 (Incorporated in NSW)
ABN 75 002 600 526

Newington Business Park
Unit 7/2 Holker Street
Newington NSW 2127 Australia
Tel: (02) 9737 9991
Fax: (02) 9737 9993
E-Mail: mbrecko@orla.com.au

Olfactometry Test Report

The measurement was commissioned by SEMA on behalf of:

Client	Organisation:	Elf Mushrooms
	Address:	108 Mulgrave Road, Mulgrave NSW 2756
	Contact:	Neil Cockerell
	Sampling Site:	Spent Compost Farm
	Telephone:	02 4577 5000
	Facsimile:	02 4587 8002
	Email:	manager@elffarm.com.au
Project	ORLA Report Number:	4077/ORLA/08 – R1
	Project Manager:	Peter Stephenson
	Testing operator:	Michael Brecko
	ORLA Sample number(s):	1673, 1674, 1675
	SEMA Sample number(s):	715303, 715304, 715305
Order	Analysis Requested:	Odour Analysis
	Order requested by:	SEMA on behalf of Elf Mushrooms
	Date of order:	17 June 2008
	Order number:	2009
	Telephone:	02 9737 9991
	Signed by:	Paul Cimbaly / Michael Brecko
	Order accepted by:	Michael Brecko

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Replacement Report for 4077/ORLA/08

Investigated Item	Odour concentration in odour units 'ou' determined by Sensory odour concentration measurements, of an odour sample supplied in a sampling bag.
Analysis Method	The samples were analysed in accordance with AS/NZS4323.3:2001.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for n-butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Instrument Used	The Olfactometer used during this testing session was: AC'SCENT International Olfactometer
Measuring Range	The measuring range of the AC'SCENT International olfactometer is $2^4 \leq \chi \leq 2^{16}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained between ± 3°C.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.05$ in accordance with the Australian Standard AS/NZS4323.3:2001. AC'SCENT International Olfactometer: $r = 0.0106$ (March 2008) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.20$ in accordance with the Australian Standard AS/NZS4323.3:2001. AC'SCENT International Olfactometer: $A = 0.069$ (March 2008) Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the AC'SCENT International Olfactometer has been determined to be 15 ou
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen.

MBrecko

Michael Brecko
Laboratory Manager

Re-issue date: 2 September 2009

Odour Research Laboratories Australia

Odour Olfactometry Results – 4077/ORLA/08 – R1

Sample Location	Sample ID No.	Sampling Date & Time	ORLA Sample No.	Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration (ou) [1]	Sample Odour Concentration (ou) [2]	Odour Character & Hedonic Tone [^ +]
Sample ID: Fresh Spent Compost	715303	17/6/08 7:35	1673	17/6/08 11:50	4	8	Nil	1,020	1,020	Compost, yeast, hops, bakery, Butanol, sweet (+0.8)[^]
Sample ID: One Day Old Spent Compost	715304	17/6/08 7:08	1674	17/6/08 11:58	4	8	Nil	236	236	Butanol, dough rising process, brewery, hops, rye (+1.5)[^]
Sample ID: 6 Weeks Old Spent Compost	715305	17/6/08 7:02	1675	17/6/08 12:12	4	8	Nil	731	731	Rotten fish, putrid, peanut oil, smokey, manure, dirt (-1.3)[^]

Odour Research Laboratories Australia

Odour Panel Calibration Results – 4077/ORLA/08 – R1

Reference Odorant	ORLA Sample No.	Concentration of Reference Gas (ppm)	Reference Gas Measured Concentration (ou)	Panel Average Measured Concentration (ppb) [3]	Does this panel calibration measurement comply with AS/NZS4323.3:P2001 (Yes/No) [4]
n-butanol	1671	52.3	799	65.5	Yes

Comments: All samples were collected by Stephenson Environmental Management Australia and analyses by Odour Research Laboratories Australia at their Sydney Laboratory.

Notes from Odour Olfactometry Results:

[1] Sample Odour Concentration: as received in the bag

[2] Sample Odour Concentration: allowing for pre-dilution

[3] Panel Average Measured Concentration: indicates the sensitivity of the panel for the session completed

[4] Target Range for reference gas n-butanol is $20 \leq \chi \leq 80$ ppb and compliance with AS/NZ4323.3:2001 is based on the individuals rolling average and not on the panel average measured concentration. Panellist Rolling Average: PR = 68.6, TT = 58.6, CS = 47.6, DH = 48.7

^ denotes the Average Hedonic Tone: describes the pleasantness of the odour being presented where (+5) represents Very Pleasant, (0) represents Neutral and (-5) represents Very Unpleasant and has been derived from the panellist responses at the recognition threshold.

+ This value is not part of our NATA Scope of Accreditation and AS4323.3

B.1.2 Odour Measurements from Pennant Hills Golf Course

THE ODOUR UNIT
Screens Odour Emission Rate Calculation Sheet

Client: Holmes Air Sciences
Sampling Site: Pennant Hills Golf Club
Project Number: N1422.01L

Sample Location	Est. Plume Width (m)	Est. Plume Height (m)	Plume cross-sectional area (m^2)	Avg. Wind Speed (m/s)	Avg. Volumetric Flow Rate (m^3/s)	Odour Concentration (ou) (Difference of upwind & downwind)	Est. OER ($ou.m^3/s$)
Screens	2.0	1.6	3.2	0.85	2.7	856	2,300

Note- The plume width and height were defined by the dimensions of the screen. The average wind speed was measured across the screen profile.

Each sample collected was a composite across the screen cross-sectional profile. OER calculations are to 2 significant figures.

Appendix L

MUSHROOM FARM BUSHFIRE ASSESSMENT



Bushfire Compliance Report

Proposed
Mushroom Farm & Associated Buildings

521 The Northern Road
Londonderry

Report prepared by **Bushfire Safety Solutions**.

Postal Address: PO Box 7196 LPO South Penrith NSW 2750
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Report No: 2010/46B

Client: Perram & Partners

Date: 27 October 2010

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FPA Accredited Business No. 16761

Bushfire Assessment Specialists

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Conditions of Use

This Report is copyright protected and can only be utilised by the Client for the purposes of this development proposal and is not available for use or to be copied in any form by others not authorised by **Bushfire Safety Solutions**.

This Report has been prepared in accordance with the Deemed to Satisfy (DTS) & Alternate Solutions compliance provisions of each relevant NSW regulatory requirement.

It is a condition that the use of this Report is only vested in the Client upon final payment of the Report fee.

The recommendations provided in the report respond to the requirements of Planning for Bushfire Protection 2006. The recommendations provide a guideline to both the relevant consent authority and the New South Wales Rural Fire Service as to how the proposed development can comply with the provisions of AS 3959 – 2009 and Planning for Bushfire Protection 2006.

Council or the RFS can then choose to provide final consent conditions based on our recommendations for compliance so as to satisfy the requirements of each relevant piece of legislation. These conditions will be outlined in your final development consent.

Disclaimer

This report is provided in good faith and is based on information supplied for the development by the Client.

Bushfire behaviour is an unpredictable phenomenon and is often erratic under extreme weather conditions.

All care has been taken in the preparation of this report and recommendations provided therein. Site conditions, vegetation regrowth and maintenance of asset protection zones are not regulated and therefore may not be maintained in perpetuity to ensure adequate separation between the assets and the bushfire prone vegetation.

Bushfire Safety Solutions accepts **no** liability for any ongoing bushfire threat to the property or maintenance of the bushfire protection measures provided to the development or any loss of any building or structure associated with this development due to a bushfire event.

It is the responsibility of the owner of the property to maintain bushfire protection of the property at all times.

Active and passive bushfire protection measures require ongoing maintenance and diligence to ensure adequate bushfire protection.

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Part 1

1.0 Introduction

This Report provides a bushfire threat analysis for a proposed Mushroom Farm and associated buildings located at 521 The Northern Road, Londonderry. The assessment examines bushfire protection compliance provisions specified in Planning for Bushfire Protection 2006 regarding asset protection zones and general building and occupant safety relating to the effects of a bushfire event in proximity to the proposed development.

The Report has been compiled using information provided by the Client and a detailed assessment of local bushfire hazards that are in proximity to the proposed development.

1.2 Report Objectives

The objectives of this Report are to:

- Develop a bushfire compliance report for the proposed development in accordance with the requirements of the New South Wales regulatory provisions for building in designated bushfire prone areas;

- Provide recommendations for active and passive bushfire protection measures that comply with deem to satisfy and or performance based solutions in accordance with Planning for Bushfire Protection 2006.

1.3 Scope and Limits of this Report

This Report provides a deem to satisfy and performance based assessment of a proposed Mushroom Farm and associated building complex located at 521 The Northern Road, Londonderry against the provisions of Planning for Bushfire Protection 2006, relevant aspects of AS3959 – 2009 for separation distances between an asset and the bushfire prone vegetation interface and any applicable bushfire compliance requirements of the Building Code of Australia for a Class 8, 9 and 10 building development.

This Report does not include an assessment of the building's compliance with the Building Code of Australia for building fire safety measures.

1.4 Summary PBP 2006 – Compliance Assessment

This bushfire compliance analysis has been undertaken as part of deem to satisfy assessment of proposed Mushroom Farm and associated buildings including a proposed staff child minding crèche, peat store and spent compost store. The analysis has found that the proposed development is capable of generally complying with both the DtS and performance requirements for bushfire protection measures as specified in AS 3959 – 2009, the relevant provisions Building Code of Australia (2010) and Planning for Bushfire Protection 2006.

1.5 Regulatory Framework

The following regulatory requirements are cited for bushfire protection compliance in New South Wales.

(a) Environmental Planning and Assessment Act 1979;
(b) Building Code of Australia - 2010;
(c) Rural Fires Act 1997;
(d) Australian Standard 3959 – 2009;
(e) International Fire Engineering Guidelines – 2005;
(f) Planning for Bushfire Protection 2006 (as amended).

It is noted though that not all of the above regulations may be required for the purposes of this assessment

1.6 Referenced Information & Documents

The following documents have been referenced for this assessment:

- Architectural Plans prepared by Apex Building Systems dated 17 May 2009.

Part 2

2.0 Principal Development Characteristics

The proposed development involves a staged development consisting of a new mushroom growing building, a staff only child minding crèche, workshop building, a spent compost storage area, open staff car park area and peat store. An existing single storey dwelling is currently constructed on site and is proposed to remain in place.

The site is within a rural residential area of Londonderry and is mostly cleared of all remnant vegetation with open grassed paddocks including a rural dam.



Plate 1 – Site Location Plan (*nearmap* 2010)

2.1 General Site Description

The property is described as Lot 138 DP 752037 known as 521 The Northern Road Londonderry. The property is on the eastern side of Londonderry and is located opposite the Castlereagh Nature Reserve, which is approximately 490ha in area, consisting mostly of Cooks River Castlereagh Ironbark, Castlereagh Scribbly Gum Woodland mixed with areas of grass and Castlereagh Swamp Woodland.

No. 521 The Northern Road is approximately 21.73 ha in size and adjoins existing rural residential lots to the west, north and south, with the prominent bushfire prone vegetation located to the east within the Castlereagh Nature Reserve (described above).

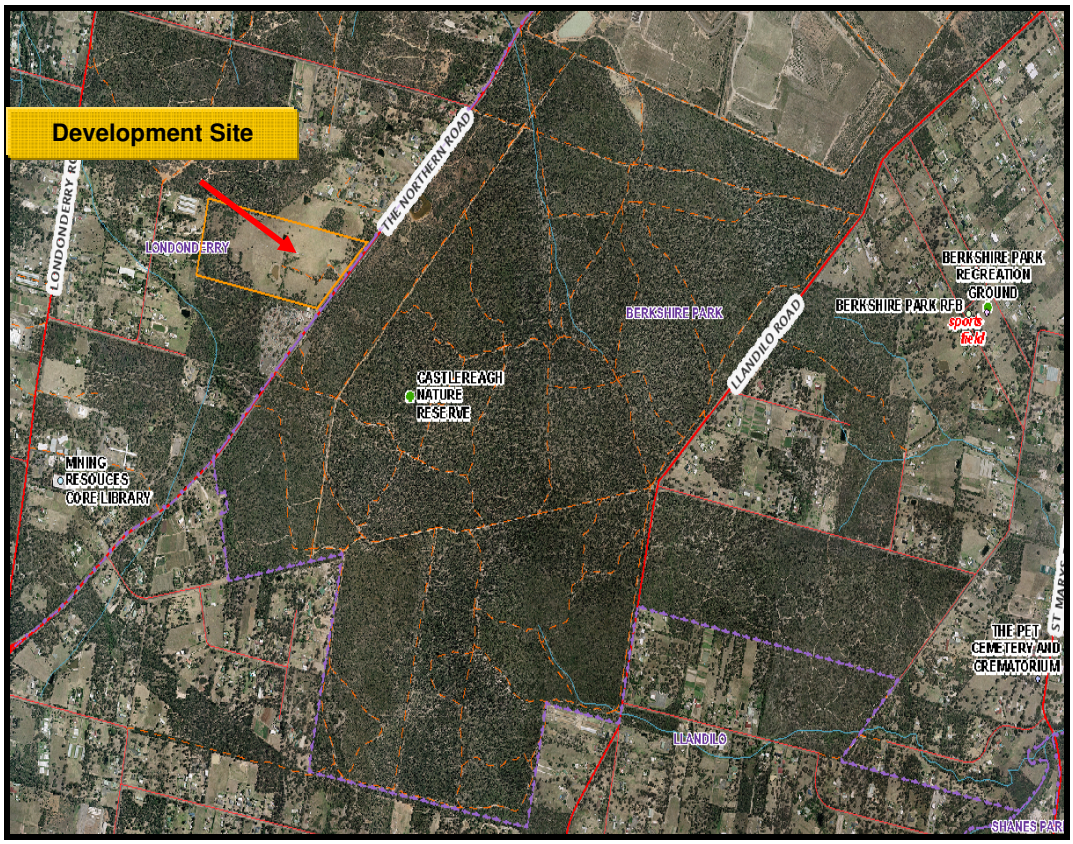


Plate 2 - Locality Map – 521 The Northern Road Londonderry

The New South Wales National Parks and Wildlife Service have prepared a bushfire management plan for the Reserve, however the area is also known to be subject to periodic bushfire incidents outside of the existing bushfire management plan frequency.

2.2 Bushfire Safety Assessment

Penrith City Council has mapped No. 521 The Northern Road as being partially bushfire buffer zone along the perimeter of the property, with a portion of the site deemed to have no bushfire hazards, mostly in the middle portion of the lot.

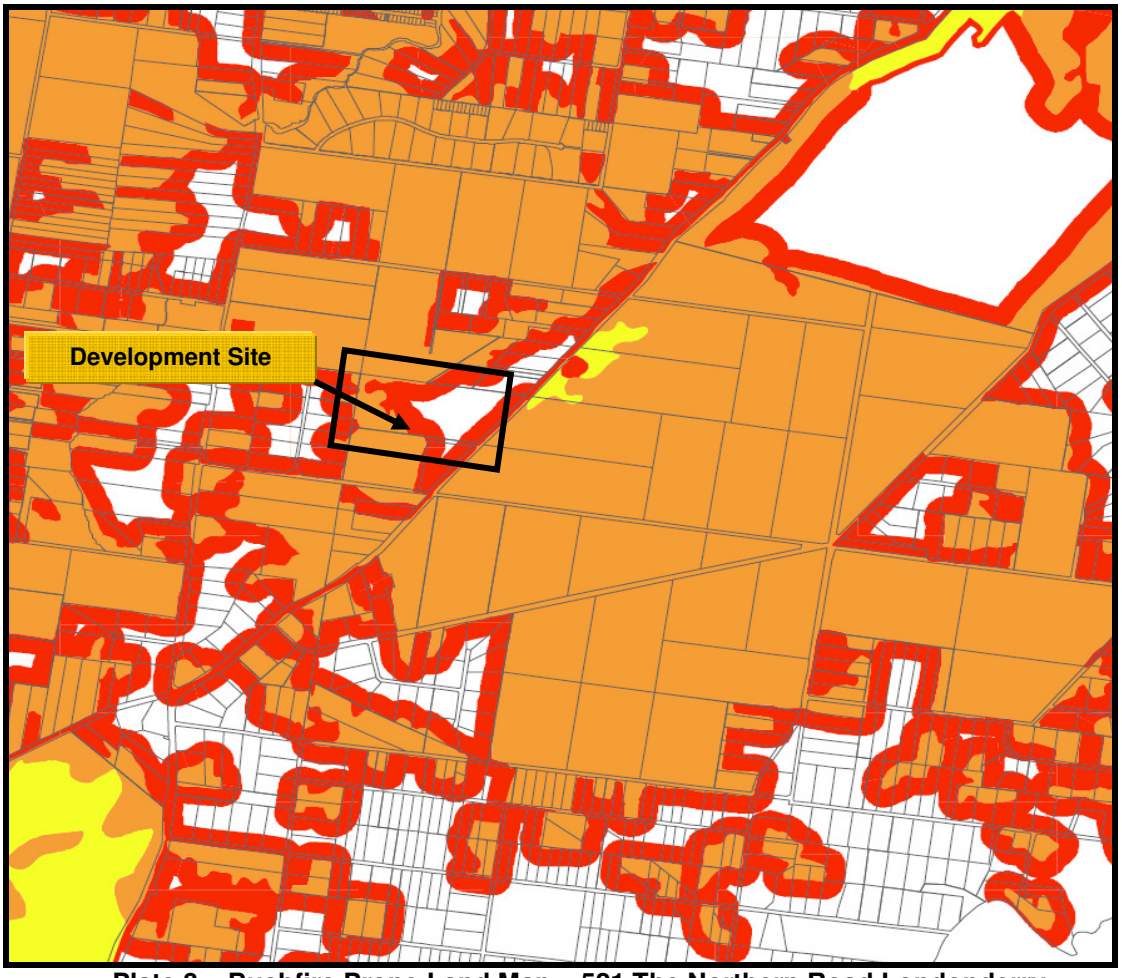


Plate 3 – Bushfire Prone Land Map – 521 The Northern Road Londonderry

Plate 3 highlights the location of the mapped bushfire prone vegetation and the proximity of the proposed development zone to the bushfire prone vegetation within the Castlereagh Nature Reserve and adjoining properties to the north west of the subject lot.

The positioning of the new buildings on site will require asset protection zones to the western, southern, northern and eastern aspects so as to comply with passive bushfire protection measures required by Planning for Bushfire Protection 2006.

A defendable space is also required for each building, whilst any new APZ would require the unbuilt areas to be managed to ensure that bushfire prone fuel would not exceed a minimum 5t/ha.

Accordingly, this assessment will examine methods of providing bushfire impact protection for the development particularly from ember attack and mid range radiant heat flux emanating from a bushfire event approaching within the development from the north west, west and to a certain extent, from the north along The Northern Road aspect through the Castlereagh Nature Reserve.

2.3 Bushfire Preventative & Protection Measures

The nature of the proposed development requires a bushfire impact assessment to ensure compliance with the performance provisions of Planning for Bushfire Protection 2006 for infill development together with construction requirements specified in AS 3959 – 2009 and the Building Code of Australia.

Planning for Bushfire Protection 2006 requires that infill development to be constructed to a certain standard of performance to ensure a high level of bushfire resilience during a bushfire event.

External building elements including wall claddings, roof cladding, window elements, door openings and external attachments are potentially exposed to the effects of radiant heat, ember throw and in some instances, flame impingement.

The performance provisions of Chapter 4, Clause 4.3.2 of PBP 2006 requires this type of development to meet certain performance criteria for asset protection zones, siting and design, construction standards, access requirements, water and utility services and landscaping.

For the purposes of this assessment, each building will be examined for specific bushfire compliance requirements including building element resistance and the provision of an APZ and defendable space.

2.3.1 General Site Layout

The proposed site layout includes the positioning of four detached buildings within the site, starting with Stage 1 “spent compost store”, a building that covers spent mushroom compost for later use as a fertilizer, the main mushroom growing building and associated works (as depicted below).

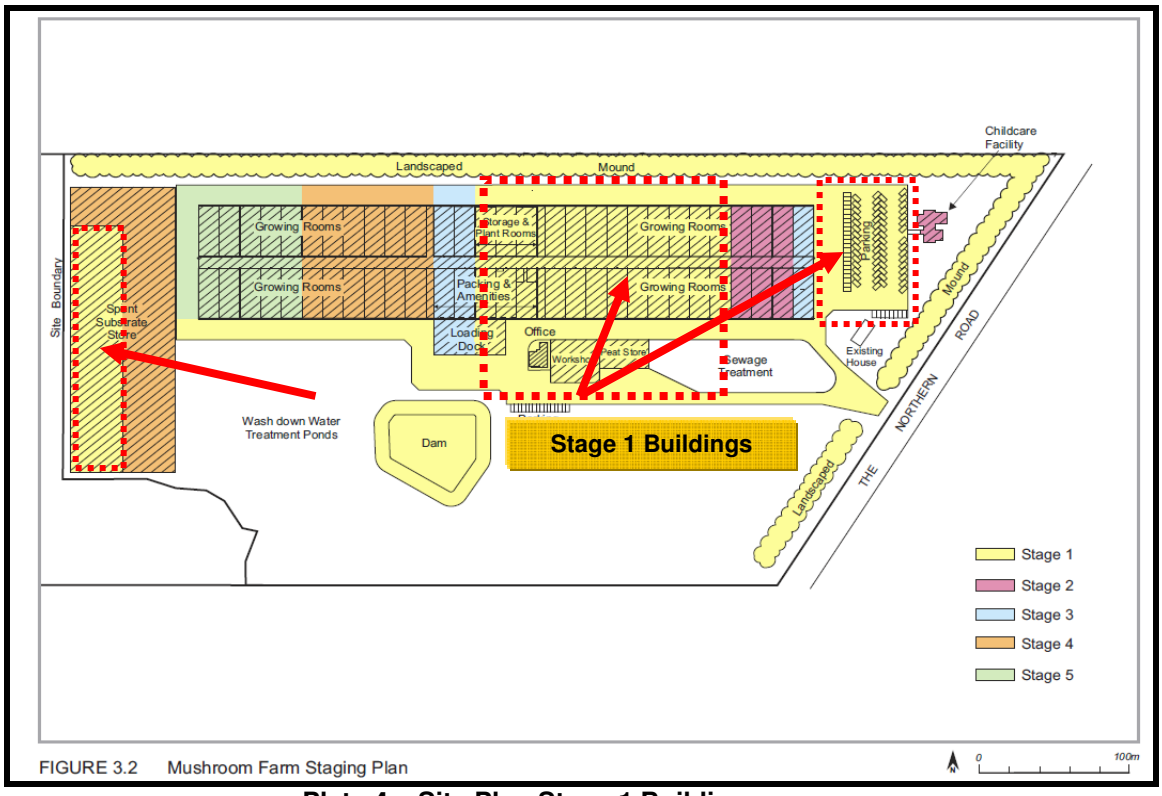


Plate 4 – Site Plan Stage 1 Buildings

2.3.2 Stage 1 Buildings

The stage 1 buildings have a variable exposure to the adjoining bushfire threat to the north and north west of the development.

The two buildings will be steel framed and steel roof cladding and therefore non combustible construction. It is noted though, that the spent mushroom store is an open structure, with only a rood cladding. The buildings are classified as Class 8 in accordance with Part A3.2 of the BCA and would require compliance with C1.1 of the BCA for Type C fire resisting construction, though the mushroom growing building would not require compliance with Part C1.1 of the BCA because it is greater than 3m from the adjoining side boundary line.

PBP 2006, Chapter 4, Section 4.3.6 states that buildings that are classified as other than Class 1, 2, 3, 4 or 9 are not required to strictly comply with the requirements of AS 3959 – 2009 (Volume 1 of the BCA 2010, does not call up AS3959 - 2009 for Class 2 to 9 buildings and relies on Section C of the BCA to require certain building elements to demonstrate either deem to satisfy or performance based fire resistance as required by Specification C1.1 of the Code).

In relation to ensuring that buildings classified as Class 2 to 9 located in bushfire prone areas comply with PBP 2006, the aims and objectives of the bushfire compliance requirements are to be met when designing the proposed development.

The two Stage 1 buildings would require the following bushfire protection compliance:

1. Spent Mushroom Store – APZ of approximately 24m to the west, north and south of the building;

2. Defendable space of approximately 10m to the west, north and south of the building;

3. Where the nominated elevations can not be provided with the minimum APZ separation distance, the side elevation of the building is enclosed with non combustible cladding to prevent ember and radiant heat exposure from any passing bushfire event (or protected by some other approved method).

The site characteristics include an average land slope of approximately 4^0 cross fall from north to south.

A detailed description of the area required to be provided with the APZ is shown over in Plate 5.

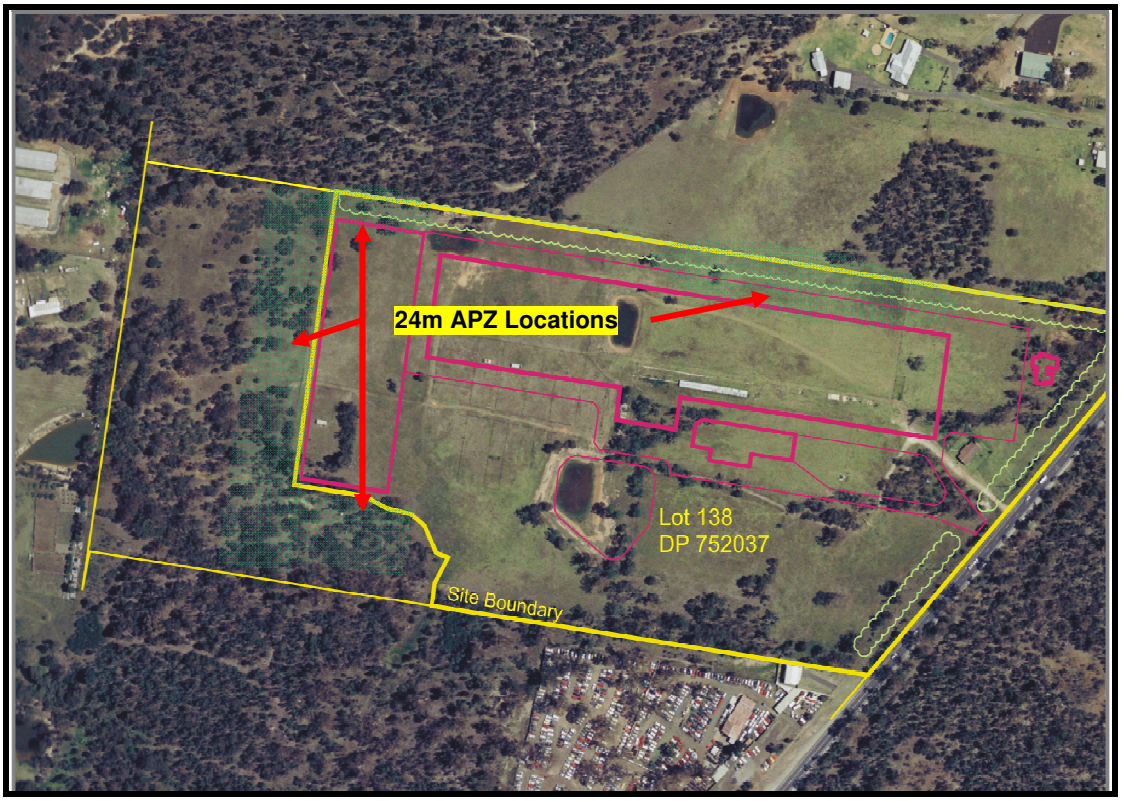


Plate 5 – Recommended APZ & Defendable Space Locations Stage 1

As a result of the bushfire threat rating to the most bushfire prone aspects, the proposed development has been calculated as having a theoretical equivalent bushfire threat rating of "**BAL 29**" based on a minimum APZ of 24m as shown in Plate 5 above.

The extent of bushfire protection measures required for each of the buildings will require from radiant heat throw and ember attack depends on the final external cladding for each building.

It is recommended that the mushroom growing buildings be provided with non combustible external cladding to reduce radiant heat penetration and to prevent ember throw into the internal portions of each building.

It is recommended that the open spent compost building be protected in accordance with the alternate solution proposed in Section 2.6 of this Report.

2.3.3 Stage 2 to 4 Buildings

The remaining stages of construction involve the following buildings:

- Remainder of the mushroom growing buildings;
- The Spent Compost Building;
- The staff child minding Crèche; and,
- Ancillary buildings.

The requirements for asset protection zones are the same as Stage 1 APZ setback distances and level of protection for each building.

The proposed crèche is for staff members only. The location of the crèche is directly off The Northern Road aspect (eastern) and is (at the worst case scenario, if deemed to be by the New South Wales Rural Fire Service as "Special Fire Protection Purpose" building) would be 60m to the east. If the crèche is deemed to be as **not within the SFPP classification**, the minimum APZ separation requirement would be 24m for "BAL 29", however a more acceptable separation distance to the Castlereagh Nature Reserve would be greater than 24m and provide an equivalent construction range of "BAL 29" bushfire construction parameters (AS3959 – 2009).

Should the crèche change its method of operation and become a commercial child minding centre, the requirements of PBP 2006 would also alter and require a greater level of bushfire protection, which would include a greater asset protection zone separation (60m), particularly to the northern and eastern aspects.

Based on the private use of the crèche, the northern and eastern aspects would require the above APZ treatment, whilst the southern and western aspects would require no APZ treatments as these two aspects are orientated towards the inner portion of the site, which is cleared and not subject to any bushfire prone vegetation hazards.

It is proposed to construct a landscaped earth mound wall around the northern and eastern perimeter boundary lines. The earth mound would require suitable landscape treatments to ensure the vegetation is not bushfire prone, however, the earth mound will act as a partial ember filter during any bushfire event.

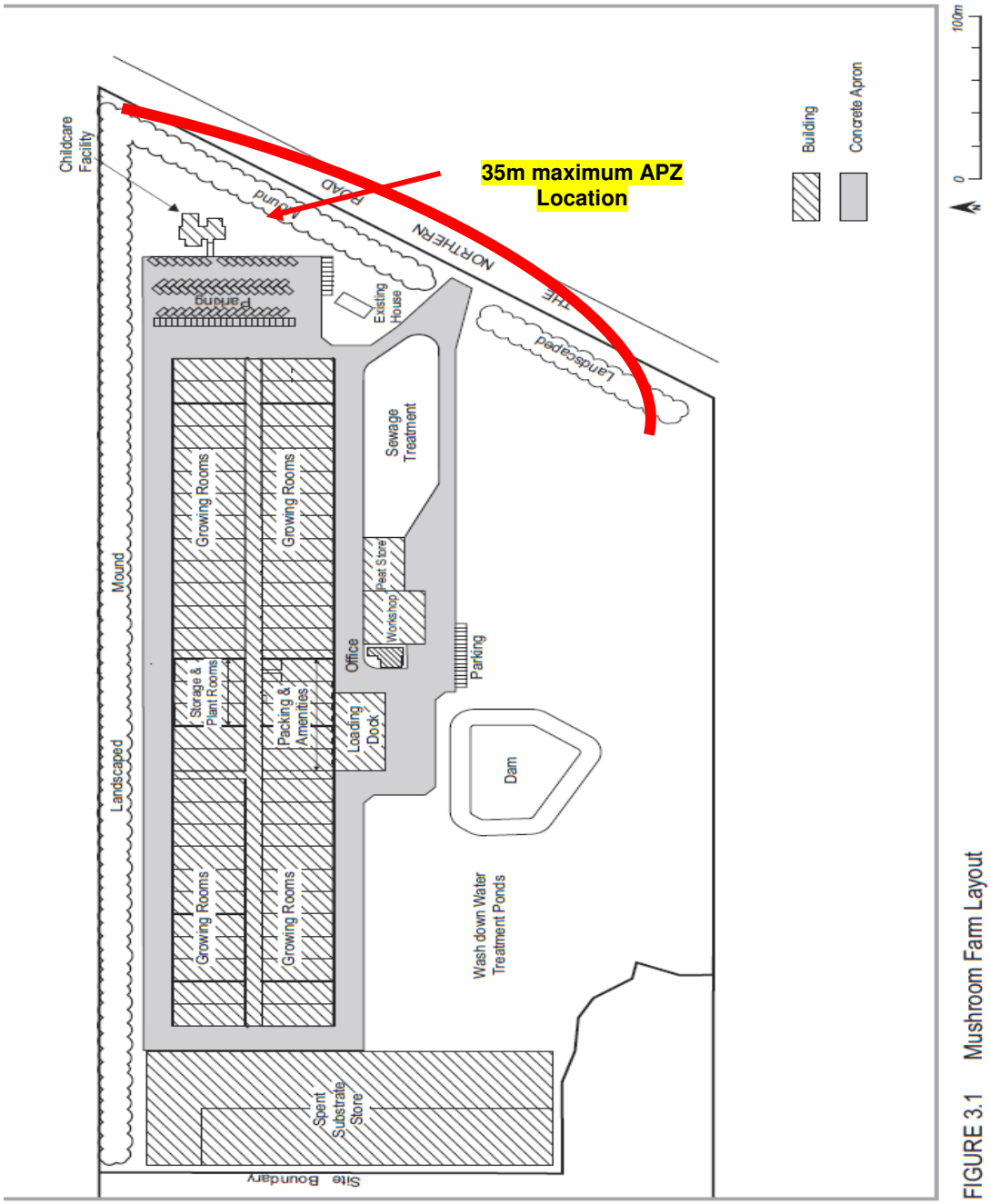


Plate 6 – Recommended APZ & Defendable Space Locations for Crèche

2.3.4 Bushfire Prevention Measures

Standard bushfire prevention measures include the construction of asset protection zones that generally comply with the requirements of Table 2.4.2 (AS3959 – 2009) for asset separation from any mapped bushfire prone vegetation, based on vegetation type and effective slope, Appendix 3 – Table A3.4.2 (PBP 2006 as amended) and the performance requirements as prescribed in PBP 2006, Clause 4.3.5, for infill developments.

The measures that are available to provide bushfire impact protection for a building include:

- Construction of a deemed to satisfy asset protection zone, in this case at least 24m separation would be required on the northern, eastern and western elevations;

- Construction standards that comply with the DtS provisions outlined in AS 3959 – 2009 for BAL 29 construction. In this case there are certain building elements that are referenced in AS 3959 – 2009 that are not referenced in the BCA for Class 8 & 9 buildings for any type of construction; and,

- The installation of active external bushfire protection measures including non combustible construction of external building elements that are exposed to the bushfire prone vegetation, active external fire protection systems including wall and opening drenchers, openable window and door screening and, in some instances, radiant heat protection shielding from non combustible fencing and the like.

Additional bushfire protection considerations may also include the protection of building occupants during a bushfire emergency. These measures can include:

- The formulation of a Bushfire Survival Plan for the development;

- An Emergency Evacuation Plan that includes consideration of the potential impacts and consequences of a local bushfire event; and,

- Emergency access to and from the development that enables an effective fire fighting response during a bushfire emergency.

2.4 Bushfire Safety Design

Bushfire safety design includes using external building elements to provide passive bushfire protection measures that meet the performance requirements of Planning for Bushfire Protection (2006) and provide equivalence to the deem to satisfy standards outlined in AS 3959 – 2009.

Bushfire safety design also involves providing bushfire prone vegetation management that reduces the bushfire hazard that threatens the proposed development.

Elements of bushfire design to be analyzed for the proposed development include:

- Anticipated radiant heat exposure levels at the interface of the northern and western elevations;
- The extent of bushfire hazards that are within the minimum separation distances (in relation to site slope conditions) to the proposed development;
- Building classification and use; and,
- The impact of any bushfire event on the proposed development in relation to building occupants, the surrounding community and the opportunity for bushfire spread to continue through the property to adjoining properties.

In relation to the proposed mushroom farm, bushfire safety design features will be outlined in the following sections of this Report.

2.4.1 Bushfire Design Scenarios

The most likely bushfire threat stems from the north, north west of the proposed development.

A bushfire originating from this aspect could theoretically attain a high intensity based on low relative humidity, very high wind speed, high ambient air temperature and available combustible fuel densities. However, the limiting factor for a bushfire in this vicinity relates to the extent of prevailing winds as the

area is relatively flat and therefore lacks the element of slope to drive a bushfire event in the absence of wind.

Surrounding land to the proposed Mushroom Farm contains variable parcels of existing bushfire prone vegetation that could spread a bushfire along the property boundaries of No. 521 The Northern Road.

As previously discussed, the development is opposite the Castlereagh Nature Reserve, which is capable of supporting a critical mass bushfire under strong wind conditions.

A bushfire is unlikely to have any critical impact in terms of flame impingement and elevated radiant heat flux upon the proposed development however, embers and smoke could affect the proposed development.

Accordingly, ember throw from a bushfire originating from the north, north west is an element of potential bushfire threat that will require passive control measures to ensure the performance and resilience of the building during a severe bushfire event.

(a) Worst Bushfire Scenario Modelling

Accordingly, a worst case bushfire scenario that could theoretically impact the proposed development will be "modelled" on environmental elements that predict a likely bushfire behaviour consequence given certain inputs.

The following hypothetical maximum fire weather components for a critical bushfire event could include:

- An ambient air temperature of 45^0 C;
- Relative humidity of 10%;
- Wind speed from north west (the most prevalent wind direction for extreme bushfire weather conditions) 50km/hr;
- Available combustible fuel levels of 20t/ha;
- Forest vegetation classification;
- Slope class of 4^0; and,

- Fire is not controllable.

Modelling of a worst case scenario design bushfire under these parameters are estimated to produce a critical level bushfire with hypothetical flame heights of approximately 35m, fire spotting distance of 8km and a rate of spread of 3.28km/hr (source modelling - McArthur Forest Danger Meter Mk 5) (Source weather data BoM 1981 – 2010).

The design bushfire would approximate a relatively severe bushfire event (the worst bushfire event that can be expected using current research and bushfire behaviour modelling systems for a 1:100 year event). The effects of a bushfire of this consequence would impact on the proposed development potentially igniting bushfire fuel either at ground level or in areas of accumulations (roof intersections, concealed spaces, corners of enclosures and the like) and cause flame impingement upon the northern and possibly western elevations.

An assessment of bushfire prone vegetation within the general area has indicated accumulation rates of less than 10t/ha, with large areas of grass ground cover, moderate understorey vegetation with low sunlight accessibility at ground level and as such, the effects of a bushfire approaching from the northern aspects would generate lesser bushfire impacts as prescribed above.

Should a bushfire approach from the north, north west to the asset, the bushfire would convert to a grass fire once it reaches the subject property.

In order to manage the interface of the adjoining bushfire threat, the open areas surrounding the development buildings would require annual maintenance to ensure the level of available bushfire prone fuel (including dry grass) is kept to a minimum.

Plate 7 over highlights the northern aspect bushfire path and the change in vegetation conditions at the boundary of the subject lot.

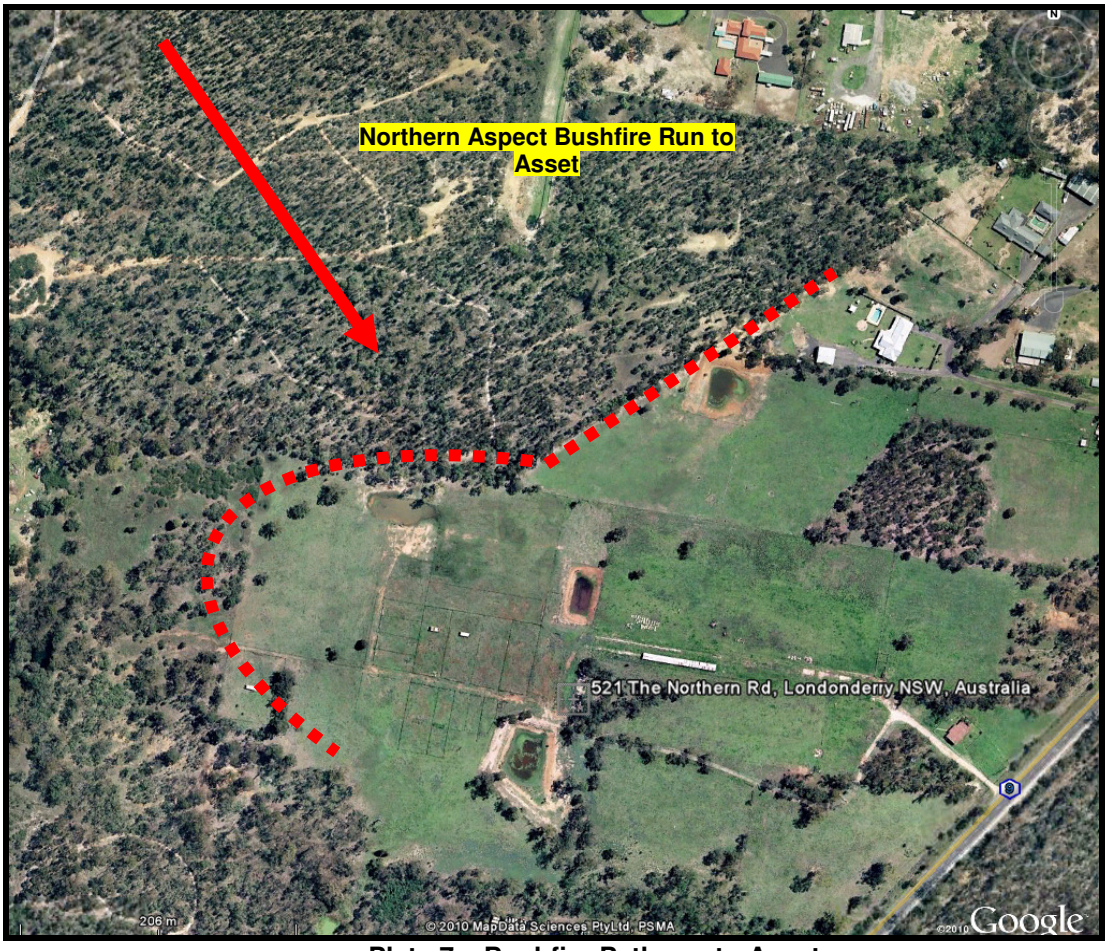


Plate 7 – Bushfire Pathway to Asset

In order to meet the performance provisions of PBP 2006 and the BCA, any building in close proximity to this bushfire scenario would need to be capable of resisting the bushfire front and the residual effects of the bushfire.

The worst case bushfire scenario is limited by the extent of the prevailing wind speed and direction so as to maintain the forward direction of the bushfire. It is also likely that a lesser bushfire event might also occur in the area.

(b) More Likely Bushfire Scenario Modelling

Accordingly, a design bushfire scenario for the proposed development will be "modelled" on average environmental elements and is based on certain environmental parameters that predict a likely bushfire behaviour consequence given certain inputs.

Therefore the following hypothetical maximum fire behaviour components for an average bushfire impact could include:

- An ambient air temperature of 37^0 C;
- Relative humidity of 12%;
- Wind speed from north west (the most prevalent wind direction for extreme bushfire weather conditions) 50km/hr;
- Available combustible fuel levels of 10t/ha;
- Forest vegetation classification;
- Slope class of 4^0; and,
- Fire is potentially controllable.

Modelling of an average bushfire design scenario under these parameters would produce a high range level bushfire with hypothetical flame heights of 15m, fire spotting distance of 4km and a rate of spread of 1.5km/hr (source modelling - McArthur Forest Danger Meter Mk 5) (Source weather data BOM 1981 – 2010).

The design bushfire would approximate an average bushfire event that could be expected for the Londonderry area. The impact of a bushfire of this consequence would not detrimentally impact on the proposed development due to deem to satisfy separation distances between the bushfire prone fuel and the maintenance of a compliant asset protection zone within the subject property.

The most likely impact of this bushfire scenario would be ember throw along the northern and western boundary lines, with the fire moving in a south east direction through a diminishing area of bushfire prone vegetation, possibly spotting into the Castlereagh Nature Reserve.

As described, ember attack would be the principle bushfire impact and, as such, the proposed development would require protection measures to reduce the impacts of the embers on vulnerable portions of each building.

Incorporating appropriate vegetation management practices within the property would assist in lessening the overall bushfire hazards and hence the threat to any or all of the assets within the development area.

The recommended practices would include:

- Limiting the extent of intensifying understorey regeneration within 24m of the proposed building such that the bushfire prone fuel accumulations do not exceed 5t/ha; and,

- Maintenance of tree branches within 5m of the proposed new building to limit the accumulations of leaf litter building up on the roof of the proposed building;

(c) Radiant Heat Flux

When modeled for radiant heat flux at the receiver the development can not exceed the construction level of **BAL 29**, with the total radiant heat flux to be maintained at >19kW/m^2 - < 29kW/m^2 but no greater.

This level of radiant heat flux exposure would produce a short term radiant heat gain at the building interface due to the direction the fire would travel, together with potentially burning embers circulating in and around the building. With the minimum APZ separation distance of 24m the building would be expected to resist any adverse consequences of a BAL 29 bushfire event.

(d) Ember Attack Scenario

The impact of ember attack can not be modelled due to the unpredictability of ember movement, size, continuing ignition and potential to remain a pilot ignition source once the ember has grounded or been deposited upon a building.

Additional uncertainties associated with ember attack relates to the probability of an ember landing in a particular location that is burdened with potentially combustible fuel that is capable of growing to a size to cause property damage.

Density of ember attack is also unpredictable and lacks research data to accurately model the overall impact of an ember attack event. Notwithstanding this, it is possible to limit vegetation that has the potential to produce elevated ember throw within an adjoining asset protection zone. It is recommended that the adjoining asset protection zone therefore be managed such that any understorey be considered in terms of potential future ember generation when subject to a bushfire event.

The consequent uncertainty of a worst case scenario ember attack will require the proposed development to implement a general site cleaning program that removes leaf litter accumulations from the roof area of the building and surrounding grounds.

Window and door openings would also require non combustible and radiant heat resistant ember protection screens.

2.5 Deem to Satisfy Bushfire Compliance Solution

The proposed Mushroom Farm is considered capable of complying with deem to satisfy construction requirements prescribed in AS 3959 – 2009 DtS for BAL 29 (where the BCA construction requirements for Type C building does not specifically address bushfire protection measures) and the objectives of PBP 2006 for the following construction elements.

- External Wall Cladding Mushroom Growing Buildings – non combustible external cladding;
- Steel roof cladding; and,
- Concrete floors;

Specific bushfire protection measures recommended for the proposed building include:

- Secure, non combustible flashing at roof intersections, with no gaps at roof cladding intersections;
- Non combustible external guttering and downpipes (where provided);

- Steel mesh screens to be fitted to all windows and doors capable of being opened along the northern and western elevations.

- The open areas surrounding the building being maintained as an inner protection area.

- An asset protection zone to be established within the adjoining western and northern aspects of the building such that, for at least 24m, the undergrowth is managed so as to not exceed 5t/ha of bushfire prone vegetation. Note, existing tree stands do not require removal, though branches within 5m of the proposed building should be trimmed so as to not overhang the building and maintained as part of the management of the 24m asset protection zone.

- The provision of a reticulated and static water supply system that is capable of providing emergency water supply for any bushfire protection activities. The reticulated water supply is to comply with the requirements of section 4.1.3 and the acceptable solutions as prescribed for reticulated water supplies requiring the provision of a fire hydrant system that complies with AS 2419.1 – 2005.

- The provision of a fire hose capable of reaching all elevations of each building. Note, the fire hose should be a rubber hose of approximately minimum 18mm diameter and located away from the northern and western elevations.

- Vehicle access to the proposed development is to comply with section 4.1.3 of the PBP 2006, together with general Fire Brigade access being provided along the western aspect to enable maintenance and management of the northern and western aspect asset protection zones.

Section 2.6 of this Report provides a further comprehensive compliance summary of all aspects of the development design (pp 24) for bushfire protection.

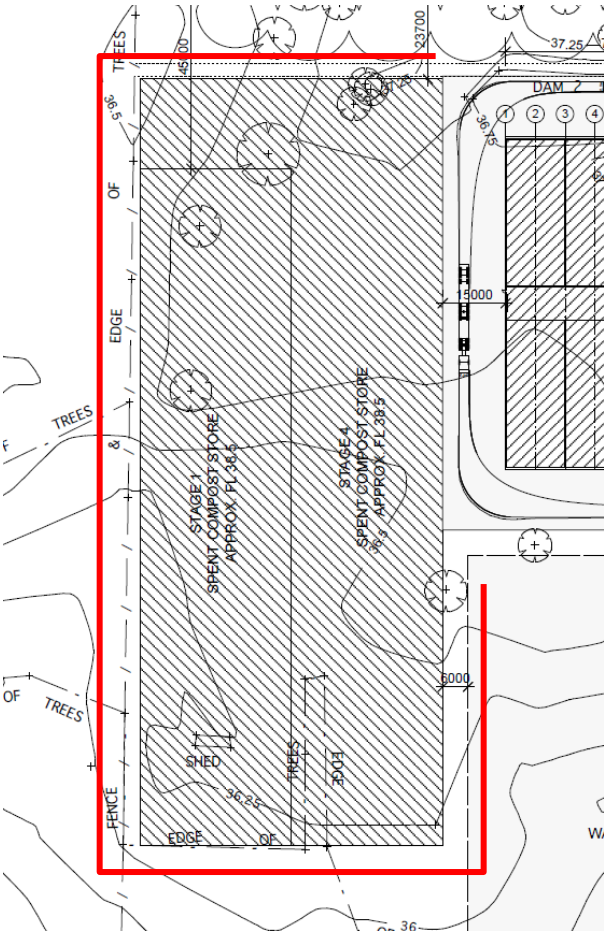
2.6 Performance Bushfire Compliance Solution

On the basis of the development achieving a compliant asset protection zone and that the building will be provided with passive bushfire protection elements that comply with AS 3959 – 2005 for ember protection, the proposed building does not require a performance based bushfire compliance solution.

The following compliance table summarises the specific areas of required compliance for bushfire protection in order to satisfy the DtS requirements of PBP 2006 and AS 3959 - 2009.

Table 2.6.1 PBP 2006 - Compliance Table Summary

PBP 2006 Performance Criterion	Performance Solution
In relation to asset protection zones:	
• **A defendable space is provided onsite.** • **An asset protection zone is provided and maintained for the life of the development.**	A defendable space is provided to all aspects for each building. The defendable space is to be a minimum of 10m and is to provide a clear area for property protection fire fighting and unimpeded access. Asset protection zone of 24m is to be provided to the west, north and east of the development. Note the extent of the minimum APZ maybe greater for some aspects depending on final design and siting of buildings. Asset protection zone to be constructed to comply with a maximum fuel level of not greater than 5t/ha. The external curtilage of the buildings along the western, northern and eastern elevations of the spent compost store are to be kept clear of any vegetation to prevent ember ignition during a bushfire. It is recommended that the curtilage be sealed for approximately 3m with hard stand materials.



Building curtilage area recommended to be sealed shown (Not to scale).

The spent compost store may contain combustible material that could be a risk of spread of fire during a bushfire event. The sealing of the building curtlidge and the cladding of the western, southern and northern elevations will assist in reducing direct ember penetration in the building in times of a bushfire.

- **Alternate Solution for Western, Northern and Eastern Elevations**

In lieu of external wall cladding to these elevations, the aspects could be protected by drencher sprays along each elevation to dampen the stored compost to prevent ignition.

• **Buildings are sited and designed to minimise the risk of bush fire attack.**	Buildings are constructed of non combustible materials. Buildings are provided with compliant APZ to each bushfire prone aspect.
• **It is demonstrated that the proposed building can withstand bush fire attack in the form of wind, smoke, embers, radiant heat and flame contact.**	Each building is constructed to comply with the BCA and is non combustible construction. Each building is designed by a Structural Engineer to withstand wind loadings.

	Siting of each building will meet the minimum standard for APZ separation so to achieve an equivalent BAL 29 rating in accordance with AS3959 – 2009 construction requirements. The APZ separation provisions isolate each building from any flame contact form a passing bushfire.
• **Internal Roads.**	Internal roads are proposed to be sealed and all weather road construction.
• **Services – Water Gas and Electricity**	All services are provided to the proposed development and are to be located under ground. Water supply is reticulated and will be provided to comply with AS2419.1 for both external and internal fire protection. All external fire safety measures will be accessible to both NSW Fire Brigades and Rural Fire Service appliances. A static water supply is recommended for the proposed development to assist with bushfire prevention.
• **Emergency and Evacuation Planning**	The proposed development will have a compliant emergency and evacuation plan that complies with AS3745, will be consistent with the NSW RFS Guidelines for "Preparation and Emergency Evacuation Planning" and comply with AS 3745– 2002 "Emergency Control Organisations and Procedures for Buildings, Structures and Workplaces"
In relation to Emergency Evacuation:	
• **An Emergency and Evacuation Management Plan is approved by the relevant fire authority for the area**	The plan adopts the RFS Bushfire Survival Plan principles.

In relation to Building Bushfire Protection Compliance

- **The building is to comply with the performance requirements of the BCA;**
- **The building is to resist the passage of a passing bushfire front; and,**
- **The building is to be provided with bushfire protection measures that protect the building from the impact of a bushfire.**

The performance requirement of the BCA for the proposed Class 9 building (crèche) in a bushfire prone area requires that the building is constructed to the requirements of AS 3959 – 2009.

The building is constructed to a standard that approximates BAL 29 standard of construction.

The following additional bushfire protection measures are recommended for the building:

(i) External fire hose to be installed and is to be capable of reaching all external building elevations. Fire hose to be solid and durable rubber hose and not plastic garden hose.

The incorporation of the above recommendations for passive and active bushfire control measures into the final design of the development will provide compliance with the current standards of construction for bushfire prone areas.

Part 3

3.0 Recommendations

The proposed development is located within an area that is designated as being bushfire prone. The proposed Mushroom Farm and associated buildings are capable of being protected against local bushfire impacts in accordance with the requirements of Chapter 4, Section 4.3 PBP 2006.

The proposed buildings will require the following bushfire protection measures to be provided prior to occupation so as to achieve a suitable level of compliance with the performance measures of PBP 2006.

- External Wall Cladding – non combustible external cladding for mushroom growing building;
- Steel roof cladding; and,
- Concrete floors;
- Secure, non combustible flashing at roof intersections, with no gaps at roof cladding intersections;
- Non combustible external guttering and downpipes (where provided);
- Steel mesh screens to be fitted to all windows and doors capable of being opened along the northern and western elevations;
- External ember protection for the Spent Compost Store – either external wall cladding along the northern, western and eastern elevations or drencher protection for the open areas to keep any combustible material damp during a bushfire event.
- The open areas surrounding each building being maintained as an inner protection area. This would include the aspects to the west, north and east of each building.
- An asset protection zone to be established for at least 24m to north, east and western aspects, the undergrowth is managed so as to not exceed

5t/ha of bushfire prone vegetation. Note, existing tree stands do not require removal, though branches within 5m of any proposed building should be trimmed so as to not overhang the building and maintained as part of the management of the 24m asset protection zone.

- Defendable space of approximately 10m to the west, north and south of each building (including the 3m hardstand area);
- The provision of a static water supply to assist in bushfire prevention.
- The provision of a reticulated water supply system that is capable of providing emergency water supply for any bushfire protection activities. The reticulated water supply is to comply with the requirements of section 4.1.3 and the acceptable solutions as prescribed for reticulated water supplies requiring the provision of a fire hydrant system that complies with AS 2419.1 – 2005.
- The provision of a fire hose capable of reaching all elevations of each building. Note, the fire hose should be a rubber hose of approximately minimum 18mm diameter and located away from the northern and western elevations.
- Vehicle access to the proposed development is to comply with section 4.1.3 of the PBP 2006, together with general Fire Brigade access being provided along the western aspect to enable maintenance and management of the northern and western aspect asset protection zones.
- Adoption of an Emergency Bushfire Protection Plan.

Note - Maintenance of Bushfire Safety Measures

All recommended bushfire safety measures require regular maintenance and testing for operational readiness. Whilst the regular inspection and maintenance of bushfire protection measures is not compulsory, it is recommended that each bushfire protection measure is tested at least once per year to ensure operational readiness.

Testing of the measures is recommended to be incorporated into the annual fire safety measures inspection and certification program undertaken in accordance with the Environmental Planning and Assessment Regulation 2000.

3.1 Conclusion

The proposed Mushroom Farm is capable of complying with the general performance provisions of Planning for Bushfire Protection 2006, the Building Code of Australia (Volume 1 – 2010) and AS 3959 – 2009.

In accordance with the recommendations provided in this Report the proposed development should be approved in accordance with Section 79BA of the Environmental Planning and Assessment Act 1979 (as amended).

Signed:  Dated: 5 October 2010
Steve Parrott – FPA Accredited Practitioner No.16761 - A
Bushfire Safety Solutions

FPA AUSTRALIA
Certified Business
Bushfire Planning & Design

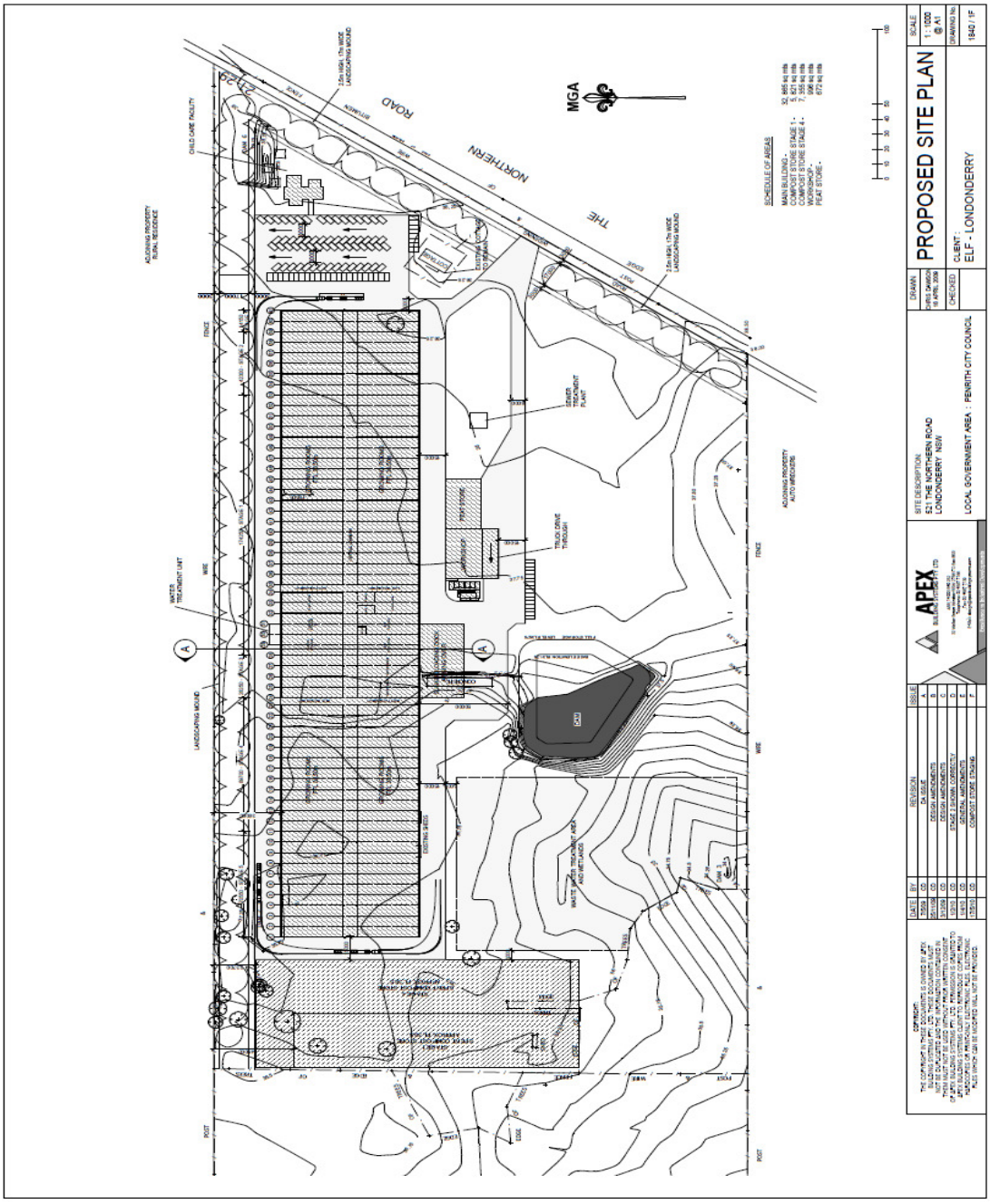
Member of Fire Protection Association of Australia

Appendix A

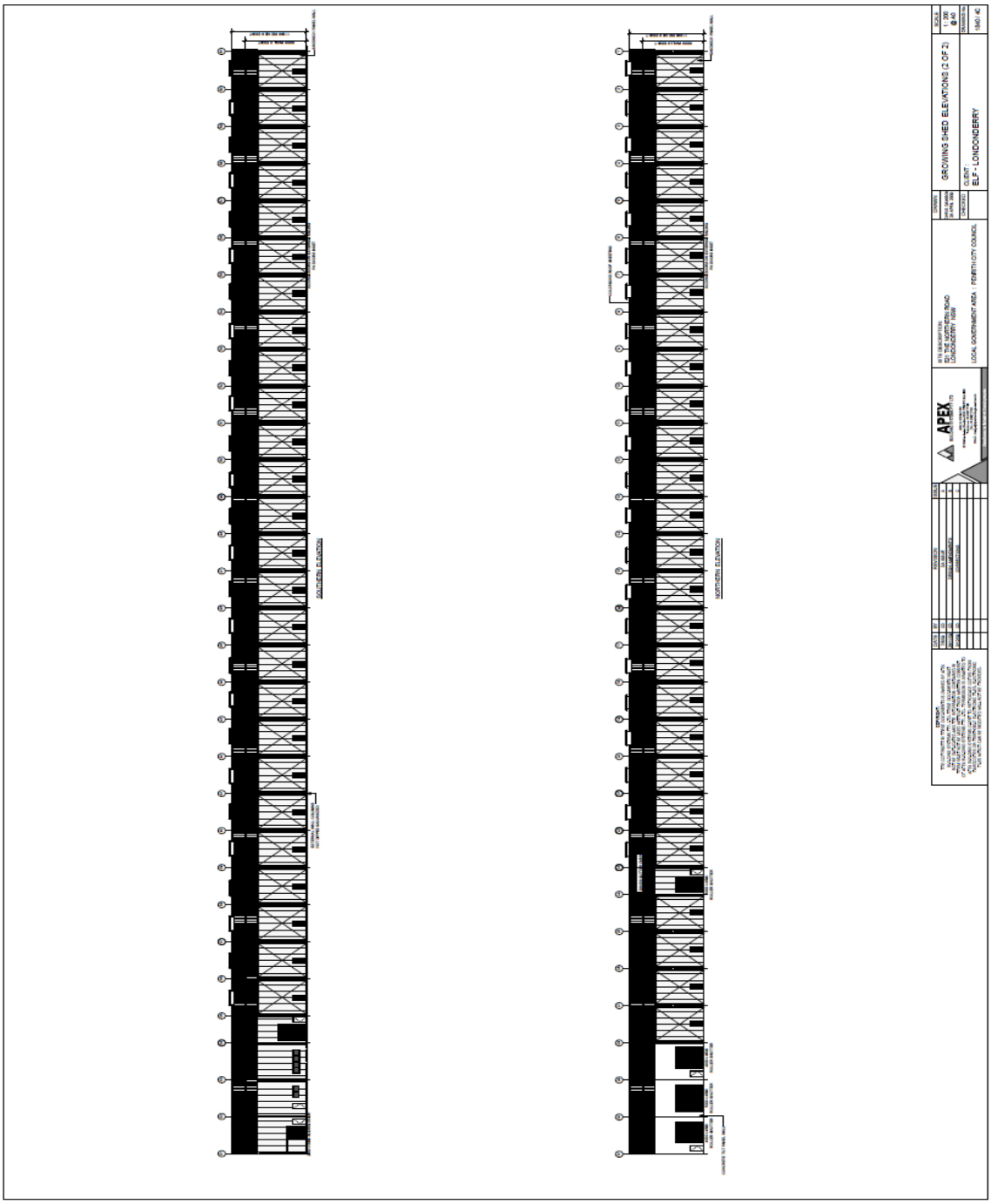
Development Plans

Mushroom Farm
521 The Northern Rd
Londonderry

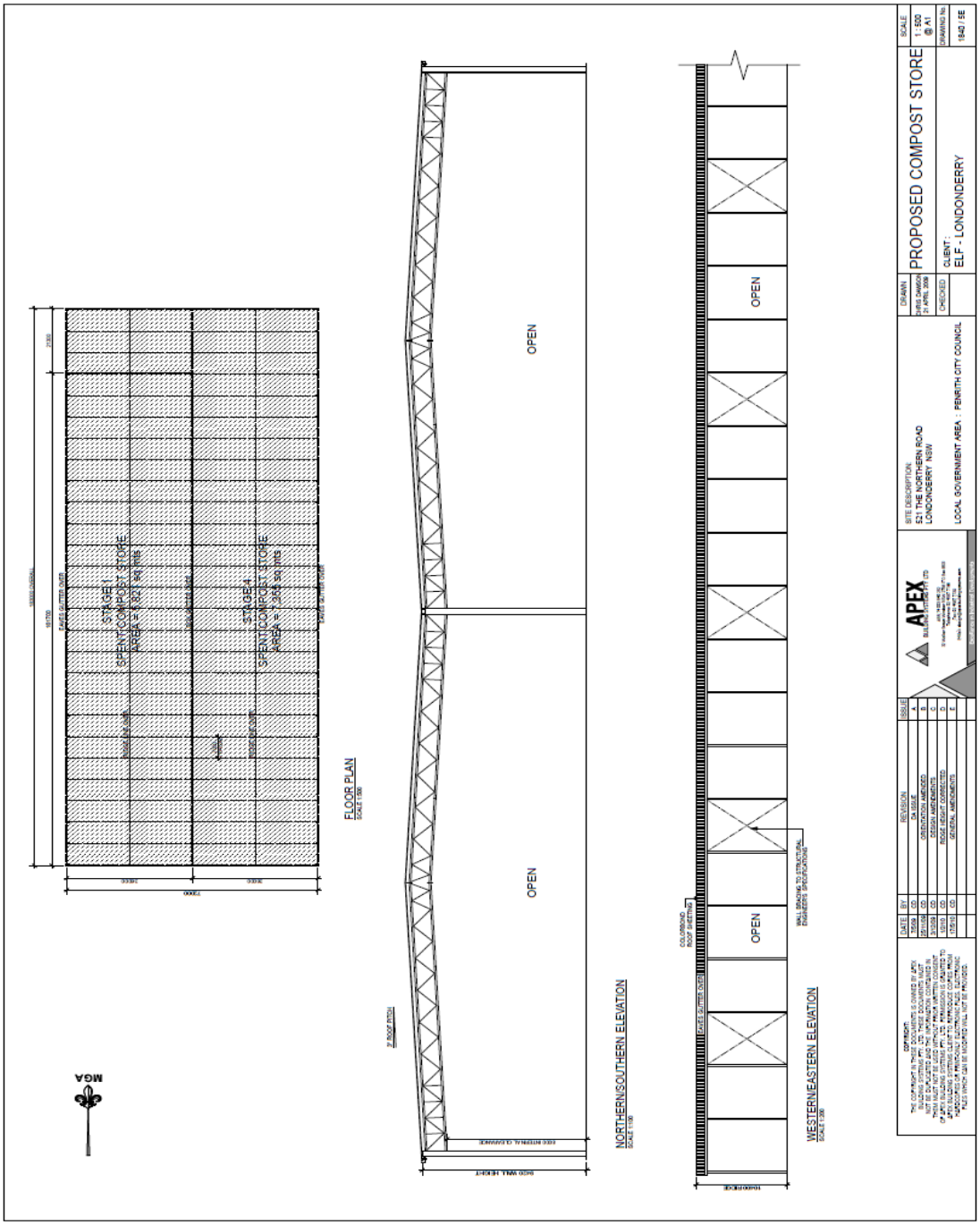
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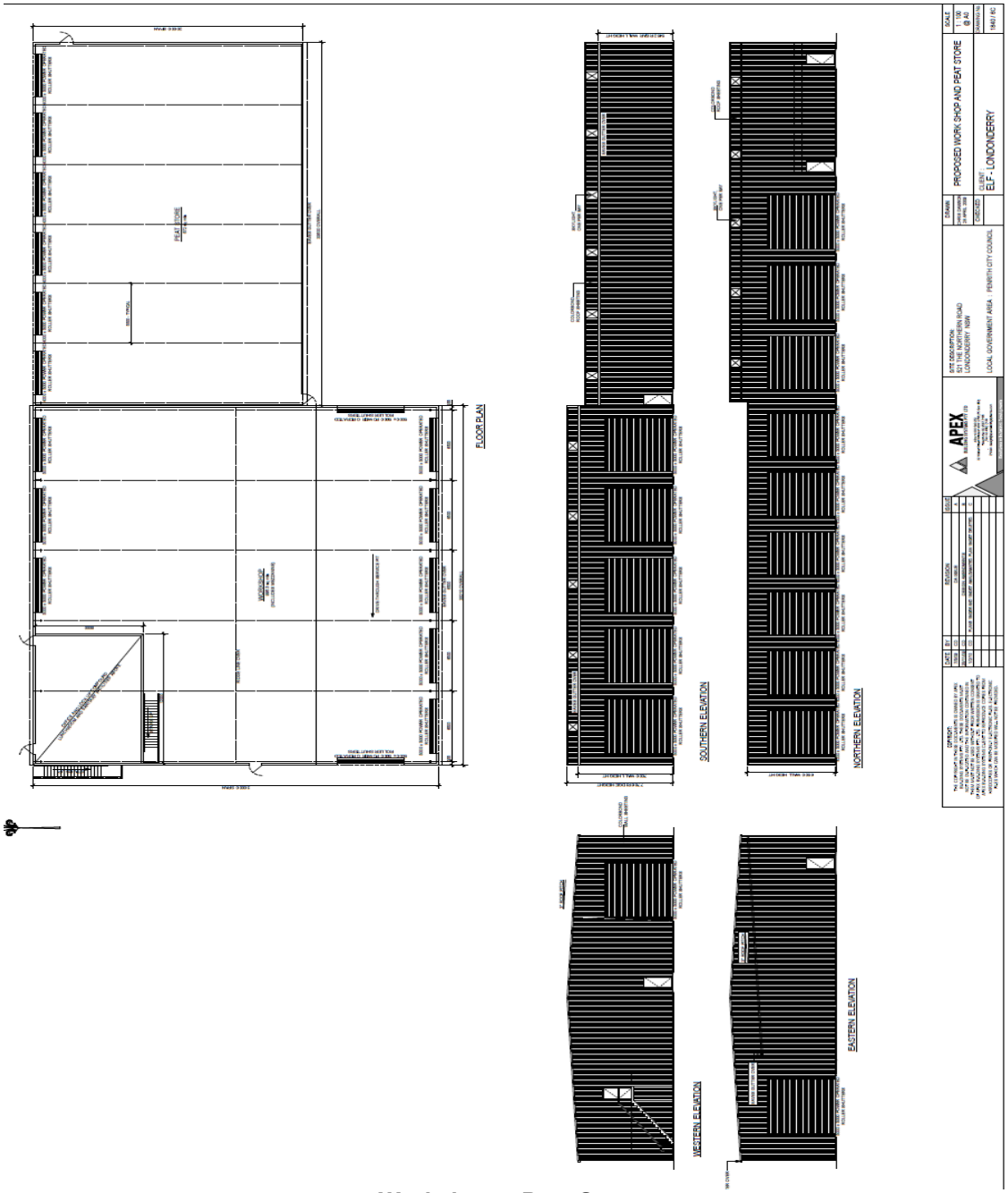
Proposed Site Plan



Elevations – Mushroom Growing Buildings



Spent Compost Store



Workshop – Peat Store

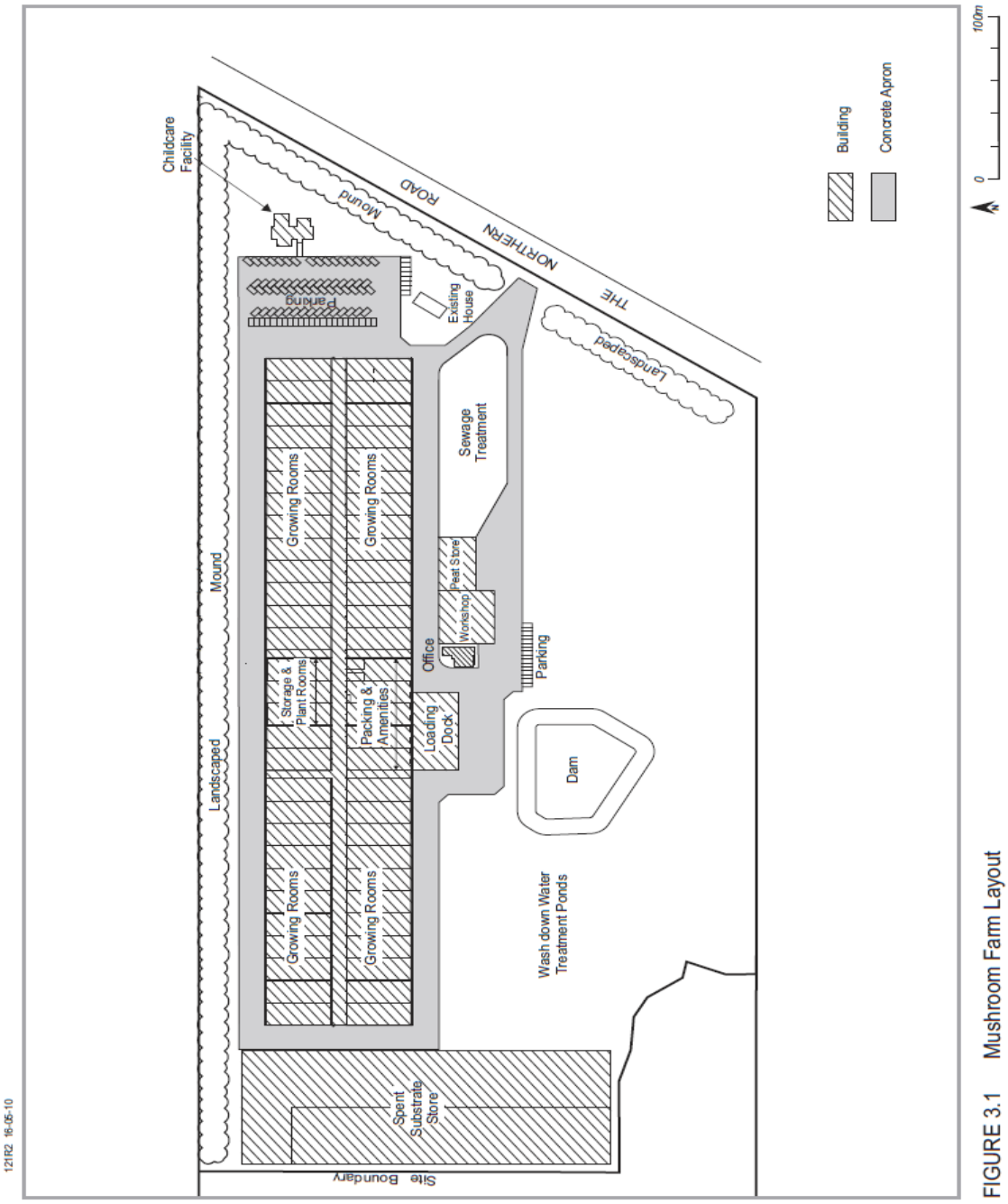


FIGURE 3.1 Mushroom Farm Layout

Site Layout Plan – Crèche at front of property shown

Appendix B

Bushfire Emergency Response Plan

Mushroom Farm
521 The Northern Rd
Londonderry

Emergency Bushfire Protection Strategies

It is recommended that the proposed Mushroom Farm and ancillary buildings develop an emergency bushfire protection procedure for a bushfire fire and how staff should react in accordance with their emergency plan.

Evacuation of a building during a bushfire event is not the same as a single evacuation of a building when the fire incident relates to within a particular premise.

Bushfire evacuation is a more involved procedure and requires forward planning to ensure the evacuees have a safe place to take refuge during the bushfire incident.

Bushfire Evacuation

Bushfire evacuation should include relevant information so as to ensure the occupants of a property that is directly threatened by a bushfire can safely move from the incident zone to a location that provides safe refuge until the emergency has passed.

The New South Wales Rural Fire Service has provided emergency evacuation criteria that a proposed plan should address including:

1. under what circumstances will the complex be evacuated.
2. where will all persons be evacuated to.
3. roles and responsibilities of persons co-ordinating the evacuation.
4. roles and responsibilities of persons remaining with the complex after evacuation.
5. a procedure to contact the NSW Rural Fire Service District Office / NSW Fire Brigade and inform them of the evacuation and where they will be evacuated to.

In accordance with generally accepted standards for emergency evacuation plans the following key points are considered for the preparation of Bushfire

Evacuation Plan for Mushroom Farm at 521 The Northern Road Londonderry, New South Wales.

Evacuation Planning Principles

The Queensland Fire and Rescue Service (2003), recommend that a fire related evacuation plan should include:

- How to report a fire, or other emergency.
- The evacuation procedures to ensure occupants can safely leave the area of danger, including escape routes and location of exit doors.
- The duties required of any staff required to assist with the evacuation.
- Procedures to account for occupants after evacuation, and the location of a safe assembly area.

Additionally, any evacuation plan should provide people with a suitable level of knowledge to ensure they can safely leave a dangerous area in an emergency, should the need arise. Also, all occupants need to know what they should do and how to respond in the event of fire occurring in the building (QLD Fire & Rescue Service 2003).

Planning for Bushfire Protection 2006 does not provide a standard guideline for the evacuation of a property or area that is being impacted upon by a bushfire emergency. Standards Australia has yet to develop an Australian Standard for bushfire emergency evacuation however an evacuation plan needs to address three (3) essential criteria;

- When to evacuate;
- How to evacuate; &
- Where to evacuate.

(Queensland Fire & Rescue Service 2003)

The proceeding bushfire evacuation plan for the Mushroom Farm complex will address these three criteria to ensure building occupants have an emergency evacuation procedure to follow during any critical incident bushfire event.

Preamble

This evacuation plan is to be used in conjunction with any future bushfire evacuation requirements specified by Standards Australia or any other statutory agency (e.g. New South Wales Rural Fire Service).

The proposed evacuation plan also adopts the principles of the New South Wales Rural Fire Service "Fast Fact 07/08" and the principles of AS 3475 – 2002 "Emergency control organization and procedures for buildings, structures and workplaces".

The incorporation of an emergency procedure for a bushfire incident can therefore be integrated into the existing evacuation plans for the proposed Mushroom Farm.

Evacuation Plan

Part 1 – When to Evacuate.

New South Wales Rural Fire Service provides regular fire weather and emergency community warnings during times of critical fire situations. Bushfire threats to property can occur quickly and may occur before the relevant authority has an opportunity to issue community warnings of the bushfire danger to property.

Management of community evacuation is vested with the New South Police Service, with orders to evacuate a property issued through Police visiting individual properties to warn occupants of the impending danger and to leave premises and proceed to a predetermined safe refuge.

Residents can monitor bushfire progress and potential dangers to property through various means including regular monitoring of a nominated public radio station, Rural Fire Service web based updates and through public awareness visits by the New South Wales State Emergency Service.

The decision to evacuate the property needs to be based on reliable, timely and up to date information about the behaviour of the fire that threatens the subject property.

The decision to evacuate occupants of the Mushroom Farm should therefore be based on:

a. Warnings or directives issued by NSW Police to residents that an evacuation of an area is required due to an approaching bushfire;

b. Pre-emptive advice issued by the NSW Police, SES or Rural Fire Service that residents should prepare for an evacuation of a property due to expected adverse conditions that may place a property in direct danger to an approaching bushfire.

An evacuation route should be predetermined to enable to the safe egress of the site to the nominated evacuation point. The New South Wales Rural Fire Service recommended ***nominated safe refuge point*** identified for Londonderry is to evacuate to Carrington Park, Londonderry.

Part 2 – Emergency Bushfire Plan

The current New South Wales Rural Fire Service has a bushfire threat warning advice system that involves six warning levels of bushfire danger.

The bushfire warning levels that are of importance for the Mushroom Farm staff to monitor are the Extreme and Catastrophic warning categories as these two warning levels provide advice that residents should be prepared to leave their properties if a bushfire event should occur in proximity to their property.

In situations where the Mushroom Farm were to open during these warning periods, it is recommended that the Farm manager liaise with the local Rural Fire Service Office to ascertain the local bushfire threat levels to determine whether the Mushroom Farm should operate for the day.

During a "Catastrophic" bushfire warning advice, it is recommended that the Mushroom Farm **not open** and staff remain at home until the bushfire warning has decreased and the Farm reopens.

It is standard procedure that bushfire warnings are issued twenty four hours in advance and, acting on this standard protocol, the Farm Manager can decide to close the Mushroom Farm with at least a day's notice in advance. This early warning will then advise staff not attend the premises during the catastrophic bushfire warning period.

Part 3 – Mushroom Farm Bushfire Protection – Extreme to Catastrophic Bushfire Warning Periods

In order to protect Mushroom Farm staff during extreme and catastrophic bushfire warning periods and in particular the latter, it is suggested that the Mushroom Farm organise a team of trained staff who are able to attend the Farm to provide intervention to suppress ember attack should a bushfire impact the building.

It is suggested that bushfire protection team wear suitable clothing to protect against radiant heat and smoke and the team be capable of operating the static water supply pump and bushfire hose reel system.

Vigilance in and around the building's curtlidge areas, external landscaping and roof areas are critical points to monitor during any bushfire ember attack.

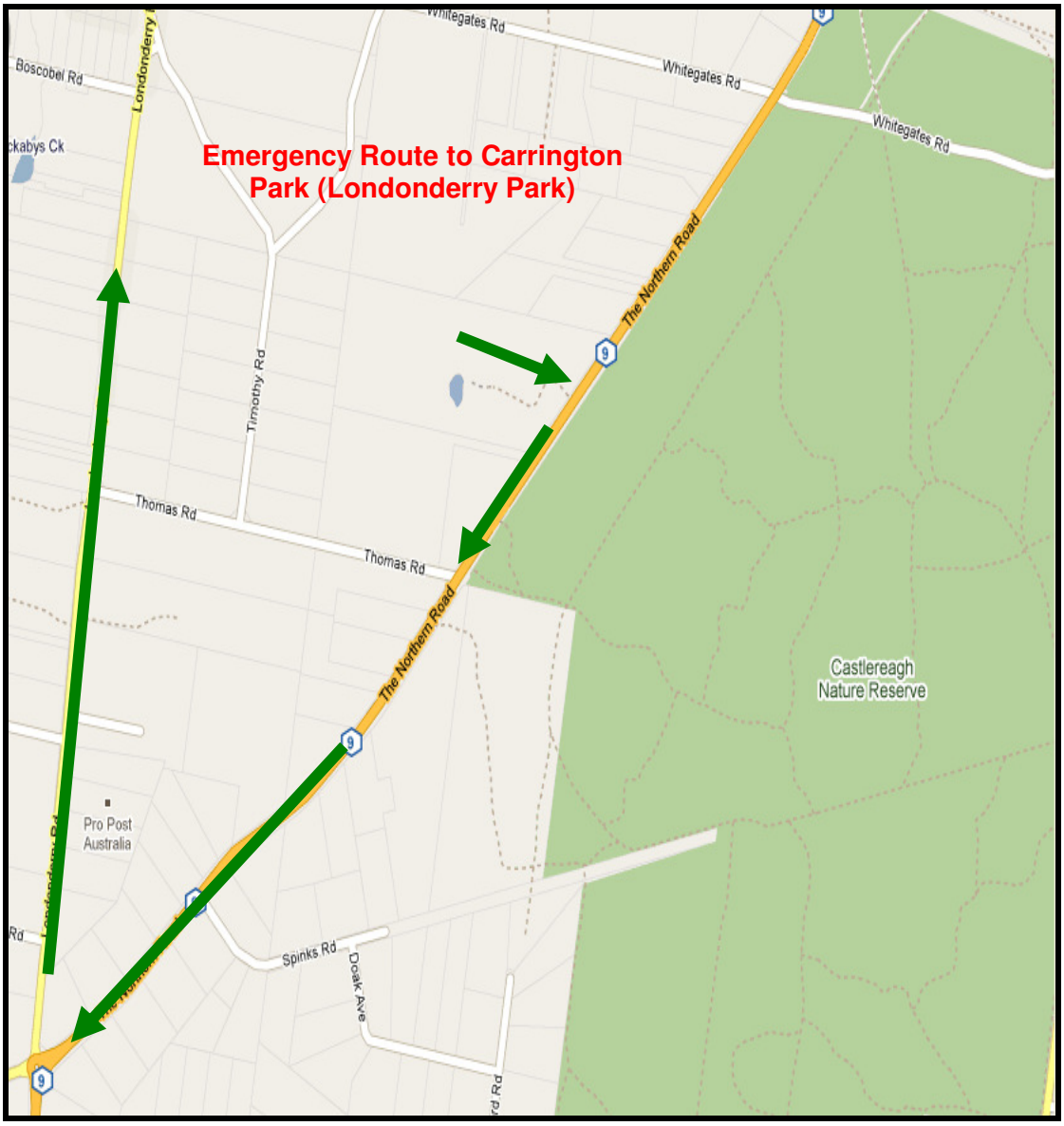
All windows and doors should remain closed during the impact phase to ensure embers do not penetrate the building internal spaces.

- **Bushfire Emergency Plan Summary**

The monitoring of bushfire warning advice by the Farm manager on a daily basis during severe to catastrophic bushfire threats provides the trigger to close the Farm in order to negate the need to evacuate staff from the Farm should that direction be given.

The monitoring of the Farm's buildings by a team of trained staff during a bushfire event close by the Farm will assist in protecting the building and outside equipment from being damaged due to ember attack.

Should a bushfire impact the area un-expectantly, it is recommended that, in the absence of any warning to the contrary, that evacuation of patrons is not undertaken and the Mushroom Farm is shut down with all occupants remaining within the building until the danger passes.


Emergency Route to Carrington Park (Londonderry Park)
Whitegates Rd
Whitegates Rd
Whitegates Rd
Boscobel Rd
Londonderry
The Northern Road
Timothy Rd
Thomas Rd
Thomas Rd
The Northern Road
Castlereagh Nature Reserve
Pro Post Australia
Spinks Rd
Doak Ave
9

Appendix C

APZ Plan

Mushroom Farm
521 The Northern Rd
Londonderry

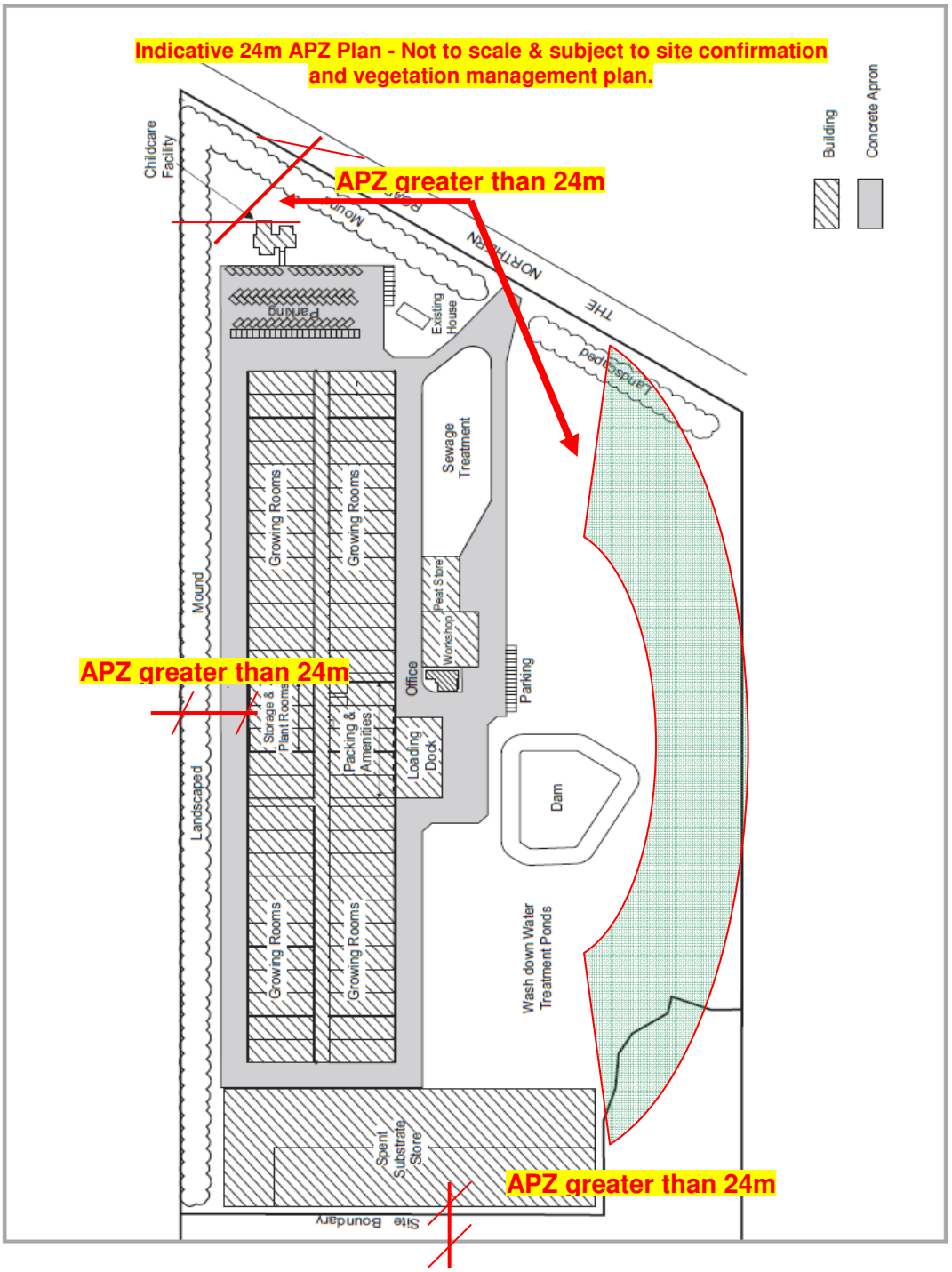


FIGURE 3.1 Mushroom Farm Layout

Appendix D

Summary of Recommendations

Mushroom Farm 521 The Northern Rd Londonderry

Summary of Recommendations

1. Defendable space of approximately 10m to the west, north and south of each building (including the 3m hardstand area);

2. Static water supply to be provided to supplement the reticulated water supply.

3. External Wall Cladding Mushroom Growing Building – non combustible external cladding;

4. External ember protection for the Spent Compost Store – either external wall cladding along the northern, western and eastern elevations or drencher protection for the open areas to keep any combustible material damp during a bushfire event.

5. Steel roof cladding; and,

6. Concrete floors;

7. Secure, non combustible flashing at roof intersections, with no gaps at roof cladding intersections;

8. Non combustible external guttering and downpipes (where provided);

9. Steel mesh screens to be fitted to all windows and doors capable of being opened along the northern and western elevations;

10. The open areas surrounding each building being maintained as an inner protection area (including the 3m hardstand area). This would include the aspects to the west, north and east of each building.

11. An asset protection zone to be established for at least 24m to north, east and western aspects, the undergrowth is managed so as to not exceed 5t/ha of bushfire prone vegetation. Note, existing tree stands do not require removal, though branches within 5m of any proposed building should be trimmed so as to not overhang the building and maintained as part of the management of the 24m asset protection zone.

12. The provision of a reticulated water supply system that is capable of providing emergency water supply for any bushfire protection activities. The reticulated water supply is to comply with the requirements of section 4.1.3 and the acceptable solutions as prescribed for reticulated water supplies requiring the provision of a fire hydrant system that complies with AS 2419.1 – 2005.

13. The provision of a fire hose capable of reaching all elevations of each building. Note, the fire hose should be a rubber hose of approximately minimum 18mm diameter and located away from the northern and western elevations.

14. Vehicle access to the proposed development is to comply with section 4.1.3 of the PBP 2006, together with general Fire Brigade access being provided along the western aspect to enable maintenance and management of the northern and western aspect asset protection zones.

15. Adoption of an Emergency Bushfire Protection Plan.

References

AS 3959 (Construction of Buildings in Bushfire Prone Areas) - 2009.

International Fire Engineering Guidelines - 2005

NSW Rural Fire Service – Guidelines for Asset Protection Zones (June 2003).

Planning for Bushfire Protection 2001 & 2006 – New South Wales Rural Fire Service.

Appendix M

TRAFFIC ASSESSMENT

Mushroom Farm and Substrate Plant

Traffic Assessment

17 June 2010

Prepared for

Perram & Partners on behalf of Tolson Group

Halcrow MWT

Mushroom Farm and Substrate Plant
Traffic Assessment

Prepared for
Perram & Partners on behalf of Tolson Group

This report has been issued and amended as follows:

Rev	Description	Date	Prepared by	Approved by
V02	Draft for Client review	13 August 2009	ML	JR
V03	Revised Draft for Client review	21 September 2009	ML	JR
V04	Revised Draft for Client review	24 November 2009	ML	JR
V05	Final Draft	22 December 2009	ML	JR
V06	Final for Submission	17 June 2010	ML	JR

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Halcrow MWT has prepared this report in accordance with the instructions of Perram & Partners on behalf of Tolson Group for their sole and specific use. Any other persons who use any information contained herein do so at their own risk.

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Appendix A Estimated Proposed Development Traffic Generation A.1

Appendix B Auxiliary Lanes B.1

1 Introduction

This traffic assessment has been prepared for Perram & Partners on behalf of the Tolson Group for a proposed mushroom farm at Londonderry and an expansion of an existing substrate plant at Mulgrave.

The Department of Planning (DoP) has advised that the proposed development will be considered under the planning provisions for a major project assessed under Part 3A of the Environmental Planning and Assessment Act. As such, this traffic assessment will accompany the Project Application to the DoP.

This report examines the traffic and parking related implications of the proposed development and has taken into consideration the Director General's Requirements. In particular the assessment has been prepared with regard to:

- RTA's *Guide to Traffic Generating Developments* (2002)*;*
- RTA *Road Design Guide; and*
- relevant Penrith City Council and Hawkesbury Council DCP's.

This report is set out as follows:

- Chapter 2 discusses the existing background conditions of the site;
- Chapter 3 provides an overview of the proposed development;
- Chapter 4 assesses the traffic and parking implications of the proposed development; and
- Chapter 5 presents the conclusions of the investigation.

2 Existing Background Conditions

2.1 Site Location

The location of the proposed Londonderry Mushroom Farm and the existing Mulgrave Substrate Plant sites are shown in Figure 1.

The Londonderry site is located at 521 The Northern Road, Londonderry within the local government area of Penrith. The site's legal description is Lot 138 of DP752037. The site has about 250m frontage to The Northern Road and is accessed from The Northern Road.

The site is set within a rural environment, and at present is used for agriculture purposes. To the immediate south of the site, is a motor vehicle wrecking yard, and to the east across The Northern Road is the Castlereagh Nature Reserve. Rural land adjoins the site to the north, west and south.

The Mulgrave site is located at Mulgrave Road, near Mulgrave Railway Station and is within the local government area of Hawkesbury. The site is part of Lot 13 of DP1138749 and whole of Lot 14 DP1138749.

The site has frontages to Mulgrave Road and is accessed directly from Mulgrave Road.

The site is located within a rural setting with some residential dwellings located south of the railway station and the railway line. Land surrounding the site is generally used for agricultural purposes. Located nearby is also the industrial area which is generally to the north east of the site.

2.2 Road Network

Below is a description of the road network in the general vicinity of the two sites.

The Londonderry site is accessed from The Northern Road. The Northern Road is a RTA State road and is part of Sydney's MetRoute No.9 linking Narellan in the south to Windsor in the north. In the vicinity of the site, it is constructed as a rural road with one traffic lane and a sealed shoulder on either side. It does not have kerb and gutter

provided. Generally, on-street parking is prohibited at all times. The Northern Road has a posted speed limit of 80km/hr.

The Mulgrave site is accessed from Mulgrave Road. Mulgrave Road is a two-lane, two-way local road providing access to properties abutting it and is maintained by Hawkesbury City Council. The speed limit on Mulgrave Rd is 60km/hr. It terminates at the southern end near Groves Avenue and connects into Windsor Road as a signalised T-intersection at its northern end. To the immediate south of the site, there is a signalised level crossing on Mulgrave Road.

To the north of the Mulgrave site is the recently completed Hawkesbury Valley Way. It was constructed to provide a flood evacuation route for the area of Windsor, and as such it is elevated above natural ground level. It has one traffic lane in each direction and posted speed limit of 70km/hr. It is connected into Mulgrave Road by way of a separate link/ramp approximately 150m north of Railway Road North. This link forms priority controlled T-junctions with Hawkesbury Valley Way and Mulgrave Road.

2.3 Traffic Flows

Traffic flows in the vicinity of the site were obtained from the RTA, as well as classified counts conducted as part of this study. These are discussed below.

2.3.1 Annual Average Daily Traffic (AADT)

Annual average daily traffic was obtained for The Northern Road, east of Londonderry Road near the Londonderry site. This data is presented in **Table 2.1**.

Table 2.1 Annual Average Daily Traffic Flows (AADT)

Year	Recorded AADT	Estimated Future AADT
1989	7,236	-
1991	8,342	-
1993	9,067	-
1996	8,975	-
1999	10,821	-
2002	11,255	-
2005	10,649	-
Growth 1989 - 2005	*2.4% pa*	
2009		*11,727*
2019†		*14,924*

Source: RTA (www.rta.nsw.gov.au)

† denotes estimated future flows extrapolated from historical flows (2.4% pa).

It is noted that the trend between the last two AADT recordings (2002 and 2005) was a negative growth value. The recent decline in traffic flows along The Northern Road may be the result of regional network changes.

Classified traffic surveys undertaken by Halcrow MWT as part of this traffic assessment indicated that the Northern Road was carrying some 9,222 vehicles per day in 2009 (see Section 2.3.2 below).

This would suggest a continuation of the trend for decreasing traffic flows along the Northern Road at the proposed Londonderry site.

Figure 2 shows a graph of the data and projected flows for 2009 and 2019 using a linear regression for long term (+2.4% pa) versus the short term growth (-2.8% pa). Long term is calculated between 1989 and 2005 while short term is calculated between 2002 and 2009 (surveyed flows).

Figure 2 – The Northern Road Annual Average Daily Traffic (AADT) Flows

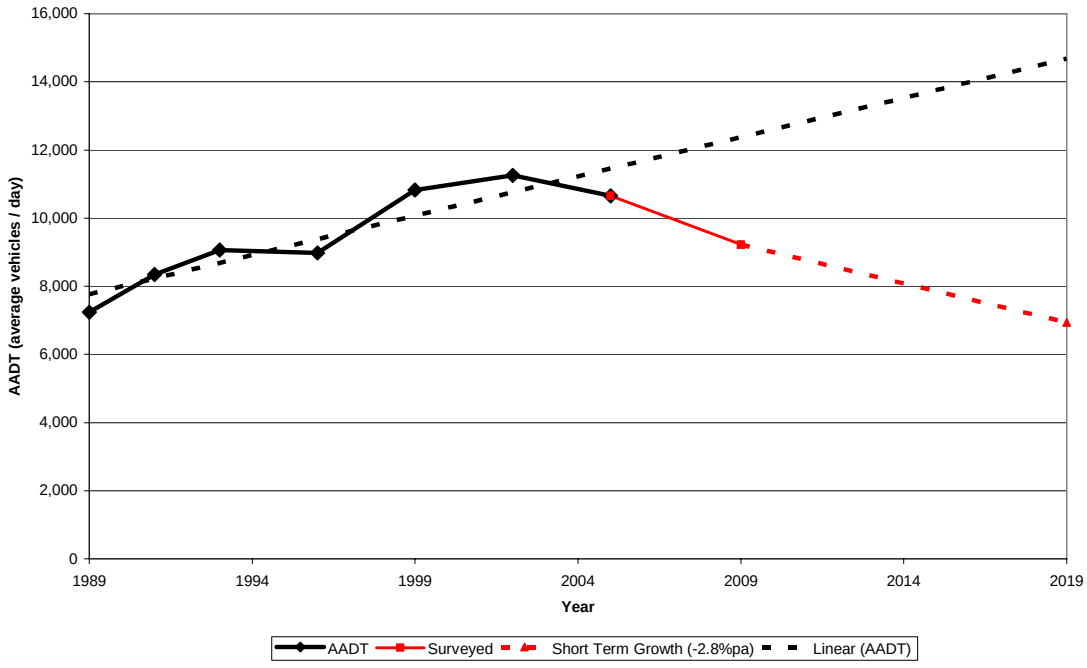


Figure 2 indicates that the continuation of historical traffic growth along the Northern Road is unlikely to occur within the short term time horizon.

2.3.2 Classified Counts

As part of this study, automatic classified counts were conducted at the following three locations:

- The Northern Road, adjacent to subject site (approximately 2.2km from Londonderry Road);
- Mulgrave Road, Mulgrave between Railway Road North and Curtis Road; and
- Hawkesbury Valley Way, approximately 150m north of Mulgrave Road.

These surveys were conducted over a seven day period starting from 13 May 2009 to 19 May 2009. The results from the classified counts are summarised in **Table 2.2**.

Table 2.2 Classified Traffic Count Summary

	The Northern Rd			Mulgrave Rd			Hawkesbury Valley Way		
	NB	**SB**	**2Way**	**NB**	**SB**	**2Way**	**NB**	**SB**	**2Way**
Morning Peak Hour (8-9am)									
- Total Flows	396	427	823	63	149	212	544	916	1,461
- Heavy Veh. Flows	66	37	103	11	17	28	39	132	171
- Percent HV	17%	9%	13%	17%	12%	13%	7%	14%	12%
Evening Peak Hour (3-4pm)									
- Total Flows	395	428	823	109	90	199	976	790	1,767
- - Heavy Veh. Flows	59	35	94	8	10	18	54	103	157
- Percent HV	15%	8%	11%	8%	11%	9%	6%	13%	9%
Daily									
- Total Flows	4,808	4,813	9,621	1,171	1,344	2,516	9,318	9,741	19,059
- Heavy Veh. Flows	668	470	1,137	141	171	312	612	1,506	2,117
- Percent HV	14%	10%	12%	12%	13%	12%	7%	15%	11%

The surveyed peak hour two-way flow on The Northern Road was approximately 800 vehicles per hour (vph) with a peak heavy vehicle flow of approximately 13 per cent, and a daily weekday flow of 9,600 vpd with a corresponding heavy vehicle flow of approximately 12 per cent.

It is noted that the surveyed average daily flow (7 day average) of 9,222 vpd is lower than the 2005 AADT volume of 10,649 vpd. This suggests a continuing negative growth trend since 2002.

Mulgrave Road was surveyed to have a peak hour flow of approximately 200 vph and a daily flow of 2,500 vpd. The per cent of heavy vehicle flows was approximately 12 per cent.

The morning peak hour on Hawkesbury Valley Way was 1,500 vph with the proportion of heavy vehicle flow being approximately 12 per cent. The evening peak hour was approximately 1,800 vph and a heavy vehicle flow percentage of nine per cent. The daily flow was approximately 19,000 vpd with a heavy flow percentage of 11 per cent.

3 The Proposed Development

3.1 Proposed Mushroom Farm (Londonderry)

The Tolson Group operates an existing mushroom farm at their Vineyard site. The Vineyard site has been operating at full production level for the last three years, producing an average of 60 tonnes of mushrooms per week (tpw). There is no scope to expand the facility at Vineyard for a number of reasons including incompatible land use of the site with anticipated future surrounding residential developments.

It is proposed to develop a new mushroom farm at the Londonderry site in five stages. The latter stages of the proposed development would see the progressive relocation of the Vineyard operation to the Londonderry site.

Table 3.1 provides a summary of the five stages of the proposed development with regard to production capacity and number of staff.

Table 3.1 Londonderry Site Proposed Development Stages

Stage of Development	Year	No. of Growing Rooms	Production Capacity	Total Staff Number	Staff per Day†
Stage 1	2010	20	85 tpw	115	77
Stage 2	2015§	24	110 tpw	130	87
Stage 3	2020§	28	140 tpw	155	103
Stage 4	2025§	40	165 tpw	165	110
Stage 5	2030§	50	220 tpw	165	110

Notes: tpw – tonnes per week

§ timing of Stages 2 - 5 will depend on market conditions

† employees generally work 4 day on 2 day off roster, therefore the number of employees on any given work day is approximately two thirds of the total staff

As the latter stages are completed, the remaining employees from the Vineyard site would progressively be relocated to the Londonderry site, with the full closure of the Vineyard site anticipated in Stage 4. White Prince, the marketing and distribution

division of the Tolson Group, currently based at Vineyard would be relocated to the Londonderry site in Stage 2.

In addition, it is proposed to provide a child care centre for employees after completion of Stage 1, if sufficient a demand exists. This is not expected to generate substantial additional traffic and parking demand.

3.2 Substrate Plant Proposed Expansion (Mulgrave)

The Tolson Group operates an existing substrate plant at Mulgrave, which is currently producing about 1,000 tpw of Phase 1 substrate.

However, due to efficiencies achieved in the production process, the Mulgrave facility can produce up to 1,600 tpw of Phase 1 substrate materials without any significant physical upgrade of the existing facility.

It is proposed to expand the production output at the Mulgrave site to supply the proposed development at Londonderry as well as meeting growing market demands for substrate materials elsewhere. It is proposed to be developed in three stages. This is summarised in **Table 3.2**.

Table 3.2 Mulgrave Site Proposed Development Stages

Stage of Development	Year	Production Capacity	Staff Number
Existing	-	1,000 tpw	20
Stage 1	2010	1,600 tpw	22
Stage 2	2015§	2,400 tpw	26
Stage 3	2020§	3,200 tpw	28

Notes: tpw – tonnes per week

§ timing of Stages 2 and 3 will depend on market conditions

3.3 Vehicle Movements

The Londonderry site would operate 24 hours a day. The Mulgrave Substrate Plant which currently operates 24 hours per day would continue to operate 24 hours per day. The majority of staff would work a normal eight-hour daytime shift.

Deliveries to the Londonderry site would occur throughout the day. At full production levels (ie. Stage 5) up to 6 loads of fresh Phase 3 substrate would generally be delivered on each of four mornings per week, commencing during the pre dawn period. The spent substrate would be picked up during daylight hours approximately 8 to 12 times a week.

The picked mushrooms would be dispatched partly during evening / early morning between the hours of 6:00pm to 4:00am. There would be 2 shipments per evening and 2 during the day. In addition, there would be 2 deliveries of cardboard boxes and 5-6 deliveries of peat casing material per week during daytime hours from 6:00am to 6:00pm.

At the existing Mulgrave site, the majority of staff arrive from 5:00am onwards and leave by about 2:00pm. Between these hours, staff are occasionally coming and going to and from the site. Trucks delivering straw and other materials to the substrate plant would generally arrive between the hours of 2:00am and 9:00pm. As the plant production is increased in Stage 3, deliveries by trucks would continue to occur 24 hours per day, but concentrated between the hours of 2:00am and 9:00pm.

For efficiency reasons, the preference is for the deliveries to be made using 19.0m semi-trailers and / or B-Double vehicles. It is noted that both B-doubles and semi trailers are currently used to make deliveries to the site.

B-Double vehicles currently access the Mulgrave site via the approved B-Double routes along the Great Western Highway and Bells Line of Road.

Both Mulgrave Road at the Mulgrave site and the Northern Road at the Londonderry site are approved B-Double routes and thus could accommodate B-Double vehicles under existing road network conditions.

At full development (Stage 5), the Londonderry site would generate approximately 34 truck movements per day (17 in and 17 out) and approximately 128 car movements per day (64 in and 64 out).

For the Mulgrave site, it would be approximately 100 truck movements per day (50 in and 50 out) and 72 car movements per day (36 in and 36 out).

3.4 On-site Parking Provision

Development Control Plans from Penrith City and Hawkesbury Councils do not have specific requirement for on-site parking for mushroom farms, substrate plants or similar land use type.

In such a case, on-site parking provision is to be provided based on anticipated site specific demands with consideration of the number of employees.

For a factory use, the Penrith DCP stipulated a parking rate of one space per two employees. This rate is considered to be appropriate to apply to both the Londonderry and Mulgrave sites.

On this basis, at full development the Londonderry site would require approximately 55 spaces while the Mulgrave site would require approximately 14 spaces.

All site generated parking demand is to be accommodated on site. The parking area is to comply with the design requirements of the relevant DCPs and the Australian Standard (AS2890.1-2004) for car parking.

3.5 Site Access Arrangements

3.5.1 Londonderry Site

At present, the access road into the Londonderry site is in the form of a dirt track and such as it does not form a fully developed intersection with The Northern Road.

A fully developed access road is proposed as part of this development in the general vicinity of the existing dirt track. The new access road would be sealed and a formalised intersection developed at The Northern Road.

The design requirements for this intersection are discussed in Section 4 of this report.

3.5.2 Mulgrave Site

The existing intersection formed by the site access to the Mulgrave site with Mulgrave Road is configured as a basic intersection where turning traffic shares the same lane.

In the future, the additional traffic would not warrant an upgrade of the site intersection or for it to be re-configured differently.

3.5.3 Internal Dock Arrangement

The internal dock layouts at both the sites shall be designed to comply with the Australian Standard for car parking *AS2890.2:2002 – Off-Street Commercial Vehicle Facilities*.

4 Traffic Assessment

4.1 Traffic Generation

The Tolson Group has undertaken an analysis of their existing usage and operation, with consideration of their future staffing requirements at the Londonderry and Mulgrave sites.

Estimates of future traffic movements at the Londonderry and Mulgrave sites are summarised in Appendix A.

Peak traffic generation of the sites will occur at the start and end of staff shift times. The proposed shift start and end times would occur outside of the general commuter traffic peaks along the surrounding road network.

The following assessment of traffic generation impacts has considered the implications of site generated traffic during both the commuter peak and site peak periods.

At the Londonderry site the peak traffic generation is expected to be approximately 38 vehicle movements per hour in Stage 1 and increasing to approximately 54 vehicle movements per hour in Stage 5.

Similarly, the Mulgrave site is expected to generate about 17 vehicle movements per hour in Stage 1 and increasing to approximately 21 vehicle movements per hour in Stage 3.

4.2 Background Traffic Growth

As indicated previously, using RTA's historical data traffic on The Northern Road, it is predicted traffic would increase at an annual rate of about 2.3 per cent, or 23 per cent over a 10 year planning horizon.

However it is noted that the period between 2002 and 2009 indicates that The Northern Road is experiencing a negative growth rate (ie. decreasing average daily flows).

As a conservative assessment site generated traffic flows have been assessed against existing (surveyed 2009) flows and a 2.4 per cent growth to 2019.

From Windsor Flood Evacuation Route Environmental Impact Statement (Connell Wagner 2002) prepared for the RTA, it is estimated that the peak hour traffic on Mulgrave Road is expected to increase at a rate of about 1.7 per cent per annum between 2006 and 2016.

In the same study, the Hawkesbury Valley Way growth rate was estimated to be about one per cent per annum.

Over a 10 year planning horizon, these are equivalent to 17 per cent and 10 per cent growth rates for Mulgrave Road and Hawkesbury Valley Way respectively.

The higher growth rate for the Hawkesbury Valley Way compared with Mulgrave Road reflects its role within the road network including a bypass of the Windsor township. For the purpose of assessing the proposed development within the context of planned future development for the surrounding area, the use of the traffic growth rates from the Windsor Flood Evacuation Route EIS is considered appropriate.

Thus the above growth factors have been applied to the surveyed traffic in the assessment of the traffic impacts due to the proposed developments.

4.3 Traffic Distribution

4.3.1 General Routes

At the Londonderry site, the future development traffic is expected to be distributed 50 per cent to the north and 50 per cent to the south.

At the Mulgrave site vehicles currently access the site using:

- Hawkesbury Valley Way via Mulgrave Road;
- Windsor Road via Curtis Road / Mulgrave Road; and
- Railway Road South via the Mulgrave Road railway level crossing.

Thus all traffic to/from the substrate plant at Mulgrave would access the site using Mulgrave Road.

The existing distribution of traffic is expected to continue with the proposed development. However the volume of traffic using Railway Street south will decrease once the operations at the existing Vineyard site are relocated to Londonderry.

4.3.2 B-Double Routes

The Northern Road near the Londonderry site, and Windsor Road and Mulgrave Road near the Mulgrave site are RTA approved B-Double routes and as such these could be used by B-Double vehicles to access the regional road network.

4.4 Road Capacity Analysis

Table 4.1 summaries the peak hour directional flows on the roads near the sites for the general commuter peak periods, while **Table 4.2** presents the peak hour directional flows during the site activity peak periods.

Table 4.1 – Peak Hour Mid Block Flows (Commuter Peak Period)

Road Locations	Existing	Stage 1 2010§	Stage 2 2015§	Stage 3 2020§	Stage 4 2025§	Stage 5 2030§
Morning Period						
The Northern Rd (North of Londonderry Rd)						
- Northbound	396	406	454	501	549	597
- Southbound	427	438	489	540	592	643
- Two-way	823	844	943	1,041	1,141	1,240
Mulgrave Rd (At Railway Underpass)						
- Northbound	63	67	73	79	-	-
- Southbound	149	155	167	181	-	-
- Two-way	212	222	240	260	-	-
Hawkesbury Valley Wy (North of Curtis Rd)						
- Northbound	544	555	601	648	-	-
- Southbound	916	933	1,011	1,089	-	-
- Two-way	1,460	1,488	1,612	1,737	-	-
Evening Period						
The Northern Rd (North of Londonderry Rd)						
- Northbound	395	405	452	500	548	595
- Southbound	428	439	490	542	593	645
- Two-way	823	843	942	1,042	1,141	1,240
Mulgrave Rd (At Railway Underpass)						
- Northbound	109	113	123	132	-	-
- Southbound	90	93	101	109	-	-
- Two-way	199	205	223	241	-	-
Hawkesbury Valley Wy (North of Curtis Rd)						
- Northbound	976	995	1,078	1,162	-	-
- Southbound	790	804	871	939	-	-
- Two-way	1,766	1,799	1,950	2,100	-	-

§ timing of Stages 2 - 5 will depend on market conditions

During the commuter peak periods, the traffic growth experienced on each of the roads shown in Table 4.1 is principally due background traffic growth rather than with the proposed development (Stage 5) traffic generation.

Table 4.2 – Peak Hour Mid Block Flows (Site Activity Peak Period)

Road Locations	Stage 1 2010§	Stage 2 2015§	Stage 3 2020§	Stage 4 2025§	Stage 5 2030§	Stage 1 2010§
Morning Period						
The Northern Rd (North of Londonderry Rd)						
- Northbound	348	374	418	463	507	548
- Southbound	211	216	241	267	292	317
- Two-way	559	590	659	730	799	866
Mulgrave Rd (At Railway Underpass)						
- Northbound	17	19	21	23	-	-
- Southbound	55	71	79	85	-	-
- Two-way	72	90	100	108	-	-
Hawkesbury Valley Wy (North of Curtis Rd)						
- Northbound	129	132	143	155	-	-
- Southbound	400	414	450	485	-	-
- Two-way	529	546	593	639	-	-
Evening Period						
The Northern Rd (North of Londonderry Rd)						
- Northbound	375	384	429	474	519	564
- Southbound	414	442	495	549	600	650
- Two-way	789	826	924	1,023	1,119	1,214
Mulgrave Rd (At Railway Underpass)						
- Northbound	96	112	121	131	-	-
- Southbound	85	89	97	105	-	-
- Two-way	181	201	218	236	-	-
Hawkesbury Valley Wy (North of Curtis Rd)						
- Northbound	664	682	740	797	-	-
- Southbound	603	615	666	718	-	-
- Two-way	1,267	1,297	1,406	1,514	-	-

§ timing of Stages 2 - 5 will depend on market conditions

During the proposed development activity peak period under full development, the additional traffic flows would be in the order of 425 vph on The Northern Road and between 36-55 vph on Mulgrave Road. On Hawkesbury Valley Way the two way flows would increase by approximately 250 vph. The additional traffic due to the proposed development would be approximately 30 vph or less at all three locations, the balance due to the increases in the background traffic.

The traffic flows estimated in **Table 4.1** and **Table 4.2** have been compared with "Level of Service" criteria for road capacity in **Table 4.3**.

Table 4.3 – Peak Hour Flows and Level of Service

Level of Service	Urban Roads (vph)	Rural Roads
A	200	-
B	380	270
C	600	450
D	900	720
E	1,400	1,170

Source: RTA's *Guide to Traffic Generating Development*, 2002

Notes: The peak hour flows in the above table relate to the flows in one direction only. The level of service is a qualitative assessment giving an indication of the operating conditions of a given section of roadway. It ranges from LoS A indicating good condition and drivers are not affected by the presence of other drivers, to LoS F indicating unsatisfactory operating conditions where the traffic demand exceeds available capacity.

Based on the traffic flows from **Table 4.1**, **Table 4.2** and the Level of Service (LoS) criteria shown in **Table 4.3**, it is estimated that The Northern Road is currently operating at LoS C (close to LoS D) with a peak directional flow of about 430 vph (or less) during the peak hours.

With the additional traffic from the proposed development, it is expected that The Northern Road would continue to operate satisfactorily at LoS D. This change of level of service is due to the growth in the background traffic.

Mulgrave Road at present has a peak directional flow of less than 200 vph and operates at LoS A. The proposed development is not expected to result in a worsening of the existing level of service for Mulgrave Road.

Hawkesbury Valley Way has an existing peak directional flow of about 975 vph and is operating at LoS E. It is noted that the existing traffic flows on the Hawkesbury Valley Way have exceeded the 2016 predicted flows (daily, morning and evening peak hour flows) reported in the Windsor Flood Evacuation Route EIS. However, it is not expected that the additional traffic from the proposed development would create any material adverse impact to the existing level of service.

4.5 Site Intersection Capacity Analysis

Intersection capacity analysis was undertaken for the two intersections serving the sites. This was done for the existing case (pre development) and post development cases for all stages. The future cases include growth in the background traffic as discussed in Section 4.2.

The capacity analysis of the site accesses were undertaken during the morning and evening periods when the traffic generation due to site activity is at its greatest. In addition, a morning peak period analysis was undertaken at the Mulgrave site examining the traffic generation during the morning commuter peak period.

Below is a discussion of the analysis.

4.5.1 Performance Measures

Intersection assessment was undertaken using the SIDRA Intersection Analysis Program (SIDRA). SIDRA calculates intersection performance measures such as the average delay that vehicles encounter and level of service. SIDRA provides analysis of the operating conditions which can be compared to the performance criteria set out in **Table 4.4**.

Level of service (LoS) is one of the basic performance parameters used to describe the operation of an intersection. The levels of service range from LoS A (indicating good intersection operation) to LoS F (indicating over saturated conditions with long delays and queues). Generally, the long term desirable level of service should be LoS D or better. At roundabout and priority controlled intersections, the LoS is based on the average delay (seconds per vehicle) for the worst movement.

Table 4.4 – Level of Service Criteria

Level of Service	Average Delay per Vehicle (secs/veh)	Signals & Roundabouts	Give Way & Stop Signs
A	less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & Spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode
F	> 70	Extra capacity required	Extreme delay, traffic signals or other major treatment required

Source: RTA *Guide to Traffic Generating Developments*, 2002.

4.5.2 Site Access Intersection Operations

The results of the SIDRA analysis are presented **Table 4.5**.

Table 4.5 – Intersection Analysis Results

Stage	Site Access Intersection	Int. Control	Site AM		Commuter AM		Site PM	
			LoS	Ave Delay	LoS	Ave Delay	LoS	Ave Delay
Existing	The Northern Rd	Priority	B	19	-	-	B	19
	Mulgrave Rd	Priority	A	7	A	7	A	7
Stage 1 (2010)	The Northern Rd	Priority	B	18	-	-	B	18
	Mulgrave Rd	Priority	A	7	A	7	A	7
Stage 2 (2015)	The Northern Rd	Priority	B	19	-	-	B	18
	Mulgrave Rd	Priority	A	7	A	7	A	7
Stage 3 (2020)	The Northern Rd	Priority	B	19	-	-	B	19
	Mulgrave Rd	Priority	A	7	A	7	A	7
Stage 4 (2025)	The Northern Rd	Priority	B	19	-	-	B	20
Stage 5 (2030)	The Northern Rd	Priority	B	20	-	-	B	25

The results indicate that both intersections serving the sites would operate satisfactorily with acceptable delay in the future, even under full development traffic conditions.

4.5.3 Site Access Intersection Design

The observed available sight distances at both the proposed Londonderry site access and the existing Mulgrave site access intersections were compared with the RTA's Road Design Guidelines minimum requirements and determined to be satisfactory for the prevailing speed conditions.

i. Londonderry

In its submission to the DoP, Penrith City Council identified the potential requirement for the provision of deceleration lanes in both directions along The Northern Road such that traffic flow is not impeded. This suggests the provision of both a sheltered right turn lane and a left turn deceleration lane within The Northern Road at the site access.

The warrants for the provision of auxiliary lanes such as right turn lanes and deceleration lanes are provided in the RTA's Road Design Guide. Compliance with these guidelines was identified in the DGR's. The warrants are generated by the relationship between main road (The Northern Road) and side road (site access) traffic flows.

An extract from the RTA's Road Design Guide with plotted survey traffic flows for The Northern Road and site access road (Stage 1 and Stage 5) is shown in Appendix B.

The RTA's *Road Design Guide* indicates that based on the anticipated site generated traffic flows, the Londonderry site access intersection with The Northern Road would need to be provided as Type AU intersection (see Appendix B) from the commencement of the proposed development (Stage 1).

As the timing of future stages of development (Stages 2 to 5) is not yet known and will be driven by market forces, the provision of site access intersection treatments for subsequent stages of development would need to consider both the future growth of traffic associated with the development and changes to through traffic flows along The Northern Road. As discussed in Section 2, traffic flows along The Northern Road have declined over recent years.

Notwithstanding the above, based on the estimated traffic generation of the Londonderry site during Stage 5, the upgrading of the intersection from Type AU to Type CH would not be warranted at ultimate development levels.

ii. Mulgrave Site

As discussed previously the operational and design conditions at the existing Mulgrave site are considered to be satisfactory for the proposed development. No major modifications are recommended for this site access.

5 Conclusion

This report has been prepared for Perram & Partners on behalf of the Tolson Group to assess the traffic implications of the proposed mushroom farm at Londonderry and a proposed expansion of a substrate plant at Mulgrave.

The proposed mushroom farm at the Londonderry site is expected to generate some 160 vehicle movements per day or some 54 vehicle movements per hour during its busiest hour under full development (Stage 5). Similarly, the proposed expansion of the substrate plant at Mulgrave is expected to generate approximately 170 vehicle movements per day or about 25 vehicle movements per hour during its peak hours.

The analysis of the operation of the intersections serving the sites indicates that they would operate within capacity.

Based on anticipated site generated traffic flows, the site access arrangements at The Northern Road / Londonderry site access intersection should be designed as a Type AU intersection upon commencement of Stage 1. A Type AU intersection would be warranted through to and including the proposed full development (Stage 5) at Londonderry.

The internal parking areas and dock arrangement would be designed to comply with the relevant Australian Standards.

Subject to the design recommendations being implemented for the site access arrangements as described in this report, the proposed development is considered satisfactory from a traffic perspective.

Appendix A Estimated Proposed Development Traffic Generation

Table A.5.1 Londonderry Estimated Traffic Movements

Time	Stage 1				Stage 2				Stage 3				Stage 4				Stage 5			
	All Staff		Trucks		All Staff		Trucks		All Staff		Trucks		All Staff		Trucks		All Staff		Trucks	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00	4	0	1	0	5	0	1	0	6	0	1	0	6	0	2	0	6	0	2	0
6:00	32	0	2	0	36	0	2	0	43	0	3	0	46	0	3	0	46	0	4	0
7:00	4	0	1	2	5	0	1	2	5	0	1	3	5	0	2	3	5	0	2	4
8:00	0	0	1	1	0	0	1	1	0	0	1	1	0	0	2	2	0	0	2	2
9:00	0	0	1	2	0	0	1	2	0	0	1	3	0	0	2	3	0	0	2	4
10:00	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0
11:00	3	0	0	1	3	0	0	1	3	0	1	1	3	0	1	2	3	0	1	2
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	1	1	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1
14:00	1	5	0	0	1	6	0	0	1	7	0	0	1	7	0	0	1	7	0	0
15:00	1	1	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1
16:00	0	38	0	0	0	43	0	0	0	51	0	0	0	54	0	0	0	54	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21:00	0	0	1	0	0	0	1	0	0	0	1	0	0	0	2	0	0	0	2	0
22:00	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	2	0	0	0	2
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**46**	**45**	**8**	**8**	**52**	**51**	**9**	**9**	**61**	**61**	**11**	**11**	**64**	**64**	**13**	**13**	**64**	**64**	**17**	**17**

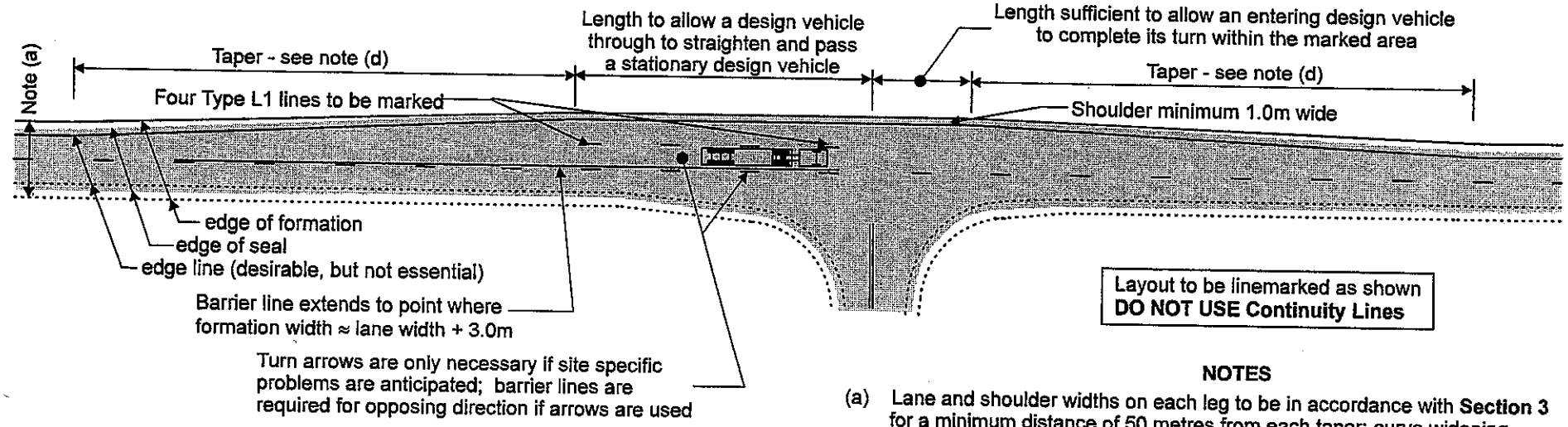
Table A.5.2 Mulgrave Estimated Traffic Movements

Time	Stage 1				Stage 2				Stage 3			
	All Staff		Trucks		All Staff		Trucks		All Staff		Trucks	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
0:00	0	0	0	0	0	0	1	1	0	0	1	1
1:00	0	0	0	0	0	0	1	1	0	0	1	1
2:00	0	0	1	1	0	0	1	1	0	0	1	1
3:00	3	0	1	1	3	0	1	1	3	0	1	1
4:00	0	0	1	1	0	0	1	1	0	0	2	2
5:00	13	0	2	2	16	0	2	2	17	0	3	3
6:00	2	0	2	2	2	0	2	2	2	0	3	3
7:00	1	1	2	2	1	1	2	2	1	1	3	3
8:00	4	1	1	1	4	1	2	2	4	1	3	3
9:00	2	1	2	2	2	1	2	2	2	1	3	3
10:00	1	1	1	1	1	1	2	2	1	1	3	3
11:00	1	1	1	1	1	1	2	2	1	1	3	3
12:00	1	1	0	0	1	1	1	1	1	1	2	2
13:00	1	6	1	1	1	8	1	1	1	8	2	2
14:00	2	13	1	1	2	14	1	1	2	15	2	2
15:00	0	1	1	1	0	1	1	1	0	1	2	2
16:00	0	4	1	1	0	4	1	1	0	4	2	2
17:00	1	0	1	1	1	0	1	1	1	0	2	2
18:00	0	0	1	1	0	0	1	1	0	0	2	2
19:00	0	1	1	1	0	1	1	1	0	1	2	2
20:00	0	1	1	1	0	1	1	1	0	1	2	2
21:00	0	0	1	1	0	0	1	1	0	0	2	2
22:00	0	0	1	1	0	0	1	1	0	0	2	2
23:00	0	0	0	0	0	0	1	1	0	0	1	1
Total	**32**	**32**	**24**	**24**	**34**	**34**	**37**	**37**	**36**	**36**	**50**	**50**

Appendix B Auxiliary Lanes

Source: RTA Road Design Guide

This layout is particularly suited to rural areas where high speed, low volume traffic occurs, yet the volume of turning traffic is sufficient to make a conflict likely.



AUR = AUxiliary lane Right turn treatment
AUL = AUxiliary lane Left turn treatment

This layout is designed to store one design vehicle and allow another design vehicle to pass. Where longer storage is necessary a channelised layout is preferred. Where an auxiliary right turn lane is required on the terminating leg, the "AUL" layout can be used.

***Section 4.8** provides details of geometry whilst **"Signs and Markings"** gives the details and location of signs and pavement marking. Advanced warning signs, alerting drivers to the presence of the intersection, may be required.*

NOTES

(a) Lane and shoulder widths on each leg to be in accordance with **Section 3** for a minimum distance of 50 metres from each taper; curve widening (where necessary) to be in accordance with **Section 2.**

(b) On arterial/sub-arterial roads an articulated vehicle is the minimum design vehicle used to define the turning path. Turning speed is 5-15km/h. Turning paths may cross the centreline of the street or road being entered provided a barrier line is not required for that leg, and traffic volumes make such a manoeuvre appropriate.

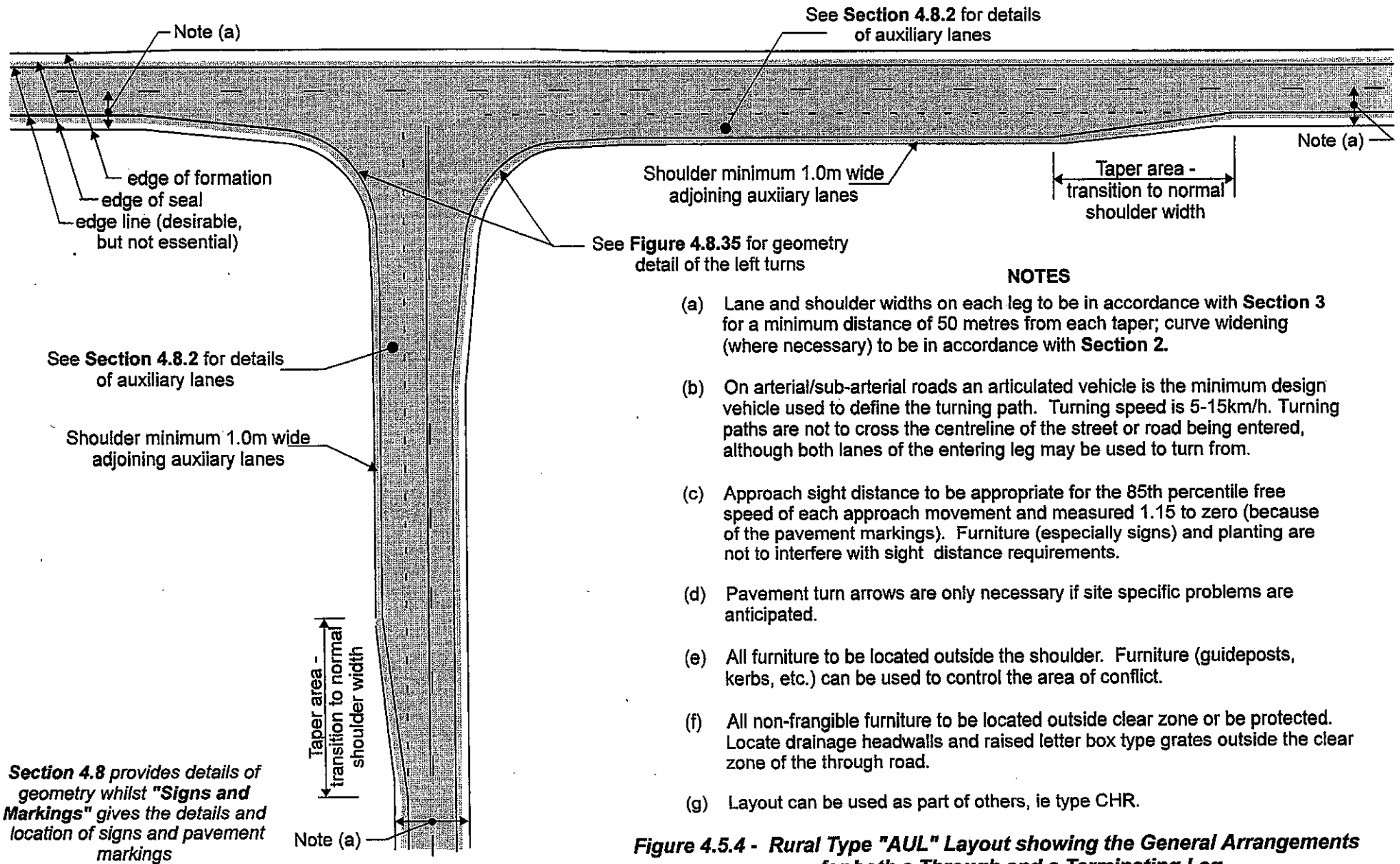
(c) Approach sight distance to be appropriate for the 85th percentile free speed of each approach movement and measured 1.15 to zero (because of the pavement markings). Furniture (especially signs) and planting are not to interfere with sight distance requirements.

(d) Taper length determined on basis that some reduction in speed occurs.

(e) All furniture to be located outside the shoulder. Furniture (guideposts, kerbs, etc. can be used to control the area of conflict.

(f) All non-frangible furniture to be located outside clear zone or be protected. Locate drainage headwalls and raised letter box type grates outside the clear zone of the through road

Figure 4.5.3 - Rural Type "AUR" Layout



*Section 4.8 provides details of geometry whilst **"Signs and Markings"** gives the details and location of signs and pavement markings*

NOTES

(a) Lane and shoulder widths on each leg to be in accordance with **Section 3** for a minimum distance of 50 metres from each taper; curve widening (where necessary) to be in accordance with **Section 2.**

(b) On arterial/sub-arterial roads an articulated vehicle is the minimum design vehicle used to define the turning path. Turning speed is 5-15km/h. Turning paths are not to cross the centreline of the street or road being entered, although both lanes of the entering leg may be used to turn from.

(c) Approach sight distance to be appropriate for the 85th percentile free speed of each approach movement and measured 1.15 to zero (because of the pavement markings). Furniture (especially signs) and planting are not to interfere with sight distance requirements.

(d) Pavement turn arrows are only necessary if site specific problems are anticipated.

(e) All furniture to be located outside the shoulder. Furniture (guideposts, kerbs, etc.) can be used to control the area of conflict.

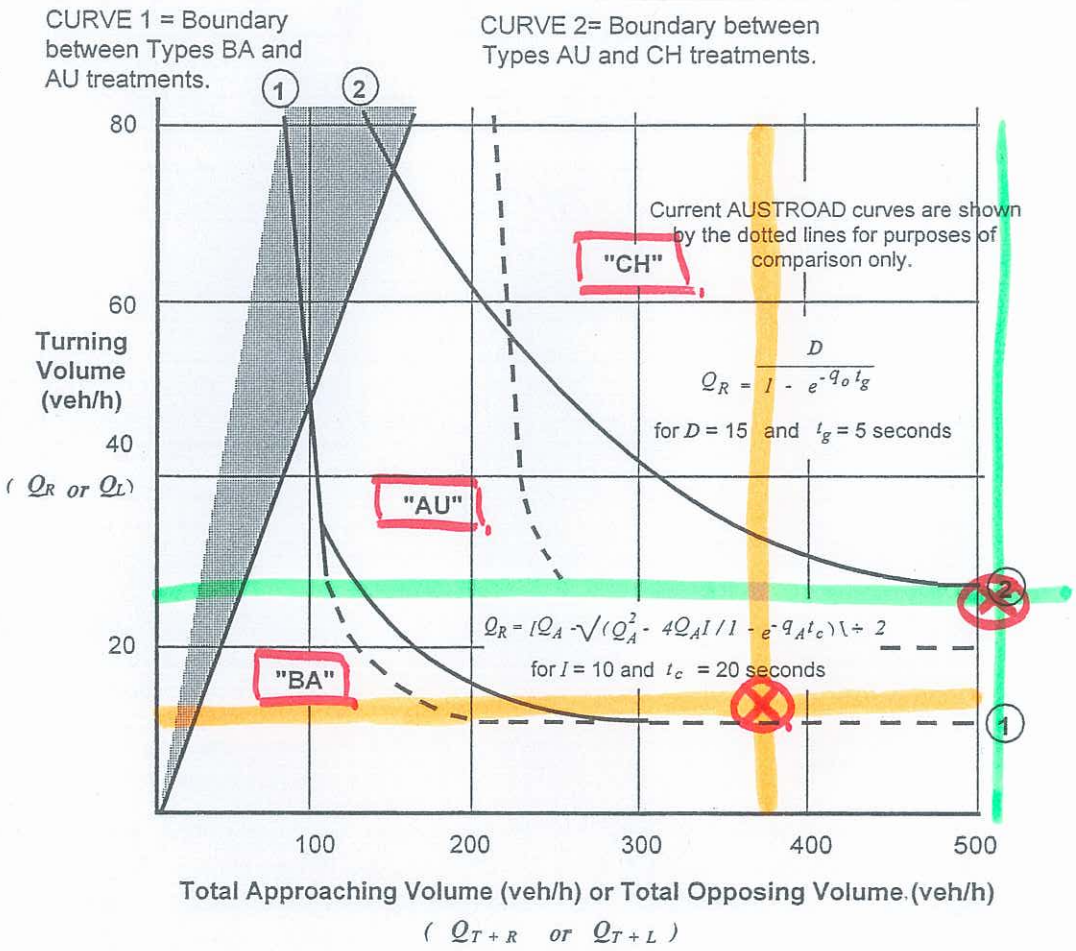
(f) All non-frangible furniture to be located outside clear zone or be protected. Locate drainage headwalls and raised letter box type grates outside the clear zone of the through road.

(g) Layout can be used as part of others, ie type CHR.

Figure 4.5.4 - Rural Type "AUL" Layout showing the General Arrangements for both a Through and a Terminating Leg.

- Stage 1 Warrants. (traffic flow)

- Stage 5 Warrants (traffic flow).



NOTES:

1. *Where peak hour volumes are not available, assume the design peak hour volume equals 15% of the AADT. for 500 hours each year; use 5% of AADT for the rest of the year. See Section 1.4. for further details.*
2. *Use graph "AU" to select need for an auxiliary lane. Use "CH" to determine if a sheltered right turn is required. On high speed roads with substantial volumes of heavy vehicles, the use of Type "AU " and "CH" is preferred for safety reasons.*
3. *Use of Types "AU" and "CH" is preferred on high speed and/or heavy vehicle routes to enhance safety.*

In this region more than 50% of the approaching traffic turns. Hence consideration needs to be given to possible realignment of the intersection to suit the major traffic movement.

Figure 4.5.12 - Warrants for Rural Turn Lanes

Appendix N

FLORA AND FAUNA ASSESSMENT

FLORA AND FAUNA ASSESSMENT

PROPOSED MUSHROOM FARM
LOT 138 DP 752037, LONDONDERRY, CITY OF PENRITH
PROPOSED SUBSTRATE PLANT EXPANSION,
LOT 3 DP 771652, MULGRAVE, SHIRE OF HAWKESBURY

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as trustee for Kevin Mills & Associates Trust

Document Reference

Kevin Mills & Associates (2009). Flora and Fauna Assessment, Proposed Mushroom Farm, Lot 138 DP 752037, Londonderry, City of Penrith, Proposed Substrate Plant Expansion, Lot 3 DP 771652, Mulgrave, Shire of Hawkesbury. Report prepared for Perram & Partners, Eastwood, September.

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This report was prepared for Perram & Partners on 6 February 2009. The report should be used only by the previously named, and only for the stated purpose and not for any other purpose.

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1. Introduction

This report was commissioned by Perram & Partners on behalf of Elf Farm Supplies Pty Ltd and Elf Mushrooms, which are part of the Tolson Group of companies. The Group proposes to establish a new mushroom farm at Londonderry in the City of Penrith and expand the capacity of their substrate plant at Mulgrave in the Shire of Hawkesbury. The application is to be assessed as a major project under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of this report is to assess the impact of the proposed development on flora and fauna. The report addresses the Director-General's Requirements for the project issued on 7 January 2009 which, for flora and fauna, are as follows:

"Flora and Fauna
Draft Guidelines for Threatened Species Assessment under Part 3A of the Environmental Planning and Assessment Act 1979 (DEC, 2005); Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC, 2004); NSW Groundwater Dependent Ecosystem Policy (DNR, 2002); Commonwealth Environment Protection and Biodiversity Conservation Act 1999 - Guide to Implementation in NSW (DoP, 2007)."

The subject land was inspected by Kevin Mills & Associates on 2 March 2009, prior to the preparation of the report. Note that the subject land encompasses the sites at Londonderry and Mulgrave.

This report contains:
i. a description of the vegetation and fauna habitat on the two sites;
ii. lists of the flora and fauna species observed;
iii. an assessment of the potential impact on flora and fauna, including species, populations and communities listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and NSW *Fisheries Management Act 1994* (FM Act), and matters of national environmental significance listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
vi. recommendations for impact mitigation.

2. The Study Area

Proposed Mushroom Farm, Londonderry
The mushroom farm is to be located on Lot 138 DP 752037, which is 22.66 hectares of land on the western side of The Northern Road at Londonderry in the City of Penrith. The land is owned by D. W. Tolson Management Pty Ltd. A single dwelling is located on the property, about 50 metres from the road. The land is currently used for grazing cattle; prior to that, it was a piggery. The property is roughly rectangular in shape, with the long axis east to west. About three-quarters has been cleared, apparently many years ago. Most of the remaining native vegetation is towards the western end, off the site to be used for the mushroom farm.

The study area covers the eastern three-quarters (approx.) of Lot 138; see **Figure 1**. It is about 20 metres above sea level, low-lying and with little topographic variation. Some parts of the study area are moist and the soils water-logged. There are no creeks, although there are four dams fed by shallow drainage lines. The study area supports small stands of remnant native vegetation and scattered native trees.

The study area is in a rural district with a long history of farming. The countryside is characterised by small farms and pockets of remnant bushland. Castlereagh Nature Reserve is to the east, on the opposite side of The Northern Road. There is farmland to the north and west, and a wrecking yard on what used to be a farm to the south.

Proposed Substrate Plant Expansion, Mulgrave
The substrate plant is located on Lot 4 DP 610341 and part Lot 3 DP 771652, Mulgrave Road, Mulgrave, Shire of Hawkesbury. The land is owned by R. N. & N. R. Tolson and the plant is operated by Elf Farm Supplies. The existing site has been filled to a level of 16 metres AHD, creating a development platform above the once in 100 year flood level. Most of the balance of the current site is in the process of being raised to the same level, as approved in a development consent issued by Hawkesbury City Council in November 2006 (Perram Partners 2008). The expansion site is an area of about 1.5 hectares, on cleared land on the eastern side of the existing facility; see **Figure 2**.

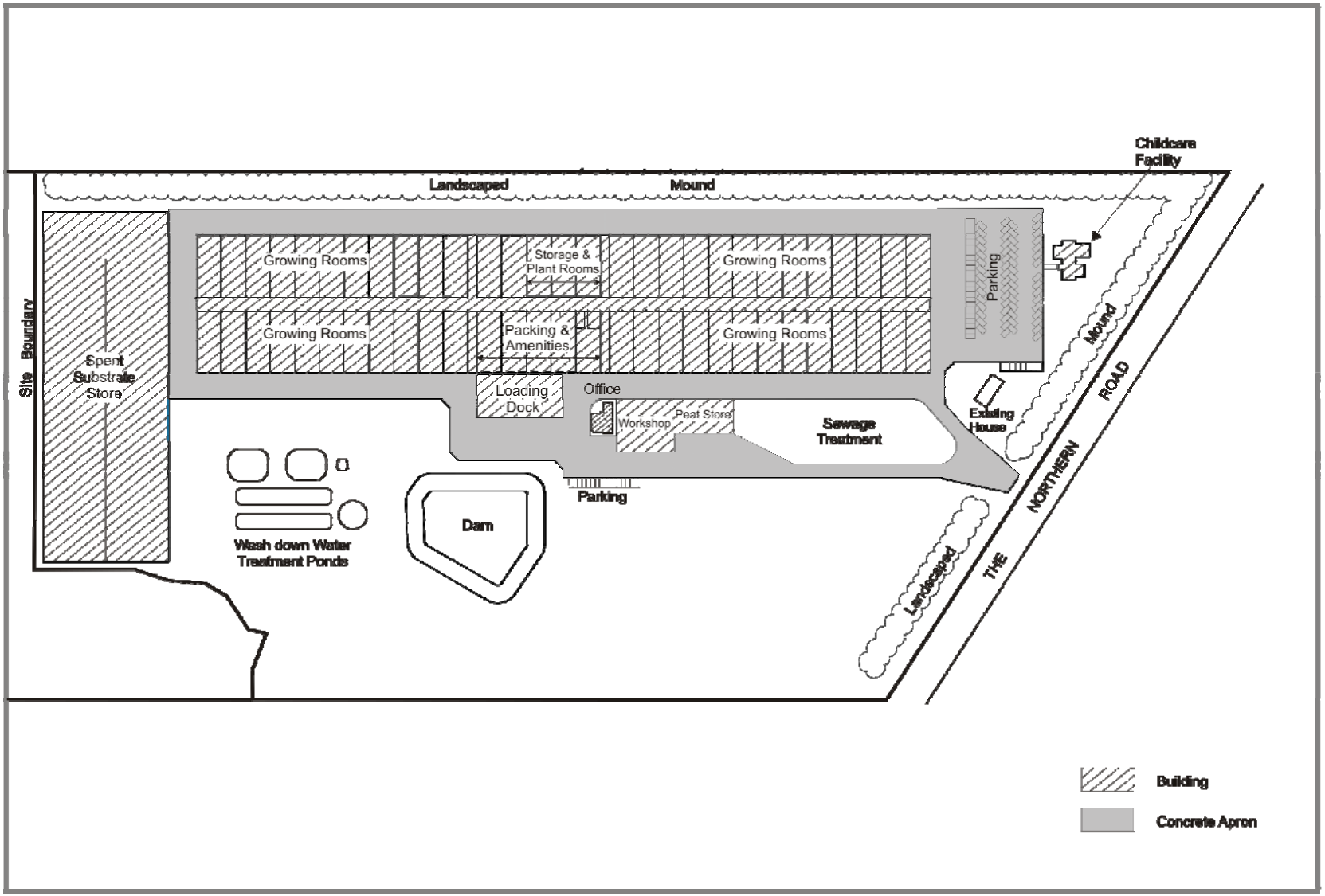


Figure 1. The Study Area, Londonderry

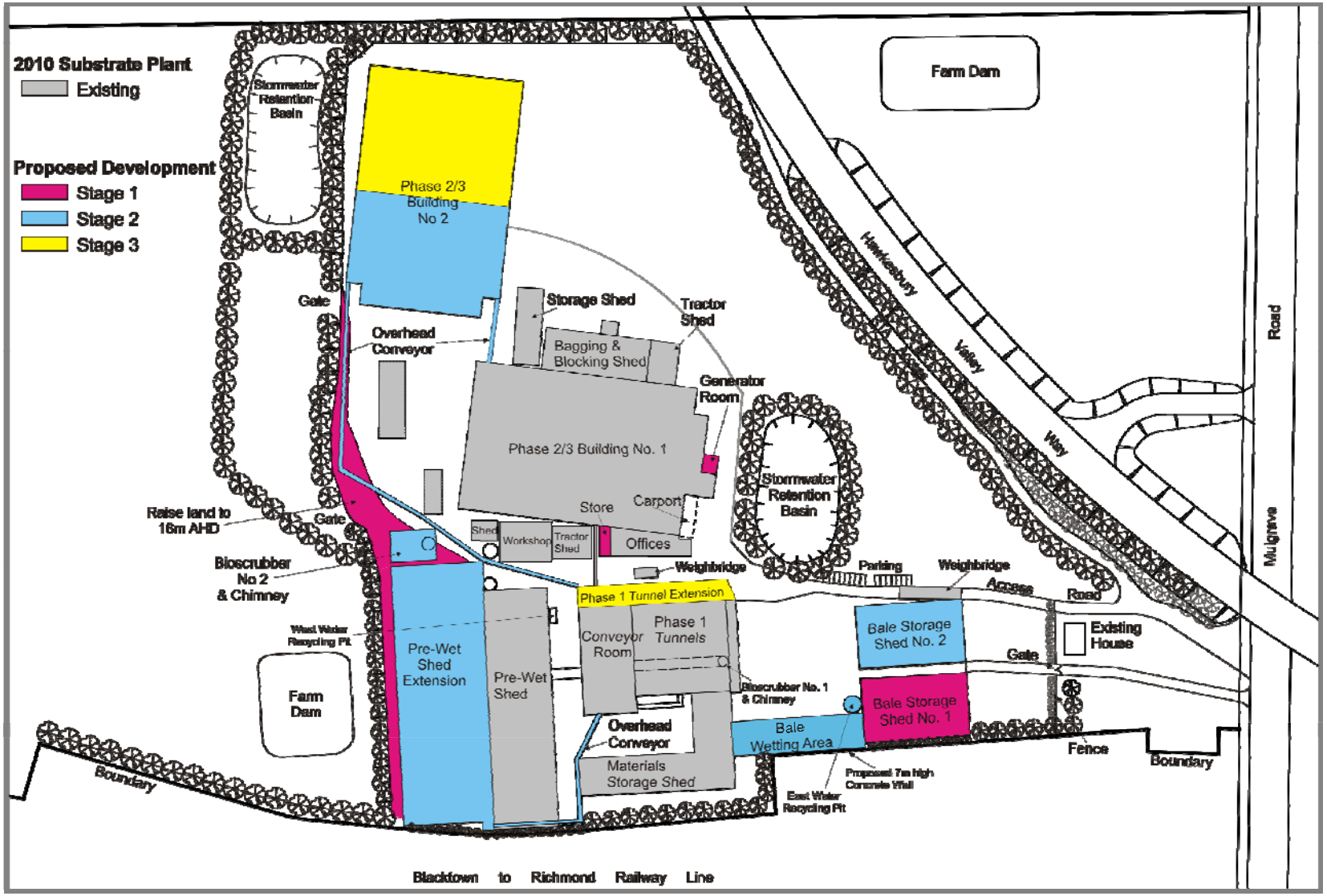


Figure 2. The Study Area, Mulgrave

As stated in the Preliminary Environmental Assessment (Perram & Partners 2008), "the property [at Mulgrave] is part of a wide band of rural land stretching in a north-south direction along the flood plain of South Creek. Land uses include market gardens, turf farms, dairy farms, feedlots, grazing and sewerage treatment. . . . The Blacktown to Richmond Railway, immediately south of the site, crosses the flood plain at this location. Mulgrave Station is about 100 metres from the front gate of the property. A sewage treatment plant is located about 700 metres to the north beside Mulgrave Road, with Windsor High School opposite. Land on the eastern side of Mulgrave Road is progressively being developed for mixed industrial uses. On the western side of South Creek a strip of higher land beside the railway line has been developed as a residential area. . . The high-level flood evacuation road for Windsor crosses the flood plain to the north of the property. Hence the land is situated in a section of the flood plain between two linear features that cross the creek, the railway, and main road. "

3. Survey Method

3.1 Guidelines for Threatened Species Surveys and Assessment

Field survey techniques for threatened species and the amount of effort required are set out in guidelines published by the former Department of Environment and Conservation (DEC), now the Department of Environment and Climate Change (DECC) in 2004; see Threatened Species Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (DEC 2004), Chapter 5, Field Surveys. **Appendix 1** provides a summary.

The Guidelines promote "a consistent and systematic approach to the survey and assessment of threatened biodiversity" (p.2-11), while at the same time acknowledging that they are not always appropriate or necessary in every situation. The Guidelines state, for example, that "not all the survey methods . . . will be appropriate or necessary in all situations" (Guidelines, p.8-72) and "ideally, surveys would be undertaken during optimal climatic and seasonal conditions and would also consider issues such as migratory species movements, availability of shelter and food resources, and the statistical issues associated with minimising sampling error [although] in many cases this will not be possible" (Guidelines, p.8-72). The purpose of the Guidelines was kept in mind when the survey program for this Flora and Fauna assessment was developed.

3.2 Flora Survey Method

Date of Survey: A flora survey was undertaken on both sites on 2 March 2009.

Objectives: The objectives were to classify and describe the vegetation in the study area, to record as many as possible of the plant species present, to search for threatened plant species and to assess the potential for threatened plant species to occur there.

Vegetation Classification and Mapping: The vegetation in the study area was classified on the basis of its structure and the name(s) of the dominant species in the tallest stratum. The vegetation was mapped by marking the boundaries directly onto a copy of the aerial photograph.

Survey Design and Technique: In keeping with the requirements of the Threatened Species Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (DEC 2004), the survey technique combined multiple traverses of the study area with vegetation sampling. The traverses were undertaken on foot and covered all areas of potential habitat for threatened plant species.

Vegetation sampling was undertaken as per the Guidelines for survey plots (plant quadrats), i.e. one quadrat was established per stratification unit <2 ha. Thus, a vegetation sampling site 20 metres by 20 metres ($400m^2$) was established where the vegetation was considered to be fairly typical or representative. A survey sheet was completed to record the following data: plot identification number, date of survey, plot size, plot location (name of property and GPS reading), land tenure, landform, geology and soil type, slope (flat, gentle, moderate, steep), aspect, altitude, the height and proportional coverage (%) of each layer or stratum (tree canopy, middle storey, shrub understorey, ground cover), the species present in each stratum and an abundance rating for each species. **Appendix 2** provides a copy of the completed survey sheet.

The characteristic species were recorded, and notes were made on the structure and condition of the vegetation. All plant species observed were recorded. The survey was fairly thorough, so most of the species present would have been detected; however, additional species can almost always be found during longer surveys and in different seasons.

Nomenclature: The plant species names in this report are the current names published by the National Herbarium of New South Wales in the *Flora of New South Wales* (Harden 1992-2002). Most of the common names are from the *Flora of New South Wales* (op. cit.), *Australian Plant Genera* by Baines (1981) and *Weeds of the South-east* by Richardson, Richardson and Shepherd (2006).

3.3 Fauna Survey Method

Date of Survey: A general fauna survey was undertaken on both sites on 2 March 2009, at the same time as the flora survey. The weather conditions at the time of the survey were favourable, with warm temperatures (28^{o}C), no wind and recent rain.

Objectives: The objectives were to describe the fauna habitat in the study area, to detect as many as possible of the fauna species present and to assess the potential for threatened fauna species to occur there.

Survey Design and Technique: The Guidelines (DEC 2004) were taken into account when determining the fauna survey techniques to be adopted and the survey effort expended. Because of the small size of the study area, the general lack of natural habitats and the fact that so much of the study area has been cleared, no nocturnal surveys were undertaken. A general fauna survey was undertaken in the study area at the same time as the flora survey, as well as a targeted search for the Cumberland Land Snail *Meridolum corneovirens* in areas of potential habitat. The search for this species consisted of looking under the various items of farm debris strew around the property, e.g. old bricks and sheets of tin, as well as leaf litter accumulated around the base of trees and shrubs, and other niches that could be used as a sheltering site.

All fauna species observed or heard during the survey were identified and recorded. Species were identified by direct observation and call-recognition, and a ground search was conducted for animal scats, tracks and diggings. The survey results indicate which species were observed during the survey, but should not be regarded as a complete inventory of the species that would occur in the study area; this could be obtained only by a long study spanning all seasons.

Nomenclature: The fauna species names in this report are based on the Australian Museum's *The Mammals of Australia* (Strahan 1995), *Australian Bats* (Churchill 1998), *The Taxonomy and Species of Birds of Australia and its Territories* (Christidis & Boles 2008) and *Reptiles and Amphibians of Australia* (Cogger 1992).

4. Flora

4.1 Description of the Vegetation

Proposed Mushroom Farm, Londonderry
The vegetation in the study area consists of (i) cleared land covered by grazing pastures and (ii) occasional patches of remnant woodland. The woodland is in poor condition, being young to sub-mature regrowth regenerating around trees retained in the paddocks during clearing. The understorey has been grazed and disturbed by other farm activities for many years. As a result, regeneration has been haphazard and natives have been out-competed in most places. **Figure 3** shows where the woodland occurs. One part of the woodland where natives dominated was sampled by survey plot; see **Appendix 2**.

The trees in the woodland consist of Hard-leaved Scribbly Gum *Eucalyptus sclerophylla*, Narrow-leaved Apple *Angophora bakeri*, Thin-leaved Stringybark *Eucalyptus eugenioides*, Red Bloodwood *Corymbia gummifera* and Parramatta Red Gum *Eucalyptus parramattenis*. Hard-leaved Scribbly Gum *Eucalyptus sclerophylla* and Narrow-leaved Apple *Angophora bakeri*, dominate the patches along the western edge of the site and towards the centre, while Parramatta Red Gum *Eucalyptus parramattenis* occurs on the low-lying water-logged soils in the north-eastern corner.

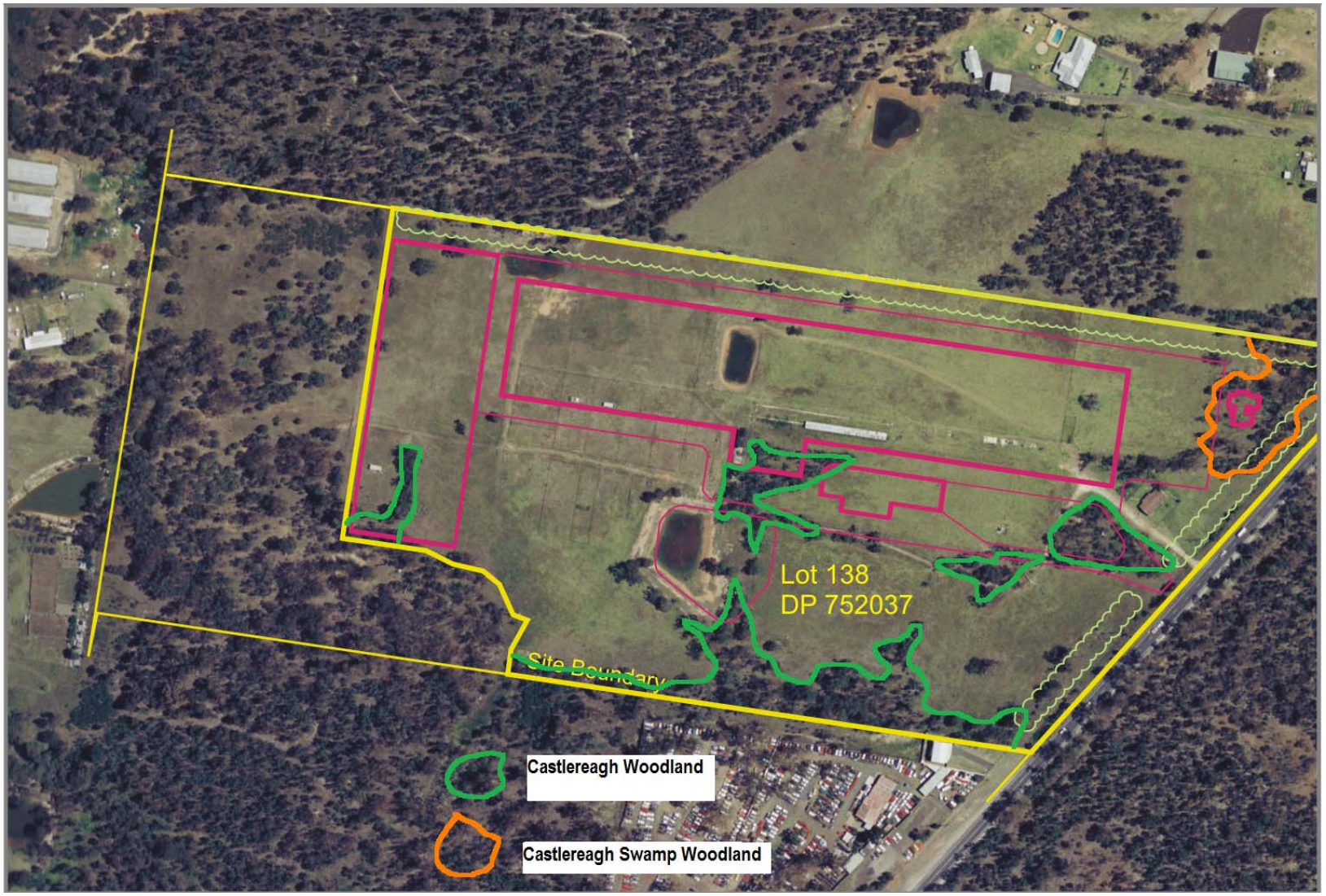


Figure 3. Vegetation Map, Londonderry

Small trees and saplings of Narrow-leaved Apple *Angophora bakeri* and, less often, of the other tree species are common in some locations. Paperbark *Melaleuca nodosa* and Everlasting *Ozothamnus diosmifolius* are the main shrub species, although the shrub layer is mostly patchy and sparse. In most places, the ground cover is a mixture of exotics and natives such as Weeping Grass *Microlaena stipoides*, Wandering Sailor *Commelina cyanea* and Lobelia Pratia *Pratia purpurascens*. Native grasses and herbs dominate in only a few locations, e.g. here and there in the woodland along the southern edge; see survey sheet, **Appendix 2**.

The vegetation in the study area is an example of the Castlereagh Woodlands described by Benson and Howell (1990), who noted "in the north-eastern corner of the Cumberland Plain, between Penrith and Windsor, . . . around Castlereagh and Londonderry are soils developed on alluvial sediments of Tertiary age; clays, silts, sands and gravels . . . The country is flat with shallow meandering drainage lines and the soils are sands or clays, often with a conspicuous component of ironstone gravels or larger river stones. . . Ironbarks, mainly Broad-leaved, *Eucalyptus fibrosa*, but also some Narrow-leaved, *Eucalyptus crebra*, and Mugga, *Eucalyptus sideroxylon*, are characteristic of the gravelly clay soils today. Where the soil is more sandy [like the soil in the study area] these trees are replaced by Scribbly Gum *Eucalyptus sclerophylla* and Narrow-leaved Apple *Angophora bakeri*. Along watercourses and poorly drained depressions are paperbark *Melaleuca decora* and Drooping Red Gum *Eucalyptus parramattenis*" (Benson & Howell 1990).

The "wet" end of the spectrum of communities in the above woodlands is now known as Castlereagh Swamp Woodland and has been listed as an endangered ecological community under the NSW *Threatened Species Conservation Act 1995* (TSC Act). **Appendix 3** provides a copy of the NSW Scientific Committee's Final Determination for Castlereagh Swamp Woodland.

The small stand of woodland in the north-eastern corner of the study area, near The Northern Road, is a remnant of the Castlereagh Swamp Woodland endangered ecological community. It is on low-lying ground with poorly drained depressions and moist soils; the soils appear to be seasonally water-logged. Parramatta Red Gum *Eucalyptus parramattensis* and Thyme Honey-myrtle *Melaleuca thymifolia*, which are indicative of the moist soil conditions associated with Castlereagh Swamp Woodland, are common; other characteristic Castlereagh Swamp Woodland species are uncommon or absent, as a result of a long history of grazing and other farm activities.

The paddocks on the property are dominated by exotic species, particularly Kikuyu Grass *Pennisetum clandestinum*, and other introduced species such as Paspalum *Paspalum dilatatum*, Carpet Grass *Axonopus fissifolius*, Slender Pigeon Grass *Setaria gracilis* and Parramatta Grass *Sporobolus indicus*. The native Couch Grass *Cynodon dactylon* is also present and sometimes common. Pasture weeds such as Spear Thistle *Cirsium vulgare*, Fireweed *Senecio madagascariensis*, Paddy's Lucerne *Sida rhombifolia* and Purpletop *Verbena bonariensis* are common in most places.

With the exception of the farm dam in the north-eastern corner, the dams on the property are poorly vegetated. They contain a few wetland plant species, e.g. Water Couch *Paspalum distichum*, Spreading Sneezeweed *Centipeda minima*, Floating Pondweed *Potamogeton tricarinatus*, Common Rush *Juncus usitatus*, and the exotic Water Primrose *Ludwigia peploides*, but these species are not extensive in occurrence. The dam in the north-eastern corner, however, contains wetland plants and is edged with occasional trees and shrubs.

Proposed Substrate Plant Expansion Site, Mulgrave

The site adjoining the existing substrate plant at Mulgrave is on unnatural ground that has been recontoured over the years. There is no naturally occurring native vegetation on the site, which is dominated by Kikuyu Grass *Pennisetum clandestinum* and is currently grazed by cattle. There are strips of planted trees in the surrounding area, these are local tree species planted to provide a visual screen. The small dam in the paddock to the north, will be enlarged to accommodate runoff from the new facility.

4.2 Plant Species recorded in the Study Area

The plant species recorded in the Londonderry study area have been listed alphabetically below, in Table 1, and under family name in **Appendix 4**. No threatened plant species were recorded, although six of the species are considered by James, McDougall and Benson (1991), authors of *Rare Bushland Plants of Western Sydney* to be regionally significant; see Table 1, column 3. All six species are, however, common and widespread in New South Wales.

The plant species on the site at Mulgrave are all common introduced species, e.g. Kikuyu Grass *Pennisetum clandestinum*, Paddy's Lucerne *Sida rhombifolia*, Spear Thistle *Cirsium vulgare* and Purpletop *Verbena bonariensis*.

Table 1
Plant species recorded in the study area, Londonderry

Taxonomic name	Common name	Regionally Significant Species
Native Species		
Alternanthera denticulata	Lesser Joyweed	
Angophora bakeri	Narrow-leaved Apple	
Aristida vagans	Three-awned Speargrass	
Callistemon pinifolius	Pine-leaved Bottlebrush	
Cardamine paucijuga	Bitter-cress	X
Centipeda minima	Spreading Sneezeweed	
Cheilanthes sieberi	Mulga Fern	
Chloris truncata	Windmill Grass	X
Commelina cyanea	Wandering Sailor	
Corymbia gummifera	Red Bloodwood	
Cynodon dactylon	Couch Grass	
Echinopogon ovatus	Forest Hedgehog Grass	
Einadia hastata	Berry Saltbush	
Eleocharis sphacelata	Tall Spike-rush	
Epaltes australis	Spreading Nut-heads	
Eragrostis leptostachya	Paddock Love-grass	
Eucalyptus eugenioides	Thin-leaved Stringybark	
Eucalyptus parramattenis	Parramatta Red Gum	
Eucalyptus sclerophylla	Hard-leaved Scribbly Gum	
Fimbristylis dichotoma	Common Fringe-rush	
Glycine microphylla	Glycine	X
Hardenbergia violacea	Native Sarsaparilla	
Hypericum gramineum	Small St John's Wort	
Hypoxis hygrometrica	Golden Weather-grass	
Juncus usitatus	Common Rush	
Lagenifera stipitata	Blue Bottle-daisy	
Melaleuca decora	Paperbark	
Melaleuca linariifolia	Narrow-leaved Paperbark	
Melaleuca nodosa	Paperbark	
Melaleuca thymifolia	Thyme Honey-myrtle	
Microlaena stipoides	Weeping Grass	
Oxalis exilis	Oxalis	X
Ozothamnus diosmifolius	Everlasting	
Paspalidium distans	Paspalidium	
Paspalum distichum	Water Couch	
Pimelea linifolia	Slender Rice-flower	
Pomax umbellata	Pomax	
Potamogeton tricarinatus	Floating Pondweed	
Pratia purpurascens	Lobelia Pratia	
Pteridium esculentum	Bracken	
Rumex sp.	Dock	
Solanum pungetium	Jagged Nightshade	X
Sporobolus creber	Slender Rats-tail Grass	
Urtica incisa	Stinging Nettle	X
Wahlenbergia gracilis	Australian Bluebell	
Exotic Species		
Alternanthera pungens	Khaki Weed	
Araujia hortorum	Moth Vine	
Axonopus fissifolius	Carpet Grass	
Chloris gayana	Rhodes Grass	
Cirsium vulgare	Spear Thistle	
Conyza sp.	Fleabane	
Cyperus brevifolius	Sedge	
Datura stromonium	Common Thornapple	
Eragrostis curvula	African Lovegrass	
Gamochaeta americana	American Cudweed	
Gomphrena celosioides	Gomphrena	
Grevillea robusta	Silky Oak	

Heliotropium amplexicaule	Blue Heliotrope
Ludwigia peploides	Water Primrose
Modiola caroliniana	Red-flowered Mallow
Opuntia stricta	Prickly Pear
Paspalum dilatatum	Paspalum
Pennisetum clandestinum	Kikuyu Grass
Phytolacca octandra	Inkweed
Rubus fruticosus sp. agg.	Blackberry
Senecio madagascariensis	Fireweed
Setaria gracilis	Slender Pigeon Grass
Sida rhombifolia	Paddy's Lucerne
Solanum nigrum	Black Nightshade
Sporobolus indicus	Parramatta Grass
Verbena bonariensis	Purpletop
Yucca aloifolia	Yucca

5. Fauna

The fauna habitat in the Londonderry study area consists of small patches of woodland, a few small farm dams and large areas of grazing pasture. The woodland contains occasional large trees with potential breeding hollows but has a fairly simple structure, with only a sparse and patchy shrub layer. There is little debris on the ground, except in the north-eastern corner where fallen branches provide small niches e.g. for small lizards and snakes, (although none were seen during the survey). There is much better habitat at the western end of the property, outside the study area, to the north and south on adjoining properties, and to the east in Castlereagh Nature Reserve.

The fauna species recorded during the survey have been listed below, in Table 2. Three introduced mammal species were recorded, but no native mammals. Because the woodland in the study area is so fragmented and sparse, only bats and perhaps echidnas are expected to occur there. Twenty-six (26) bird species were recorded in the trees and around the dams. Because the shrub/small tree layer is so patchy and sparse, few small birds were present. Only one reptile species was recorded. Additional species would occur in the study area, although diversity would be lower within the study area than in the better quality habitats in the surrounding area.

The fauna habitat in the Mulgrave study area is grassland dominated by exotic grasses and herbs suitable for grazing. There is virtually nothing there to attract native fauna. The dam to the north provides habitat for the Long-necked Tortoise and probably attracts a few waterbirds and reptiles, but it lacks fringing vegetation, shelter sites and shade, and is therefore not an important wetland habitat.

Table 2
Fauna species recorded in the study area, Londonderry

Fauna group	Common name	Taxonomic name
<u>Mammals</u>	Cattle*	*Bos taurus*
	Horse*	*Equus caballus*
	Rabbit*	*Oryctolagus cuniculus*
<u>Birds</u>	Australian Magpie	*Cracticus tibicen*
	Australian Raven	*Corvus coronoides*
	Australian Wood Duck	*Chenonetta jubata*
	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*
	Chestnut Teal	*Anas castanea*
	Common Myna*	*Sturnus tristis*
	Eastern Rosella	*Platycercus eximius*
	Galah	*Eolophus roseicapillus*
	Grey Butcherbird	*Cracticus torquatus*
	Grey Goshawk	*Accipiter novaehollandiae*
	Grey Shrike-thrush	*Colluricincla harmonica*
	Laughing Kookaburra	*Dacelo novaeguineae*
	Little Corella	*Cacatua sanguinea*
	Little Pied Cormorant	*Microcarbo melanoleucos*
	Magpie-lark	*Grallina cyanoleuca*
	Masked Lapwing	*Vanellus miles*
	Noisy Miner	*Manorina melanocephala*
	Pacific Black Duck	*Anas superciliosa*

	Rainbow Lorikeet	*Trichoglossus haematodus*
	Red Wattlebird	*Anthochaera carunculata*
	Spotted Pardalote	*Pardalotus punctatus*
	Sulphur-crested Cockatoo	*Cacatua galerita*
	Superb Fairy-wren	*Malurus cyaneus*
	Welcome Swallow	*Hirundo neoxena*
	White-faced Heron	*Egretta novaehollandiae*
	Willie Wagtail	*Rhipidura leucophrys*
Frogs	Nil	
Reptiles	Delicate Skink	*Lampropholis delicate*
Fish	Plague Minnow	*Gambusia holbrooki*

*Introduced species.

6. Threatened Species, Populations and Communities

6.1 Introduction

Threatened species, populations and communities in New South Wales are listed on schedules attached to the NSW *Threatened Species Conservation Act 1995* (TSC Act), the NSW *Fisheries Management Act 1994* (FM Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Under the TSC and FM Acts they are classified "endangered", "vulnerable", "critically endangered" or "presumed extinct". Under the EPBC Act, threatened species and communities are classified "extinct", "critically endangered", "endangered", "vulnerable" or "conservation dependent". The EPBC Act also lists "protected migratory species".

The "Threatened Species Assessment Guidelines; the Assessment of Significance", published by the Department of Environment and Climate Change (DECC 2007), state that the applicant/proponent should develop a list of threatened species, populations and ecological communities that may be affected directly or indirectly by the proposed action, development or activity" [and that] "adequate reasons must be provided to show how the list was derived" (p.2, para.6). In order to develop such a list, the consultant undertook a search of the NSW Wildlife Atlas (DECC) for threatened species previously recorded in the local area, i.e. in the 10 kilometre grid square centred on the Londonderry study area.

6.2 Threatened Species

Threatened species previously recorded in the local area (Londonderry) have been listed below, in Table 3. Table 3 also contains an assessment of the potential for each threatened species to occur in the study area or utilise the habitats in the study area on occasion. In this regard, consideration was given to determining the extent to which the subject land satisfies the habitat requirements and preferences of the species in question. The frequency of previous records in the NSW Wildlife Atlas was also taken into account.

No threatened species were recorded in the Londonderry study area during the survey and none are expected to occur there. It is conceivable, however, that Cumberland Land Snails occur in the study area in low numbers. A thorough search was undertaken for the Cumberland Land Snail and none were found, but the presence of this species cannot be ruled out on the basis of a single survey because the snails sometimes burrow into the soil. One or two other threatened species, such as the Grey-headed Flying-fox and Swift Parrot, could also occur in the study area from time to time. Any occurrences would, however, be fleeting; these wide-ranging species are not likely to have a close affinity with this small area of potential habitat when there are vast areas of good quality habitat in the local area and throughout the district.

No threatened species were recorded in the Mulgrave study area during the survey and none are expected to occur there. The site is too small, measuring only about 100 x 50 metres, and it has been totally cleared.

Table 3
List of threatened species for the local area, Londonderry (Source: NSW Wildlife Atlas)

Species	TSC Act[+]	EPBC Act[+]	Habitat Requirements/Preferences, etc.	Potential to occur in the study area (High / Medium / Low)
Plants				
Bynoe's Wattle *Acacia bynoeana*	E	V	*Acacia bynoeana* is a spreading shrub that grows from half a metre to one metre tall. It occurs in an area extending from Morisset in the Hunter District to the Southern Highlands and the Blue Mountains, and there are outlying populations in the Colymea Creek and Parma Creek areas to the west of Nowra. The species occurs in heath and dry eucalypt forest, usually with an open understorey, on sandy soils. It prefers disturbed sites, e.g. along the edge of tracks and roads, and in areas recently burnt.	Low. *Acacia bynoeana* was not found in the study area and is not likely to occur there. Because the study area has been cleared and grazed, there are few shrubs.
Coastal Parrot-pea *Dillwynia tenuifolia*	V	V	*Dillwynia tenuifolia* is a spreading shrub that reaches a height of about one metre. It occurs on the Cumberland Plain from Windsor to Penrith and east to Deans Park, with outlying populations at Voyager Point and Kemps Creek in the Liverpool LGA, Luddenham in the Penrith LGA and South Maroota in the Baulkham Hills Shire (DECC). In Western Sydney, can be locally common in scrubby/dry heath areas in Castlereagh Ironbark Forest and Shale Gravel Transition Forest on Tertiary alluvium or laterised clays. It can also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland.	Low. *Dillwynnia tenuifolia* was not found in the study area and is not likely to occur there. Few shrubs species have survived the long history of grazing.
Downy Wattle *Acacia pubescens*	V	V	*Acacia pubescens* is a spreading shrub or small tree one to four metres tall. It occurs in open woodland and forest, including Cooks River / Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland. It occurs on alluvium, on shale, and at the intergrade between shale and sandstone. The soils are usually gravely, and often with ironstone. The species does not occur on sandstone. Occurrences are concentrated around the Bankstown Fairfield - Rookwood area and in the Pitt Town area, with outliers at Barden Ridge, Oakdale and Mountain Lagoon (DECC).	Low. *Acacia pubescens* was not found in the study area and is not likely to occur there. The site has been cleared and grazed, so shrubs are scarce. The wildlife Atlas contains only three records of this species from the area.
Juniper-leaved Grevillea *Grevillea juniperina* subsp. *juniperina*	V	-	*Grevillea juniperina* subsp. j*uniperina* is endemic to Western Sydney. It occurs in Castlereagh Woodland in an area extending from Blacktown to Erskine Park, Londonderry and Windsor, with outlier populations at Kemps Creek and Pitt Town (DECC). On sandy soils, the dominant tree species are *Eucalyptus fibrosa*, *E. sclerophylla*, *Angophora bakeri* and *Melaleuca decora*.	Low. *Grevillea juniperina* subsp. *juniperina* may once have occurred in the study area, for the site provides potential habitat and the species is very common in the local area. However, it was not found.
Nodding Geebung *Persoonia nutans*	E	E	*Persoonia nutans* is an erect to spreading shrub that grows to a height of 2.5 metres. It occurs on the Cumberland Plain in Western Sydney, between Richmond and Macquarie Fields, mainly In the Penrith and, to a lesser extent, Hawkesbury LGAs, with isolated and relatively small populations also occurring in the Liverpool, Campbelltown, Bankstown and Blacktown LGAs. It is restricted to aeolian and alluvial sediments, where it occurs in a range of sclerophyll forest and woodland vegetation communities, with most plants being in Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland.	Low. *Persoonia nutans* was not recorded on the site and is not expected to occur there. The subject land has been heavily grazed for many years.

Spiked Rice-flower *Pimelea spicata*	E	E	*Pimelea spicata* occurs in grasslands dominated by native species or a mixture of natives and introduced plants. It occurs on sea cliffs and headlands, and in open woodland and open forest with a grassy understorey.	Low. *Pimelea spicata* was not found on the site. This species is particularly vulnerable to grazing, so it is not likely to occur on a grazing property. There are only four records from the local area
She-oak *Allocasuarina glareicola*	E	E	*Allocasuarina glareicola* is small tree species that grows to a height of about two metres. It is endemic to Western Sydney, where it occurs in Castlereagh Woodlands on lateritic soils. Most of the population occurs in the Londonderry - Castlereagh district, but there is a small outlying population at Liverpool. The species occurs in Castlereagh Nature Reserve.	Low. *Allocasuarina glareicola* occurs nearby, in Castlereagh Nature Reserve, but it was not found in the study area.
Small-flowered Bush-pea *Pultenaea parviflora*	E	V	*Pultenaea parviflora* is a shrub that reaches a height of 1.8 metres. It is endemic to the Cumberland Plain. It mainly occurs in the area from Windsor to Penrith and east to Dean Park, with outlying populations at Kemps Creek and Wilberforce. The species can be locally abundant, particularly in scrubby/dry heath in Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays (DECC). It can also be common in transitional areas adjoining Castlereagh Scribbly Gum Woodland.	Low. *Pultenaea parviflora* was not recorded during the survey and is not likely to occur there. If ever the species was present, it has has not survived the long history of grazing.
Tiny Heath-myrtle *Micromyrtus minutiflora*	E	V	*Micromyrtus minutiflora* is a slender, spreading shrub that reaches a height of two metres. It occurs in Western Sydney, from Richmond and Penrith. It grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest and Shale/Gravel Transition Forest, and in open forest on tertiary alluvium and consolidated river sediments.	Low. *Micromyrtus minutiflora* was not recorded in the study area and is not likely to occur in such heavily grazed regrowth woodland.
Mammals				
Eastern Bentwing Bat *Miniopterus schreibersii oceanensis*	V	-	Eastern Bentwing Bats occur in a wide range of habitats, such as rainforest, eucalypt forest, woodland and grassland. They fly just above or through the tree canopy foraging for moths, but closer to the ground more open areas. The species is cave-dwelling, so the bats usually roost in caves and under rock overhangs. They also roost in built structures, such as mine tunnels, buildings and culverts. Eastern Bentwing Bats breed and raise their young in caves, so natural caves free of disturbance and degradation are essential.	Low. There are no potential roost sites in the study area for this species and there are large areas of potential foraging habitat across the district.
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	V	-	Eastern False Pipistrelles prefer moist forest habitat containing trees taller than 20 metres. They fly through the tree canopy or just above, feeding on flying insects such as moths, and beetles, weevils and ants. They roost in tree hollows, and sometimes under tree bark and in buildings.	Low. These and other threatened microbats could occur in the study area from time to time, in the warm summer months, to forage for insects among the trees. Occurrences would, however, be fleeting. These microbats are extremely wide-ranging, and vast areas of foraging habitat are available throughout their range. There are very few tree hollows that could be used for roosting.
Eastern Freetail Bat *Mormopterus norfolkensis*	V	-	East-coast Freetail Bats usually occur in dry eucalypt forest and woodland, where they forage for insects. They mainly roost in tree hollows, but sometimes roost in built structures.	
Greater Broadnosed Bat *Scoteanax rueppellii*	V	-	Greater Broadnosed Bats occur in rainforest, moist eucalypt forest, dry eucalypt forest and woodland, but prefer the moist end of the spectrum, particularly moist gullies in mature coastal forest and rainforest (Churchill 1998). They fly slowly and low, seeking beetles and insects, especially along creek corridors. They roost in tree hollows and congregate at maternity sites in suitable trees to breed and rear their young.	

Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	Grey-headed Flying-foxes occur in rainforest, mangroves, paperbark forest, eucalypt forest, woodland, orchards and gardens. They are highly mobile, have a large territory, and often travel long distances at night to feed. Their diet consists of fleshy fruit and blossom. In summer, large numbers of flying-foxes congregate in camps to breed and rear their young. The camps are in moist locations with a dense tree canopy. They exhibit a strong fidelity to their camp sites, but the same camp is not necessarily used every year.	Moderate. Flying-foxes could forage in the trees in the study area in summer, in response to seasonal flowering.
Koala *Phascolarctos cinereus*	V	-	Koalas occur in eucalypt forest and woodland containing their preferred feed tree species, i.e. *Eucalyptus tereticornis*, *E. microcorys*, *E. punctata*, *E. viminalis*, *E. camaldulensis*, *E. albens, E. haemastoma*, *E. signata*, *E. populnea* and *E. robusta*. Where Koalas occur, one or more of these species is often dominant or prominent. Because so much native vegetation in NSW has been cleared, Koalas now occur in marginal habitat.	Low. There are no Koala feed tree species in the study area and Koalas are now thought to be extinct in Western Sydney. The Wildlife Atlas contains only one previous record from the local area.
Large-footed Myotis *Myotis adversus*	V	-	Myotis will occur in a wide range of habitats, but the habitat must always be near water. They usually forage over bodies of water, feeding on small fish, insects, moths and beetles, while skimming the surface of the water with their relatively large feet. They often roost in caves and overhangs, but utilise tree hollows and built cave-substitutes such as tunnels, drains and bridges.	Low. The small dams on the property are not likely to attract this species.
Spotted-tailed Quoll *Dasyurus maculatus*	V	V	Quolls live in a wide variety of habitats, e.g. rainforest, eucalypt forest, woodland and coastal heath. Their diet consists of medium sized mammals, birds, small mammals and carrion. They have a large home range, 1287-1452 ha for males and 614-1067 ha for females (Edgar & Belcher 1995). Dens are in hollow logs, tree hollows, caves and crevices. Usually terrestrial.	Low. Given the large size of their territory and their reclusive nature, quolls are not likely to occur in the tiny areas of woodland In the study area. The Wildlife Atlas contains only two previous records from the local area.
Squirrel Glider *Petaurus norfolcensis*	V	-	Squirrel Gliders have highly specialised habitat requirements. They inhabit open, dry eucalypt forest and woodland, and are generally absent from closed and/or moist forest.	Low. There is insufficient habitat in the study area to support a population of Squirrel Gliders, and there have been only three previous records from the local area.
Yellow-bellied Glider *Petaurus australis*	V	-	Yellow-bellied Gliders occur in eucalypt forest containing their preferred feed tree species which, in the Shoalhaven district, are Spotted Gum *Corymbia maculata*, Red Bloodwood *Corymbia gummifera* and Grey Gum *Eucalyptus punctata*. Their diet consists of nectar, pollen, insects and eucalypt sap. The presence of Yellow-bellied Gliders is suggested by V-shaped marks incised through the bark, the gliders feeding on sap as it oozes out. To ensure a continuous supply of food throughout the year, Yellow-bellied Gliders have a large home range, a small family group occupying from 20-85 hectares (NSW NPWS 2003).	Low. The habitat in the study area is not suitable for Yellow-bellied Gliders, and there have been only two previous sightings in the local area.
Birds				
Black-chinned Honeyeater (eastern subspecies) *Melithreptus gularis gularis*	V	-	The Black-chinned Honeyeater eastern subspecies ranges from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range. The species occurs in dry open forests and woodlands dominated by box and ironbark eucalypts, especially *Eucalyptus sideroxylon*, *E. albens*, *E. microcarpa*, *E. melliodora* and *E. tereticornis*. It also inhabits open forest with smooth-barked gums, stringybarks, ironbarks and tea-trees. The species is nomadic, in pairs	Low. The Black-chinned Honeyeater has been recorded in Castlereagh Nature Reserve and elsewhere in the local area, but the NSW Wildlife Atlas contains only four local records. The species could conceivably occur in the study area, but only small

			and small groups of up to 12 birds. Recent studies have found that the Black-chinned Honeyeater tends to occur in the largest woodland patches in the landscape as birds forage over large home ranges of at least five hectares (DECC).	patches of potential habitat are available. Any occurrences would be sporadic.
Black-necked Stork *Ephippiorhynchus asiaticus*	E	-	Black-necked Storks inhabit lagoons, swamps, estuarine mudflats and mangrove swamps. They also occur on dry floodplains, among irrigated crops, and in open grassy woodlands. They feed in shallow water.	Low. There is no suitable habitat in the study area, and the NSW Wildlife Atlas contains only one record from the local area.
Glossy Black-Cockatoo *Calyptorhynchus lathami*	V	-	Glossy Black-Cockatoos live in mature eucalypt forest and woodland containing stands of cone-bearing Black She-oak *Allocasuarina littoralis* trees, which are their primary source of food. They prefer mature forest, because only mature forest contains tall old eucalypts with hollows for nesting and casuarina fruit in sufficient quantities to sustain whole populations. Glossy Black-Cockatoos are nomadic and sedentary in behaviour. Their movements are mostly local, as they roam from one foraging area to another in a district.	Low. There is no suitable habitat in the study area for Glossy Black-Cockatoos and the NSW Wildlife Atlas contains only one record from the local area.
Masked Owl *Tyto novaehollandiae*	V	-	Masked Owls inhabit forest and woodland. They hunt along the edge of the forest and roost in dense trees in gullies. Their diet consists mainly of small and medium sized terrestrial mammals, at least two thirds of which are captured on the ground (Debus & Rose 1994). Masked Owls require tree hollows for breeding. They have a large territory of 500-1000ha.	Low. Masked Owls are not likely to occur in the study area. The Wildlife Atlas contains only one local record. The small patches of woodland on the site provide only marginal habitat, and there are vast areas of better habitat throughout the district.
Painted Honeyeater *Grantiella picta*	V	-	Painted Honeyeaters occur on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During winter, they are more likely to occur in the northern part of their range. They are nomadic and occur in low densities across their range. Painted Honeyeaters usually inhabit Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests, where they feed on the fruit of mistletoes (mainly the genus *Amyema*) growing on woodland eucalypts and acacias (DECC).	Low. Painted Honeyeaters are not likely to occur in the study area. The species rarely occurs on the eastern side of the Great Dividing Range. There has been only one record in the local area, which raises the possibility of a misidentification.
Regent Honeyeater *Xanthomyza phrygia*	E	E	Regent Honeyeaters occur in temperate eucalypt woodland and open forest, in wooded farmland and in urban areas with mature trees. They prefer areas with large trees, many flowering trees and a tall shrub layer. They are wide ranging and highly nomadic.	Low. Regent Honeyeaters are not likely to occur in the study area, but chance occurences cannot be totally ruled out.. It could turn up virtually anywhere, but there is nothing to particularly attract it to this site.
Speckled Warbler *Chthonicola sagittata*	V	-	The range of the Speckled Warbler extends southwards from south-eastern Queensland, across the eastern half of NSW and into Victoria, as far west as the Grampians. The species' distribution is patchy. Speckled Warblers usually occur on the hills and tablelands of the Great Dividing Range. They are rarely seen on the coast. They inhabit eucalypt woodland with an open canopy, grassy understorey and typically a sparse shrub layer, often on rocky ridges or in gullies (DECC). They usually forage on the ground.	Low. Speckled Warblers have been recorded nearby, in Castlereagh Nature Reserve, and in several other locations. Chance occurrences in the study area cannot be totally ruled out; however, any occurrences would be fleeting because of the lack of shrubs and the heavily grazed and mostly exotic nature of the ground cover.

Square-tailed Kite *Lophoictinia isura*	V	-	Square-tailed Kites occur in forest and woodland in coastal and subcoastal regions. They prefer a structurally diverse landscape with a good supply of small birds for prey and large trees in undisturbed forest for nesting. Square-tailed Kites migrate to south-eastern NSW in summer. Each pair ranges widely over a large territory.	Low. Square-tailed Kites probably occur in the general area from time to time, but are not likely to occur in these small patches of regrowth. There have been only three previous sightings in the local area
Swift Parrot *Lathamus bicolour*	E	E	Swift Parrots occur in south-eastern Australia and breed only in Tasmania. They occur on the mainland in winter, outside the breeding period, in winter-flowering eucalypts such as Red Iron-bark *Eucalyptus sideroxylon*, Yellow Gum *E. leucoxylon*, White Box *E. albens* and Swamp Gum *E. ovata* (Brown 1989). They also occur in fertile forest habitat containing Woollybutt *E. longifolia* and, along the coast, Coast Banksia *Banksia integrifolia*.	Low. Although the study area provides only small areas of potential habitat, Swift Parrots could occur in the study area from time to time. Although a nomadic species, there are numerous records from the local area.
Frogs				
Green and Golden Bell Frog *Litoria aurea*	E	V	Green and Golden Bell Frogs occur in freshwater streams, swamps, lagoons, dams, soaks and ponds, preferably those containing bullrushes and spikerushes. However, they sometimes occur on highly disturbed sites, e.g. disused industrial sites, brick pits and landfill areas. Their optimum habitat is an unshaded body of water that is free of predatory fish, with a grassy area nearby and daytime shelter sites, such as vegetation and/or rocks.	Low. Green and Golden Bell Frogs are not likely to occur in the study area. All of the farm dams contain Plague Minnow *Gambusia holbrooki*, a small introduced fish that feeds on the eggs and spawn of frogs, including Green and Golden Bell Frogs. Emergent aquatic plants are also rare.
Other				
Cumberland Land Snail *Meridolum corneovirens*	E	-	Cumberland Land Snails occur in remnant woodland on the Cumberland Plain, on Wianamatta Shale and old Nepean river gravels. They are usually found under logs and debris and around the base of trees and clumps of grass, burrowing in loose soil (NSW Scientific Committee).	Medium. Cumberland Land Snails could occur in the study area, although none were found during what was a reasonably thorough search. The species is common in the local area and the study area contains potential habitat, albeit with little ground cover in most places.

[+] V = vulnerable, E = endangered, - = not listed.

6.3 Threatened Populations

The *Marsdenia viridiflora* subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas has been listed as an endangered population. The population does not occur in the study area at Londonderry and no individual specimens of *Marsdenia viridiflora* subsp. *viridiflora* were found in the study area.

No threatened populations occur in the Mulgrave study area. The site is cleared land supporting mostly exotic plant species.

6.4 Threatened Communities

The small stand of woodland in the north-eastern corner of the study area, near The Northern Road, is an example of the Castlereagh Swamp Woodland endangered ecological community. It is on low-lying ground with poorly drained depressions and areas of moist soils. The soils appear to be seasonally water-logged. Parramatta Red Gum *Eucalyptus parramattenis* and Thyme Honey-myrtle *Melaleuca thymifolia*, which are indicative of the moist soil conditions associated with Castlereagh Swamp Woodland, are common; other characteristic Castlereagh Swamp Woodland species are uncommon or absent, as a result of a long history of grazing and other farm activities. More of the woodland at the eastern end of the study area may be Castlereagh Swamp Woodland, but a less obvious example because few *Eucalyptus parramattenis* trees are present, and the soils are drier and the conditions are less "swampy".

No threatened communities occur in the Mulgrave study area. The site is cleared land, and covered in thick Kikuyu Grass *Pennisetum clandestinum*.

6.5 Migratory Species

The EPBC Act allows for the listing of internationally protected migratory species, i.e. species listed under the Japan - Australia Migratory Bird Agreement (JAMBA), the China - Australia Migratory Bird Agreement (CAMBA) and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Many internationally protected migratory species occur in the Penrith local government area. A few were recorded in the study area during the survey, namely the Australian Wood Duck, Chestnut Teal, Masked Lapwing and Grey Goshawk. There is no important habitat in the study area for these species, however, and the habitat in the study area does not support an ecologically important proportion of a population of these species.

7. Impact on Flora and Fauna

7.1 General Impact

The development of the mushroom farm will primarily be contained on cleared land, generally absent of any woodland or stands of native plants. The development would result in the removal of a few trees here and there. The woodland to the rear of the property is totally avoided. Some of the trees associated with the Castlereagh Swamp Woodland in the front of the land would be removed; these are near the childcare centre.

For full details of the proposal, refer to the Part 3A Application prepared by Perram & Partners.

7.2 Impact on Threatened Species, Populations and Communities, etc.

7.2.1 Legislative Context

(1) Threatened Species Conservation Act 1995

The New South Wales *Environmental Planning and Assessment Act 1979* (EP&A Act), as amended by the *Threatened Species Conservation Act 1995* (TSC Act), the *Threatened Species Conservation Amendment Act 2002* (TSC Amendment Act) and the *Fisheries Management Act 1994* (FM Act), requires that various factors of assessment be taken into account in deciding whether a proposed action, development or activity is likely to have a significant effect on threatened species, populations or communities, or their habitats and, hence, whether the preparation of a Species Impact Statement (SIS) is warranted.

The DECC's "Threatened Species Assessment Guidelines; the Assessment of Significance" (DECC, August 2007) "clarify the specific terminology of the relevant legislation and provide clear interpretations of the factors of assessment" (p.2, para.4), thereby assisting applicants and proponents of developments and activities in the interpretation and application of the factors of assessment.

(2) Environment Protection and Biodiversity Conservation Act 1999

The impact of a proposed action on matters of national environmental significance is assessed under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Matters of national environmental significance are World Heritage properties, National Heritage places, wetlands of international importance (RAMSAR wetlands), threatened species and ecological communities listed under the EPBC Act, migratory species listed under the EPBC Act, Commonwealth marine environment, and nuclear actions (including uranium mining).

An "action" is a project, a development, an undertaking, an activity or a series of activities, and an alteration of any of the above. An action can be on Commonwealth land, State land council land, private land, or water.

Approval is required from the Commonwealth Environment Minister for actions that are likely to have a significant impact on a matter of national environmental significance; these are called "controlled actions". A proposed action is a "controlled action" if:

- is likely to have a significant impact on a matter of national environmental significance,
- is likely to have a significant impact on the environment of Commonwealth land,
- is to be undertaken on Commonwealth land and is likely to have a significant impact on the environment anywhere, and
- is an action to be taken by the Commonwealth that is likely to have a significant impact on the environment anywhere.

Only the Commonwealth can advise definitively whether a proposed action is a controlled action; however, the Department of the Environment and Heritage has prepared guidelines to help proponents decide whether an action is likely be a controlled action that should be referred to the Minister for assessment and approval; these are known as the *Significant Impact Guidelines: Matters of National Environmental Significance* (DEH May 2006).

(3) The Bilateral Agreement

The Agreement between the Commonwealth of Australia and the State of New South Wales relating to environmental impact assessment (Australian Government 2007), referred to as the Bilateral Agreement, accredits the assessment regimes under Part 3A, Part 4 and Part 5 of the EP&A Act for assessment purposes under the EPBC Act. The Bilateral Agreement applies to "controlled actions" in relation to matters of national environmental significance, with the exception of nuclear actions.

The following implications of the agreement for environmental impact assessment processes in New South Wales have been set out by the NSW Department of Planning in their Guide to Implementation in NSW (NSW Department of Planning 2007).

"Prior to the Bilateral Agreement, the NSW assessment process was accredited by the Commonwealth on a project by project basis when a full assessment was required under the EPBC Act. This avoided the need to assess the developments under both Acts. Now under the Bilateral Agreement, project by project accreditation of the process is no longer required.

Following the assessment and determination under the EPA Act, the Assessment Report and determination including approval conditions (if approved) is forwarded to the Department of the Environment and Water Resources. This means that there is no longer a need for parallel assessments by the Commonwealth and the NSW government for controlled actions, and that projects which require approval from both the State and Commonwealth would only be assessed once – by a State agency or a council. The same assessment is then used by both the State and the Commonwealth to determine whether to approve the proposal.

The Bilateral Agreement will only apply to projects that are determined to be controlled actions by the Commonwealth. These projects may be assessed under the Bilateral Agreement if Part 3A, Part 4 and Part 5 of the EPA Act apply. . . The Bilateral Agreement does not apply to developments that affect Commonwealth land or developments undertaken by Commonwealth agencies. Such developments will need to be assessed separately by the Commonwealth and NSW State governments.

The Bilateral Agreement only provides for accreditation of the specified state assessment processes to meet the assessment requirements of the EPBC Act. The Commonwealth will still need to issue a separate approval for the development (based on the state assessment and approval conditions)."

(4) SEPP No.44 - Koala Habitat Protection

State Environmental Planning Policy No.44 - Koala Habitat Protection (SEPP 44) (New South Wales 1995) encourages the conservation and management of natural vegetation providing habitat for Koalas, to ensure a permanent free-living population over the species' present range and to reverse the current trend of Koala population decline. SEPP 44 applies only in the local government areas listed in Schedule 1 of the policy.

SEPP 44 helps to identify "potential Koala habitat", i.e. "areas of native vegetation where the trees of the types listed in Schedule 2 [of SEPP 44] constitute at least 15% of the total number of trees in the upper or lower strata of the tree component". If no Schedule 2 tree species are present or if they constitute less than 15% of the total number of trees present, then no further provisions of the Policy apply.

If more than 15% of the trees in the area are Schedule 2 tree species, then an assessment must be made by a qualified person to determine whether the area contains "core Koala habitat", a term applied to "an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population".

7.2.2 Assessment under the TSC Act

Factors of Assessment; Assessment of Significance

The factors of assessment set out under Section 5A of the EPA Act have been applied, below, to assist in determining whether the proposed development/activity is likely to have a significant effect on species, populations and communities (and their habitats) listed under the TSC Act and FM Act. The factors have been interpreted and applied in accordance with the Department of Environment and Climate Change's "Threatened Species Assessment Guidelines; the Assessment of Significance" (DECC 2007).

The factors of assessment have been applied, threatened species, populations and communities that:

- were recorded on the subject land, or
- are likely to use the on-site habitats, or
- are likely to be influenced by off-site impacts of the proposal.

Note that no further assessment of the Mulgrave site is undertaken below, as it is entirely covered in exotic vegetation and is a completely modified landscape.

The Assessment Guidelines (DECC 2007, pp.3-4) provide the following definitions as they apply to the Factors of Assessment:

Subject site means the area directly affected by the proposal.

Study area means the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly. The study area should extend as far as is necessary to take all potential impacts into account.

Direct impacts are those that directly affect habitat and individuals. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat. When applying each factor, consideration must be given to all of the likely direct impacts of the proposed activity or development.

Indirect impacts occur when project-related activities affect species, populations or ecological communities in a manner other than a direct loss. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas. As with direct impacts, when applying each factor, consideration must be given to all of the likely direct impacts of the proposed activity or development.

Assessment of Significance - Castlereagh Swamp Woodland

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The Assessment Guidelines (DECC 2007, p.5) provide the following context and interpretation of key terms used in this factor, as well as a note on the application of this factor.

Context

This factor refers only to those species listed on Part 1 and Part 4 of Schedule, Part 1 of Schedule 1A and Part 1 of Schedule 2 of the TSC Act, and Part 1 and Part 4 of Schedule 4 and Schedule 5 of the FM Act.

Interpretation of key terms used in this factor

Life cycle: the series or stages of reproduction, growth, development, ageing and death of an organism.

Viable: the capacity to successfully complete each stage of the life cycle under normal conditions.

Local population: the population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the definitions.

- The *local population* of a threatened plant species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.
- The *local population* of *resident fauna* species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitat in the study area.
- The *local population* of *migratory or nomadic fauna* species comprises those individuals that are likely to occur in the study area from time to time.

In cases where multiple populations occur in the study area, each population should be assessed separately.

Risk of extinction: the likelihood that the local population will become extinct either in the short-term or in the long-term as a result of direct or indirect impacts on the viability of that population.

Application

The key assessment is risk of extinction of the local population. The risk of extinction will increase if any factor operates to reduce the population size or reproduction success. The components of the life cycle of a species are dependent on its habitat and affected by threatens to the species. The removal or modification of habitat or changes to the nature of important periodic disturbances such as fire or flood may affect the survival of that species. Therefore, it is important that the applicant/proponent not only has an understanding of the species' life cycle, but also an understanding of the way in which a species makes use of its habitat, the way this may change at particular times or in certain conditions, and whether the life cycle is dependent on a particular disturbance.

Demonstrating that a population is not viable would require considerable effort and study. Therefore any known or presumed local population should be assumed viable unless the contrary can be conclusively demonstrated through analysis of local ecological information, records, references and knowledge of the species' behaviour and habitat or through a comprehensive on-site ecological study.

Response to factor (a):

Not relevant; no threatened species are known or expected to occur on the study area.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

The Assessment Guidelines (DECC 2007, p.6) state that "this factor is essentially identical to factor (a) except it refers only to endangered populations. . . . whereas factor (a) refers to species.

Response to factor (b):
Not relevant; no endangered populations occur on, or adjacent to, the study area.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its occurrence is likely to be placed at risk of extinction

The Assessment Guidelines (DECC 2007, p.7) provide the following context and interpretation of key terms used in this factor, as well as a note on the application of this factor.

It is important to note that the size or age of a remnant are not determining factors as to whether that remnant constitutes a listed endangered or critically endangered ecological community.

Ecological communities are usually defined by two major components - the geographical distribution and the species composition which influences the physical structure and ecological function of the ecological community. The relative importance of the geographical distribution and the species composition varies according to the specific listed ecological community. Hence, this factor provides for consideration of two criteria:
(i) local occurrence of the ecological community
(ii) modification of the ecological community's composition.
Local occurrence: the ecological community that occurs within the study area. However, the local occurrence may include adjacent areas if the ecological community on the study area forms part of a larger contiguous area of that ecological community and the movement of individuals and exchange of genetic material across the boundary of the study area can be clearly demonstrated.
Risk of extinction: similar to the meaning set out in factor (a), this is the likelihood that the local occurrence of the ecological community will become extinct either in the short-term *or* in the long-term as a result of direct or indirect impacts on the ecological community, and includes changes to ecological function.
Composition: both the plant and animal species present, and the physical structure of the ecological community. Note that while many ecological communities are identified primarily by their vascular plant composition, an ecological community consists of all plants and animals as defined under the TSC and FM Acts that occur in that ecological community.
Application
Determining the risk of extinction of an ecological community is difficult. Critical thresholds of remnant size, and species and structural composition required to maintain ecological functioning will vary from ecological community to ecological community. When evaluating the significance of the impact, consideration must be given to whether the life cycles of the species which make up the ecological community will be disrupted in a similar manner to the consideration of individual species described in factor (a). Disproportionate impacts may occur on certain components of the community that may that may cause those components to be placed at greater risk of extinction without explicitly placing the entire ecological community at risk. Loss of individual species from a community may simplify faunal, floristic or vegetation structure and have flow-on effects to other plant and animal species. This may increase its susceptibility to extreme events and decrease its resilience. An assessment of ecological functioning is critical to this factor.

Response to (c) (i) and (ii):
(i) The proposed development is not likely to have a significant impact upon the extent of **the Castlereagh Swamp Woodland** such that its local occurrence is likely to be placed at risk of extinction. The development will modify a tiny remnant of **Castlereagh Swamp Woodland**, by removing a few trees and possibly other species. This is unlikely to substantially and adversely modify the composition of the ecological community such that its occurrence is likely to be placed at risk of extinction. This conclusion is reached because the development, i.e. the child care centre, impinges only marginally on the edge of the small and highly degraded remnant of the community in the far north-eastern corner of the land. We have made a recommendation regarding improving the condition of this vegetation remnant later in this report.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The Assessment Guidelines (DECC 2007, p.8) provide the following interpretation of key terms used in this factor, as well as a note on the application of this factor.
Habitat: the area occupied, or periodically or occasionally occupied, by any threatened species, population or ecological community and includes all the different aspects (both biotic and abiotic) used by species at different stages of their life cycles.
Extent: the physical area removed and/or to the compositional components of the habitat and the degree to which each area is affected.
Importance: related to the stages of the species' life cycles and how reproductive success may be affected.
Locality: the same meaning ascribed to local population of a species or local occurrence of an ecological community.
Application
When applying this factor, consideration must be given to all short- and long-term impacts (direct and indirect) on habitats which are likely to support threatened species, populations and ecological communities regardless of whether the habitat occurs on the subject site. This applies to both occupied and unoccupied habitat because the recovery of threatened species, populations and ecological communities relies on them having access to suitable habitat to move into as numbers increase.
The extent to which habitat is likely to be removed or modified should be determined by estimating the total area of habitat to be directly and indirectly impacted by the proposed development, activity or action. This may an estimation of the surface area of land to be affected, and/or in some cases the number of key habitat components to be affected.
When deciding whether an area of habitat is likely to become fragmented or isolated from other areas of habitat, it is necessary to identify and assess patterns and extent of habitat connectivity. The affected habitat may form part of a habitat corridor, cul-de-sac or an isolated area. . . The dispersal and genetic exchange mechanisms of individual species should be considered. . . .
When assessing the importance of the habitat likely to be removed, modified, fragmented or isolated in the locality, a quantitative and qualitative approach should be adopted, as follows:

- an assessment of the area and quality of habitat of the threatened species, population or ecological community that occurs within the locality from recent Landsat imagery, vegetation mapping, topographic maps, air photos and in some cases data obtained from on-ground investigations
- an estimate of the area and quality that the habitat of the study area represents in relation to the area and quality of that habitat within the locality
- an assessment of the role of the habitat to be affected in sustaining habitat connectivity in the locality
- an assessment the ecological integrity of the habitat to be affected in the study area in relation to the ecological integrity, tenure and security of the habitat which will remain both in the study area and in the locality.

Response to factor (d) (i), (ii) and (iii):
Castlereagh Swamp Woodland occurs in the far north-eastern corner of the land. The proposed development generally avoids this stand of the community and proposes to generally protect and enhance the vegetation remnant. The development therefore is not likely to impact upon the community to such as extent that its habitat is significantly removed or modified, nor fragmented or isolated from other areas of habitat. In summary, the community will not be removed, modified, fragmented or isolated such that its long-term survival in the locality is compromised.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

The Assessment Guidelines (DECC 2007, p.9) provide the following note on the application of this factor.
This factor is aimed at assessing whether the proposal is likely to affect (directly or indirectly) areas of critical habitat present in the study area. Critical habitat refers only to those areas of land listed in the following registers:

- The Register of Critical Habitat kept by the Director-General, DECC; and
- The Register of Critical Habitat kept by the Director-General, DPI.

Response to factor (e):
No critical habitat has been declared in the study area.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

The Assessment Guidelines (DECC 2007, p.10) provide the following note on the application of this factor.
Application
When deciding whether the proposal is consistent with the objectives or actions of a recovery plan or threat abatement plan, applicants/proponents must consider all relevant approved recovery plans and threat abatement plans. In addition, it is recommended that they refer to draft recovery plans and draft threat abatement plans, and threatened species profiles and related guidelines ...

Response to factor (f):
Not applicable; recovery plans have not been prepared for **Castlereagh Swamp Woodland**.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The Assessment Guidelines (DECC 2007, p.11) provide these notes on the context and application of this factor.
Context
This factor refers only to those key threatening processes (KTPs) listed in Schedule 3 of the TSC Act and Schedule 6 of the FM Act.
Application
In addition to deciding whether the action/activity constitutes a KTP, consideration must also be given to whether the proposal is likely to exacerbate a KTP. Species listed in the determination as being 'at risk' warrant particular consideration if these species are known or likely to occur within the study area of the development or activity.

Response to factor (g):
The applicability of key threatening processes to the proposed development has been assessed below.

Key Threatening Process	Applicable; Yes/No
TSC Act	
Weeds	
Invasion and establishment of exotic vines and scramblers	no
Invasion and establishment of Scotch Broom *Cytisus scoparius*	no
Invasion of native plant communities by bitou bush *Chrysanthemoides monilifera* and boneseed	no
Invasion of native plant communities by exotic perennial grasses	no
Invasion, establishment and spread of *Lantana camara*	no
Pest Animals	
Competition and grazing by feral European Rabbit	no
Competition and habitat degradation by Feral Goats	no
Competition from Feral Honey Bees	no
Herbivory and environmental degradation caused by feral deer	no
Importation of Red Imported Fire Ants	no
Introduction of the Large Earth Bumblebee	no
Invasion and establishment of the Cane Toad *Bufo marinus*	no
Invasion of the Yellow Crazy Ant, *Anoplolepis gracilipes*	no
Predation by the Feral Cat	no
Predation by the European Red Fox	no
Predation by Plague Minnow *Gambusia holbrooki*	no
Predation from the Ship Rat on Lord Howe Island	no
Impact of Feral Pigs	no
Habitat loss/change	
Alteration to the natural flow regimes of rivers, etc.	no
Bushrock removal	no
Clearing of native vegetation	yes
Alteration of habitat following subsidence due to longwall mining	no
High frequency fire resulting in the disruption of life cycle processes	no
Anthropogenic Climate Change	yes
Loss and/or degradation of sites used for hill-topping by butterflies	no
Loss of hollow-bearing trees	no

Removal of dead wood and dead trees	yes
Diseases	
Infection by Psittacine Circoviral Disease in Parrots	no
Infection of frogs by amphibian chytrid	no
Infection of native plants by *Phytophthora cinnamomi*	no
Other Threats	
Death or injury to marine species following capture in shark control programs	no
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments	no
FM Act	
Current shark meshing program in NSW waters	no
Hook and line fishing in areas important for the survival of threatened fish	no
Introduction of fish to fresh waters within a river catchment outside their natural range	no
The removal of large woody debris from NSW rivers and streams	no
The degradation of native riparian vegetation along NSW water courses	no
Instream structures and other mechanisms that alter natural flow	no
Introduction of non-indigenous fish and marine vegetation to the coastal waters of NSW	no

A small amount of native vegetation on the Londonderry study area will be cleared, as native plants are scatted over the land.

Although the sites are very small, clearing the native vegetation will, to a very minor extent, contribute to anthropomorphic climate change by the release of green house gases.

Some dead wood would be removed, but this is very minor and is not from significant stands of woodland where it is a valuable habitat component.

Conclusion, TSC Act

The Assessment Guidelines (DECC 2007, p.12) emphasise that, in making an assessment of significance, "the threatened species assessment of significance should **not** be considered a 'pass or fail' test. Instead, consideration of the factors will inform the decision-making process of the likelihood of significant effect. Where necessary, the process will trigger further assessment in the form of a species impact statement.

All factors should be considered as well as any other information deemed relevant to the assessment. The assessment of significance should not be used as a substitute for a species impact statement. Application of the precautionary principle requires that a lack of scientific certainty about the impacts of an action does not itself justify a decision that the action is not likely to have a significant impact. If information is not available to conclusively determine that there will not be a significant impact on a threatened species, population or ecological community, or its habitat, then it should be assumed that a significant impact is likely and a species impact statement should be prepared.

Proposed measures that mitigate, improve or compensate for the action, development or activity should not be considered in determining the degree of the effect on threatened species, populations or ecological communities, unless the measure has been used successfully for that species in a similar situation.

In many cases where complex mitigating, ameliorative or compensatory measures are required, such as the translocation, bush restoration or purchase of land, further assessment through the species impact statement is likely to be required.

In determining the nature and magnitude of an impact, it is important to consider matters such as:

- pre-construction, construction and occupation/maintenance phases
- all on-site and off-site impacts, including location, installation, operation and maintenance of auxiliary infrastructure and fire management zones
- all direct and indirect impacts
- the frequency and duration of each known or likely impact/action
- the total impact which can be attributed to that action over the entire geographic area affected, and over time
- the sensitivity of the receiving environment
- the degree of confidence with which the impacts of the action are known and understood.

Recovery and threat abatement plans, priorities action statement, threatened species profiles and other fact sheets prepared by DECC and DPI may provide further guidance on whether an action or activity is likely to be significant.

In our opinion, the development of the proposed mushroom facility at Londonderry is **not likely** to have a significant effect on any threatened species, populations or communities listed under the *Threatened*

Species Conservation Act 1995 and the *Fisheries Management Act 1994*, or their habitats, and the preparation of a Species Impact Statement (SIS) is not warranted.

7.2.3 Assessment under the EPBC Act

The following questions in the *Significant Impact Guidelines* (DEH May 2006) must be addressed when deciding whether or not to refer a proposed action to the Commonwealth Minister for the Environment:

1. Are there any matters of national environmental significance located in the area of the proposed action (noting that 'the area of the proposed action' is broader than the immediate location where the action is undertaken; consider also whether there are any matters of national environmental significance adjacent to or downstream from the immediate location that may potentially be impacted)?

Response: No matters of national environmental significance are known to be located in the area of the proposed action. The Grey-headed Flying-fox, which is a nationally threatened species, is the only matter of national environmental significance expected to occur on the subject land; this species could occasionally visit the site.

2. Considering the proposed action at its broadest scope (that is, considering all stages and components of the action, and all related activities and infrastructure), is there potential for impacts, including indirect impacts, on matters of national environmental significance?

Response: Considering the proposed action at its broadest scope, the proposed development is not likely to have a direct or indirect impact on Grey-headed Flying-foxes. Few trees will be removed as a result of the proposed action; in fact, hardly any native vegetation will be removed.

3. Are there any proposed measures to avoid or reduce impacts on matters of national environmental significance (and if so, is the effectiveness of these measures certain enough to reduce the level of impact below the 'significant impact' threshold)?

Response: The proposed development is not likely to have an impact on Grey-headed Flying-foxes or on any other matter of national environmental significance.

4. Are any impacts of the proposed action on matters of national environmental significance likely to be significant impacts (important, notable, or of consequence, having regard to their context or intensity)?

Response: The proposed development is not likely to have a significant impact on Grey-headed Flying-foxes or on any other matter of national environmental significance.

An action must be referred to the Commonwealth Minister if the action has, will have, or is likely to have a significant impact on matters of national environmental significance. In addition to setting out "significant impact criteria" for the various matters of national environmental significance, e.g. endangered species, vulnerable species, endangered ecological communities and listed migratory species, the *Guidelines* provide the following important definitions.

> "A *significant impact* is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. You should consider all of these factors when determining whether an action is likely to have a significant impact on matters of national environmental significance."
>
> "To be *likely*, it is not necessary for a significant impact to have a greater then 50% chance of happening, it is sufficient if a significant impact on the environment is a real or not remote chance or possibility."
>
> "*Population*, in relation to critically endangered, endangered or vulnerable, threatened species, means:
> - a geographically distinct regional population, or collection of local populations; or
> - a regional population, or collection of local populations occurring within a particular bioregion."
>
> "An *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:
> - key source populations either for breeding or dispersal,

- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species' range.

"*Habitat critical to the survival of a species or ecological community*" refers to areas that are necessary:
- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community."

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

Significant Impact Criteria for Vulnerable Species
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:
- lead to a long-term decrease in the size of an important population of a species;
- reduce the area of occupancy of an important population;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of an important population;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;
- introduce disease that may cause the species to decline; or
- interfere substantially with the recovery of the species.

Impact of the Proposal on Grey-headed Flying-foxes
The development is not likely to have a significant impact on Grey-headed Flying-foxes. The site is not known or expected to support an "important population" of Grey-headed Flying-foxes, as defined above, and the development involves clearing only a relatively small area of potential foraging habitat for the species, not breeding habitat. There are vast areas of similar habitat in the local area and throughout the district.

Significant Impact Criteria for Listed Migratory Species
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:
- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

An area of "important habitat" for a migratory species is:
- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or
- habitat that is of critical importance to the species at particular life-cycle stages; and/or
- habitat utilised by a migratory species which is at the limit of the species range; and/or
- habitat within an area where the species is declining.

Listed migratory species cover a broad range of species with different life cycles and population sizes. An "ecologically significant proportion" of a population therefore varies from species to species.

In relation to migratory species, "population" means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries including Australia.

Impact of the Proposed Development on Listed Migratory Species

The proposal is not likely to have a significant impact on listed migratory species. There is no "important habitat" in the area for such species and the habitat in the area is not likely to support an ecologically important proportion of a population of such species.

Conclusion, EPBC Act

In our opinion, the proposed development is not likely to have a significant impact on matters of national environmental significance listed under the *Environment Protection and Biodiversity Conservation Act*. Referral to the Commonwealth Minister for the Environment for assessment and approval is therefore not warranted. The proposed development is not likely to constitute a "controlled action" because is it not "likely to have a significant impact on a matter of national environmental significance". The Bilateral Agreement, which applies only to projects determined to be "controlled actions", does not apply.

7.2.4 Assessment under SEPP 44

The Penrith LGA is not one of the local government areas in which *State Environmental Planning Policy No.44 - Koala Habitat Protection* (SEPP 44) applies; no further assessment is required under this Policy.

8 Conclusion and Recommendations

The proposed development at Mulgrave and Londonderry are not likely to have a significant impact on flora and fauna, including species, populations and communities listed under the *Threatened Species Conservation Act 1995*, the *Fisheries Management Act 1994* and the *Environment Protection and Biodiversity Conservation Act 1999*. The preparation of a Species Impact Statement and referral to the Commonwealth Minister for assessment and approval are therefore not warranted.

Recommendations

(i) Tree removal should be avoided wherever possible.

(ii) Where the development is close to woodland remnants that are unaffected by the development, temporary fencing should be installed prior to work commencing to protect the woodland from incursion by machinery.

(iii) Stormwater should not be indiscriminating directed into woodland areas. Preferably, stormwater and waste water should be held in dams and never allowed to enter the patches of woodland.

(iv) The eastern (road frontage) end of the land should be planted with local native species. The following species existing on the site are suitable for this purpose and for screen planting around the site:

Corymbia gummifera	Red Bloodwood
Eucalyptus eugenioides	Thin-leaved Stringybark
Eucalyptus parramattenis	Parramatta Red Gum
Eucalyptus sclerophylla	Hard-leaved Scribbly Gum
Hardenbergia violacea	Native Sarsaparilla
Melaleuca decora	Paperbark
Melaleuca linariifolia	Narrow-leaved Paperbark

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Appendix 1

Summary of Guidelines for Threatened Species Surveys and Assessments (Working Draft) *(DEC 2004)*

Table 5.1 Suggested survey techniques and effort for plant transects (traverses) and random meanders, per stratification unit

Suggested technique	*Suggested minimum effort*	*Information to be recorded*
Transect	1 x 100m traverse per stratification unit <2 ha. 2 x 100m traverses per 2-50 ha of stratification unit. 3 x 100m traverses per 51-250 ha of stratification unit. 5 x 100m traverses per 251-500 ha of stratification unit. 10 x 100m traverses per 501-1000 ha of stratification unit, plus 1 additional 100m traverse for each extra 100 ha.	Floristics, structure, vegetation boundaries.
Random meander	30 minutes for each quadrat sampled within the same stratification unit as the quadrat.	Threatened species.

Table 5.2 Suggested survey techniques and effort for plant quadrats

Suggested technique	*Suggested minimum effort*	*Information to be recorded*
Quadrat	At least: 1 quadrat per stratification unit <2 ha. 2 quadrats per 2-50 ha of stratification unit. 3 quadrats per 51-250 ha of stratification unit. 5 quadrats per 251-500 ha of stratification unit. 10 quadrats per 501-1000 ha of stratification unit, plus 1 additional quadrat for each extra 100 ha.	Floristics, structure, threatened species.

Table 5.3 Suggested survey methods and effort for frogs

Suggested method	*Suggested minimum effort*	*Survey period*
Systematic day habitat search	1 hour per stratification unit.	Varies with seasonal peak activity of target species.
Night habitat search of damp and watery sites	30 minutes on 2 separate nights per stratification unit .	See above.
Nocturnal call playback	At least 1 playback on 2 nights.	See above.
Night watercourse search	2 hours per 200m of water body edge.	See above.

Table 5.4 Suggested survey methods and effort for reptiles

Suggested method	*Effort per stratification unit up to 100 ha on the coast and ranges and up to 200 ha west of the ranges*	*Survey period*
Habitat search	30 minutes search on 2 separate days targeting specific habitat.	November to March.
Pitfall traps with drift nets	24 trap nights, preferably with 6 traps for a minimum of 4 consecutive nights.	November to March.
Spotlighting	30 minutes search on 2 separate days targeting specific habitat.	November to March.

Table 5.5 Suggested survey methods and effort for birds

Suggested method	*Suggested minimum effort*	*Survey period*
Area search	Not resolved, but a species-time curve approach should be utilised for surveying diurnal birds; e.g. the survey session on a given day may cease when no additional species are identified within a set time period.	All year.
Wetland census	A one-hour census at dawn or dusk, at each wetland	All year.
Water source census	A 20-minute census at dawn or dusk, at each water source.	All year.

Table 5.6 Number of sampling sessions required to find an owl species (that was in fact present on site) with a given probability (Debus 1995)

Owl species	*50% probability*	*90% probability*
Powerful Owl	3	7
Masked Owl	4	9
Sooty Owl	3	8

Table 5.7 Suggested survey methods and effort for nocturnal birds

Suggested method	*Suggested minimum effort*	*Survey period*
Call playback	Sites should be separated by 800 metres – 1km, and each site must have the playback session repeated as follows: • at least 5 visits per site, on different nights, for the Powerful Owl, Barking Owl and Grass Owl; • at least 6 visits per site for the Sooty Owl, and 8 visits per site for the Masked Owl. Bush Stone-curlew survey sites should be 2 - 4km apart.	All year. In the breeding season.
Day habitat search	Search habitat for pellets, and likely hollows. Flushing of Bush Stone-curlews by walking through potential habitat.	All year.
Stag-watching	Observing potential roost hollows for 30 minutes prior to sunset and 60 minutes following sunset.	All year.
Spotlighting	Spotlighting for Plains Wanderer and Bush Stone-curlew by foot or from a vehicle driven in first gear.	All year.

Table 5.8 Suggested survey methods and effort for non-flying mammals

Suggested method	*Effort per stratification unit up to 50 ha, plus an additional effort for every additional 100 ha*	*Animal sampled*
Small Elliott traps	100 trap nights over 3-4 consecutive nights.	Small mammals.
Large Elliott traps	100 trap nights over 3-4 consecutive nights.	Medium to large mammals.
Arboreal Elliott traps	24 trap nights over 3-4 consecutive nights.	Arboreal mammals.
Wire cage traps	24 trap nights over 3-4 consecutive nights.	Medium to large mammals.
Pitfall traps with drift nets	24 trap nights over 3-4 consecutive nights.	Small mammals.
Hair tubes	10 large and 10 small tubes in pairs for at least 4 days and 4 nights.	Small and medium mammals.
Arboreal hair tubes	3 tubes in each of 10 habitat trees up to 100 ha of stratification unit, for at least 4 days and 4 nights.	Arboreal mammals.
Spotlighting on foot	2 x 1 hour and 1km up to 200 ha of stratification unit, walking at ~1k.p.h. on 2 separate nights.	
Spotlighting from vehicle	2 x 1 km of track at max. speed of 5km per hour, up to 200 ha of stratification unit, on 2 separate nights.	Arboreal and terrestrial mammals.
Sand plots	6 soil plots for 4 nights.	Medium to large ground mammals.
Call playback	2 sites per stratification unit up to 200 ha, plus an additional site per 100 ha above 200 ha. Each playback site must have the session conducted twice, on separate nights.	Gliders, koalas.
Stag-watching	Observing potential roost hollows for 30 minutes prior to sunset and 60 minutes following sunset.	Gliders and possums.
Search for scats and signs	30 minutes searching each relevant habitat, including trees, for scratch marks.	Mammals.
Track search	1km of track search, mainly where substrate is soft.	Medium to large ground mammals.
Collection of predator scats	Opportunistic collection of scats for hair analysis.	All mammals.

Table 5.9 Appropriate survey methods for threatened bat species (Parnaby 1998)

Common name	*Scientific name*	*Roosts*[+]	*Traps*	*Call Survey*	*Additional methods*
Eastern Cave Bat	*Vespadelus troughtoni*	S	■		Search rocks, overhangs, caves/mines
Inland Forest Bat	*Vespadelus baverstocki*	H	■		
Large Pied Bat	*Chalinolobus dwyeri*	S	■	■	Search rocks, overhangs, caves/mines.
Hoary Bat	*Chalinolobus nigrogriseus*	H	■	■	
Little Pied Bat	*Chalinolobus picatus*	H	■	■	
Greater Long-eared Bat	*Nyctophilus timoriensis*	H	■		Harp traps within vegetation.
Northern Long-eared Bat	*Nyctophilus bifax*	H/V	■		
Greater Broad-nosed Bat	*Scoteanax rueppellii*	H		■	
Great Falsistrelle	*Falsistrellus tasmaniensis*	H	■		
Large-footed Myotis	*Myotis adversus*	S/H	■		Detector and spotlight around water bodies, trapping along riparian flyways.
Golden-tipped Bat	*Kerivoula papuensis*	H/V	■		
Large Bentwing Bat	*Miniopterus schreibersii*	S	■		Search rocks, overhangs, caves/mines.
Little Bentwing Bat	*Miniopterus australis*	S/H	■	■	Search rocks, overhangs, caves/mines.
Little Eastern Mastiff Bat	*Mormopterusnorfolkensis*	H	■	■	

Beccarii's Mastiff Bat	*Mormopterus beccarii*	H	■	■	
Eastern Freetail-bat	*Mormopterus norfolkensis*	H	■	■	
Yellow-bellied Sheathtailed Bat	*Saccolaimus flaviventris*	H	■	■	Spotlight observations.
Grey-headed Flying-fox	*Pteropus poliocephalus*				Spotlight observations, roost surveys.

[+]*Roosts: H-tree hollows, S-subterranean and artificial roosts, V-vegetation.*

Table 5.10 Suggested survey methods and effort for bats

Method	Effort per 100 ha (or portion thereof) of stratification unit targeting preferred habitat	Survey Period
Harp trapping	4 trap nights over two consecutive nights, with 1 trap placed outside the flyways for one night.	October to March.
Ultrasonic call recording	2 sound activated recording devices utilised for the entire night (min. 4 hrs), starting at dusk for 2 nights.	October to March.
Mist netting	Targeted survey: one trap set for at least 2 hours, starting at dusk, for 2 nights.	October to March.
Trip line	For targeted survey of water bodies: at least 2 hours duration starting at dusk, for 2 nights.	October to March.
Spotlighting and transect walking	For targeted survey near likely food resources: 2 x 1 hour spotlighting on 2 separate nights.	All year.
Day habitat search	Search for bat excreta at or near potential habitats.	All year.

Appendix 2
Vegetation Survey Sheet

Vegetation Survey Sheet ***Kevin Mills & Associates***

Date: 2009 **Site No.: 01**

Vegetation Community:
Location: .
GPS Grid Ref. (AGD 66): 56 0290780 6271344 Land Tenure:
Geology: Berry Formation Soil Type: Deep grey clay
Altitude: ?? metres Slope: Flat.
Aspect: North Topography: Broad flat.
Plant Species Cover: (1:<5%; 2:<5-25%, 3:5-25%; 4:25-50%; 5:50-75%; 6:75-100%)

Trees (8-25 m)

Eucalyptus eugenioides	3
Eucalyptus haemastoma	2
Corymbia gummifera	2

Shrubs (1-4m)

Angophora bakeri	3
Ozothamnus diosmifolius	1

Ground cover (<1m)

Angophora bakeri	2
Cheilanthes sieberi	1
Commelina cyanea	3
Echinopogon ovatus	1
Einadia hastata	1
Eragrostis leptostachya	1
Glycine clandestina	1
Gonocarpus teucrioides	1
Hypericum gramineum	1
Lazula ????	1
Microlaena stipoides	5
Oxalis sp.	1
Ozothamnus diosmifolius	1
Portulaca oleracea	1
Pratia purpurascens	3
Solanum americanum	1
Sporobolus creber	1
Urtica incisa	1

Weeds

Axonopus fissifolius	1
Cirsium vulgare	1
Conyza sp.	1
Cyperus polystachyos	1
Grass	1
Modiola caroliniana	1
Setaria gracilis	2
Sida rhombifolia	2
Verbena bonariensis	2

Appendix 3
Final Determination - Castlereagh Swamp Woodland Community

NSW Scientific Committee - final determination

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list the Castlereagh Swamp Woodland Community as an ENDANGERED ECOLOGICAL COMMUNITY on Part 3 of Schedule 1 of the Act. Listing is provided for by Part 2 of the Act.

The Scientific Committee has found that:

1. The Castlereagh Swamp Woodland (CSWL) is the name given to the plant community that is characterised by the following assemblage of species:

Angophora bakeri
Banksia oblongifolia
Baumea articulata
Boronia polygalifolia
Callistemon linearis
Cyperus flaccidus
Dianella revoluta
Elatine gratioloides
Eleocharis sphacelata
Eragrostis elongata
Eucalyptus parramattensis subsp. parramattensis
Eucalyptus sclerophylla
Eucalyptus sideroxylon
Goodenia paniculata
Gratiola pedunculata
Hakea sericea
Kunzea capitata
Lepidosperma spp
Leptospermum polygalifolium
Lepyrodia anarthria
Lepyrodia muelleri
Lythrum hyssopifolia
Melaleuca decora
Melaleuca erubescens
Melaleuca nodosa
Melaleuca thymifolia
Philydrum lanuginosum
Pultenaea villosa
Themeda australis

2. The total species list of the community is larger than that given in 1 (above), with many species present in only one or two sites or in very small quantity. In any particular site not all of the assemblage listed in 1 may be present. At any one time, seeds of some species may only be present in the soil seed bank with no above-ground individuals present. The species composition of the site will be influenced by the size of the site and by its recent disturbance history. The number of species and the above-ground composition of species will change with time since fire, and may also change in response to changes in fire frequency.

3. The structure of the community is generally woodland or may occur as remnant trees. Characteristic tree species in the CSWL are *Eucalyptus parramattensis* subsp. *parramattensis* and *Melaleuca decora*. Small billabongs and/or wetlands may occur within the community.

4. Species composition at any site depends on local topography and drainage conditions; understorey may be seasonally waterlogged.

5. CSWL has been recorded from the local government areas of Bankstown, Hawkesbury, Liverpool and Penrith.
6. CSWL typically is associated with poorly-drained depressions and creeklines on clay soils associated with Tertiary alluvium.

7. CSWL includes the vegetation described as map unit 14c of Benson (1992) and as Castlereagh Woodlands and Wetlands in the Urban Bushland Biodiversity Survey, NPWS (1997).

8. CSWL provides habitat for a number of plant species recognised as being of regional conservation significance in the Urban Bushland Biodiversity Survey, NPWS (1997). These include:

Cyperus haspan
Eriocaulon scariosum
Glossostigma cleistanthum
Goodenia dimorpha var. angustifolia
Isachne globosa
Lepidosperma longitudinale
Myriophyllum simulans
Sacciolepis indica

9. CSWL has an understorey that may be either grassy or herbaceous with many annual and ephemeral species which respond to wet conditions. The shrub layer can be mid-dense to sparse depending on frequency and period since the last fire.

10. Adjacent communities are generally on better-drained soils derived from Tertiary alluvium and may include Castlereagh Ironbark Forest, Castlereagh Scribbly Gum Woodland and Shale-Gravel Transition Forest, Urban Bushland Biodiversity Survey, NPWS (1997). Castlereagh Swamp Woodland may intergrade with adjacent Castlereagh Woodland communities, and these intergrade areas should be considered part of the Castlereagh Swamp Woodland community.

11. Occurrences of CSWL are all less than 100 hectares in size and are restricted to low-lying terrain. They are subject to weed invasion related to nutrient enrichment from surrounding urban and rural areas as well as from direct destruction for hobby farm, rural and residential development, and clay and shale extraction. Additional threatening processes include sedimentation, rubbish dumping, recreational vehicles and trail bikes.

12. Small areas of CSWL are included in Castlereagh Nature Reserve.

13. In view of the small size of existing remnants the threat of further clearing and other threatening processes, the Scientific Committee is of the opinion that the Castlereagh Swamp Woodland Community is likely to become extinct in nature in New South Wales unless factors threatening its survival or evolutionary development cease to operate and that listing as an endangered ecological community is warranted.

Proposed Gazettal date: 24/12/99
Exhibition period: 24/12/99 - 4/2/00

References

NPWS (1997) Urban Bushland Biodiversity Survey (NSW National Park and Wildlife Service: Hurstville).
Benson, D. (1992) The natural vegetation of the Penrith 1:100 000 map sheet. *Cunninghamia* 2(4):541-596.

Appendix 4
Plant Species List, Lot 138 DP 752037, The Northern Road, Londonderry

Pteridophyta (Ferns)

Dennstaedticeae	
Pteridium esculentum	Bracken
Sinopteridaceae	
Cheilanthes sieberi	Mulga Fern

Angiospermae (Flowering Plants)

Agavaceae	
**Yucca aloifolia*	Yucca
Amaranthaceae	
Alternanthera denticulata	Lesser Joyweed
Alternanthera pungens	Khaki Weed
Anacardiaceae	
**Gomphrena celosioides*	Gomphrena
Asclepiadaceae	
**Araujia hortorum*	Moth Vine
Asteraceae	
Centipeda minima	Spreading Sneezeweed
Epaltes australis	Spreading Nut-heads
Lagenifera stipitata	Blue Bottle-daisy
Ozothamnus diosmifolius	Everlasting
**Cirsium vulgare*	Spear Thistle
**Conyza* sp.	Fleabane
**Gamochaeta americana*	American Cudweed
**Senecio madagascariensis*	Fireweed
Boraginaceae	
**Heliotropium amplexicaule*	Blue Heliotrope
Brassicaceae	
Cardamine paucijuga	Bitter-cress
Cactaceae	
**Opuntia stricta*	Prickly Pear
Campanulaceae	
Wahlenbergia gracilis	Australian Bluebell
Chenopodiaceae	
Einadia hastata	Berry Saltbush
Commelinaceae	
Commelina cyanea	Wandering Sailor
Cyperaceae	
**Cyperus brevifolius*	Sedge
Eleocharis sphacelata	Tall Spike-rush
Fimbristylis dichotoma	
Faboideae (subfamily)	
Glycine microphylla	Glycine

Hardenbergia violacea	Native Sarsaparilla
Hypericaceae	
Hypericum gramineum	Small St John's Wort
Hypoxidaceae	
Hypoxis hygrometrica	Golden Weather-grass
Juncaceae	
Juncus usitatus	Common Rush
Lobeliaceae	
Pratia purpurascens	Lobelia Pratia
Malvaceae	
**Modiola caroliniana*	Red-flowered Mallow
**Sida rhombifolia*	Paddy's Lucerne
Myrtaceae	
Angophora bakeri	Narrow-leaved Apple
Callistemon pinifolius	Pine-leaved Bottlebrush
Corymbia gummifera	Red Bloodwood
Eucalyptus eugenioides	Thin-leaved Stringybark
Eucalyptus parramattenis	Parramatta Red Gum
Eucalyptus sclerophylla	Hard-leaved Scribbly Gum
Melaleuca decora	Paperbark
Melaleuca linariifolia	Narrow-leaved Paperbark
Melaleuca nodosa	Paperbark
Melaleuca thymifolia	Thyme Honey-myrtle
Onagraceae	
**Ludwigia peploides*	Water Primrose
Oxalidaceae	
Oxalis exilis	Oxalis
Phytolaccaceae	
**Phytolacca octandra*	Inkweed
Poaceae	
Aristida vagans	Three-awned Speargrass
Chloris truncata	Windmill Grass
Cynodon dactylon	Couch Grass
Echinopogon ovatus	Forest Hedgehog Grass
Eragrostis leptostachya	Paddock Love-grass
Microlaena stipoides	Weeping Grass
Paspalidium distans	Paspalidium
Paspalum distichum	Water Couch
Sporobolus creber	Slender Rats-tail Grass
**Axonopus fissifolius*	Carpet Grass
**Chloris gayana*	Rhodes Grass
**Eragrostis curvula*	African Lovegrass
**Paspalum dilatatum*	Paspalum
**Pennisetum clandestinum*	Kikuyu Grass
**Setaria gracilis*	Slender Pigeon Grass
* *Sporobolus indicus*	Parramatta Grass
Polygonaceae	
Rumex sp.	Dock

Potomogetonaceae	
Potamogeton tricarinatus	Floating Pondweed
Proteaceae	
**Grevillea robusta*	Silky Oak
Rosaceae	
**Rubus fruticosus* sp. agg.	Blackberry
Rubiaceae	
Pomax umbellata	Pomax
Solanaceae	
Solanum pungetium	Jagged Nightshade
**Datura stromonium*	Common Thornapple
**Solanum nigrum*	Black Nightshade
Thymelaeaceae	
Pimelea linifolia	Slender Rice-flower
Urticaceae	
Urtica incisa	Stinging Nettle
Verbenaceae	
**Verbena bonariensis*	Purpletop

Appendix O

CULTURAL HERITAGE ASSESSMENT

BIOSIS
RESEARCH



Tolson's Mushroom Farm and Substrate Plant Project: Cultural Heritage Assessment

Report for Perram and Partners on behalf of the Tolson Group

April 2009

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AUTHOR(S):	Melanie Thomson

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- Steve Randall and Tanya McEwen (Deerubbin Local Aboriginal Land Council)
- Melanie Thomson and Robert Suansri (Biosis Research)

ABBREVIATIONS

AHC	Australian Heritage Council
AHIMS	Aboriginal Heritage Information Management System
ALALC	Armidale Local Aboriginal Land Council
ATSIC	Aboriginal and Torres Strait Islander Commission
CHL	Commonwealth Heritage List
DLALC	Derrubbin Local Aboriginal Land Council
DEH	Department of Environment and Heritage
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change (formerly Department of Environment and Conservation)
EP&A	Environmental Protection and Assessment
EPBC	Environment Protection and Biodiversity Conservation
GSV	Ground surface visibility
ICOMOS	International Council on Monuments and Sites
LEP	Local Environmental Plan
LGA	Local Government Area
MGA	Map Grid of Australia – unless otherwise specified
NHL	National Heritage List
NNTT	National Native Title Tribunal
NPWS	National Parks and Wildlife Service (now part of DECC)
REP	Regional Environment Plan
RNE	Register of the National Estate
SHI	State Heritage Inventory
SHR	State Heritage Register

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EXECUTIVE SUMMARY

Biosis Research Pty. Ltd. was commissioned by Perram & Partners on behalf of the Tolson Group, to undertake an archaeological and cultural heritage assessment of the proposed construction of a new mushroom farm at Londonderry and the proposed expansion of the Mulgrave substrate plant. The aim of the current project is to assess the archaeological and cultural heritage values within the proposed development footprints.

The assessment was walked in transect formation focussing on areas of archaeological potential within the Study Area as well as any exposures and areas of ground surface visibility.

No new Aboriginal archaeological sites were identified as a result of the current field survey.

Recommendations

Recommendation 1 - Stop work provision: Aboriginal sites

All Aboriginal places and objects are protected under the NSW *National Parks and Wildlife Act 1974*. This protection includes Aboriginal places and objects which have not been identified in this report, but which may be identified during construction. Should any previously unidentified Aboriginal objects or places be identified during excavation and construction, all works must cease in the vicinity of the find and the following be notified:

- NSW Department of Environment and Climate Change
- A qualified archaeologist
- Aboriginal stakeholders from the Deerubbin Local Aboriginal Land Council

Recommendation 2 – Human Remains

In the case of skeletal remains the following process will be implemented.

- The find will be reported to police and state coroner
- The Tolson Group will be notified of the find
- Aboriginal stakeholders will be notified of the find
- NSW DECC will be notified of the find
- If the skeletal remains are of Aboriginal ancestral origin an appropriate management strategy will be developed in consultation with the Aboriginal stakeholders
- The find will be recorded in accordance with the *National Parks and Wildlife Act* 1974 (NSW) and the NSW NPWS *Aboriginal Cultural Heritage Standards and Guidelines Kit*
- This Aboriginal Heritage Plan will be amended to include the newly discovered Aboriginal ancestral remains in the management regime established by the plan

1.0 INTRODUCTION

Cultural heritage legislation protecting Aboriginal and historic heritage places applies in New South Wales. These places are an important part of our heritage. They are evidence of more than 40,000 years of occupation of New South Wales by Aboriginal people, and of the more recent period of post-contact settlement.

Heritage sites and places can provide us with important information about past lifestyles and cultural change. Preserving and enhancing these important and non-renewable resources is encouraged.

It is an offence under sections of legislation to damage or destroy heritage places & objects without a permit or consent from the appropriate body (see Appendix 5 for a discussion of relevant heritage legislation and constraints).

When a project or new development is proposed, it must be established whether any cultural heritage places & objects are in the area and how they might be affected by the project. This cultural heritage may be historical or Aboriginal. Often it is possible to avoid & minimise the impact of development or find an alternative to damaging or destroying a heritage place, site or objects. Therefore, preliminary research and field survey to identify these heritage places and objects is a fundamental part of the background study for most developments.

The first stage of a study incorporates background research to collect information about the land relevant to the proposed development project (the Study Area). A second stage involves a detailed field inspection of this area.

Possibly the most important part of the study involves assessing the cultural heritage and archaeological significance of heritage places in the Study Area. Understanding the significance of a heritage place and objects is essential for formulating management recommendations and making decisions.

The subject matter of this report involves the use of a number of technical words and terms with which the reader may be unfamiliar. An extensive glossary has been included at the end of the report and reference to this may be of assistance.

1.1 Project background

Biosis Research Pty. Ltd. was commissioned by Perram and Partners on behalf of the Tolson Group to undertake a Cultural heritage assessment of the proposed development of a new mushroom farm at Londonderry and expand the capacity of the Mulgrave substrate plant.

Recommendations designed to minimise impacts to Aboriginal cultural heritage places and objects have been formulated in accordance with State and Commonwealth statutory provisions, 'best practice' heritage management, and the concerns of the Aboriginal communities.

1.2 Study Area

The Study Area is located in two areas. The first area is the proposed location of the new Londonderry Mushroom Farm which is located on Lot 138 DP 752037, located on the Northern Road in the Penrith Local Government Area. The property is approximately 22.66 hectares. The second property comprises of Lot 4 DP 610341 and part of Lot 3 DP 771652, these properties are located off Mulgrave Road and at part of the Hawkesbury Local Government Area. The area within the development footprint is 12.4 hectares. The location and extent of the Study Area is shown in **Figure 1** and Figure 2.

1.3 Proposal

The Tolson Group is proposing the development of a new mushroom farm at Londonderry and an extension to their existing substrate Plant at Mulgrave.

The farm is proposed for Lot 138 DP 752037, located on The Northern Road in the Penrith Local Government Area. The most recent use of this property has been for grazing, however, it was also used as a piggery prior to that. There has been evidence that stony surface material has been scraped from parts of the site at some time in the past. Approximately three quarters of the property has been cleared. The remaining vegetation comprises of trees, mainly in the rear of the property with some minor clusters on the southern section. There are also a number of dams located on the property and some minor drainage lines leading to the south west (Perram & Partners 2008, 2.1).

The development of the substrate plant is proposed for all of Lot 4 DP 610341 and part of Lot 3 DP 771652. These properties are located just of Mulgrave Road and are part of the Hawkesbury Local Government Area. The existing substrate plant site has been filled to a level of 16 metres AHD creating a development platform above the once in 100 year flood level (Perram & Partners 2008, 2.3-2.4). A further area of approximately 1.5 Ha will be raised to this level by filling.

1.4 Planning approvals

The Tolson's mushroom farm and substrate Plant project will be considered for approval under Part 3A of the *NSW Environmental Planning and Assessment Act 1979* (EPA Act). Under this part of the Act, the project does not have to comply with requirements under Part 6 of the NPW Act. Instead, conditions outlined by the Director-General on approval of the Development Consent will require commitments regarding cultural heritage, including consideration of DECC and NPW Act guidelines and processes for the purposes of 'best practice' heritage management.

This document presents the results of the preliminary Aboriginal archaeological and cultural heritage assessment as per the DECC's *DRAFT Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DECC, 2005).

1.5 Aims

The following is a summary of the major objectives.

- Conduct heritage register searches to identify any previously recorded Aboriginal cultural heritage sites within the survey area. Searches will include the Aboriginal Heritage Information Management System (AHIMS), State Heritage Register / Inventory, National Heritage List, Commonwealth Heritage List, Register of the National Estate, Local and Regional Environmental Plan (LEPs & REPs) and other relevant statutory and non statutory heritage lists.

- Conduct additional background research involving the review of all relevant literature in order to recognise any identifiable trends in Aboriginal archaeological site distribution and location.

- Undertake an archaeological survey of the Study Area, relocating any previously recorded sites within the Study Area and identifying any new Aboriginal archaeological sites or areas of Aboriginal archaeological potential which may be impacted by the proposed works. The survey methodology will take into account the geomorphology, landforms, previous and current land use within and adjacent to the Study Area.

- Record and assess sites identified during the survey in compliance with the guidelines issues by the NSW DECC.

- Identify impacts to all known Aboriginal archaeological sites based on potential ground disturbances caused by the proposed development.

- Make recommendations to minimise or mitigate impacts to Aboriginal archaeological sites within the Study Area.

1.6 Consultation

Consultation with the Deerubbin Local Aboriginal Land Council was carried out by Biosis Research

A general discussion with the Aboriginal representative concerning the proposed recommendations and cultural significance of the Study Area was undertaken on site.

2.0 HERITAGE STATUS AND PLANNING DOCUMENTS

2.1 Commonwealth Registers

2.1.1 National Heritage Registers

The *Environment Protection and Biodiversity Conservation* Act 1999 (Cth) (EPBC Act) establishes two mechanisms for the protection of heritage places of National or Commonwealth significance. The National Heritage List provides protection to places of cultural significance to the nation of Australia. The Commonwealth Heritage List comprises natural, Aboriginal and historical heritage places owned and controlled by the Commonwealth and therefore mostly includes places associated with defence, communications, customs and other government activities.

Nominations to these two lists are assessed by the Australian Heritage Council (AHC), who also compiles the Register of the National Estate (RNE), a list of places identified as having national estate values. There are no management constraints associated with listing on the RNE unless the listed place is owned by a commonwealth agency..

APPLICATION TO THE STUDY AREA – NATIONAL HERITAGE REGISTERS

A search of the National Heritage List, Commonwealth Heritage List and Register of the National Estate was conducted on 03/03/2009. No Aboriginal items listed on the National Heritage Registers are located within the present Study Area (Appendix 2 provides a copy of this information).

2.1.2 National Native Title Register

The Commonwealth *Native Title Act* 1993 establishes the principles and mechanisms for the preservation of Native Title for Aboriginal people.

The purpose of searching the register is to identify any Traditional Owner groups with current registered claims close to the Study Area that may identify themselves as relevant stakeholders with traditional knowledge or experience.

APPLICATION TO THE STUDY AREA – NATIONAL NATIVE TITLE REGISTER LISTINGS

A search of the National Native Title Register, the Register of Native Title Claims and the Register of Indigenous Land Use Agreements of the Haweksbury and Penrith Local Government Areas was completed for the Study Area on 20/02/09 and no claims are listed within the Study Area. The search results identified two Native Title Claims in the area of the proposed mushroom farm, one lodged by the Gundungurra Tribal Council Aboriginal Corporation #6 (reference NC97/7 – NSD6060/98) and a second lodged by Darug Tribal Aboriginal Corporation (reference NC97/8 - NSD6061/98). There was one Native Title Claims in the area of the substrate plant, it was lodged by Darug Tribal Aboriginal Corporation (reference NC97/8 - NSD6061/98).

Although neither claim includes parcels of land within the current Study Area, both groups will be consulted

regarding their cultural knowledge of the Study Area.

2.2 State Registers

2.2.1 National Parks and Wildlife Act Registers

The Department of Environment and Climate Change (DECC) maintains two registers of heritage sites under the auspices of the NSW *National Parks and Wildlife Act 1974*. All Aboriginal sites in NSW are required to be registered on the Aboriginal Heritage Information Management System (AHIMS) register. Historic heritage places within lands managed by DECC (lands such as National Parks) are listed on the Historic Heritage Information Management System (HHIMS).

AHIMS: A search of the AHIMS register was undertaken at the commencement of the project. The AHIMS database is maintained by the DECC and contains a list of all Aboriginal objects, Aboriginal places and other Aboriginal heritage values in NSW that have been registered as required under the NSW *National Parks and Wildlife Act 1974*.

The area searched on the AHIMS database was larger than the Study Area, as Aboriginal sites recorded within the wider area will provide a regional perspective on the types of sites that maybe expected to be found within the Study Area.

APPLICATION TO THE STUDY AREA – AHIMS DATABASE

Two searches of the AHIMS Database were completed on 18/02/09 identified 10 previously recorded Aboriginal sites within a 6 x 6 km search area around the proposed mushroom farm and 31 previously recorded sites within a 6 x 6 km search area encompassing the substrate plant. Of these there are no sites situated within either Study Areas.

2.2.2 Heritage Act Registers

The NSW Heritage Office, part of the Department of Planning, maintains registers of heritage and archaeological items that are of significance to New South Wales.

State Heritage Register: The State Heritage Register (SHR) contains items that have been assessed as being of State Significance to New South Wales. The State Heritage Inventory (SHI) contains items that are listed on Local Environmental Plans and/or on a State Government Agency's Section 170 registers. Items on the SHI have been identified as having heritage significance, but have not been included on the SHR.

If an item or place does not appear on either the SHR or SHI this may not mean that the item or place does not have heritage or archaeological significance; many items have not been assessed to determine their heritage significance. An assessment is required for items that are 50 years or older.

Items that appear on either the SHR or SHI have a defined level of statutory protection. This is discussed more fully in Appendix 2.

APPLICATION TO THE STUDY AREA – NSW STATE HERITAGE REGISTER LISTINGS

A search of the State Heritage Register and State Heritage Inventory of both Study Areas was undertaken on 03/03/2009. The neither Study Area contains items that are listed on the State Heritage Register and no items listed on the State Heritage Inventory.

The NSW Heritage Act 1977 currently affords automatic statutory protection to 'certain relics' that form part of archaeological deposits. Sections 139–145 of the Act prevent the excavation of a relic, except in accordance with a gazetted exception or an excavation permit issued by the Heritage Council of New South Wales. Consultation and discussion with the NSW Heritage Office should begin well before lodging an application for a permit to disturb or destroy a historical archaeological site.

APPLICATION TO THE STUDY AREA – NSW HERITAGE ACT 1977 RELICS PROVISIONS

There are no identified archaeological sites within the Study Area; however, the relics provisions are applicable to relics regardless of heritage listing. Archaeological sites that may be identified in the Study Area during survey will be protected by the relics provisions of the NSW *Heritage Act 1977*.

2.2.3 Environmental Planning and Assessment Act Registers

The *Environmental Planning and Assessment Act 1979* includes provisions for local government authorities to consider environmental impacts in land-use planning and decision making. Such impacts are generally considered in relation to the planning provisions contained in the Local Environment Plan (LEP) or Regional Environment Plan (REP).

Local Environmental Plans: Each Local Government Area (LGA) is required to create and maintain a LEP that includes Aboriginal and historic heritage items. Local Councils identify items that are of significance within their LGA, and these items are listed on heritage schedules in the local LEP and are protected under the *EP&A Act 1979* and *Heritage Act 1977*.

APPLICATION TO THE STUDY AREA – PENRITH LEP 1998 AND HAWKESBURY LEP 1989

A search of the Penrith LEP 1998 and the Hawkesbury LEP 1989 amended was undertaken on 03/03/2009 Both Study Area contain no items listed in the heritage schedule.

2.3 Summary of heritage listings in the Study Area

Of all the heritage registers searched, Aboriginal sites were only recorded on AHIMS. Ten Aboriginal archaeological sites are currently listed by DECC AHIMS database as being within the mushroom farm Study Area corridor (Table 1). There were thirty one registered aboriginal sites by DECC on AHIMS within the substrate plants Study Area corridor.

Table 1: Summary of known heritage items within the vicinity of the proposed Londonderry Mushroom Farm, NSW.

ITEM	RNE	CHL	NHL	AHIMS	SHR	SHI	WLEP 1991	NATIONAL TRUST
45-5-0379 (Open Camp Site)				**Y**				
45-5-0380 (Open Camp Site)				**Y**				
45-5-0384 (Open Camp Site)				**Y**				
45-5-0388 (Open Camp Site)				**Y**				
45-5-0660 (Open Camp Site)				**Y**				
45-5-0662 (Open Camp Site)				**Y**				
45-5-0664 (Open Camp Site)				**Y**				
45-5-2413 (Open Camp Site)				**Y**				
45-5-2850 (Isolated Artefact)				**Y**				

Table 2: Summary of known heritage sites within the vicinity of the Mulgrave Substrate Plant site, NSW.

ITEM	RNE	CHL	NHL	AHIMS	SHR	SHI	WLEP 1991	NATIONAL TRUST
45-2-0355 (Open Camp Site)				**Y**				
45-2-0356 (Open Camp Site)				**Y**				
45-2-0357 (Open Camp Site)				**Y**				
45-2-0358 (Open Camp Site)				**Y**				
45-5-0394 (Open Camp Site)				**Y**				
45-5-0399 (Open Camp Site)				**Y**				
45-5-0400 (Open Camp Site)				**Y**				
45-5-0403 (Open Camp Site)				**Y**				
45-5-0405 (Isolated Artefact)				**Y**				
45-5-0406 (Open Camp Site)				**Y**				

ITEM	RNE	CHL	NHL	AHIMS	SHR	SHI	WLEP 1991	NATIONAL TRUST
45-5-0699 (Open Camp Site)				**Y**				
45-5-0700 (Open Camp Site)				**Y**				
45-5-0701 (Open Camp Site)				**Y**				
45-5-0715 (Open Camp Site)				**Y**				
45-5-0716 (Open Camp Site)				**Y**				
45-5-0717 (Open Camp Site)				**Y**				
45-5-0718 (Open Camp Site)				**Y**				
45-5-0954 (Open Camp Site)				**Y**				
45-5-0955 (Open Camp Site)				**Y**				
45-5-2842 (Isolated Artefact)				**Y**				
45-5-2843 (Isolated Artefact)				**Y**				
45-5-2844 (Open Camp Site)				**Y**				
45-5-2847 (Isolated Artefact)				**Y**				
45-5-2936 (Potential Archaeological Deposit)				**Y**				
45-5-2937 (Potential Archaeological Deposit)				**Y**				
45-5-2938 (Potential Archaeological Deposit)				**Y**				
45-5-2939 (Potential Archaeological Deposit)				**Y**				
45-5-3118 (Potential Archaeological Deposit)				**Y**				
45-5-3303 (Potential Archaeological Deposit)				**Y**				
45-5-3548 (Potential Archaeological Deposit)				**Y**				

3.0 ENVIRONMENTAL CONTEXT

3.1 Geomorphology

3.1.1 Geology, Soils and Landforms

The geology of the region consists of sandstones and shales from the mid-Triassic. The Study Area is located on the Cumberland Plain and is formed on the sediments of the Wianamatta Group shales, in particular the Bringelly Shales. They comprise shale, with occasional calcareous claystone, laminate and coal. More recent Tertiary and Quaternary sediments overlie the shales along river and creek beds, including South and Rickabys creeks and their tributaries. This part of the Cumberland Plain generally comprises gently undulating plains and low rolling hills, rising gradually from the flat, low-lying areas just above sea level in the north, to an altitude of around 300 metres on the hills of the Razorback Range to the south (Hazelton and Tille 1990).

The region comprises different landscapes, with distinct morphological and topological characteristics. This results in each soil landscape having different archaeological potential. Within the present Study Area, there is one distinct type of soil landscape known as fluvial. Fluvial Soil Landscapes are characterised by alluvium that has been transported and then deposited on terraces along creeks floodplains.

The Berkshire Park (bp) soil landscape (fluvial) comprises three depositional phases or alluvial and colluvial soils from the St Marys, Rickabys and Londonderry Clay formations; all of which are derived from sandstone and clay. Depending on erosional factors, all of these formations care exposed at various points across this landscape. The landscape comprises dissected, gently undulation low rises on the Tertiary terraces if the Hawksbury/Nepean River system (Bannerman and Hazleton 1990: 81). Flat terrace tops are now dissected by recent drainage channels and lines. Soils have increasing clay content with depth although erosion and deposition cycles, on occasion, reverse this trend (Bannerman and Hazleton 1990: 83). Despite the erosional cycles across this landscape, it is highly likely that cultural material will be associated with water line corridors, associated terraces and ridge lines. The depositional process will have, to some extent, buried and preserved some of these deposits.

The South Creek (sc) soil landscape (fluvial) also consists of alluvium soils derived from deposits of the Wianamatta Group shale and Hawkesbury sandstone parent materials. The topography is predominantly flat to gently sloping, active floodplain with occasional terraces or levees providing low relief, incised river beds and banks are present; in this case Lowes Creek, which dissects the northern section of the Study Area corridor (Bannerman & Hazelton 1990). Frequent flooding and high creek bank erosion commonly occur. This landscape is an active floodplain presently being reworked by fluvial processes. According to the soil landscape information, soils are deep from the depositional processes of the river, increasing in depth from the riverbank to its outer terraces (up to 2 m on terraces). The dominant soil material is layered plastic clays and loams over rock or residual soils (Bannerman & Hazelton 1990).

3.2 Climate

The climate at Richmond consists of mild summers with an average maximum of 30.5 degrees Celsius and minimum of 17.7 degrees Celsius in July, and cool, wet winters with a maximum rainfall occurring in October with an average maximum of 256.2mm of rain (Bureau of Meteorology 2008, based on records taken between 1971 and 2008). Whilst conditions and temperatures are wide ranging, the conditions in the region of the Study Area can be summarised as being mild and very suitable for year round hunter-gatherer occupation of all parts of the region.

3.3 Flora

Much of the Study Area comprises open pastured paddocks as a result of land clearance for agricultural practices and settlement, and more recently, the development of housing. Some pockets of remnant vegetation do however occur within the Study Area corridor and are indicative of the vegetation communities that were once present across the entire region prior to settlement and non-traditional land use in New South Wales. Within proximity to the Londonderry site, both Castlereagh Scribbly Gum Woodland and Castlereagh Swamp Woodland still occur in small pockets. Adjacent to the Mulgrave substrate property, Riparian Forest occurs along South Creek, while Alluvial Woodland and Shale Plains Woodland occur across the open,, flat plains (NPWS 2002).

Londonderry Site

Castlereagh Swamp Woodland occurs in poorly drained depressions on soils derived from Tertiary Alluvium, or on adjacent shale soils where the influence of Tertiary Alluvium is strong. This vegetation community is dominated by medium to dense stands of *Melaleuca decora* (White Feather Honey Myrtle). *Eucalyptus fibrosa* (Broad-leaf Ironbark), *Angophora subvelutina*(Broad-leaf Apple) and *Melaleuca linariifolia* (Snow in Summer) are present less frequently in both the tree and small tree strata (NPWS 2002: 33). The Ground stratum is such as *Goodenia paniculata* (Swamp Goodenia), *Schoenus apogon* (Common Bog-rush), *Centella asiatica* (Indian Pennywort) and *Juncus usitatus* (Common Rush).

Castlereagh Scribbly Gum Woodland occurs almost exclusively on soils derived from Tertiary Alluvium, Castlereagh Scribbly Gum Woodland is dominated by *Eucalyptus parramattensis subsp. Parramattensis* (Parramatta Red Gum) and *Angophora bakeri* (Narrow-leaved Apple). The ground stratum contains a diverse range of forbs including *Themeda australis* (Kangaroo Grass), *Entolasia stricta* (Wiry Panic), *Cyathochaeta diandra* (Grass-like Sedge), *Dianella revoluta subsp revolute* (Mauve Flax Lily), *Stylidium graminifolium* (Grass Trigger-Plant), *Platysace ericoides* (Heathy Platysace), *Laxmannia gracilis* (Slender Wire Lily) and *Aristida warburgii* (Thin Spear Grass).

Mulgrave Site

Prior to settlement, the dominant tree species of the Shale Plains Woodland included Grey Box *Eucalyptus moluccana* and Forest Red Gum *E. tereticornis*, with Narrow-leaved Ironbark *E. crebra*, Spotted Gum *Corymbia maculata* and Thin-leaved Stringybark *E. eugenioides* occurring less frequently. The shrub layer is dominated by Blackthorn *Bursaria spinosa*, and it is common to

find abundant grasses such as Kangaroo Grass *Themeda australis* and Weeping Meadow Grass *Microlaena stipoides var stipoides* (NSW NPWS 2002).

The Alluvial Woodland comprised *Eucalyptus amplifolia* (Cabbage Gum) and *E. tereticornis* (Forest Red Gum), with *Angophora floribunda* (Rough-barked Apple) occurring slightly less frequently. The lower stratum frequently includes *Acacia parramattensis subsp. Parramattensis* (Parramatta Wattle), and less frequently *Casuarina glauca* (Swamp Oak), and sometimes *Melaleuca linariifolia* (Flax-leaved Paperbark). A shrub stratum is usually evident, but is often sparse and invariably dominated by *Bursaria spinosa* (Boxthorn). Herb species are also common, including *Solanum prinophyllum* (Forest Nightshade), *Pratia purpurascens* (White Root) and *Commelina cyanea* (Native Wandering Jew).

Riparian Forest occurs just outside the Study Area along South Creek on the terraces immediately adjacent to the Hawksbury/Nepean river system. *Eucalyptus botryoides* (Bangalay), *E. elata* (River Peppermint), *Angophora subvelutina* (Broad-leafed Apple) and *A. floribunda* (Rough-barked Apple) dominate this vegetation community (NPWS 2002:47).

3.4 Fauna

Terrestrial mammals would presumably have been an abundant and reliable food source in the woodlands for Aboriginal people. Land mammals such as kangaroos and arboreal mammals such as possums would have been important prey species within these vegetation communities. Birds, reptiles and fish would also have been important resources. As well as being important food sources, animal products were also used for tool making and fashioning a myriad of utilitarian items. For example, tail sinews are known to have been used as a fastening cord, while 'bone points', which would have functioned as awls or piercers, are often an abundant part of the archaeological record. Aquatic vertebrates such as fish and eels may have been present in the larger creeks and waterways such as those within the Study Area.

3.5 Land use history

The mushroom farm Study Area is located within the Londonderry parish which was named by Thomas Kendall who gave his 30 acre land grant in 1831 Londonderry. The Kendall family were early settlers in the Castlereagh area and, it is quite possible, that Thomas was the same Thomas Kendall who worked as a convict labourer under William Cox, in the building of the road over the Blue Mountains in 1814. If this was the case, he was still working for Harriet Purcell at Castlereagh as a conditionally pardoned labourer in 1828. In 1829, this Thomas Kendall received a permit to de-pasture livestock, and shortly after received a land grant (http://www.penrithcity.nsw.gov.au/index.asp?id=440).

Within the road reserve, the construction of The Northern Road will have contributed to varying levels of ground disturbance associated with excavated drains, culverts, creek bridges, power lines, driveways and limited vegetation clearance. While large areas have been disturbed, other sections maintain undisturbed sections of remnant woodland.

The resultant high level of ground surface disturbance from these factors will have affected the survival of many archaeological sites within the Study Area corridor. Impacts to archaeological sites would have occurred through direct processes such as vegetation clearance, ploughing, trenching, road building, building and infrastructure construction.

4.0 ABORIGINAL CONTEXT

4.1 Ethnohistory

Our knowledge of Aboriginal people and their land-use patterns and lifestyles prior to non-Aboriginal contact is mainly reliant on documents written by non-Aboriginal people. The inherent bias of the class and cultures of these authors necessarily affect such documents. They were also often describing a culture that they did not fully understand – a culture that was in a heightened state of disruption given the arrival of settlers and disease. Early written records can, however, be used in conjunction with archaeological information and surviving oral histories from members of the Aboriginal community in order to gain a picture of Aboriginal life in the region.

Despite a proliferation of Aboriginal sites there is considerable ongoing debate about the nature, territory and range of pre-contact Aboriginal language groups in the greater Sydney region. These debates have arisen largely because by the time colonial diarists, missionaries and proto-anthropologists began making detailed records of Aboriginal people in the late 19th Century; pre-European Aboriginal groups had been broken up and reconfigured by European settlement activity. The following information relating to Aboriginal people on the Cumberland Plains is based on such early detailed records.

Despite conflicting views between historical sources of the exact boundaries of tribal groups in the region, the linguistic evidence does identify distinct language groups at the time of European contact. Based on this information it appears that the Study Area was situated close to the boundary of three language groups, the Darug, Dharawal and Gandangara.

The *Darug* language group was first described by pioneer surveyor, anthropologist and linguist R H. Mathews in the early 20th century. He described the *Darug* speaking people as extending along the cost to the Hawkesbury River, and inland to Windsor, Penrith and Campbelltown (Mathews 1901). The *Gandangara* occupied the coastal regions, from the Hawksbury River to Cape Howe, and extending inland to the Blue Mountains (Mathews and Everitt 1900:262). The *Dharawal* speaking language group inhabited the coast from Port Hacking, south to Jervis Bay, and inland for a considerable distance (Mathews 1901:127).

These 'defined' language areas are considered to be indicative only, and would have changed through time, and possibly also changed depending on circumstances. It is more likely that language groups shared enough common dialect that definitive boundaries varied, and are not set along a single defined geological boundary.

The arrival of settlers in the region and new competition for resources began to restrict the freedom of movement of Aboriginal hunter-gatherer inhabitants from the early 1800's. European expansion along the Cumberland Plain was swift and soon there had been considerable loss of traditional lands to agriculture. This led to violence and conflict between Europeans and Aboriginal people as both groups sought to compete for the same resources (Dallas 2003). In the Camden region, it began following the murder of an Aboriginal woman and her children, which resulted in violent

clashes between several Aboriginal men and European settlers between 1814 and 1816 (Liston 1988:50). The violence had escalated by 1816 following the outlaw proclamation by Macquarie, resulting in the massacre of 14 Aboriginal people hiding at Appin (Liston 1988:54). This event is known as the 'Appin Massacre' and is regarded as the destruction of the Aboriginal people of the Campbelltown / Camden region.

During the early settlement years, diseases such as small pox were having a devastating affect on Aboriginal populations. Death, starvation and disease were some of the disrupting factors that lead to a reorganisation of the social practices of Aboriginal communities after European contact. The formation of new social groups and alliances were made as Aboriginal people sought to retain some semblance of their previous lifestyle.

4.2 Regional Context

It is generally accepted that people have inhabited the Australian landmass for at least 50,000 years (Allen and O'Connell 2003). Dates of the earliest occupation of the continent by Aboriginal people are subject to continued revision as more research is undertaken. The timing for the human occupation of the Sydney Basin is still uncertain. Whilst there is some possible evidence for occupation of the region around 40,000 years ago, the earliest undisputed radiocarbon date from the region comes from a rock shelter site north of Penrith on the Nepean, known as Shaws Creek K2, which has been dated to 14,700 +/- 250 Before Present (BP) (Attenbrow 1987, 2002: 20). The assessment of the deposits concurred that the people living in the shelter exploited the food and resources from the nearby creeks and rivers, as well as the surrounding country side. East of Campbelltown, a sandstone rock shelter site (known as Bull Cave) was excavated and yielded a basal date of 1820 $\pm$ 90 BP (Koettig 1985). In general, the majority of both open and rock shelter sites in the Sydney region date to within the last 3,000 to 5,000 years. Dibden (2003) attributes the increase in apparent occupation intensity to sea level stabilisation after the last ice age at around 5,000 years ago. She states that,

> 'Following the stabilisation of seal levels, the development of coastal estuaries, mangrove flats and sand barriers would have increased the resource diversity, predictability, and the potential productivity of coastal environments for Aborigines.' (Dibden 2003:27)

Archaeological evidence of Aboriginal occupation of the Cumberland Plain indicates that the area was intensively occupied from approximately 4,000 years BP (JMCHM 2007). Such 'young' dates are probably more a reflection of conditions of archaeological site preservation and sporadic archaeological excavation, rather than actual evidence of the presence or absence of an Aboriginal hunter-gatherer population prior to this time.

Results of archaeological work completed in the northern, central and southern Cumberland Plain region have clearly identified that the predominant recorded sites on the Cumberland Plain are open camp sites (Kohen 1986; Smith 1989; Haglund 1989; McDonald 1992; JMCHM 2006, 2007a, b & c; Dibden 2003). Towards the peripheries of the plain on Hawkesbury sandstone, shelters with art

and/or deposit and grinding grooves have been recorded. Most recent archaeological studies have been impact driven assessments in response to increasing development activity in the region and changing legislation requirements.

4.3 Local Context

4.3.1 Identified Aboriginal Archaeological Sites – Study Area

A search of the NSW DECC Aboriginal Heritage Information Management System (AHIMS) database was conducted on 17 February 2009. The search results listed 41 previously identified Aboriginal archaeological sites within two 6 x 6 km search areas. (see Figure 2) (see also Appendix 2). Of these, none are located within either the Londonderry mushroom farm or Mulgrave substrate plant Study Area.

It should be noted that the AHIMS database reflects Aboriginal sites that have been officially recorded and included on the list. Large areas of NSW have not been subject to systematic, archaeological survey; hence AHIMS listings may reflect previous survey patterns and should not be considered a complete list of Aboriginal sites within a given area. Details of specific site locations are considered sensitive and have not been included in this report.

Stone artefact sites are the only site type identified within the Study Area corridor and are abundant throughout the wider Cumberland Plain region. Within the current Study Area there are no registered burials, shelters with art and / or deposit, middens or carved trees. Further detail of the distribution of known sites and predicative modelling for the likely distribution of sites within the Study Area is discussed below.

4.3.2 Localised Archaeological Record

A limited amount of archaeological work has been undertaken in the area surrounding both the proposed mushroom farm and the substrate station Study Areas. The findings from these studies have contributed to the informed understanding of the Aboriginal cultural heritage in the area surrounding both Study Areas (McDonald 1986, Smith 1988 and McDonald 1997). The studies have been summarised below:

McDonald (1986) completed and initial archaeological assessment for the proposed Schofields regional waste disposal depot in Plumpton, N.S.W. This work comprised of three surface sample areas. In these areas McDonald also compared surface finds to the excavated material which also indicated considerable difference in tool types. The results of the excavation confirm that the excavated cultural material is generally of a smaller size than those located on the surface.

Smith (1988) undertook a detailed survey as part of the first management study of the Aboriginal sites on the Cumberland Plain. As part of the survey fifteen areas on the northern section of the Cumberland Plain were surveyed. A total of seventy nine open camp sites were identified as well as twenty nine isolated artefacts. The preliminary analysis of these sites indicated that the types of

artefacts contained within these sites are of a similar type. These types included debitage and a few utilised pieces as well as cores or implements.

McDonald (1997) was commissioned by Penrith City council to undertake a survey of seventy hectares of land off Londonderry Road which the council proposed to subdivide into 31 rural/ residential lots. During this survey McDonald identified one open camp site and two areas of potential archaeological deposit.

4.4 Discussion

The Study Area would have provided many natural resources for the local Aboriginal inhabitants to exploit. Ethnographic information regarding the Study Area indicates that the region was intensively occupied by up to three separate language groups. Tangible evidence of such occupation will be present across the landscape in the form of scarred trees and the remains of open stone artefact sites.

The current Study Area is characterised by the open, gently undulating plains, typical of the Cumberland Plain. The depths of the soils across the plain are generally favourable for accumulation of archaeological materials; however, disturbance resulting from land use to these soils will have a significant effect on the archaeological sites. The soil deposits along the floodplain terraces are the result of the depositional and erosional forces of the river. Archaeological deposits, such as Aboriginal open camp sites are likely to have been covered during depositional processes, and while it is known that Aboriginal people used these areas in the past, these sites may exist as PADs and as such are less likely to be visible during surface surveys. Archaeological sites are less likely to occur along the inner banks of the creeks within the Study Area as the erosional and scouring processes of the river flow are likely to have removed any cultural remains. Considerable ground disturbance has occurred as a result of European occupation including vegetation clearance, agricultural purposes and urban development, affecting cultural deposits and site preservation.

Previous archaeological work within or close to the Study Area has been development driven and as such they tend to focus primarily on the specific impact footprints of each particular project. However, when assessed together these studies provide a general overview of Aboriginal archaeological site modelling and predictive behaviour within the current Study Area. In general, previous studies indicate that areas of archaeological potential will occur where disturbance has been limited, the most likely site type to be encountered will be open lithic scatter or isolated artefact occurrences, and that the identification of each site type will depend greatly upon permanence of water (stream-order analysis), landscape unit and proximity to lithic sources. However, Aboriginal archaeological material occurs anywhere within the Cumberland Plain landscape.

Due to the highly disturbed nature of the mushroom farm; which has been extensively ploughed and used as a piggery in the past, there is little potential for archaeological deposit to remain in tact (Plate 1).



Plate 1: Location of former piggery, on what is now to be the mushroom farm.

The area of the substrate plant which is to be filled for extension also has little potential for archaeological deposit as the top soils were cut out for similar construction during the 1980's (Plate 2).



Plate 2: Location of cut which will be filled to extend the substrate plant.

4.5 Site Definitions and Predictive Model

The archaeological predictive model has been formulated based on the results of the landform, location and type of Aboriginal sites previously recorded within the regional area, the results of the AHIMS database search and information from previous archaeological work completed throughout the region. This information has been broken down into patterns that have been compared to the character of the Study Area to allow for an understanding of Aboriginal archaeological potential.

Based on this information, the following predictive model for the Study Area has been developed, indicating the site types most likely to occur within the present Study Area. The definition of each site type is described firstly, followed by the predicted likelihood of this site type occurring within the current Study Area.

Open campsites, artefact scatters, isolated finds and raw material sources/quarries

Open campsites and artefact scatter sites can range from high-density concentrations of artefacts to sparse, low-density 'background' scatters. These represent a diversity of everyday activities, settlement, hunting and gathering and tool manufacture. Isolated stone artefact occurrences can be located anywhere in the landscape. They can represent discard or loss during transitory movement, or an eroded larger subsurface site.

The identification of these sites depends greatly on ground surface visibility, resulting in the boundaries of a site being defined by the visible extent of the artefacts on the surface. Paddock grasses and open woodland vegetation occur within the Study Area and are likely to obscure stone artefact scatters or isolated occurrences. However, the relatively frequent occurrence of these sites across the southern region of the Study Area indicates that where ground exposure does occur, there is a moderate likelihood of finding stone artefacts. Low density artefact scatters and isolated artefact occurrences are likely to be the most commonly occurring site types within the Study Area.

Potential Archaeological Deposits

Potential Archaeological Deposits (PADs) generally comprise stable deposits or landforms that are highly likely to contain intact sub-surface archaeological evidence of use or occupation. PAD areas generally have very minimal impact (natural and historic), comprise a stable landform, consist of predictable occupation locations and contain *in situ* archaeological material.

A number of PAD areas have been previously identified within the region, and are situated adjacent to water courses in depositional soil landscapes or on high points within the region. It is likely that within the Study Area such landforms will occur, particularly close to water courses and on ridgelines where previous disturbance has been minimal.

Scarred and Carved Trees

Scarred trees exhibit scars caused by the removal of bark used in the manufacture of shields, canoes, containers or shelters. These occur on older trees, generally of a size from which a suitable

piece of bark can be removed. A small number of scarred trees are known to exist within close proximity to the Study Area.

Carved trees exhibit intricate geometric designs or figures by cutting the bark itself or by removing an area of bark and then cutting the underling hardwood. Carved trees can be associated with burial places or ceremonial/initiation ground. The existence of carved trees (dendroglyphs) is extremely rare occurrence in Australia and are generally limited to south east Queensland and north eastern New South Wales (Attenbrow 1992:144). Carved trees can be associated with both burial places and initiation grounds. Etheridge (1918) describes those trees associates with burial places as taphoglyphs, and those indicative of initiation grounds as teleglyphs.

Both types of carved trees exhibit intricate geometric designs or figures carved either on the bark or by removing an area of bark and then cutting designs or figures into the hardwood. Some of the earliest reported carved trees were located near Narellan and Picton. The closest carved trees to the Study Area corridor were situated at Greendale Estate, Vermont, near Narellan (Etheridge 1918: 23, Plate XIV). These carved trees exhibit taphoglyphs, representing an initiation site and are now held at the Australian Museum.

Land clearance for early agricultural purposes, including grazing, will have removed most large trees, as have periodic bush fires. Although a number of larger trees survive within the Study Area corridor, the likelihood that any of these trees contain cultural scarring is considered to be low, in view of the factors indicated.

Aboriginal Ceremony and Dreaming Sites

Such sites are often intangible places and features and are identified through oral histories, ethnohistoric data, or Aboriginal informants. These types of highly significant sites tend to occur at places where the connections and pathways between the spiritual and physical worlds occur. They are natural features of the landscape such as rock outcrops, waterholes or trees that often exist in marked contrast to their surroundings and bear a special significance because of their role in Aboriginal cosmology. Generally they are located away from habitation sites, although this is likely to require further testing when more of such site types are recorded.

Post-Contact Sites

These are sites relating to the shared history of Aboriginal and non-Aboriginal people of an area. Many of these sites can hold special significance for Aboriginal people and may include places such as missions, massacre sites, post-contact camp sites and buildings associated with post-contact Aboriginal use. This site type is usually known from historical records or knowledge preserved within the local community.

Liston (1988) recounts a period of conflict in the general region, including incidents near Camden and Bringelly. It is however, considered highly unlikely that any additional, unregistered post-contact sites are present within the Study Area. Aboriginal representatives will be consulted regarding their knowledge of such events.

Aboriginal Places

Aboriginal *places* may not contain any "archaeological" indicators of a site, but are nonetheless important to Aboriginal people. They may be places of cultural, spiritual or historic significance. Often they are places tied to community history and may include natural features (such as swimming and fishing holes), places where Aboriginal political events commenced or particular buildings. Often these places are significant in the living memory of a community. There are currently no known Aboriginal 'Places' within the Study Area. The likelihood of Aboriginal Places occurring will be identified through a separate Aboriginal Cultural Assessment involving consultation with the local Aboriginal community.

Aboriginal Resource and Gathering Sites

Aboriginal Resource and Gathering Sites are sites where there is ethnographic, oral, or other, evidence that suggest that natural resources have been collected and utilised by Aboriginal people. These natural resources have a cultural significance and connection for the Aboriginal community, such as ochre outcrops that were used for art or ceremonial purposes. These sites are still considered important places today. There are no such known sites within the Study Area however the likelihood of these sites occurring will be further identified through a separate Aboriginal Cultural Assessment involving consultation with the local Aboriginal community.

Site Prediction Summary for Current Study Area

In summary the site types which are likely to be identified during the archaeological field survey include:

- Surface occurrences of stone artefacts, as isolated incidences or low-medium density scatters;
- Areas of Potential Archaeological Deposit where sub-surface cultural material is likely to occur – generally in close proximity to water sources where disturbance has been minimal; and
- Mature trees that exhibit cultural scarring

5.0 SURVEY

5.1 Survey Methods

Although this was a preliminary assessment, it was the aim of this investigation to examine most of the Study Area on foot. The mushroom farm Study Area consists of an almost rectangular Study Area of 22.66 hectares (Figure 3). The substrate plant Study Area consists of 12.4 hectares of previously cut land that is of a roughly triangular shape. The field survey methods have been designed to locate archaeological sites within the Study Area with reference to the following information:

- Areas of archaeological potential, based on the background research predictive model (regional site patterns overlain on the physical environment of the Study Area).

The area of land which is to be developed into a new mushroom farm was surveyed in a transect method with all members of the survey team spreading out and walking across the property. Extra time was taken where visibility was better also around exposures, cattle tracks, tree bases, fence lines and around dams. The length of the grass as well as water seepage in some areas meant that there was zero visibility in some areas.

5.2 Survey Team

The survey was conducted on Wednesday 26th February 2009. The field survey was undertaken by Renée Regal (Biosis Research), Steve Randall (Deerubbin Local Aboriginal Land Council), and Tanya Mc Ewen (who was observing from Deerubbin Local Aboriginal Land Council).

5.2.1 Archaeological Survey Constraints

With any archaeological survey there are several factors that influence the effectiveness or the likelihood of finding sites. The factors that contribute most to how detectable archaeological sites may be are summarised as *visibility* and *exposure*. A brief discussion of these factors is presented below.

Visibility

In most Aboriginal archaeological reports and guidelines, visibility refers to *ground surface visibility*, and is usually a percentage estimate of the ground surface that is visible and allowing for the detection of (usually stone) artefacts that may be present on the ground surface (NSW NPWS 1997). The primary factor that affects visibility is vegetation cover; however other things such as introduced fill will also significantly hamper visibility and surface site detection. Grassed paddocks obscure large areas of the ground surface within the current Study Area, and were the major contributing factor that restricted visibility during the detailed archaeological survey for this assessment. Thick weeds, dumped rubbish and other vegetation also obscured most of the road reserve.

Exposure

Exposure refers to the geomorphic conditions of the local landform being surveyed, and attempts to describe the relationship between those conditions and factors that may allow for the exposure of (buried) archaeological materials. While also usually expressed as a percentage estimate, exposure is different to visibility in that it is in part a summation of geomorphic processes, rather than a simple observation of the ground surface (Burke and Smith 2004: 79, NSW NPWS 1997).

Factors that affect archaeological exposure include the natural geomorphic process acting on a landscape—whether it is aggrading, stable or eroding—and the level of previous disturbance which will expose or potentially bury archaeological sites. A number of geomorphic processes were observed within the Study Area corridor, including fluvial, erosional and residual components within the general landscape. Residual landscapes are likely to accumulate archaeological material over long periods but are not particularly likely to reveal buried artefacts. Erosional landscapes within the Study Area, particularly areas with shallower soils may expose artefacts as surface expressions. Fluvial areas associated with each of the creek banks will have been affected by various episodes of depositional and erosional processes caused from the varying flow levels of the creeks. These processes are most likely to have washed away any Aboriginal archaeological material associated with these areas.

Exposures occurred most frequently within the erosional and fluvial landscapes, as a result of surface disturbance, while exposures within residual landscapes were limited to intrusive processes, such as ploughing.

Disturbance

Disturbance in the Study Area is associated with natural and human agency. Natural agents generally affect small areas and include the burrowing and scratching in soil by animals such as wombats, foxes, rabbits (see plate 3) and wallabies, and sometimes exposure from slumping or scouring. Disturbance associated with recent human action is prevalent in the Study Area, and covers large sections of the land surface. The agents include farming practices such as the initial vegetation clearance for the creation of paddocks, ploughing and cropping, fencing, pig farming and cattle grazing and stock movement at the proposed mushroom farm. The entire level of top soil at the substrate farm has all been removed during the 1980's for a past extension of the substrate plant.



Plate 3: Rabbit burrows in the south western corner of the Mushroom Farm Study Area.

5.3 Survey Results

During the site survey there were no new aboriginal sites identified.

5.3.1 Existing Conditions

In general, the proposed Londonderry mushroom farm Study Area comprises of open paddocks with limited visibility. The area has been cleared of most tree cover though there is a sparse area of rehabilitated tree cover on the southern side of the property. Surrounding the boundary of the property is open woodland.

The Mulgrave substrate property has been highly disturbed by the development and expansion of the plant over a number of years. As previously mentioned the area of the substrate plant that was surveyed was cut out a number of years ago, this cutting would have removed any remaining archaeological deposit. Currently there are a number of cows grazing in quite long pasture that has grown in this area. As a result of the length of the pasture there is zero visibility.

5.3.2 Effective Survey Coverage

The overall effective survey coverage within the Study Area corridor based on the:

- Visibility – a percentage of the total visible ground surface with the surveyed area
- Exposure – a percentage estimate of the surveyed area that has been exposed through natural or human agency to potentially reveal (buried) archaeological material

Areas of exposure occurred primarily along stock tracks, unsealed tracks, erosion on slopes and creek banks, farm dams, sheet wash and patchy grass cover. Based on this information, the overall effective coverage of the Study Area corridor is considered to be low. This can be attributed to pasture grasses and road reserve vegetation. It should be noted however that this growth is a direct result of high seasonal rainfall. At other times of the year, larger areas of ground surface would be visible.

Aboriginal sites, which were identified during the field survey, were identified in areas of exposure on upper slopes and in close proximity to major creek lines.

5.4 Discussion of Results

Land use practices, particularly ploughing, pig farming, cattle grazing, tilling and cropping, were evident throughout both Study Areas, and have reduced the likelihood of locating intact archaeological cultural deposits within both Study Areas.

In general, the results of the archaeological survey reflect the predictive modelling for the Cumberland Plain; Though when looking at the Aboriginal site types that were identified whilst

searching the DECC AHIMS database that the most likely site type to which may have occurred would have been occur will be open lithic scatters, and isolated occurrences to a lesser extent. In addition, two definite scarred trees were identified. The predominant raw material recorded included silcrete, although a number of other materials were present, including chert, mudstone and quartz. This archaeological evidence indicates Aboriginal settlement and exploitation of major and minor creeks and drainage features, and along the top of small ridges and hill crests within the surrounding landscape.

6.0 SIGNIFICANCE ASSESSMENT

Heritage assessment criteria in NSW fall broadly within the significance values outlined in the Australia ICOMOS Burra Charter (Australia ICOMOS 1999). This approach to heritage has been adopted by cultural heritage managers and government agencies as the set of guidelines for best practice heritage management in Australia. These values include:

- **historical** significance (evolution and association) refers to historic values and encompasses the history of aesthetics, science and society, and therefore to a large extent underlies all of the terms set out in this section. A place may have historic value because it has influenced, or has been influenced by, an historic figure, event, phase or activity. It may also have historic value as the site of an important event. For any given place the significance will be greater where evidence of the association or event survives in situ, or where the settings are substantially intact, than where it has been changed or evidence does not survive. However, some events or associations may be so important that the place retains significance regardless of subsequent treatment.

- **aesthetic** significance (Scenic/architectural qualities, creative accomplishment) refers to the sensory, scenic, architectural and creative aspects of the place. It is often closely linked with social values and may include consideration of form, scale, colour, texture, and material of the fabric or landscape, and the smell and sounds associated with the place and its use.

- **social** significance (contemporary community esteem) refers to the spiritual, traditional, historical or contemporary associations and attachment that the place or area has for the present-day community. Places of social significance have associations with contemporary community identity. These places can have associations with tragic or warmly remembered experiences, periods or events. Communities can experience a sense of loss should a place of social significance be damaged or destroyed. These aspects of heritage significance can only be determined through consultative processes with local communities.

- **scientific** significance (Archaeological, industrial, educational, research potential and scientific significance values) refers to the importance of a landscape, area, place or object because of its archaeological and/or other technical aspects. Assessment of scientific value is often based on the likely research potential of the area, place or object and will consider the importance of the data involved, its rarity, quality or representativeness, and the degree to which it may contribute further substantial information.

The significance of Aboriginal sites and places will be assessed on the basis of the significance values outlined above. As well as the ICOMOS Burra Charter significance values guidelines, various government agencies have developed formal criteria and guidelines that have application when assessing the significance of heritage places within NSW. Of primary interest are guidelines prepared by the NSW DECC, and the Commonwealth Department of Environment Water Heritage and Arts (DEWHA). The relevant sections of these guidelines are presented below.

6.1 Assessment of Significance

The following Aboriginal significance assessment is based on the NSW National Parks and Wildlife Service *Aboriginal Cultural Heritage: Standards and Guidelines Kit* (1997). These guidelines state that an area may contain evidence and associations which demonstrate one or any combination of the ICOMOS Burra Charter significance values outlined above in reference to Aboriginal heritage. Reference to each of the values will be made when evaluating Aboriginal significance for sites and places.

In addition to the previously outlined heritage values, the *Guidelines* also specify the importance of considering cultural landscapes when determining and assessing Aboriginal heritage values. The principle behind a cultural landscape is that 'the significance of individual features is derived from their inter-relatedness within the cultural landscape'. This means that sites or places cannot be 'assessed in isolation' but must be considered as parts of the wider cultural landscape. Hence the site or place will possibly have values derived from its association with other sites and places. By investigating the associations between sites, places, and natural resources in the cultural landscape the stories behind the features can be told. The context of the cultural landscape can unlock 'better understanding of the cultural meaning and importance' of sites and places.

The two principal values that are likely to be addressed in a consideration of Aboriginal sites and places are the cultural/social significance to Aboriginal people and the archaeological or scientific significance to archaeologists, although other values – such as educational or tourism values – may be considered. The former is discussed in greater depth below, as it is more comprehensively addressed in the DECC *Guidelines for Aboriginal Heritage Impact Assessment* (1997). However, we note here that it is best practice for archaeologists when undertaking significance assessments to keep in mind that scientific assessments are part of a larger picture.

The determinations of Aboriginal significance for sites and places are expressed as *statements of significance* that preface a concise discussion of the contributing factors to Aboriginal cultural heritage significance. Nomination of the level of value—high, moderate, low or not applicable—for each relevant category will also be proposed and presented in a summary table in Section 7.2.

6.1.1 Aboriginal community or cultural values

The NSW DECC recognises that 'Aboriginal community are the primary determinants of the significance of their heritage' (NSW DECC 2004). Biosis Research recognises that our role in the cultural heritage assessment process is to provide specialist skills, particularly in regard to archaeological and heritage management expertise. These specialist skills can be articulated and enhanced through consultation with the Aboriginal community, with the aim of providing a comprehensive assessment of cultural heritage significance.

The heritage assessment criteria outlined above that relate to community or cultural values include social, historic and aesthetic value. Social and aesthetic values are often closely related. Social value refers to the spiritual, traditional, historical or contemporary associations and attachments that the place or area has for the present-day Aboriginal community. Aesthetic values related to

Aboriginal sites and places that may contain particular sensory, scenic, architectural and creative values and meaning to Aboriginal people. Historic value refers to the associations of a place with a person, event, phase or activity of importance to the history of an Aboriginal community. Gaining a sufficient understanding of this aspect of significance will often require the collection of oral histories and archival or documentary research, as well as field documentation. Places of post-contact Aboriginal history have generally been poorly recognised in investigations of Aboriginal heritage, and the Aboriginal involvement and contribution to important regional historical themes is often missing from accepted historical narratives.

These aspects of heritage significance can only be determined through consultative processes with one or more Aboriginal communities. In terms of Aboriginal communities, heritage places – including those that are otherwise defined as 'archaeological sites' – will always attract differing values. These may include custodianship obligations, education, family or ancestral links, identity, and symbolic representation. History and traditions are important: this generation has an obligation to future generations to retain certain things as they are currently seen and understood. This includes retaining alternative understandings to those that come through scientific assessments. Heritage places are often more complex than is identified through the scientific determination of value. Cultural and social values can be complex and rich - the past is a vital component of cultural identity. Feelings of belonging and identity are reinforced by knowledge of the existence of a past, and this is further reinforced and maintained in the protection of cultural heritage.

6.1.2 Statement of Cultural (Social) Significance

All Aboriginal cultural heritage sites that are located in the Study Area are considered to be of cultural significance to the Aboriginal stakeholders, and it is important that comment on the area is provided directly by members of this Aboriginal community. All sites are evidence of past Aboriginal occupation and use of the area, and are the main tangible source of information about the Aboriginal past. In addition, any recorded (and unrecorded) post-contact sites are of cultural significance because they are rare or, at least, uncommon site-types. In particular, many sites have been destroyed as a result of land clearance and land-use practices in the historic period.

6.1.3 Archaeological (Scientific) Significance

Archaeological significance (also called scientific significance) refers to the value of archaeological objects or sites as they relate to research questions that are of importance to the archaeological community, including indigenous communities, heritage managers and academic archaeologists. Generally the value of this type of significance will be determined on the basis of the potential for sites and objects to provide information regarding the past life-ways of people (Burke and Smith 2004: 249, DECC NPWS 1997). For this reason, the NSW NPWS in summarising the situation, notes that 'while various criteria for archaeological significance assessment have been advanced over the years, most of them fall under the heading of archaeological research potential' (NPWS 1997: 26). The NPWS criteria for archaeological significance assessment are based largely on the Register of the National Estate Criteria, and under the heading of 'research potential' include the following aspects and definitions (DECC NPWS 1997):

General site considerations, including factors such as:

- *Site intactness or integrity:* This includes the state of preservation of archaeological objects, as well as the stratigraphic integrity of the site, the taphonomic processes acting on the site (ie. the factors that affect a site after its original use), and the impact of past artefact collections made at the site.

- *The connectedness* of the site to other sites – when considered as part of a larger assemblage or landscape the site may have greater research potential than if it was simply considered in isolation.

- *Chronological potential* refers to the potential of a site to provide a dateable framework extending back into the past. The potential antiquity of a site is also an important consideration, as older sites are relatively less common than younger sites. In many cases stratified, dateable artefact bearing deposits are sufficiently rare to be a very valuable resource.

Representativeness

Representativeness refers to the ability of a site or object to serve as a representative example of sites in the same class. This aspect of value is only meaningful when considered in conjunction with a conservation goal, and must be determined against the archaeological record at various scales of consideration - local, regional and continental for example. It takes into account site and object variability, connectedness and a consideration of what is already, and likely to be, conserved. Burke and Smith (2004: 247) define representativeness as 'an assessment of whether or not a place is a good example of its type, illustrating clearly the attributes of its significance.'

Rarity

Rarity is, of course, closely related to representativeness (if a site is rare, it is likely to have high representative value), and will include a consideration of those issues discussed under general site considerations. In many ways, the determination of rarity is a summation of exceptional research potential, or a representative of a small class of sites or objects. Burke and Smith further describe rarity as 'an assessment of whether the place represents a rare, endangered or unusual aspect of our history or cultural environment that has few parallels elsewhere' (2004: 247).

Research Potential

Research potential is essentially a summation of the above values in the general, representativeness and rarity criteria (DECC NPWS 1997). Pearson and Sullivan note that Aboriginal archaeological sites are generally of high research potential because 'they are the major source of information about Aboriginal prehistory' (1995: 149). Indeed, the often great time depth of Aboriginal archaeological sites gives them research value from a global perspective, as they are an important record of humanity's history. Research potential can also refer to specific local circumstances in space and time – a site may have particular characteristics (well preserved samples for absolute dating, or a series of refitting artefacts, for example) that mean it can provide information about

certain aspects of Aboriginal life in the past that other less or alternatively valuable sites may not (Burke and Smith 2004: 247-8). When determining research potential value particular emphasis has been placed on the potential for absolute dating of sites.

In addition to the research potential related value factors, the NSW DECC NPWS (1997: 32) also discuss *Educational Potential* and *Aesthetic Significance*, as items that may be included in scientific significance. The NPWS general advice is that archaeologists should give careful consideration prior to attempting to determine educational and aesthetic values (NPWS 1997: 32). We make no attempt to determine educational potential of sites under scientific assessment, but do consider educational value as a contributing factor that may be included in an assessment of social significance by the Aboriginal community.

Aesthetic values

There is a diverse yet accessible literature regarding identifying aesthetic values and determining aesthetic significance (Burke and Smith 2004: 248-9, Kerr 1996: 15-16, Pearson and Sullivan 1999: 134-8). It is generally agreed that aesthetic values are an important part of cultural heritage significance, however they are dependent on an individual's sensory response, which means determining aesthetic value is fraught with difficulty, and should be applied on a case-by-case basis as it is not always a value applicable to archaeological sites (Burke and Smith 2004: 248). However, when dealing with some types of sites aesthetic values and landscape context are an important consideration. The question 'does the place have a relationship between its parts and the setting which reinforces the quality of both', while originally proposed in an architectural context (Kerr 1996: 15), is relevant also for many sites in a local setting—such as in forests, deserts, coastlines or indeed wetlands—where there is often an important relationship between the cultural site and natural environment, which contribute to the values of a 'sense of place'.

7.0 IMPACT ASSESSMENT

7.1 Proposed Development

There are two areas proposed for development. The first area situated at Londonderry is a proposed development of a mushroom farm. The development of the mushroom farm will occur in stages, with the first stage consisting of more then half of the development. This includes the building of more then twenty growing rooms and ancillary areas such as packing and loading, plant room, administration, workshop, staff amenities, stores and waste water management. The future three stages of development entail the expansion of what will already be the operational farm as the need arises. A child care centre is planned for construction at a later stage.

The extension of the existing substrate plant at Mulgrave will occur in three stages over the next ten years. These stages of development include:

- The fill of an area of 1.5 hectares for the development of a new straw bale storage shed; Pre-wet shed extension
- An extra two Phase 1 tunnels and thirteen phase 2/3 tunnels

7.2 Potential Impacts

As discussed above, the development of the Londonderry mushroom farm will cause some levels of disturbance within the Study Area. With the development of the mushroom growing sheds as well as the common ancillary areas for packing, loading, plant room, workshop. Staff amenities, stores and waste water management. The filling of the Mulgrave site will also result in some disturbance. At neither property will these disturbances have an impacts on archaeological sites or cultural heritage places.

8.0 RECOMMENDATIONS

Recommendation 1 - Stop work provision: Aboriginal sites

All Aboriginal places and objects are protected under the NSW *National Parks and Wildlife Act 1974*. This protection includes Aboriginal places and objects which have not been identified in this report, but which may be identified during construction. Should any previously unidentified Aboriginal objects or places be identified during excavation and construction, all works must cease in the vicinity of the find and the following be notified:

- NSW Department of Environment and Climate Change
- A qualified archaeologist
- Aboriginal stakeholders from the Deerubbin Local Aboriginal Land Council

Recommendation 2 – Human Remains

In the case of skeletal remains the following process will be implemented.

- The find will be reported to police and state coroner
- The Tolson Group will be notified of the find
- Aboriginal stakeholders will be notified of the find
- NSW DECC will be notified of the find
- If the skeletal remains are of Aboriginal ancestral origin an appropriate management strategy will be developed in consultation with the Aboriginal stakeholders
- The find will be recorded in accordance with the National Parks and Wildlife Act 1974 (NSW) and the NSW NPWS Aboriginal Cultural Heritage Standards and Guidelines Kit
- This Aboriginal Heritage Plan will be amended to include the newly discovered Aboriginal ancestral remains in the management regime established by the plan.

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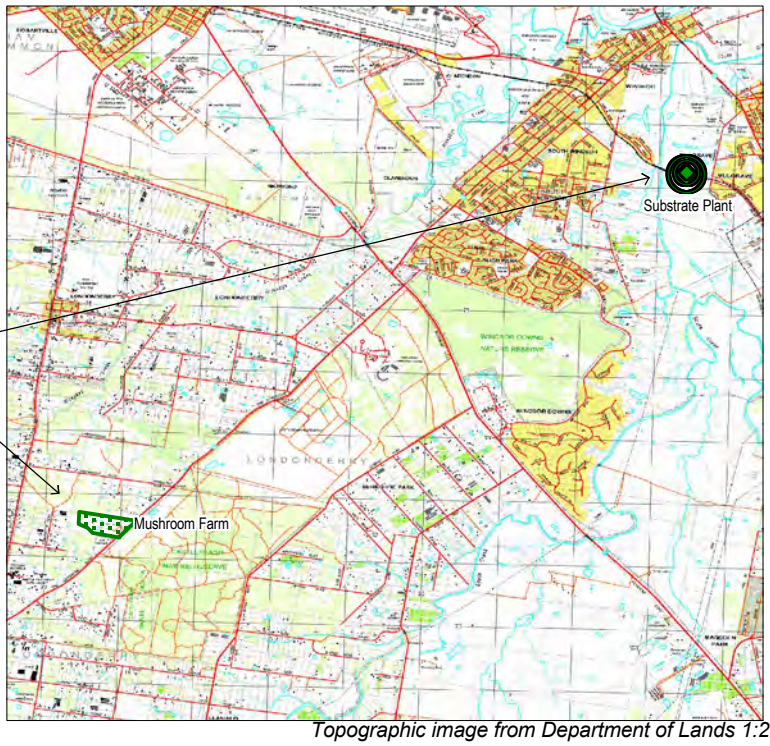
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FIGURES





Study areas

Topographic image from Department of Lands 1:25000 topographic map series (2006)
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8 Tate St
WOLLONGONG
NEW SOUTH WALES 2500

Figure 1: Location of the Study Area in a regional context.

27 April 2009

Checked by: RBR | File number: S5336

Location: 5000\5300s\5336\Mapping\S5336 F1 Region.WOR

Scale: 0 1 2 3 4 kilometres

N W E S

At the request of the Department of Planning, the following figures have been removed from the Cultural Heritage Assessment report:

Figure 2a: AHIMS Sites within the region of Tolson's Mushroom Farm

Figure 2b: AHIMS Sites within the region of the Substrate Plant.

Legend

Survey Areas

Mushroom Farm

Survey Transects

Topographic image from Department of Lands 1:25000 topographic map series (2006)
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wreckers

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Figure 3a : Survey transects completed during field surveys, Mushroom Farm

Date: 19 March 2009

Checked by: RBR | File number: S5336

Location:-..5000\5300s\5336\Mapping\S5336 F3a Survey Transects.WOR

Scale: 0 30 60 90 120 150 metres

N W E S

Figure 3a : Survey transects completed during field surveys, Mushroom Farm

Legend
Survey Areas

Substrate Plant

Survey Transects

Acknowledgements:
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MULGRAVE



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Figure 3b: Survey transects completed during field surveys, Substrate Plant

Date: 19 March 2009

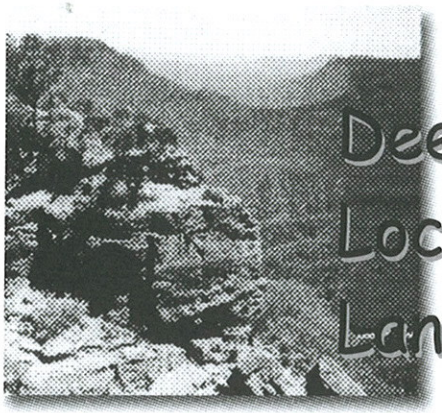
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Scale: 0 20 40 60 80 100 metres

Figure 3b: Survey transects completed during field surveys, Substrate Plant

APPENDICES



Deerubbin Local Aboriginal Land Council

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WOOLONGONG NSW 2500

Our Reference: 1989

2 March 2009

SUBJECT: PROTECTION OF ABORIGINAL CULTURAL HERITAGE
Proposed Mushroom Farm
Lot 138 in DP 752037,
Northern Road, Londonderry.

Attention: Renee Regal

A representative of the Deerubbin Local Aboriginal Land Council (Steve Randall) inspected lot 138 in DP 752037, Northern Road, Londonderry on 26 February 2009. An Aboriginal cultural heritage assessment was undertaken to evaluate the likely impact the proposed development has on the cultural heritage of the land.

Our representative reports, ground visibility was poor because of the grass cover over the study area and in the few exposures, no Aboriginal cultural heritage material (in the form of stone artefacts, for example) were found

Deerubbin LALC therefore, has no objections to the proposed development on the grounds of Aboriginal cultural heritage, however prior to any construction or activity that may disturb the soil, the proponent shall arrange with Deerubbin LALC for our appropriately qualified representative to be present on-site to monitor such works.

Yours Faithfully,

(Kevin Cavanagh
Chief Executive Officer)

c.c. Laurel Alexander, Aboriginal Heritage & Planning Officer, Dept. of Environment & Climate Change
c.c. General Manager, Penrith City Council

Deerubbin
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Our Reference: 1989

2 March 2009

SUBJECT: PROTECTION OF ABORIGINAL CULTURAL HERITAGE
Proposed extension of the Substrate Plant
Lot 4 in DP 610341, Mulgrave Road, Mulgrave.

Attention: Renee Regal

As you are aware a representative of Deerubbin Local Aboriginal Land Council (Steve Randall) inspected the area for the proposed extension to the Substrate Plant at Lot 4 in DP 610341, Mulgrave Road, Mulgrave on 26 February 2009. An Aboriginal cultural heritage assessment was undertaken to evaluate the likely impact the proposed development has on the cultural heritage of the land.

Our representative reports that, no Aboriginal cultural heritage material (in the form of stone artefacts, for example)were found.

Deerubbin LALC therefore, has no objection on the grounds of Aboriginal cultural heritage for the landfill for the proposed extension of the substrate plant, Lot 4 in DP 610341, Mulgrave Road, Mulgrave.

Yours Faithfully,

Kevin Cavanagh
(Chief Executive Officer)

c.c. Laurel Alexander, Aboriginal Heritage & Planning Officer, Dept. of Environment and Climate Change
c.c. General Manager, Hawkesbury City Council

Appendix 2: Legislation

COMMONWEALTH LEGISLATION

ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

In January 2004 the Commonwealth *Australian Heritage Commission Act 1975* was repealed and in its place amendments to the EPBC Act were made. The amendments were contained in three new pieces of Commonwealth Heritage Legislation. The three new Acts are the:

1. Environment and Heritage Legislation Amendment Act (No. 1) 2003 which:

   (a) amends the Environment Protection and Biodiversity Conservation Act 1999 to include 'national heritage' as a new matter of National Environmental Significance and protects listed places to the fullest extent under the Constitution

   (b) establishes the National Heritage List

   (c) establishes the Commonwealth Heritage List

2. Australian Heritage Council Act 2003 which establishes a new heritage advisory body to the Minister for the Environment and Heritage, the Australian Heritage Council, and retains the Register of the National Estate.

3. Australian Heritage Council (Consequential and Transitional Provisions) Act 2003 which repeals the Australian Heritage Commission Act, amends various Acts as a consequence of this repeal and allows for the transition to the new heritage system.

Any place that has been nominated and assessed as having cultural heritage significance at a national level can be added to the National Heritage List.

Under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) an action requires approval from the Federal Environment Minister if the action will, or is likely to, have a significant impact on a matter of national environmental significance. Matters of national environmental significance relating to cultural heritage are:

- World Heritage Places, and
- National Heritage Places.

An action includes a project, development, undertaking, activity, or series of activities.

Actions that are likely to have a significant impact on the environment of Commonwealth land (even if taken outside Commonwealth land), and actions taken by the Commonwealth that are likely to have a significant impact on the environment anywhere in the world, may also require approval under the EPBC Act.

NATIVE TITLE ACT 1993

The Commonwealth Native Title Act establishes the principles and mechanisms for the preservation of Native Title for Aboriginal people.

Under Subdivision P of the Act, *Right to negotiate*, native title claimants can negotiate about some proposed developments over land and waters (known as 'Future Acts') if they have the right to negotiate. Claimants gain the right to negotiate if their native title claimant application satisfies the registration test conditions.

The right to negotiate applies over some proposed developments or activities that may affect native title. These are known as future acts under the Native Title Act 1993. Native title claimants only have the right to negotiate over certain types of future acts, such as mining. Activities such as exploration and prospecting on the land do not usually attract the right to negotiate.

The right to negotiate is not a right to stop projects going ahead — it is a right to have a say about how the development takes place. In some situations, the right to negotiate does not apply. In these circumstances, claimants may have the right to be notified, to be consulted, to object and to be heard by an independent umpire.

The right to negotiate is triggered when a government issues a notice to say that it intends to allow certain things to happen on land, such as granting a mining lease. This notice is called a 'section 29 notice.

People who claim to hold native title in the area, but have not yet made a native title claimant application, have three months from the date given in the section 29 notice to file a claim if they want to have a say about the proposed development. To get the right to negotiate, the claim must be registered within a month after that.

If the right to negotiate applies, the government, the developer and the registered native title parties must negotiate 'in good faith' about the effect of the proposed development on the registered native title rights and interests of the claimants.

The parties can ask the National Native Title Tribunal to mediate during the negotiations.

If the negotiations do not result in an agreement the parties can ask the Tribunal (no sooner than six months after the notification date) to decide whether or not the future act should go ahead, or on what conditions it should go ahead.

The National Native Title Tribunal administers the future act processes under the Commonwealth legislation. The Tribunal's role includes mediating between parties, conducting inquiries and making decisions (called 'future act determinations') where parties can't reach agreements.

When the Tribunal receives a future act determination application, it must conduct an inquiry (an arbitration) in order to determine whether the future act can be done and if so whether any conditions should be imposed.

A member of the Tribunal (or a panel of three members) will be appointed to conduct the inquiry, and will initially hold a preliminary conference and set directions for the parties to provide submissions and evidence. Members who have mediated a particular matter are not usually appointed as inquiry members. Inquiry members conduct hearings, receive submissions and evidence from the parties and take into account matters set out in section 39 of the Native Title Act such as:

- the effect of the future act on the enjoyment by the native title party of their registered native title rights and interests; their way of life, culture and traditions; the development of their social, cultural and economic structures; their freedom of access to the land and freedom to conduct ceremonies and other cultural activities; and the effect of the future act on any area or site of particular (special) significance to the native title party;
- the interests, proposals, opinions or wishes of the native title party;
- the economic or other significance of the future act;
- the public interest; and
- the presence of any existing non-native title rights and interests and use of the land by other persons (for instance, pastoralists).

ABORIGINAL AND TORRES STRAIT ISLANDER HERITAGE PROTECTION ACT 1984

The Commonwealth *Aboriginal and Torres Strait Islander Heritage Protection Act* 1984 provides protection for Aboriginal cultural property. Whereas the State Act provides legal protection for all the physical evidence of past Aboriginal occupation, the Commonwealth Act deals with Aboriginal cultural property in a wider sense. Such cultural property includes any places, objects and folklore that 'are of particular significance to Aboriginals in accordance with Aboriginal tradition'. There is no cut-off date and the Act may apply to contemporary Aboriginal cultural property as well as ancient sites.

PROTECTION OF MOVABLE CULTURAL HERITAGE ACT 1986

Australia's movable cultural heritage is protected at both Commonwealth and State levels. This web site only provides information on the Commonwealth laws.

In 1970 the United Nations Educational, Scientific and Cultural Organisation (UNESCO) adopted the UNESCO Convention on the Means of Prohibiting the Illicit Import, Export and Transfer of Ownership of Cultural Property. Australia ratified the convention by passing the *Protection of Movable Cultural Heritage Act 1986* (the Act), giving the 1970 Convention force in Australian law.

The Act regulates the export of Australia's significant cultural heritage objects. It is not intended to restrict normal and legitimate trade in cultural property and does not affect an individual's right to own or sell within Australia.

It implements a system of export permits for certain heritage objects defined by the Act as 'Australian protected objects'. Australian protected objects are objects which form part of the movable cultural heritage of Australia and which meet the criteria established under the National Cultural Heritage Control List. The Control List is located in the Regulations to the Act, and divides Australian protected objects into two classes:

- Class A objects which may not be exported
- Class B objects which may be exported if granted a permit under the Act.

A person wishing to export a Class B object is required to apply for a permit in writing. Applications are processed in accordance with the legislative process established under section 10 of the Act.

Certificates of Exemption, granted under section 12 of the Act, allow Australian protected objects that are currently overseas to be imported into Australia and subsequently re-exported. This includes Class A objects.

The Act also includes provisions that allow Australia to respond to an official request by a foreign government to return movable cultural heritage objects that have been illegally exported from their country of origin.

The *Protection of Movable Cultural Heritage Act 1986* is administered by the Minister for the Environment and Heritage. This responsibility was transferred from the Minister for Communication, Information Technology and the Arts in November 2001.

The Movable Cultural Heritage Unit in the Department of the Environment and Heritage provides the Secretariat to the National Cultural Heritage Committee

STATE LEGISLATION

NATIONAL PARKS AND WILDLIFE ACT 1974

The *National Parks and Wildlife Act 1974* provides for the protection of Aboriginal objects (sites, relics and cultural material) and Aboriginal places. Under the Act (S. 5), an Aboriginal object is defined as:

> *any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.*

This includes individual artefacts, scatters of stone artefacts, rock art sites, ancient camp sites, human burials, scarred trees, and ruins and archaeological deposits associated with Aboriginal missions or reserves.

Aboriginal places (areas of cultural significance to the Aboriginal Community declared by the Minister) are protected under Section 84 of the Act.

Aboriginal objects (any material evidence of the Aboriginal occupation of NSW) are protected under Sections 86, 87 and 90 of the Act. Section 86 of the Act identifies that a person, other than the Director-General or a person authorised by the Director-General in that behalf, who:

> *(a) disturbs or excavates any land, or causes any land to be disturbed or excavated, for the purpose of discovering an Aboriginal object*

is guilty of an offence under the NPW Act.

The *National Parks and Wildlife Act* requires that a permit from the Director General be obtained before archaeological fieldwork involving disturbance to an Aboriginal site is carried out. Consent is granted under section 87 and 90 of the Act. Queries and applications to excavate or disturb an Aboriginal archaeological site for purposes of archaeological fieldwork, should directed to the relevant Planning and Aboriginal Section Manager at the appropriate Environment Protection and Regulation Branch office. For this study the relevant branch office is at Armidale.

Section 91 of the Act requires the mandatory reporting of the discovery of Aboriginal objects, and establishes a mechanism for interim protection orders that may be used to protect objects. Identified Aboriginal objects and sites are registered with the NSW Department of Environment and Climate Change (DECC) on the Aboriginal Heritage Information Management System (AHIMS). DEC administers *the National Parks and Wildlife Act 1974*.

HERITAGE ACT 1977

The *Heritage Act 1977* details statutory responsibilities for historic buildings and gardens, historic places and objects, historical archaeological sites, and historic shipwrecks. The Act is administered by the Heritage Council of New South Wales, through the NSW Heritage Office.

The aim of the Act is to conserve the 'environmental heritage' of the state, which includes items such as buildings, works, relics, moveable objects or precincts significant for historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic values. A 'Place' is defined as an area of land, with or without improvements and a 'Relic' is defined as any:

> *deposit, object or material evidence:*
>
> *(a) which relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and*
>
> *(b) which is 50 or more years old.*

An excavation permit is required for any works, excavations or activities, associated with an archaeological site. Excavation permits are issued by the Heritage Council of New South Wales in accordance with sections 60 or 140 of the *Heritage Act*.

It is an offence to disturb or excavate land to discover, expose or move a relic without obtaining a permit from the NSW Heritage Council.

> *139 Excavation permit required in certain cases*
>
> *(1) A person must not disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed unless the disturbance or excavation is carried out in accordance with an excavation permit.*
>
> *(2) A person must not disturb or excavate any land on which the person has discovered or exposed a relic except in accordance with an excavation permit.*

Excavation permits are usually issued subject to a range of conditions that will relate to matters such as reporting requirements and artefact cataloguing, storage and curation. A permit may be required from the Heritage Council of NSW for works or activities associated with a registered place or object.

General queries about site issues and permit applications can be made to the archaeological officers at the Heritage Office. The contact details are:

NSW Heritage Office
3 Marist Place
PARRAMATTA NSW 2150
Ph: (02) 9873 8500
Fax: (02) 9873 8599

Consultation and discussion with the NSW Heritage Office should begin well before lodging an application for a permit to disturb or destroy a historical archaeological site.

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

The *NSW Environmental Planning and Assessment Act* will have relevance for all development projects because it requires that environmental impacts are considered in land-use planning and decision making. The definition of 'environment impacts' includes impacts on the cultural heritage of the project area. The Act has three relevant parts: Part III, which governs the preparation of planning instruments; Part IV, which relates to development where consent is required under an environmental planning instrument (EPI); and Part V, which relates to activity where development consent is not required but some other government approval assessments are needed.

Under the Act, local government authorities and The Department of Infrastructure, Planning and Natural Resources (formerly Planning NSW) prepare local and regional environmental planning instruments (LEPs and REPs) to give statutory force to planning controls. These may incorporate specific provisions for conserving and managing archaeological sites.

Integrated Development Assessment (IDA) was introduced under the *Environmental Planning and Assessment Act* so that all matters affecting a development application would be considered by the consent authority in an integrated way.

Integrated Development is one which requires development consent as well as one or more approvals from different government agencies. Such agencies may include NSW DEC or the NSW Heritage Council. If a development is likely to impact a heritage item, the consent authority must refer it, to NSW DEC (for Indigenous objects) or the NSW Heritage Council (for sites listed on the State Heritage Register) prior to approval determination.

The Local Government Act 1993

Under the State Local Government Act, councils can prepare local approvals policies that set out specific matters for consideration in relation to applications to demolish, build or undertake works. Archaeological sites could be considerations under such policies

APPENDIX 3: HERITAGE DATABASE SEARCH RESULTS

GLOSSARY

Introduction & terminology

The following list provides definitions of various terms used in this report. Many of the terms have been referenced and the sources included in the reference list at the end of this report.

There is often a degree of confusion about the use of terms such as heritage place, historical site, archaeological site and so on. The definitions of these terms, as used in this report, have been included in the glossary and their relationship outlined in Figure 1 below. The term used most consistently is heritage place and this is defined as follows:

Heritage place: A place that has aesthetic, historic, scientific or social values for past, present or future generations – ' ... this definition encompasses all cultural places with any *potential* present or future value as defined above' (Pearson & Sullivan 1995: 7).

For the purpose of discussion in this document 'heritage place' can be sub-divided into Aboriginal place and historic place (i.e. a historic place refers more particularly to non-Aboriginal sites).

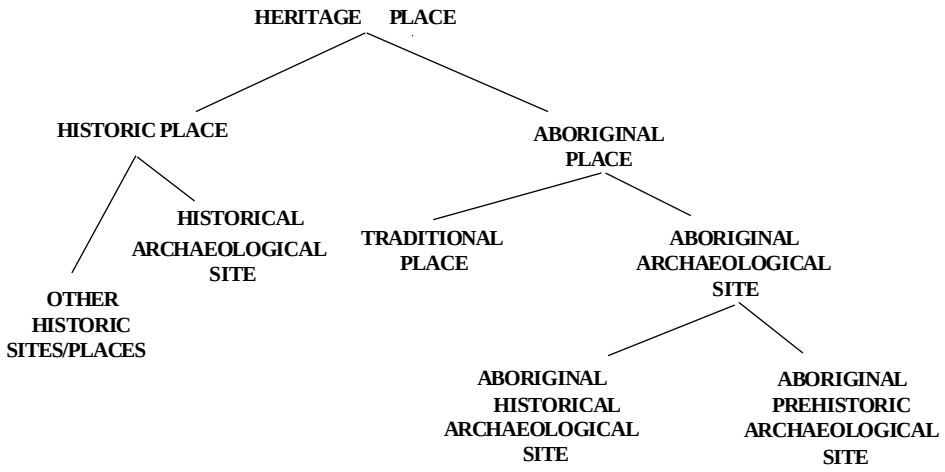


Figure G1: Terminology used for categories of heritage places.

Archaeological site types

The archaeological site types encountered in Australia can be divided into three main groups:

Historical archaeological site: an archaeological site formed since non-Aboriginal settlement that contains physical evidence of past human activity (for example a structure, landscape or artefact scatter).

Aboriginal historical archaeological site (or contact site): a site with a historical context such as an Aboriginal mission station or provisioning point; or a site that shows evidence of Aboriginal use of non-Aboriginal materials and ideas (for example: artefact scatter sites that have artefacts made from glass, metal or ceramics).

Aboriginal prehistoric archaeological site: a site that contains physical evidence of past Aboriginal activity, formed or used by Aboriginal people either before, or not long after, European settlement. These sites are commonly grouped as follows (further definition of each is contained in the glossary list):

- artefact scatter
- burial
- hearth
- isolated artefact
- mound
- quarry
- scarred tree
- shell midden
- structures
- rock art
- rock shelter
- rock well

One of the most common artefact types that provides evidence of Aboriginal people are those made from stone. Types and categories are outlined below in Figure G2, with further definition of each in the glossary list.

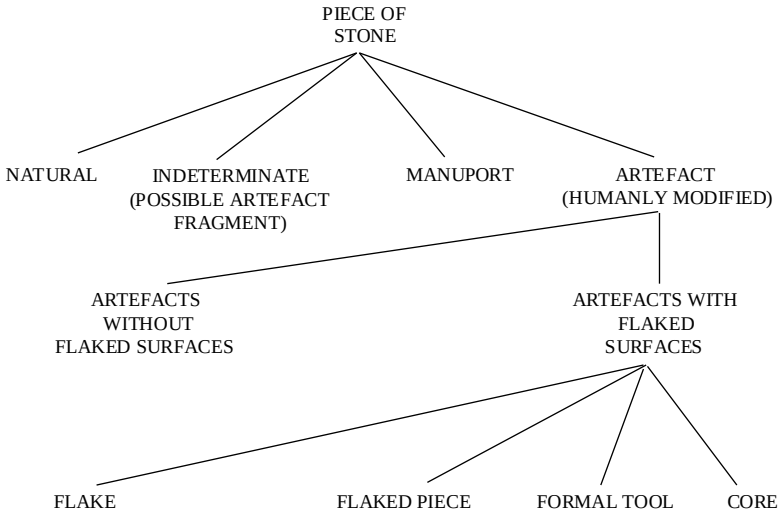


Figure G2: Stone artefact types/categories.

List of definitions

Aboriginal historical archaeological site (or contact site): either a site with an historic context such as an Aboriginal mission station or provisioning point; or a site that shows evidence of Aboriginal use of European/non-Aboriginal materials and ideas (e.g. artefact scatter sites that contain artefacts made from glass, metal or ceramics).

Aboriginal prehistoric archaeological site: a site that contains physical evidence of past Aboriginal use, formed or used by Aboriginal people either before, or not long after, European settlement.

Archaeology: the study of the remains of past human activity.

Artefact scatter: a surface scatter of cultural material. Artefact scatters are often the only physical remains of places where people have lived camped, prepared and eaten meals and worked.

Backed piece: a flake or blade that has been abruptly retouched along one or more margins opposite an acute (sharp) edge. Backed pieces include backed blades and geometric microliths. They are thought to have been hafted onto wooden handles to produce composite cutting tools. Backed pieces are a feature of the 'Australian small tool tradition', dating from between 5000 and 1000 years ago in southern Australia (Mulvaney 1975).

Bipolar working: technique used for the reduction of stone, in particular quartz, by placing a core on an anvil and 'smashing' with a hammerstone.

Blade: a flake at least twice as long as it is wide.

Burial site: usually a sub-surface pit containing human remains and sometimes associated artefacts.

Contact site: see 'Aboriginal historical archaeological site'.

Core: an artefact from which flakes have been detached using a hammerstone. Core types include single platform, multi-platform and bipolar forms.

Cortex: original or natural (unflaked) surface of a stone.

Flake: a stone piece removed from a core by percussion (striking it) or pressure. It is identified by the presence of a striking platform and bulb of percussion, not usually found on a naturally shattered stone.

Flaked piece: a piece of stone with definite flake surfaces, which cannot be classified as a flake or core.

Hammerstone: a piece of stone, often a creek/river pebble/cobble, which has been used to detach flakes from a core by percussion. During flaking, the edges of the hammerstone become 'bruised' or crushed by impact with the core.

Heritage Place: A place with aesthetic, historic, scientific or social values for past, present or future generations – '... this definition encompasses all cultural places with any *potential* present or future value as defined above' (Pearson & Sullivan 1995).

Historic place: a place that has some significance or noted association in history.

Historical archaeological site: an archaeological site formed since non-Aboriginal settlement that contains physical evidence of past human activity (for example a structure, landscape or artefact scatter).

Isolated artefact: the occurrence of one (or a small number as defined by the survey methodology) of artefacts within a given area. It/they can be evidence of a short-lived (or one-off) activity location, the result of an artefact being lost or discarded during travel, or evidence of an artefact scatter that is otherwise obscured by poor ground visibility.

Obtrusiveness: how visible a site is within a particular landscape. Some site types are more conspicuous than others. A surface stone artefact scatter is generally not obtrusive, but a scarred tree will be (Bird 1992).

Pebble/cobble: natural stone fragments of any shape. Pebbles are 2–60 mm in size and cobbles are 60–200 mm in size (McDonald et al. 1984: 78).

Pre-contact: before contact with non-Aboriginal people.

Post-contact: after contact with non-Aboriginal people.

Retouch: a flake, flaked piece or core with intentional secondary flaking along one or more edges.

Rock art: 'paintings, engravings and shallow relief work on natural rock surfaces' (Rosenfeld 1988: 1). Paintings were often produced by mineral pigments, such as ochre, combined with clay and usually mixed with water to form a paste or liquid that was applied to an unprepared rock surface. Rock engravings were made by incising, pounding, pecking or chiselling a design into a rock surface. Rare examples of carved trees occAS1onally survive.

Rock shelter: may contain the physical remains of camping places where people prepared meals, flaked stone, etc. They are often classed as a different type of site due to their fixed boundaries and greater likelihood of containing sub-surface deposits. Rock shelters may also contain rock art.

Rock-well: a natural or modified depression within a stone outcrop, which collects water. The most identifiable of these sites have been modified by Aboriginal people, either by deepening or enlarging.

Scarred tree: scars on trees may be the result of removal of strips of bark by Aboriginal People e.g. for the manufacture of utensils, canoes or for shelter; or resulting from small notches chopped into the bark to provide hand and toe holds for hunting possums and koalas. Some scars may be the result of non-Aboriginal activity, such as surveyors marks.

Significance: the importance of a heritage place or site for aesthetic, historic, scientific or social values for past, present or future generations.

Survey Transect: is a defined track recorded using a Hand-held GPS that records all area walked during the field survey.

Utilised artefact: a flake, flaked piece or core that has irregular small flake scarring along one or more margins that does not represent platform preparation.

Visibility: the degree to which the surface of the ground can be seen. This may be influenced by natural processes such as wind erosion or the character of the native vegetation, and by land-use practices, such as ploughing or grading. Visibility is generally expressed in terms of the percentage of the ground surface visible for an observer on foot (Bird 1992).

Appendix P

SUBSTRATE PLANT AIR QUALITY ASSESSMENT

AIR QUALITY ASSESSMENT

EXPANSION OF SUBSTRATE FACILITY, MULGRAVE

Elf Farm Supplies

Job No: 2966

9 December 2010

PROJECT TITLE:	Expansion of Substrate Facility, Mulgrave
JOB NUMBER:	**2966**
PREPARED FOR:	Perram and Partners on behalf of **ELF FARM SUPPLIES**
AUTHOR:	Philip Henschke, Kerry Holmes
APPROVED FOR RELEASE BY:	Kerry Holmes
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1 INTRODUCTION

This report has been prepared by PAEHolmes on behalf of Perram & Partners who in turn are acting for Elf Farm Supplies. It presents an assessment of the odour impacts for the proposed expansion of the existing substrate facility at Mulgrave, NSW.

The report comprises the following components:

- A description of the project;
- Discussion of air quality issues related to the project;
- A description of local dispersion conditions at the site;
- A description of modelling parameters;
- Results of dispersion modelling;
- Discussion on the model validation; and
- A Greenhouse Gas Assessment.

The dispersion modelling was undertaken using the CALPUFF model, in accordance with the NSW Department of Environment, Climate Change and Water (NSW DECCW) "*Approved methods for the modelling and assessment of air pollutants in NSW*" (herein referred to as the Approved Methods) (**DEC, 2005**) and the NSW DECCW document "*Technical Framework: Assessment and management of odours from stationary sources in NSW*" (herein referred to as the framework) (**DEC, 2006**). A Level 3 odour impact assessment was undertaken.

2 BACKGROUND

The Elf Farm Supplies substrate facility at Mulgrave has previously been assessed by Holmes Air Sciences in July 2002 (**Holmes Air Sciences, 2002**). The focus of the assessment was to determine an appropriate stack odour limit and stack height for the proposed bio-scrubber to ensure compliance with NSW DECCW odour goals for residential areas.

Dispersion modelling was conducted using AUSPLUME Version 5.4 with an emission rate of 54,996 ou.m^3/s exhausted through a 40 m stack. The results found that compliance of the 2 ou criteria would be achieved using far-field peak-to-mean ratios. The assessment formed the basis of setting the current Environment Protection Licence (No. 6229) for stack odour emissions at 55,400 ou.m^3/s.

This assessment has adopted the methodology used in the 2002 assessment to determine if compliance can be achieved with the proposed increase in production rate.

3 PROJECT DESCRIPTION

The Elf Farm Supplies substrate facility has reached the capacity set by the Hawkesbury Council of 1000 tonnes of Phase 1 substrate per week. The farm has been operating at its maximum level for the last 3½ years. Due to evolving operational techniques, which include a pre-wet/Phase 1 process time reduction from 3 to 2 weeks, the site is now capable of producing 1,600 tonnes with only minor alterations to the current infrastructure.

The market demand for the substrate has continued to increase and Elf Farm Supplies have proposed to expand the existing operations. This proposed development is intended to occur in conjunction with the proposed establishment of a new mushroom farm at Londonderry, NSW,

operated by Elf Mushrooms; which is the subject of a separate odour assessment (**PAEHolmes, 2010**).

The preparation of mushroom substrate involves a four step process, each part of which is undertaken on-site. The four steps are outlined below;

- Pre-wet: combining all ingredients and initiating the composting process. Water is added and fresh air pulsed through the compost to keep the material aerobic;
- Phase 1: the mix is processed through tunnels in which temperature, oxygen and moisture content are controlled and regulated;
- Phase 2: material is transferred to clean tunnels where it is pasteurised and peak heated to remove any weed moulds or pests before spawning; and
- Phase 3: mushroom spawn is added and grown through the substrate for a minimum of 2 weeks prior to Mushroom Farm delivery.

The first two steps of this process generate the majority of odour and have been analysed in this assessment.

3.1 Proposed development

The mushroom substrate facility is located at Mulgrave approximately 2 km southeast of Windsor. The site has isolated semi-rural properties immediately to the southeast and an industrial area to the east and northeast. To the west of the facility is a floodplain area and adjoining this is a suburban residential area (see **Figure 1**).

The terrain surrounding the substrate facility is relatively flat; the nearest sensitive receptor is located approximately 200 m to the southeast.

Figure 2 presents a site layout for the proposed expansion of the existing substrate facility. The proposed expansion of the site is planned to occur within a 10-year time frame. The expansion has been planned to ensure the production rate matches the growing demand for the substrate.

The planned expansion will involve three construction stages; these have been outlined below.

- Stage 1 – construction of a new straw bale storage shed as the production level is increased to 1,600 tonnes of Phase 1 product per week;
- Stage 2 - construction of a second bale storage shed, a new bale wetting area with water recycling pit, a new Phase 2/3 building and an extension to the existing pre-wet shed with an additional bio-scrubber. All fugitive odour sources will be enclosed and odours arising from these sources will be processed by the bio-scrubbers. Production is designed to reach 2,400 tonnes of Phase 1 substrate per week; and
- Stage 3 - further extension to the new Phase 2/3 building and an extension of the Phase 1 building, the capacity of the facility is proposed to reach a maximum of 3,200 tonnes of Phase 1 substrate per week.

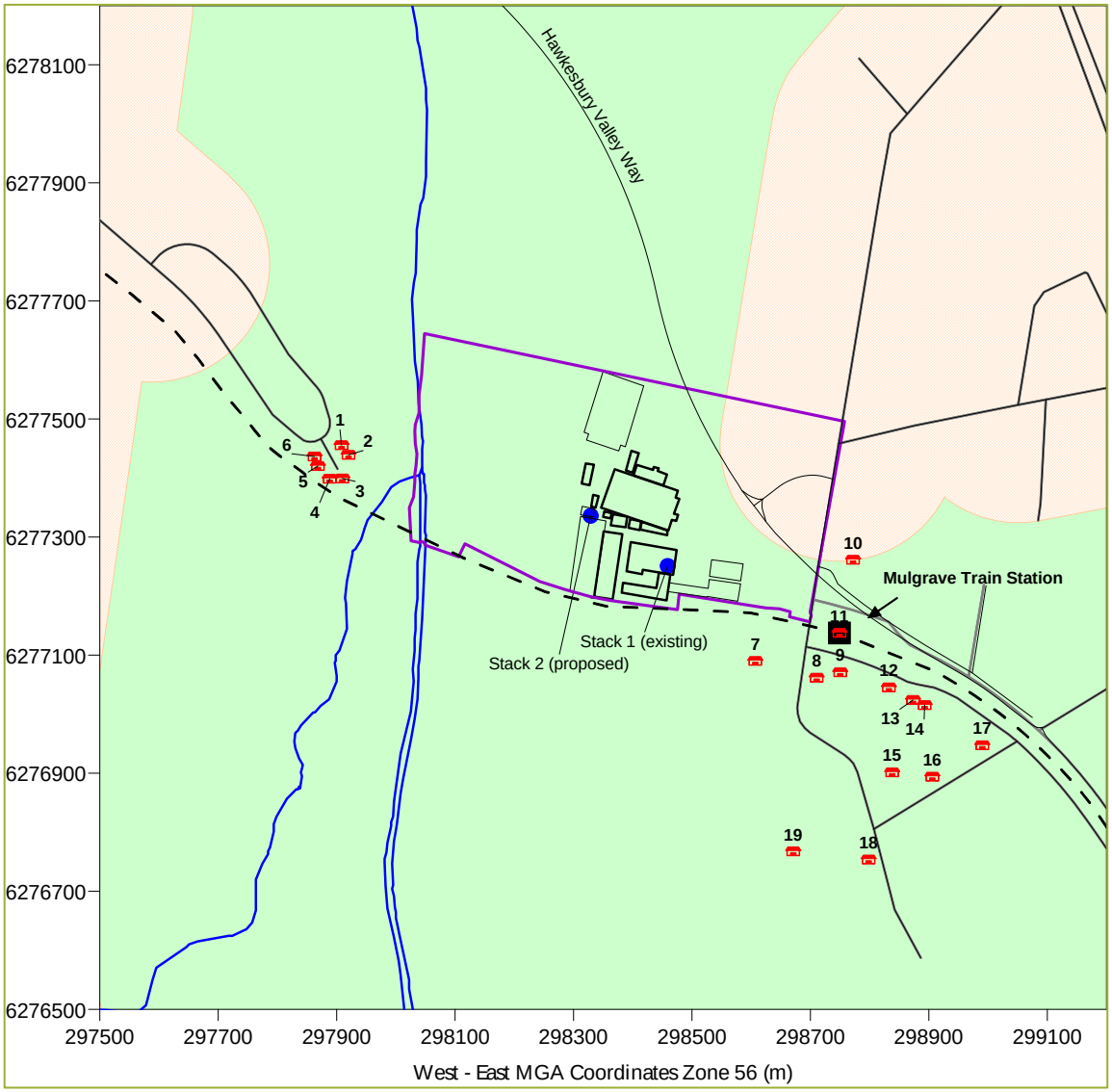


Figure 1: Location of Elf Farm Supplies Substrate Facility, Mulgrave NSW

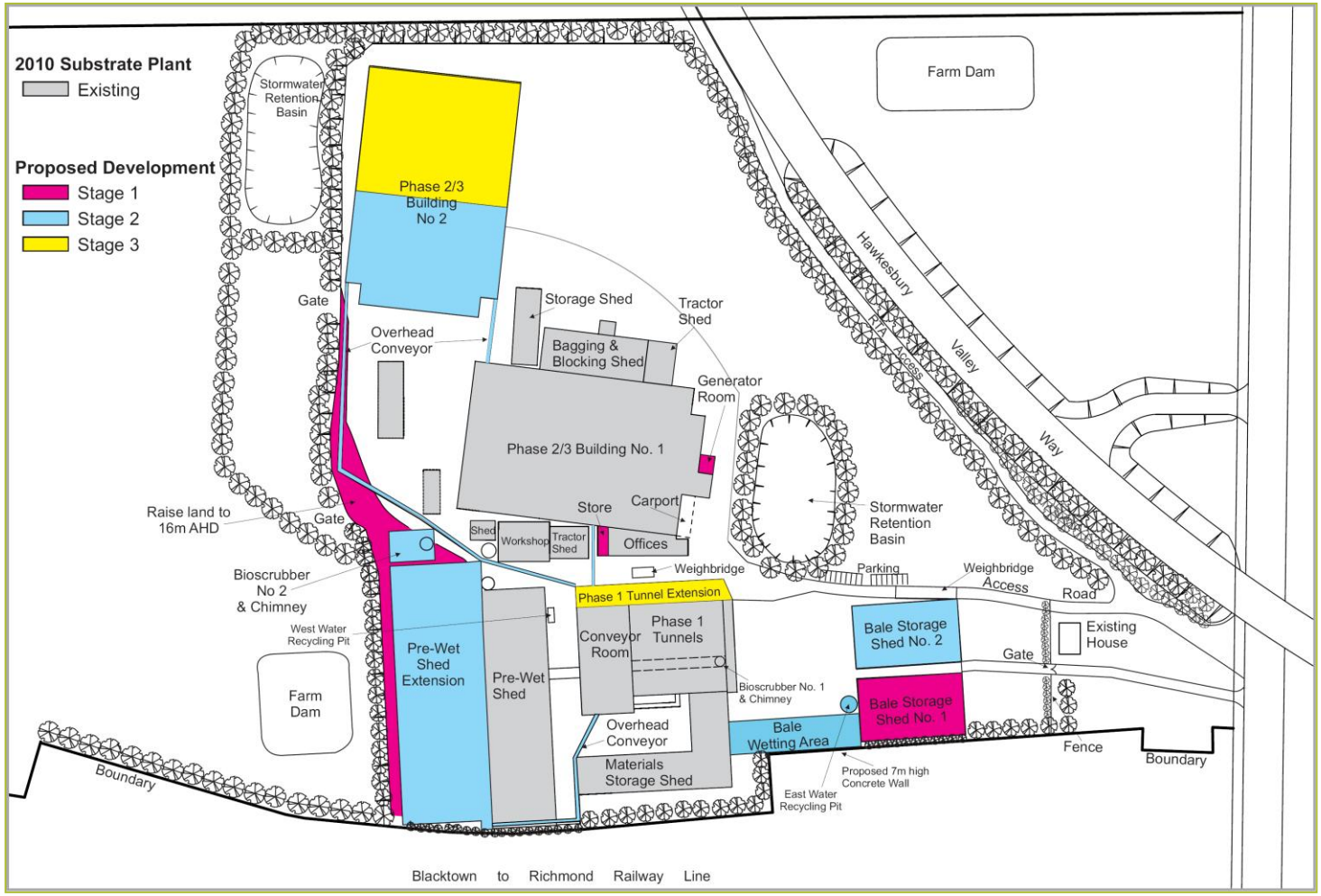


Figure 2: Proposed site layout

4 DISCUSSION OF AIR QUALITY ISSUES

4.1 Measuring Odour Concentration

There are no instrument-based methods that can measure an odour response in the same way as the human nose. Therefore "dynamic olfactometry" is typically used as the basis of odour management by regulatory authorities.

Dynamic olfactometry is the measurement of odour by presenting a sample of odorous air to a panel of people with decreasing quantities of clean odour-free air. The panellists then note when the smell becomes detectable. The correlations between the known dilution ratios and the panellists' responses are then used to calculate the number of dilutions of the original sample required to achieve the odour detection threshold. The units for odour measurement using dynamic olfactometry are "odour units" (ou) which are dimensionless and are effectively "dilutions to threshold".

Olfactometry can involve a "forced choice" end point where panellists identify from multiple sniffing ports the one where odour is detected, regardless of whether they are sure they can detect odour. There is also a "yes/no" or "free choice" endpoint where panellists are required to say whether or not they can detect odour from one sniffing port. Forced choice olfactometry generally detects lower odour levels than yes/no olfactometry and is the preferred method for use in Australia.

In both cases, odorous air is presented to the panellists in increasing concentrations. For the forced-choice method, where there are multiple ports for each panellist, the concentration is increased until all panellists consistently distinguish the port with the sample from the blanks. For a yes/no olfactometer (which has only one sniffing port) one method used is to increase the concentration of odour in the sample until all panellists respond. The sample is then shut off and once all panellists cease to respond, the sample is introduced again at random dilutions and the panellists are asked whether they can detect the odour.

During the 1990s significant research was undertaken in Europe to refine the olfactometry method. This led to considerable improvements in panellist management and standardisation and, importantly, clear criteria for repeatability and reproducibility of results.

The draft Committé Européen de Normalisation (CEN) odour measurement standard (**CEN, 1996)** is a performance based standard with strict criteria for repeatability and reproducibility. The Australian standard (introduced in September 2001) (**Standards Australia, 2001**) is based upon the CEN standard.

As with all sensory methods of identification there is variability between individuals. Consequently the results of odour measurements depend on the way in which the panel is selected and the way in which the panel responses are interpreted.

Relevant odour data has been obtained from testing conducted during the current operations of the substrate plant to establish predicted odour emission values.

4.2 Odour Performance Criteria

4.2.1 Introduction

The determination of air quality goals for odour and their use in the assessment of odour impacts is recognised as a difficult topic in air pollution science. The topic has received

considerable attention in recent years and the procedures for assessing odour impacts using dispersion models have been refined considerably. There is still considerable debate in the scientific community about appropriate odour goals as determined by dispersion modelling.

The DECCW has developed odour goals and the way in which they should be applied with dispersion models to assess the likelihood of nuisance impact arising from the emission of odour.

There are two factors that need to be considered:

1. what "level of exposure" to odour is considered acceptable to meet current community standards in NSW and
2. how can dispersion models be used to determine if a source of odour meets the goals which are based on this acceptable level of exposure

The term "level of exposure" has been used to reflect the fact that odour impacts are determined by several factors the most important of which are:

- the **F**requency of the exposure;
- the **I**ntensity of the odour;
- the **D**uration of the odour episodes; and
- the **O**ffensiveness of the odour (the so-called FIDO factor).

In determining the offensiveness of an odour it needs to be recognised that for most odours the context in which an odour is perceived is also relevant. Some odours, for example the smell of sewage, hydrogen sulfide, butyric acid, landfill gas etc., are likely to be judged offensive regardless of the context in which they occur. Other odours such as the smell of jet fuel may be acceptable at an airport, but not in a house, and diesel exhaust may be acceptable near a busy road, but not in a restaurant.

In summary, whether or not an individual considers an odour to be a nuisance will depend on the FIDO factors outlined above and although it is possible to derive formulae for assessing odour annoyance in a community, the response of any individual to an odour is still unpredictable. Odour goals need to take account of these factors.

4.2.2 Complex Mixtures of Odorous Air Pollutants

The DECCW Approved Methods include ground-level concentration (glc) criterion for complex mixtures of odorous air pollutants. They have been refined by the DECCW to take account of population density in the area. **Table 4.1** lists the odour glc criterion to be exceeded not more than 1% of the time, for different population densities.

The difference between odour goals is based on considerations of risk of odour impact rather than differences in odour acceptability between urban and rural areas. For a given odour level there will be a wide range of responses in the population exposed to the odour. In a densely populated area there will therefore be a greater risk that some individuals within the community will find the odour unacceptable than in a sparsely populated area.

Areas to the west of the site adjoining the floodplain are considered urban. Areas generally to east of the Mulgrave site are a mixture of semi-rural and industrial. Therefore, as shown in **Table 4.1**, the relevant impact assessment criterion for areas to the west of the site is 2 ou **(DEC, 2005)**. For the areas to the east of the site a less stringent criteria, between 4-7 odour units, should be applicable as the population is sparser and in some instances including the railway station and the industrial areas only present during part of the day.

Table 4.1: Odour Performance Criteria for the Assessment of Odour

Population of affected community	glc criterion for complex mixtures of odorous air pollutants (ou)
≤ ~2	7
~10	6
~30	5
~125	4
~500	3
Urban (2000) and/or schools and hospitals	2

4.2.3 Peak-to-mean Ratios

It is common practice to use dispersion models to determine compliance with odour goals. This introduces a complication because Gaussian dispersion models are only able to directly predict concentrations over an averaging period of 3-minutes or greater. The human nose, however, responds to odours over periods of the order of a second or so. During a 3-minute period, odour levels can fluctuate significantly above and below the mean depending on the nature of the source.

To determine more rigorously the ratio between the one-second peak concentrations and three-minute and longer period average concentrations (referred to as the peak-to-mean ratio) that might be predicted by a Gaussian dispersion model, the DECCW commissioned a study by **Katestone Scientific Pty Ltd (1995, 1998)**. This study recommended peak-to-mean ratios for a range of source types. The ratio is also dependent on atmospheric stability (discussed in **Section 4.2**) and the distance from the source.

The DECCW Approved Methods take account of this peaking factor and the goals shown in **Table 4.1** are based on nose-response time. A summary of peak-to-mean ratios for different circumstances is provided in **Appendix C**.

The odour emission sources at the Mulgrave facility comprise area sources (water pits) volume sources (emissions from buildings) and point sources (bioscrubber stacks). These are discussed in detail in **Section 7.** Sensitive receptors are located in both the near and far field (near-field defined as within a distance of 10 times the largest dimension of the source).

Katestone 1995 provides a broad definition of a tall stack as one with height greater than the mean depth of the boundary layer in flat terrain, typically 50 m. The examples of stacks on which the tall stack peak-to-mean ratios are based are all above 100 m. In the case of the Mulgrave facility the existing stack height is 40 m and the proposed stack height is also 40 m. This places the height in the middle range where tall stack peak-to-mean ratios are very likely to be an overestimate. For this application, surface point peak-to-mean ratios have been used for the bio-scrubber stacks. This provides a less conservative estimate of impacts for the near-field and a more conservative estimate of impacts for the far-field. Area and volume source peak to mean ratios have been applied as appropriate.

5 APPROACH TO ASSESSMENT

5.1 Dispersion Modelling Methodology

The air dispersion modelling conducted for this assessment has been based on an advanced modelling system using the models TAPM and CALMET/CALPUFF (see **Figure 3**). This system substantially overcomes the basic limitations of the steady-state Gaussian plume models such as AUSPLUME. These limitations are most severe in very light winds, in coastal environments, and where terrain affects atmospheric flow.

The modelling system works as follows:

- TAPM (v. 4.0) is a prognostic meteorological model that generates gridded three-dimensional meteorological data for each hour of the model run period;
- CALMET (v. 6.326), the meteorological pre-processor for the dispersion model CALPUFF, calculates fine resolution three-dimensional meteorological data based upon observed ground and upper level meteorological data, as well as observed or modelled upper air data generated for example by TAPM; and
- CALPUFF (v. 6.263) then calculates the dispersion of plumes within this three-dimensional meteorological field.

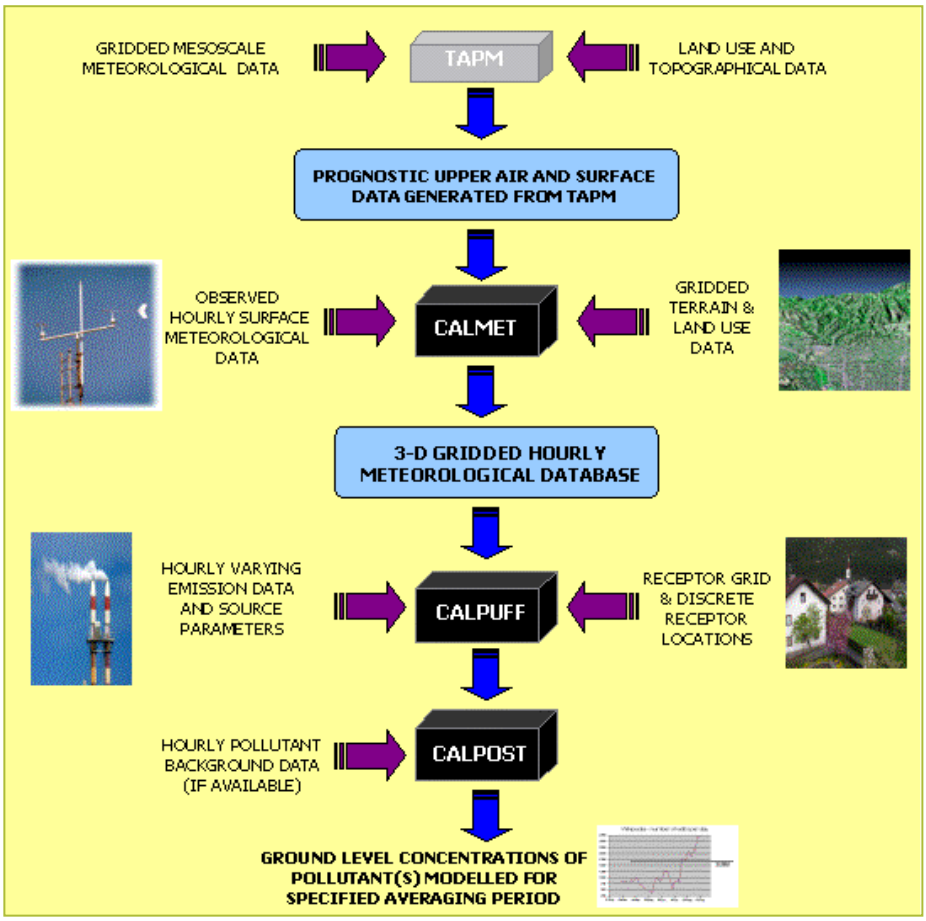


Figure 3: Modelling Methodology Used in this Study

5.1.1 TAPM

The Air Pollution Model, or TAPM, is a three dimensional meteorological and air pollution model developed by the CSIRO Division of Atmospheric Research. Detailed description of the TAPM model and its performance is provided elsewhere. The Technical Paper by **Hurley (2005)** describes technical details of the model equations, parameterisations, and numerical methods. A summary of some verification studies using TAPM is also given in **Hurley *et al*. (2005)**.

TAPM solves the fundamental fluid dynamics and scalar transport equations to predict meteorology and (optionally) pollutant concentrations. It consists of coupled prognostic meteorological and air pollution concentration components. The model predicts airflow important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of larger scale meteorology provided by synoptic analyses.

Observed surface meteorological data collected from the on-site weather station at Elf Farm Supplies was merged into TAPM. Surface meteorological data and 3-D prognostic data were generated over the study region using TAPM. The TAPM-generated data and observed surface meteorological data were then entered into the CALMET diagnostic meteorological model, which is discussed below.

5.1.2 CALMET

CALMET is a meteorological pre-processor that includes a wind field generator containing objective analysis and parameterised treatments of slope flows, terrain effects and terrain blocking effects. The pre-processor produces fields of wind components, air temperature, relative humidity, mixing height and other micro-meteorological variables to produce the three-dimensional meteorological fields that are used in the CALPUFF dispersion model.

The hourly observed data supplemented with TAPM-generated data for the period of analysis were used as input to the CALMET pre-processor to create a fine resolution, three-dimensional meteorological field for input into the dispersion model. CALMET uses the meteorological inputs in combination with land use and geophysical information for the modelling domain to predict gridded meteorological fields for the region.

Terrain data has been sourced from the Shuttle Terrain Mission dataset. The spatial resolution of these data is 100 m.

Meteorological information collected on-site at the Elf Farm Supplies facility in Mulgrave, Sydney Airport AMO, Richmond RAAF and TAPM-generated surface information were used as input into the CALMET model. TAPM surface information was only included when no observed data from the other meteorological stations was available. This data comprised of 0.15% of the total data points input, therefore should not influence the model output.

The data were additionally supplemented with upper air data derived from TAPM simulations as no measured upper air data is available for the site.

A summary of the data and parameters used for the meteorological component of this study are shown in **Table 5.1**.

Table 5.1: Meteorological Parameters used for CALMET

TAPM (v 4.0)	
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Number of grid points	25 x 25 x 25
Year of analysis	April 2008 – March 2009
Centre of analysis	"Elf Farm Supplies", Mulgrave (33°37' S, 150°49' E)
CALMET (v. 6.326)	
Meteorological grid domain	20 km x 20 km
Meteorological grid resolution	0.2 km
TERRAD	10 km
IEXTRP	-4
BIAS (NZ)	-1,-0.5,-0.25,0,0,0,0
R1	5 km
R2	5 km
RMAX1	10 km
RMAX2	10 km
Surface meteorological stations	"Elf Farm Supplies" on-site station -Wind speed -Wind direction -Temperature Sydney Airport AMO (Bureau of Meteorology, Station Number 066037) -Cloud cover -Cloud height Richmond RAAF (Bureau of Meteorology, Station Number 067105) -Wind speed -Wind direction -Temperature -Relative Humidity -Pressure TAPM -Wind speed -Wind direction -Relative humidity -Pressure
Upper air meteorological stations	Data extracted from TAPM

The CALMET generated meteorological data was analysed in detail to confirm local meteorology and has been presented in the following sections.

Figure 4 presents the wind vectors from CALMET output for an hour of the modelling period. The figure shows the distribution of winds and influence of landuse and terrain within the modelling domain. For example, in the northwest corner of the domain, katabatic winds flow down from the mountain range towards the site in an easterly direction. The flows are then directed southwards along the shallow floodplain region directly adjacent to the site.

Winds from other directions and hours have also been analysed and can be provided upon request.

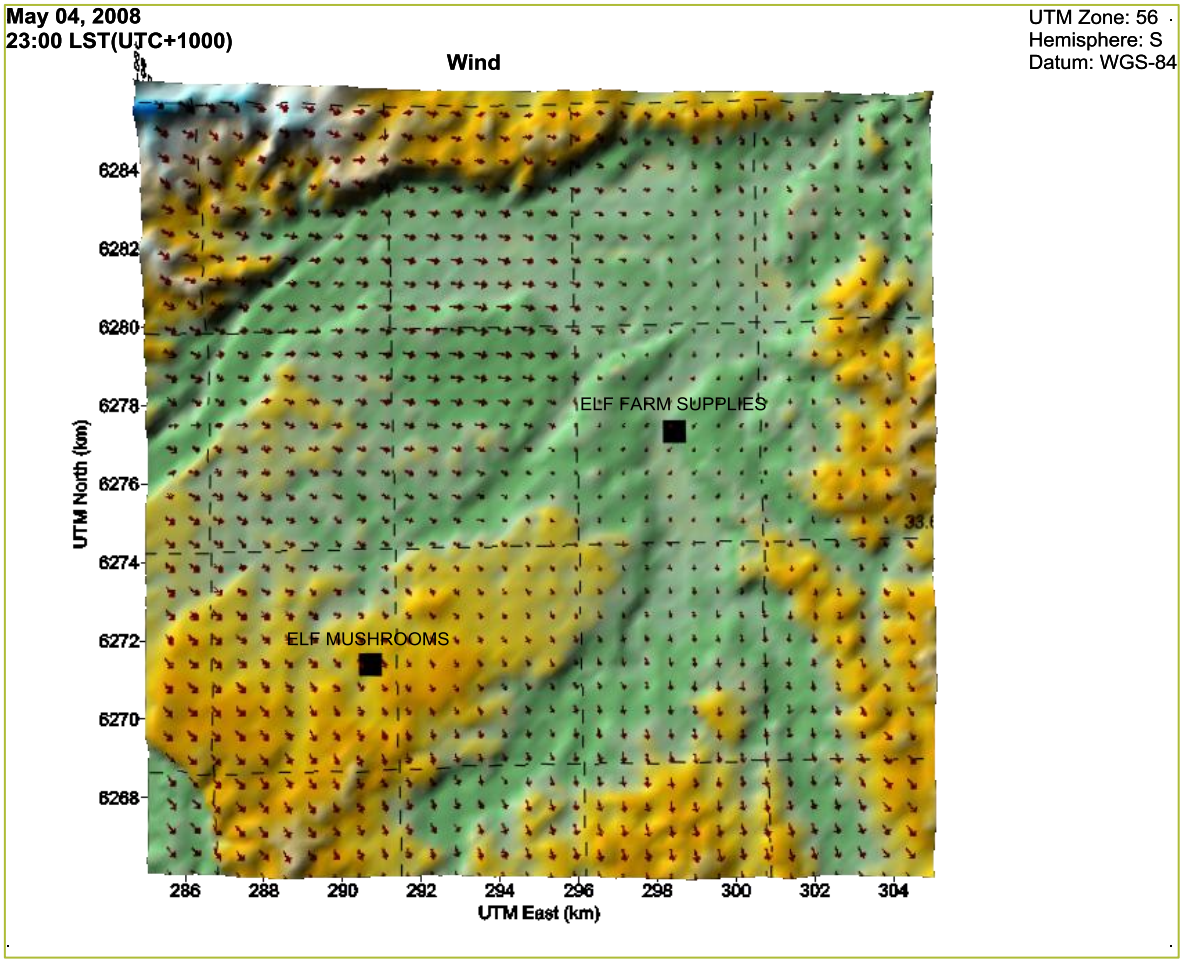


Figure 4: CALMET Wind Vectors – 4th May 2008, 23:00

The method used in the CALMET modelling was a 'Hybrid mode' approach that incorporated measured hourly surface data in combination with a TAPM generated 3-D input field. This method was used in light of recent guidance notes provided by TRC Atmospheric Studies Group (**TRC, 2010**) on the preferred methodologies for running CALMET.

When this method is compared with previous methodologies using an 'Observations only' approach that inputs TAPM derived upper air data from a discrete location within the modelling domain as opposed to using the 3-D input, it was found that there were little to no difference between the data extracted at the site. This may be attributed to the absence of significant terrain features within the CALMET modelling domain that may have affected the predictions between the modelling methodologies.

5.1.3 CALPUFF

CALPUFF (**Scire *et al.*, 2000a**) is a multi-layer, multi-species, non-steady state puff dispersion model that can simulate the effects of time and space varying meteorological conditions on pollutant transport, transformation and removal. The model contains algorithms for near-source effects such as building downwash, partial plume penetration, sub-grid scale interactions as well as longer-range effects such as pollutant removal, chemical transformation, vertical wind shear and coastal interaction effects. The model employs dispersion equations based on a Gaussian distribution of pollutants across the puff and takes into account the complex arrangement of emissions from point, area, volume, and line sources.

As with any air dispersion model, CALPUFF requires inputs in three major areas:

- Emission rates and source details;
- Meteorology; and
- Terrain and surface details, as well as specification of specific receptor locations.

CALPUFF is a DECCW approved model, and has been used in many studies in New South Wales, Queensland and other parts of Australia.

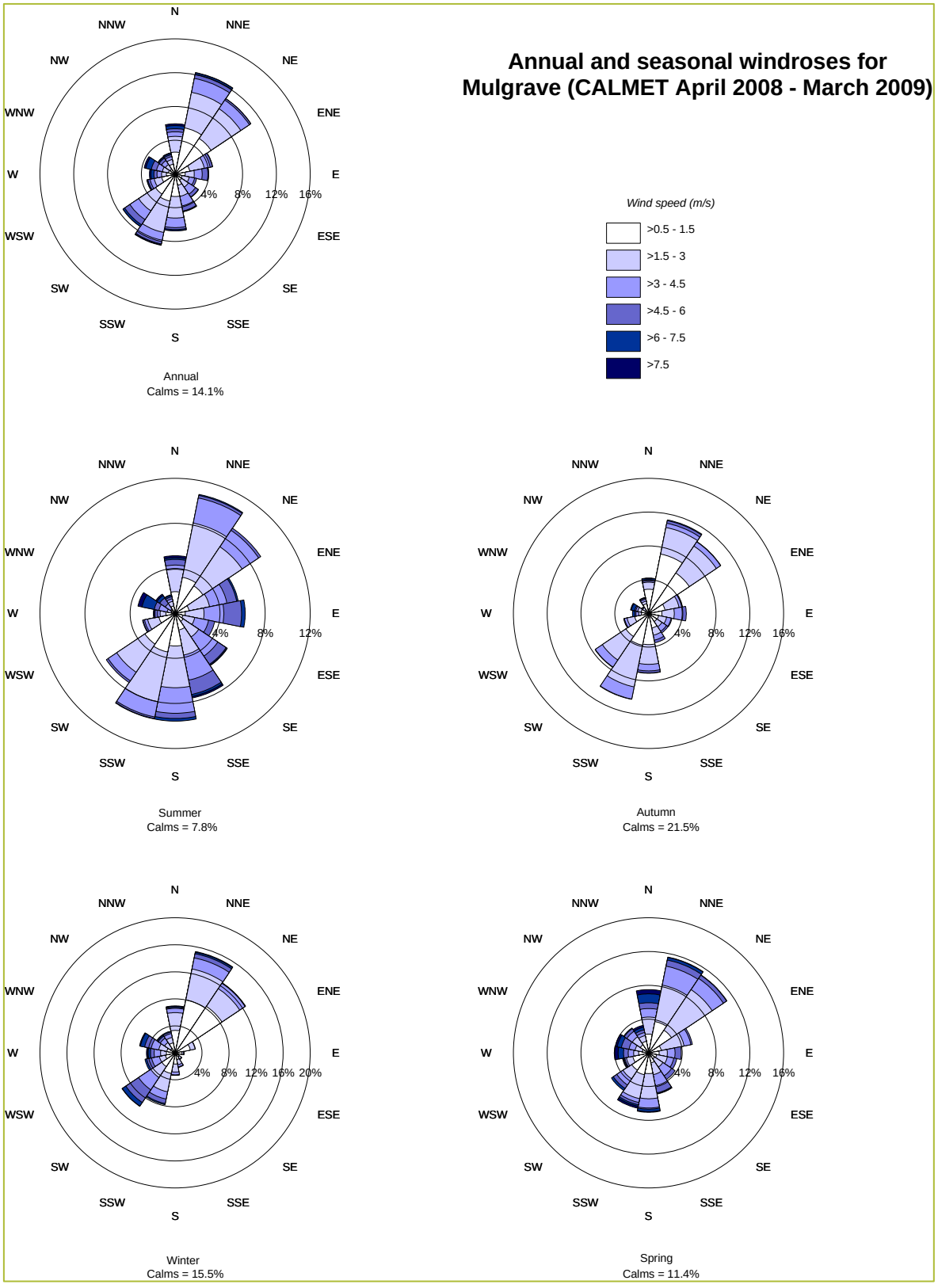
6 METEOROLOGICAL DATA USED IN ASSESSMENT

6.1 Wind

Windroses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points – N, NNE, NE, etc. The bar at the top of each windrose diagram represents winds blowing from the north (i.e. northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the colour of the bar sections correspond to wind speed categories, the lighter colour representing the lightest winds.

The diurnal windroses based on the CALMET extract are shown in **Figure 5**.

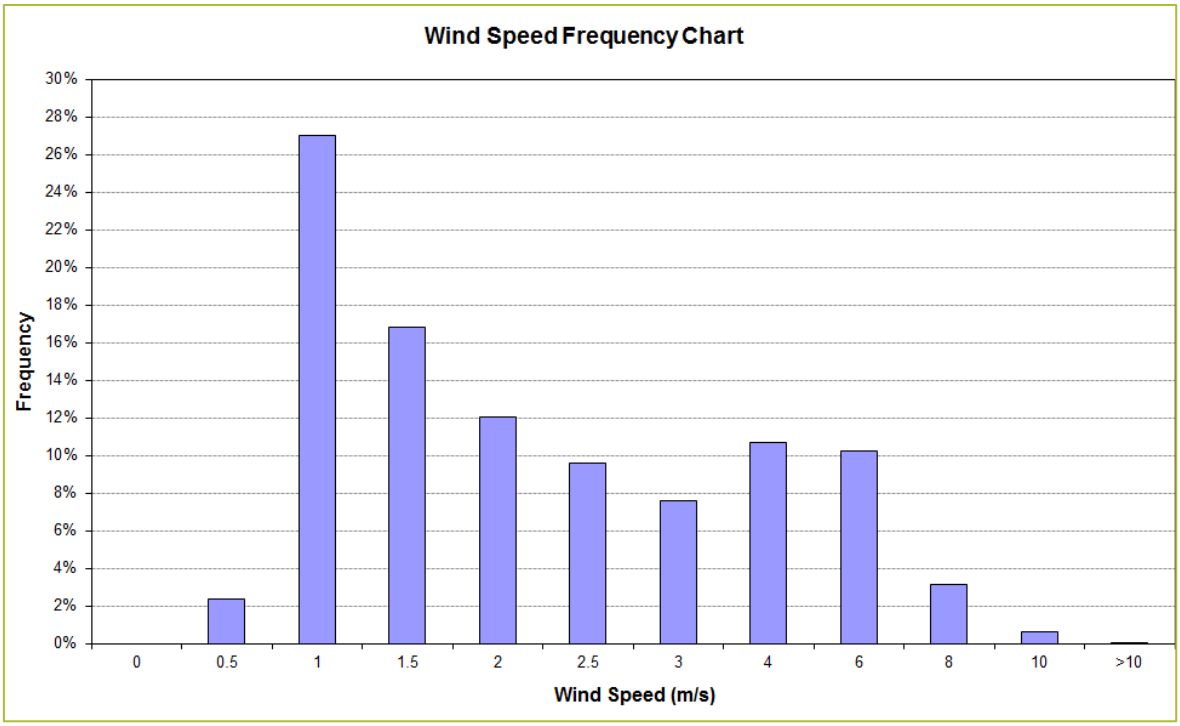
On an annual basis winds from the north-northeast are most predominant with a good proportion of winds from the northeast. In autumn, winds blow predominantly from north-northeast and are similar to the annual windrose. In summer winds from the north-northeast, northeast, south and south-southwest are most significant. Winter winds predominantly occur from the north-northeast. In spring, the dominant wind directions are from the north-northeast and northeast.



Source: CALMET

Figure 5: Annual and seasonal windroses

The frequency distribution of hourly averaged wind speed values is shown in **Figure 6**. Light wind speeds (up to 2 m/s) are relatively frequent and occur approximately 58.1% of the time. Strong winds (greater than 6 m/s) occur approximately 14% of the time.



Source: CALMET

Figure 6: Wind Speed Distribution for April 2008 to March 2009

6.2 Stability

Atmospheric turbulence is an important factor in plume dispersion. Turbulence acts to increase the cross-sectional area of the plume due to random motions, thus diluting or diffusing a plume. As turbulence increases, the rate of plume dilution or diffusion increases. Weak turbulence limits plume diffusion and is a critical factor in causing high plume concentrations downwind of a source, particularly when combined with very low wind speeds.

Turbulence is related to the vertical temperature gradient, the condition of which determines what is known as stability, or thermal stability. For traditional dispersion modelling using Gaussian plume models, categories of atmospheric stability are used in conjunction with other meteorological data to describe atmospheric conditions and thus dispersion.

The most well-known stability classification is the Pasquill-Gifford scheme[a], which denotes stability classes from A to F. Class A is described as highly unstable and occurs in association with strong surface heating and light winds, leading to intense convective turbulence and much enhanced plume dilution.

At the other extreme, class F denotes very stable conditions associated with strong temperature inversions and light winds, which commonly occur under clear skies at night and in the early

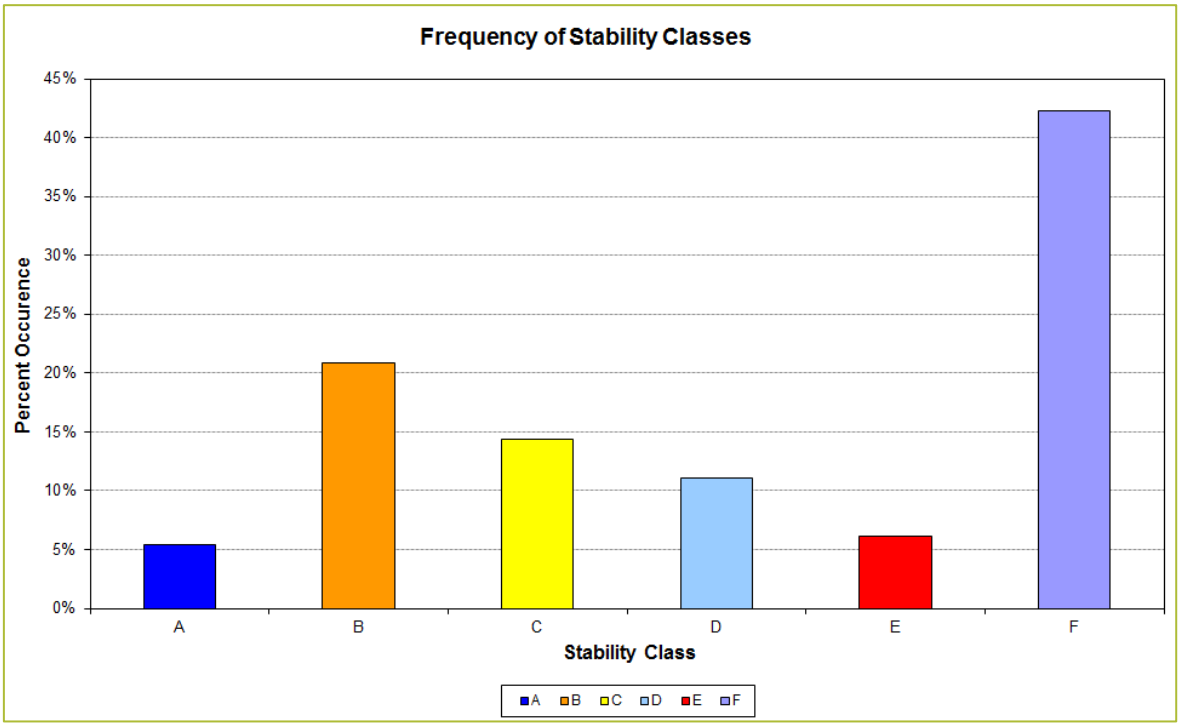
[a] A more accurate turbulence scheme within CALPUFF, based on micrometeorological parameters, was used for modelling.

morning. Under these conditions plumes can remain relatively undiluted for considerable distances downwind.

Intermediate stability classes grade from moderately unstable (B), through neutral (D) to slightly stable (E). Whilst classes A and F are strongly associated with clear skies, class D is linked to windy and/or cloudy weather, and short periods around sunset and sunrise when surface heating or cooling is small.

As a general rule, unstable (or convective) conditions dominate during the daytime and stable flows are dominant at night. This diurnal pattern is most pronounced when there is relatively little cloud cover and light to moderate winds.

The frequency distribution of estimated stability classes in the meteorological file is presented in **Figure 7**Source: CALMET
Figure 7. The data show a total of 48.4% of hours with either E or F stability class.



Source: CALMET

Figure 7: Frequency Distribution of Estimated Stability Classes

6.3 Local Climate

This section describes the general climate in the study area to give a more complete picture of the local meteorology.

Table 6.1 presents the temperature, humidity and rainfall data for the closest Bureau of Meteorology site which is located at Richmond RAAF (067105); approximately 4 km north-east of the site. Also presented are monthly averages of maximum and minimum temperatures, 9am and 3pm temperatures and humidity. Rainfall data consist of mean monthly rainfall and the average number of rain days per month.

The annual average maximum and minimum temperatures experienced are 24.1°C and 11.0°C. July is the coldest month, with an average minimum temperature of 3.5°C. January is the hottest month, with an average maximum temperature of 30.1°C.

Rainfall data show that February is on average the wettest month, with a mean rainfall reading of 128.7 mm, over 8.3 rain days. July is the driest month with an average rainfall of 31.7 mm, over an average of 4.1 rain days. The average annual rainfall is 726.7 mm and the average number of rain days annually is 72.6.

Table 6.1: Temperature, Humidity and Rainfall Data for Richmond RAAF

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
9 am Mean Temperatures (°C) and Relative Humidity (%)													
Dry-bulb	22.1	21.3	19.1	17.0	13.1	10.1	8.9	11.4	15.4	18.3	19.2	20.9	16.4
Humidity	72	78	80	76	81	82	80	70	63	58	68	68	73
3 pm Mean Temperatures (°C) and Relative Humidity (%)													
Dry-bulb	28.5	27.4	25.8	23.0	19.6	17.0	16.6	18.7	21.5	23.5	25.2	27.5	22.9
Humidity	47	52	52	49	53	53	47	39	38	40	46	44	47
Daily Maximum Temperature (°C)													
Mean	30.1	29.1	26.8	24.0	20.6	18.0	17.5	19.8	22.7	25.1	26.6	28.7	24.1
Daily Minimum Temperature (°C)													
Mean	17.5	17.7	15.5	11.4	7.9	4.9	3.5	4.4	8.1	11.0	13.9	15.9	11.0
Rainfall (mm)													
Mean	70.7	128.7	67.5	43.8	56.2	46.0	31.7	33.3	50.0	55.3	83.3	62.1	726.7
Rain days (Number)													
Mean	7.6	8.3	7.8	5.5	5.9	5.1	4.1	3.6	4.8	5.8	7.9	6.2	72.6

Station Number 067105, Latitude: -33.60 South, Longitude: 150.78 East, Elevation: 19 m
Source: **Bureau of Meteorology, 2010**

7 ESTIMATE OF EMISSIONS

The substrate facility has multiple sources of odour that have been assessed in this report. Odour testing was conducted by Stephenson Environmental Management Australia (SEMA); the results for each source tested are summarised and presented in **Table 7.1** and **Table 7.2**; extracts of the odour emission surveys are provided in **Appendix B**.

7.1 Fugitive Sources

Fugitive odour sources present at the site have been identified as the chicken manure stockpile, the pre-wet material, the recycled water pit and the bale wetting area. Odour testing results on these sources have been summarised in **Table 7.1**.

Table 7.1: Odour Testing Results for Fugitive Sources at Mulgrave Substrate Facility

Odour Source	Odour concentration (ou)	Specific Odour Emission Rate (ou.m/s)	Area (m^2)	Volumetric Odour Emission Rate (ou.m^3/s)
Chicken manure stockpile	799	0.513	40	20.52
Pre-wet material	1,413	-	822	2001 (see below)
Recycled water pit	301	0.193	-	-
Bale wetting	121	0.078	670	52.26

Odour emissions rates based on the odour testing results for the pre-wet materials have been adjusted to include the effect of the "air-under" system in use at the site. In a previous report by **Holmes Air Sciences (1999)**, a study was conducted in light of a Public Enquiry regarding odour emission rates from composting processes. It determined that the measured odour emission rate via the method of flux hood sampling underestimated the actual rate of emission for a composting process that was actively aerated. A better approximation is to determine the flow rate of air circulated through the "air-under" system, as was used in this assessment. This method is likely to conservatively overestimate the emission rate because some of the circulated air will bypass the pre-wet ricks via floor spigots that are not covered with pre-wet material.

The facility uses three identical fans to provide air to the pre-wet material in the shed. The fans are sequenced to allow only one fan to operate at a time. This "air-under" system delivers an aeration rate through the pre-wet ricks of 1.415 m^3/s per fan. Multiplying this by the measured odour concentration of 1,413 ou gives an odour emission rate of 2001 ou.m^3/s per rick. It has been assumed conservatively that for the current operations, where there are two ricks on the floor at any given time, both fans are operating giving an emission rate of 4002 ou.m^3/s. It should be noted that to produce 1000 t of Phase 1 substrate, approximately 1,300 t of raw materials are required. The current mode of operating is by a split batch process where approximately 700 t or two ricks of pre-wet material are on the floor at any given time and are transferred to the tunnels every 3-4 days. Approximately 500 t of Phase 1 material are then removed as the pre-wet material is added to the tunnels. The pre-wet material can be considered as Stage 1 (on the floor) and Stage 2 (in the tunnels)

The chicken manure stockpile has been modelled as a volume source. We have conservatively estimated the possible area covered by the manure stockpile as 40 m^2. This area has been multiplied by the emission rate determined from odour testing to estimate the volumetric emission rate as 20.52 ou.m^3/s.

The bale wetting area has been modelled as a volume source. The estimated area covered by the bale wetting area is 670m^2. This area has been multiplied by the emission rate determined from odour testing to estimate the volumetric emission rate as 52.26 ou.m^3/s.

The odour emission rates from the fugitive source have been calculated on a pro-rata basis according to the production schedule of Phase 1 material during each of the development stages.

7.2 Stack Emissions

Stack testing is conducted at Mulgrave on a regular basis as per the facility's Environment Protection Licence (EPL) No. 6229. The EPL sets a stack limit of 55,400 ou.m^3/s and this level has not been exceeded since testing began in late 2003.

It should be noted that odour emissions generated during the composting process are variable and dependent on a number of different factors that cannot be easily reflected in the modelling. Three sets of stack emission testing that occurred during March 2007, September 2009 and October 2010 have been reviewed for this assessment and used to estimate an average odour emission rate for an equivalent 1,000 tonnes of Phase 1 product.

The June 2008 stack emission testing data were not included in the calculation to estimate the bio-scrubber stack emissions. The recorded values during this round of stack testing were found to be low in comparison to the other rounds stack emission testing data reviewed. The emission calculation is conservative by excluding this data.

To estimate the constant odour emission rate for the bio-scrubber stack, odour testing results were matched with the average tonnage of material loaded in the tunnels for each week of testing to calculate an emission per tonne of material loaded in the tunnels.

The calculated emission per tonne of material loaded into the tunnels were then averaged and multiplied by 1.3 to represent a constant emission rate for an equivalent tonne of product Phase 1. It is assumed that approximately 1.3 tonnes of raw material are needed to produce one tonne of product.

Table 7.2 summarises the bio-scrubber stack odour testing results and the estimated bio-scrubber emission rate scaled to represent 1,000 tonnes of product during Stage 0.

Table 7.2: Odour testing results for bio-scrubber stack at Mulgrave substrate facility

Date	Average material amount loaded in Phase 1 tunnels (tonnes)	Equivalent product material in Phase 1 tunnels (tonnes)	Average Odour concentration (ou)	Average Odour Emission Rate (ou.m^3/s)
14th Mar to 20th Mar 2007	1,360	1,046	1,271	19,447
28th Sept to 2nd Oct 2009	2,309	1,775	1,847	29,640
11th Oct to 15th Oct 2010	1,611	1, 239	1,627	27,438
Estimated bio-scrubber stack emission	1,300	1,000	-	19,200

This emission rate for each stage has been calculated on a pro-rata basis to account for the proposed increase in the production rate.

The material contained within the Phase 1 tunnels during testing is a combination of Phase 1 product and Stage 2 Pre-wet. As discussed in **Section 7.1** the current method of composting is via a split batch where half the weekly tonnage of pre-wet is loaded to the tunnel every 3-4

days. For the purpose of this assessment it has been assumed that this approach will be adopted for the increased tonnage. The construction of the new pre-wet shed may in future house the pre-wet material during the full cycle to Phase 1 and will reduce the total odour load emitted from the first bio-scrubber.

The efficiency of the existing bio-scrubber has been calculated from odour testing results in an attempt to estimate the effectiveness of the new bio-scrubber. The proposed bio-scrubber will have similar stack specifications as the existing bio-scrubber but the internal architecture will have considerably greater surface area for the possibility of increased efficiency.

Odour testing was conducted on the two inlet chambers (labelled North and South) leading into the bio-scrubber. This inlet data was then compared to the stack testing (outlet) results conducted at the same time. The efficiency of the bio-scrubber was estimated as the difference in odour between the sets of samples. A summary of the odour testing results is provided in **Table 7.3** below.

Table 7.3: Efficiency of Bio-scrubber

Date	Source	Measured Odour concentration	Average Odour concentration	Efficiency (%)
11/06/2008	Inlet – North	2,670	2,230	61
	Inlet – South	1,790		
	Outlet – Stack	863		
13/06/2008	Inlet – North	3,380	3,018	71
	Inlet – South	2,655		
	Outlet – Stack	866		
20/02/2009	Inlet – North	6,105	6,371	87
	Inlet – South	6,636		
	Outlet – Stack	815		
25/02/2009	Inlet – North	12,791	11,375	86
	Inlet – South	9,958		
	Outlet – Stack	1,565		
			Average efficiency	77

The average efficiency of the existing bio-scrubber stack has been estimated at 77%, to take a conservative approach we have used 75% efficiency in this assessment. The efficiency calculated has been applied to the modelling to estimate the reduction of odour emissions from the current fugitive sources fed through the proposed bio-scrubber, as presented in **Table 8.2**.

8 APPROACH TO MODELLING

The methodology used in this assessment has followed a similar approach taken in a previous assessment conducted for the substrate facility by **Holmes Air Sciences, 2002**. The approach considered impacts from the existing bio-scrubber stack in the far-field using AUSPLUME Version 5.4. This assessment has used an updated dispersion model (CALPUFF Version 6.263) to determine odour impacts in accordance with DECCW recommendations.

For the purposes of this assessment, the substrate facility has been considered in three separate stages to reflect the proposed development as discussed in **Section 3.1**. **Table 8.1** below presents a summary of the modelling scenarios presented in this assessment.

Table 8.1: Summary of modelling scenarios for Mulgrave substrate facility

Development Stage	Proposed Construction	Production rate of Phase 1 (tonnes/week)
Stage 0	Current situation	1,000
Stage 1	Bale storage shed	1,600
Stage 2	Pre-wet shed extension Additional Bio-scrubber Additional recycling water pit Additional bale wetting area New Phase 2 & 3 building	2,400
Stage 3	Additional Phase 1 tunnels Additional Phase 2 & 3 building	3,200

Stage 0 and Stage 1 will not involve any new sources of odour. Stage 0 is intended to reflect the current situation and production rate, Stage 1 will be an increase of 600 tonnes of Phase 1 product generated per week.

There will be no fugitive emissions from the existing and proposed Pre-wet buildings in Stage 2 and Stage 3. All emissions will be ducted to the available bio-scrubber, with the total emissions generated on-site, apart from the recycled water pits and bale wetting area, to be distributed to one of the available bio-scrubbers. Bio-scrubber #1 will service emissions from the Phase 1 tunnels and bio-scrubber #2 will service emissions from the pre-wet shed and chicken manure stockpile.

Table 8.2 below summarises the estimated emissions from all sources input in the model over the various scenarios. As discussed in **Section 7**, the emission rate for bio-scrubber stack 1 and the pre-wet area for Stage 1 have been scaled from existing measurements, to represent an output of 1000 tonnes Phase 1 substrate per week, with 700 tonnes of pre-wet on the floor. The emission rates for Stages 1-3 have been scaled proportionally, with the emission from the pre-wet area and the manure stockpiles moving to bio-scrubber 2. It should be noted that the combined emission rate for the two bio-scrubber stacks for Stage 2, that is 48,529 ou.m^3/s, is similar to the current licence limit for the existing bio-scrubber stack, namely 55,400 ou.m^3/s. The estimated stack emission rate for Stage 1 is substantially below the current licence limit.

As noted in **Section 7**, in Stage 2 all of the pre-wet material may be retained in the new pre-wet shed so that the odour emissions are more evenly divided between the two stacks, however the scenario presented in this report is the most conservative in terms of predicted odour impacts.

Table 8.2: Summary of modelling emissions for Mulgrave substrate facility

Source	Type	Units	Stage 0	Stage 1	Stage 2	Stage 3
Bio-scrubber stack 1 (existing)	Point	ou.m^3/s	19,200	30,720	46,080	61,440
Bio-scrubber stack 2 (proposed)	Point	ou.m^3/s	-	-	2,449	3,265
Pre-wet shed (existing)	Volume	ou.m^3/s	4,000	6,400	-	-
Chicken Manure stockpile (existing)	Volume	ou.m^3/s	20.52	32.83	-	-
Water Pit 1 (existing)	Area	ou.m^2/s	0.193	0.193	0.193	0.193
Water Pit 2 (proposed)	Area	ou.m^2/s	-	-	0.193	0.193
Bale wetting area (existing)	Volume	ou.m^3/s	52.26	83.6	62.7	83.6
Bale wetting area (proposed)	Volume	ou.m^3/s	-	-	62.7	83.6

The modelling has been performed using the CALMET meteorological information as described in **Section 5** with the odour emission information in **Table 8.2**. The CALPUFF model has been used in this study to predict the 1-hour average 99th percentile odour levels (expressed in odour units) over a set of gridded and discrete receptors.

A summary of the parameters used in the CALPUFF modelling is presented in **Table 8.3** below.

Table 8.3: Summary of CALPUFF parameters used for this study

CALPUFF (v 6.263)						
Year of analysis	April 2008 to March 2009					
Computational grid domain	20 km x 20 km					
Computational grid resolution	0.2 km					
Area sources						
Dimensions of Water pit 1			**Dimensions of Water pit 2**			
Easting (m)	Northing (m)		Easting (m)	Northing (m)		
298381	6277296		298514	6277224		
298384	6277296		298522	6277224		
298380	6277289		298513	6277217		
298383	6277290		298521	6277215		
Volume sources						
Source ID	**Easting (m)**	**Northing (m)**	**Sigma y (m)**	**Sigma z (m)**		
Pre-wet Shed	298360	6277251	8	3		
Chicken Manure	298397	6277212	1	1		
Bale Wetting 1	298379	6277233	1.2	0.9		
Bale Wetting 2	298499	6277205	1.2	0.9		
Point sources						
Source ID	**Easting (m)**	**Northing (m)**	**Stack height (m)**	**Stack diameter (m)**	**Exit velocity (m/s)**	**Exit temperature (K)**
Bio-scrubber 1	298459	6277251	40	1.27	14.3	303
Bio-scrubber 2	298329	6277336	40	1.27	14.3	303

Isopleth plots of the odour levels at the 1-hour averaged 99th percentile have been generated showing the extent to which odours are predicted to occur for 99% of the time. This allows for direct comparison with the DECCW's odour assessment criteria.

9 ASSESSMENT OF IMPACTS

The 99th percentile 1-hour average predicted odour concentrations with near-field and far-field peak-to-mean ratios applied for nearby sensitive receptors are provided in **Table 9.1** below. It should be noted that Receptors 7, 8, 9, 10 and 11 are within the near-field zone of bio-scrubber stack #1 and Receptor 7 is also within the near-field zone of bio-scrubber stack #2.

Table 9.1: 99th percentile 1-hour average predicted odour concentration for sensitive receptors, Near-field and Far-field P/M Ratios.

Receptor ID	Easting (m)	Northing (m)	1-hour average, 99th percentile (ou)			
			Stage 0	**Stage 1**	**Stage 2**	**Stage 3**
1	297908	6277456	1	2	1	1
2	297920	6277439	1	2	1	1
3	297910	6277399	1	2	1	1
4	297888	6277399	1	2	1	1
5	297868	6277420	1	2	1	1
6	297863	6277436	1	2	1	1
7	298607	6277090	5	7	7	9
8	298711	6277062	4	6	5	7
9	298750	6277071	4	6	5	7
10	298772	6277261	4	6	5	7
11	298749	6277138	4	7	6	8
12	298833	6277045	2	3	2	2
13	298873	6277024	2	3	2	2
14	298893	6277015	2	3	2	2
15	298838	6276901	1	2	1	2
16	298906	6276894	1	2	1	2
17	298990	6276947	1	2	1	2
18	298798	6276754	1	2	1	1
19	298671	6276768	1	2	1	1

Note: the values provided in the table above have been rounded to the nearest whole number.

The 1-hour average 99th percentile predicted odour concentration isopleths with far-field peak-to-mean ratios applied from the proposed expansion of the Mulgrave substrate facility are presented in **Appendix C**.

It is important to note that the isopleth figures are presented to provide a visual representation of the predicted impacts. To produce the isopleths it is necessary to make interpolations, and as a result the isopleths will not always match exactly with predicted impacts at any specific location. The actual predicted impacts at the sensitive receptors are presented in **Table 9.1**.

The results indicate that for the receptors to the west of the site (Receptors 1 to 6); the predicted impacts for all stages modelled and would comply with the most stringent DECCW criterion of 2 ou.

Additionally for the far-field receptors to the east of the site (Receptors 12 to 19) the predicted impacts would comply with a criterion of 4 to 7 ou for Stages 1, 2 and 3.

Overall, for the receptors in the far-field it is unlikely that they will experience any noticeable increase in odour impact due to the proposed stages of the project compared to the current impact.

The receptors in the near-field zone (Receptors 7 to 11) include; three private residences, one industrial and one public (train station) receptor. At these locations the dispersion model predicts an increase in impacts as the facility increases its production rate in Stage 1 over Stage 0, the current operations.

As the facility proceeds from Stage 1 to Stage 2, the total fugitive emissions from the site are reduced as these emissions are exhausted through one of the available bio-scrubbers. The dispersion modelling indicates that the establishment of Stage 2 would lead to a reduction in odour level at most receptors compared to that of Stage 1.

The predicted impacts during Stages 1 and 2 for these receptors show compliance with an odour criterion of 4 to 7 ou. For Stage 3, the predicted impacts show an odour level between 7 and 9 for these receptors.

The potential for odour generated from the site is influenced by the quality of material used to produce the substrate. The facility would aim to ensure that material used is of a good standard to keep to the total odour amount low. It should be noted that the estimation of emissions from the site are conservative and can be assumed that the likely impacts at all stages would be lower than the predicted impacts presented in **Table 9.1**.

It is recommended that the facility conduct stack odour emission testing after the establishment of each of the proposed stages to ensure the current license limit would not be exceeded. This data would show that the facility is operating comparably as per the modelling predictions and that the potential for exceedence is low. If the stack emission data indicates that the licence condition may be exceeded, the facility will review the current operation practices to find ways to reduce the odour emitted to an acceptable level before proceeding further to the next stage.

10 GREENHOUSE GAS ASSESSMENT

10.1 International Framework

10.1.1 Intergovernmental Panel on Climate Change (IPCC)

The Intergovernmental Panel on Climate Change (IPCC) is a panel established in 1988 by the World Meteorological Organisation (WMO) and the United Nations Environment Programme (UNEP), to provide independent scientific advice on climate change. The panel was asked to prepare, based on available scientific information, a report on all aspects relevant to climate change and its impacts and to formulate realistic response strategies. This first assessment report of the IPCC served as the basis for negotiating the United Nations Framework Convention on Climate Change (UNFCCC).

Since the UNFCCC has entered into force, the IPCC remains the pivotal source for its scientific, technical and socio-economic information.

The stated aims of the IPCC are to assess scientific information relevant to:

- Human-induced climate change;
- The impacts of human-induced climate change; and
- Options for adaptation and mitigation.

The fourth IPCC assessment report was released in 2007 (**IPCC, 2007**). IPCC reports are widely cited in climate change debates and policies, and are generally regarded as authoritative.

10.1.2 United Nations Framework Convention on Climate Change (UNFCCC)

The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognises that the climate system is a shared resource, the stability of which can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The Convention enjoys near universal membership, with 183 countries (Parties) having ratified the contained treaty, the Kyoto Protocol – see **Section 10.1.2.1**. Australia ratified the Kyoto Protocol in December 2007.

Under the UNFCCC, governments:

- Gather and share information on greenhouse gas emissions, national policies and best practices;
- Launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries; and
- Cooperate in preparing for adaptation to the impacts of climate change.

10.1.2.1 Kyoto Protocol

The Kyoto Protocol entered into force on 16 February 2005. The Kyoto Protocol builds upon the UNFCC by committing Annex I Parties to individual, legally-binding targets to limit or reduce their GHG emissions for the following gases:

- Carbon dioxide (CO_2);
- Methane (CH_4)
- Nitrous oxide (N_2O);

- Hydrofluorocarbons (HFCs);
- Perfluorocarbons (PFCs); and
- Sulfur hexafluoride (SF_6)

The emission reduction targets are calculated based on a Party's domestic emission greenhouse inventories (which include the sectors land use change and forestry clearing, transportation, stationary energy, etc). Domestic inventories require approval by the Kyoto Enforcement Branch. The Kyoto Protocol requires developed countries to meet national targets for greenhouse gas emissions over a five year period between 2008 and 2012.

To achieve their targets, Annex I Parties must put in place *domestic policies and measures.* The Kyoto Protocol provides an indicative list of policies and measures that might help mitigate climate change and promote sustainable development.

Under the Kyoto Protocol, developed countries can use a number of flexible mechanisms to assist in meeting their targets. These are trading-based market mechanisms which include:

- Joint Implementation (JI) – where developed countries invest in GHG emission reduction projects in other developed countries; and
- Clean Development Mechanism (CDM) – where developed countries invest in GHG emission reduction projects in developing countries.

Annex I countries that fail to meet their emissions reduction targets during the 2008-2012 period may be liable for a 30 percent penalty, to be made up in the post 2012 commitment period.

10.2 Australian Context

10.2.1 Australia and the Kyoto Protocol

The Kyoto Protocol is an international agreement under the United Nations Framework on Climate Change (UNFCC) that was agreed in 1997. As of October 2009 it has been ratified by 187 countries. Australia ratified the protocol in December 2007.

The aim of the Protocol is to reduce global greenhouse gas emissions by requiring developed countries to meet national targets for greenhouse gas emissions over the five year period from 2008 to 2012. Australia's annual target is 108% of the 1990 emissions.

Countries are required to take on a range of monitoring and reporting commitments, which are designed to ensure they remain on track to meet their obligations and to measure the overall success of the Protocol. Australia is in the process of developing a Carbon Pollution Reduction Scheme to ensure compliance with its Kyoto targets and successive international agreements to constrain greenhouse emissions.

10.2.1.1 National Greenhouse and Energy Reporting Act

The *National Greenhouse and Energy Reporting (NGER) Act 2007* was passed in September 2007. The NGER Act establishes a mandatory corporate reporting system for greenhouse gas emissions, energy consumption and production. The NGER scheme consolidates existing greenhouse reporting schemes.

The NGER Act is underpinned by a number of legislative instruments that provide greater detail about obligations, which in conjunction with the NGER Act, form the National Greenhouse and Energy Reporting System, as follows:

- The National Greenhouse and Energy Reporting Regulations 2008;
- The National Greenhouse and Energy Reporting (Measurement) Determination 2008; and

NGER is seen as an important first step in the establishment of a domestic emissions trading scheme. This intention is explicitly stated in the objectives for the NGER scheme, as follows:

- Establish a baseline of emissions for participants in a future Australian emissions trading scheme;
- Inform the Australian public;
- Meet international reporting obligations;
- Assist policy formulation of all Australian governments while avoiding duplication of similar reporting requirements.

Companies must register and report if they emit greenhouse emissions or produce/consume energy at or above the following trigger thresholds:

- If they own facilities that emit greater than 25kt greenhouse emissions (expressed as CO_2-e) or produce/consume greater than 100 TJ of energy;
- If the corporate group emits greater than 125kt of greenhouse emissions (expressed as CO_2-e) or produce/consume greater than 500TJ of energy.

A project is required to report to the NGER system if it will emit greater than 25kt of greenhouse emissions. As such, the Project would be subject to the reporting under the system based on initial estimates (see **Section 10.5**).

10.2.1.2 Carbon Pollution Reduction Scheme

A green paper detailing Australia's plans to implement a domestic emissions trading scheme was released on the 16 July 2008 (**DCC, 2008a**). A subsequent white paper was released in December 2008 (**DCC, 2008b**) with the intent that a Carbon Pollution Reduction Scheme (CPRS) would commence in July 2010. Due to the global financial crisis, the start date was deferred to July 2011. Legislation was introduced to Parliament in May 2009, and again in November 2009 but has been voted down in the senate.

The proposed CPRS is a 'cap and trade' emissions trading mechanism scheme whereby emitters of greenhouse gases greater than 25,000t carbon dioxide-equivalent (CO_2-e) are required to purchase a permit for every tonne of greenhouse gas that they emit. As such, should the CPRS come into being, the Project would not be subject to the scheme (see **Section 10.5**).

10.3 Greenhouse Gas Inventories

Greenhouse gas inventories are calculated according to a number of different methods. The procedures specified under the Kyoto Protocol United Nations Framework Convention on Climate Change are the most common.

From the point of view of the proposed development, CO_2, CH_4 and N_2O would be the most significant gases for the project which would be formed and released during the combustion of fuel. It would be liberated when fuels are burnt in diesel and natural gas powered equipment and in the generation of the electrical energy that will be used at the site.

The composting activity will also generate significant amounts of CH_4 and N_2O emissions.

Inventories of greenhouse gas emissions can be calculated using published emission factors. Different gases have different greenhouse warming effects (referred to as warming potentials) and emission factors take into account the global warming potentials of the gases created during combustion.

The estimated emissions are referred to in terms of CO_2-equivalent (CO_2-e) emission by applying the relevant global warming potential.

10.4 Greenhouse Emission Calculation Methodology

10.4.1 Introduction

The following equation (**DCC, 2009**) was used to estimate the greenhouse gas emissions from fuel usage:

$$GHG\ Emissions\ (tCO_2 - e) = \frac{Q \times EC \times EF}{1000} \qquad \text{Equation 1}$$

Where:

Q = quantity of fuel in tonnes or thousands of litres

EC = energy content of the fuel in GJ/tonne or GJ/kL

EF = relevant emission factor in kg CO_2-e/GJ

To calculate emissions from electricity usage, the following equation was used:

$$GHG\ Emissions\ (tCO_2 - e) = Q \times \frac{EF}{1000} \qquad \text{Equation 2}$$

Where:

Q = electricity consumed in GJ

EF = relevant emission factor in kg CO_2-e/GJ

To calculate emissions from Natural gas usage, the following equation was used:

$$GHG\ Emissions\ (tCO_2 - e) = \frac{Q \times EC \times EF}{1000} \qquad \text{Equation 3}$$

Where:

Q = natural gas consumed in GJ

EC = energy content factor in GJ/m^3

EF = relevant emission factor in kg CO_2-e/GJ

To calculate emissions from fuel used for transport purposes, the following equation was used;

$$GHG\ Emissions\ (tCO_2 - e) = \frac{Q \times EC \times EF}{1000} \qquad \text{Equation 4}$$

Where:

Q = the quantity of fuel used in kilolitres

EC = energy content factor in GJ/m^3

EF = relevant emission factor in kg CO_2-e/GJ

To calculate emissions from the process of composting, the following equations were used; obtained from the calculation for the biological treatment of solid waste:

$$CH_4\ Emissions\ (tCO_2 - e) = (Q_i \times EF_i) - R \qquad \text{Equation 5}$$

Where:

Q_i = mass of wet organic waste treated by biological treatment type i, in tonnes

EF_i = emission factor for treatment i, tonnes CO_2-e/tonne of wet waste treated

For composting: 0.08

R = total amount of CH_4 recovered in inventory year, tonnes CO_2-e

$$N_2O\ Emissions\ (tCO_2 - e) = \sum i\ (Q_i \times EF_i) \qquad \text{Equation 6}$$

Where:

Q_i = mass of wet organic waste treated by biological treatment type i, tonnes

EF = emission factor for treatment i, tonnes of CO_2-e/tonnes of wet waste treated and equal to:

For composting: 0.09

10.4.2 Emission factors

Data provided in the National Greenhouse Accounts (NGA) Factors, published by the Department of Climate Change (**DCC, 2009**) were used. DCC defines three 'scopes' (or emission categories):

- Scope 1 covers direct emissions from sources within the project boundary such as fuel combustion and manufacturing processes;
- Scope 2 covers indirect emissions from the consumption of purchased electricity, steam or heat produced by another organisation; and
- Scope 3 includes all other indirect emissions that are a consequence of the organisations activities but are not from sources owned or controlled by the organisations, for example, delivery of diesel fuel and electrical energy, etc.

For the purposes of this assessment, a full fuel cycle emission factor (that is the sum of scope 1, scope 2 and 3 emission factors, where applicable) has been used.

It should also be noted that some Scope 3 emissions have not been considered in this assessment as the information is not available.

Table 10.1 provides a summary of the emission factors used.

Table 10.1: Summary of emission factors for greenhouse gas assessment

Type of Fuels and Electricity	Emission factor		Scope	Source
Diesel - Non-transport activities	69.5	kg CO_2-e/GJ	1	Table 3 (**DCC, 2009**)
	5.3	kg CO_2-e/GJ	3	Table 38 (**DCC, 2009**)
Diesel – Energy content factor	38.6	kg CO_2-e/GJ	-	Table 3 (**DCC, 2009**)
Diesel – Transport activities	69.9	kg CO_2-e/GJ	1	Table 4 (**DCC, 2009**)
	5.3	kg CO_2-e/GJ	3	Table 38 (**DCC, 2009**)
Diesel – Energy content factor	38.6	kg CO_2-e/GJ	-	Table 3 (**DCC, 2009**)
Electricity	0.89	kg CO_2-e/kWh	2	Table 39 (**DCC, 2009**)
	0.18	kg CO_2-e/kWh	3	Table 3 (**DCC, 2009**)
Natural Gas	51.33	kg CO_2-e/GJ	1	Table 2 (**DCC, 2009**)
	16.4	kg CO_2-e/GJ	3	Table 37 (**DCC, 2009**)
Natural Gas – Energy content factor	25.3	kg CO_2-e/GJ	-	Table 2 (**DCC, 2009**)

10.4.3 Diesel, electricity and natural gas usage on-site

Based on information provided by the proponent, **Table 10.2** presents a summary of annual diesel, electricity and natural gas usage for the current situation and each stage of the proposed production rate.

Table 10.2: Summary of annual diesel, electricity and natural gas usage

Fuel Type	Production Rate			
	1,000 (t/week)	**1,600 (t/week)**	**2,400 (t/week)**	**3,200 (t/week)**
Diesel (kl) (Stationary)	135	216	276	336
Electricity (kWh)	3,000	4,800	6,720	8,640
Natural Gas (GJ)	810	1,296	1,944	2,592

Source: Elf Farm Supplies

10.4.4 Diesel usage for Transport of product off-site

There will also be diesel consumed in the transport of the product substrate to customers. The numbers of substrate deliveries per year have been provided by the proponent and summarised in **Table 10.3** below.

Table 10.3: Summary of substrate deliveries per year

	Production Rate			
	1,000 (t/week)	**1,600 (t/week)**	**2,400 (t/week)**	**3,200 (t/week)**
Number of Deliveries	1,095	1,825	2,920	4,015

Source: Elf Farm Supplies

The annual diesel usage has been calculated using the assumption that an average return distance of 100 km per load and an average fuel consumption of articulated trucks being 54.6 litres per 100 kilometres (**ABS, 2007**). The annual fuel usage to transport the product is calculated from following equation ((No. of deliveries) * 100 [km/trip] * 0.546 [L/km]) and presented below in **Table 10.4**.

Table 10.4: Summary of annual diesel usage for transport

Fuel Type	Production Rate			
	1,000 (t/week)	**1,600 (t/week)**	**2,400 (t/week)**	**3,200 (t/week)**
Diesel (kl) (Transport)	60	100	159	219

10.4.5 Composting

Greenhouse gas emissions from the waste materials used in the composting process have not been included in this assessment. If not used in the composting process, these waste materials would undergo natural decomposition and release equivalent greenhouse gas emissions. Therefore the composting process does not contribute any additional increase in greenhouse gas emissions and has been excluded from this assessment.

For information purposes we have calculated the equivalent greenhouse gas emissions using information provided by the Proponent and Equations 5 and 6 (**Section 10.4.1**) for the maximum production rate of 3,200 (t/week), in **Table 10.2** below.

Table 10.5: Summary of estimated emissions from Composting

	Production Rate **3,200 (t/week)**
Annual mass of wet organic waste (t)	216,320
CO_2-e emissions (t CO_2-e/y)	36,774

Source: Elf Farm Supplies

10.5 Greenhouse Gas Emissions Results

Based on the fuel, electricity and natural gas usage presented in **Section 10.4.3** and emissions generated from the transport of product off-site in **Section 10.4.4**, the annual CO_2-e emissions for each of the proposed stages are summarised in **Table 10.6** to **10.9**.

Table 10.6: Summary of estimated CO_2-e emissions (t CO_2-e/y) – Stage 0 (1,000 t/week)

Source	Scope 1	Scope 2	Scope 3	TOTAL (t CO2-e)
Diesel (Stationary)	362	-	28	390
Diesel (Transport)	161	-	12	173
Electricity	-	3	1	4
Natural Gas	20	-	13	33
Total	**543**	**3**	**54**	**600**

Note: some figures not exact due to rounding

Table 10.7: Summary of estimated CO_2-e emissions (t CO_2-e/y) – Stage 1 (1,600 t/week)

Source	Scope 1	Scope 2	Scope 3	TOTAL (t CO2-e)
Diesel (Stationary)	579	-	44	623
Diesel (Transport)	269	-	20	289
Electricity	-	4	1	5
Natural Gas	33	-	21	54
Total	**881**	**4**	**86**	**971**

Note: some figures not exact due to rounding

Table 10.8: Summary of estimated CO_2-e emissions (t CO_2-e/y) – Stage 2 (2,400 t/week)

Source	Scope 1	Scope 2	Scope 3	TOTAL (t CO2-e)
Diesel (Stationary)	740	-	56	796
Diesel (Transport)	430	-	33	463
Electricity	-	6	1	7
Natural Gas	49	-	32	81
Total	**1,219**	**6**	**122**	**1,347**

Note: some figures not exact due to rounding

Table 10.9: Summary of estimated CO_2-e emissions (t CO_2-e/y) – Stage 3 (3,200 t/week)

Source	Scope 1	Scope 2	Scope 3	TOTAL (t CO2-e)
Diesel (Stationary)	901	-	69	970
Diesel (Transport)	591	-	45	636
Electricity	-	8	2	10
Natural Gas	66	-	43	109
Total	**1,558**	**8**	**159**	**1,725**

Note: some figures not exact due to rounding

During Stage 1 of the proposed expansion of the Mulgrave facility, it has been estimated that the development would release approximately 0.001 Mt/y CO_2-e. The annual greenhouse emissions in NSW for 2008 were 164.7 Mt (**DCC, 2010**). Therefore, the proposed development represents approximately 0.0006% of the total NSW greenhouse gas emissions.

In Stages 2 and 3, the estimated CO_2-e emissions generated from the site are 0.001 Mt/y and 0.002 Mt/y respectively. Comparing these estimates to NSW emissions in 2008, they represent 0.0006% and 0.001% respectively.

In 2007, Australia's total greenhouse gas emissions were estimated at 581.9 Mt CO_2-e (**DCC, 2010**). When comparing emissions for each of the respective development stages proposed, the predicted increase is 0.0001%, 0.0001% and 0.0003% of total 2008 Australian emissions.

10.6 Energy Efficiency and GHG Emission Reduction Measures

The facility will implement an energy efficiency program with the proposed expansion to look at ways to reduce the overall impact of greenhouse gas emissions from its operation. This will be achieved by focusing on each of the processes that take place at the facility and review how these can be improved. Aspects of this energy efficiency program can include:

- Improving energy use and efficiency; and
- Raising awareness amongst stakeholders, employees and clients.

This program will be revised as required to respond to new information, technologies and policies as they evolve.

11 CONSTRUCTION IMPACTS

The construction process for the proposed expansion at the Mulgrave substrate facility will temporarily generate dust.

Development will involve construction of a number of buildings and related infrastructure. The impact due to these activities is difficult to accurately quantify due to the time frame over which they will occur. However the total amount of dust generated from such activities is predicted to be minor without any off-site impacts.

To ensure dust generation is controlled, the site has a dust management plan which will be utilised to help reduce any off-site impacts from these activities.

The major dust emissions during construction phase likely to occur on-site are identified as vehicles travelling on temporary access roads and from wind erosion of exposed areas. Mitigation measures to control dust from these sources include:

- Maintaining active road surfaces including wetting down;
- Limit vehicle speeds;
- Rehabilitate completed sections of the site.

12 ODOUR COMPLAINT MANAGEMENT

Elf Farm Supplies currently has an odour complaint management system in place at their operations. As each compliant is received the time and origin of the complaint is logged into the database. The complaint is then verified against the meteorological conditions at the time of the complaint with reference to the facility. The meteorological conditions are taken from one of the two meteorological stations installed at the site.

Appropriate actions are then taken if the complaint is validated from the meteorological conditions. These include reviewing current activities that are taking place on-site to determine the possible cause of the odour complaint and finding ways to prevent future complaints. This process allows Elf Farm Supplies to be more aware of what activities occurring on-site can lead an odour complaint being made and take appropriate action.

13 CONCLUSIONS

This study has assessed the worst-case air quality impacts due to the proposed expansion of the substrate facility at Mulgrave. A Level 3 assessment of odour, based on measured odour emissions data, combined with computer-based dispersion modelling, was used to determine the air quality impacts on areas in the vicinity of the site.

Results from the dispersion modelling indicate that the predicted ground-level odour concentrations are unlikely to exceed the most stringent DECCW assessment criteria of 2 ou for receptors to the west of the site during Stage 1, Stage 2 and Stage 3. The far-field receptors to the east of the site also show compliance with an odour criterion between 4 to 7 ou during Stages 1, 2 and 3.

For the receptors in the near-field zone, the modelling shows the applicable criteria of 4 to 7 ou is achieved for these receptors in Stages 1 and 2.

The estimation of emissions from each stack is presented as a worse case apportionment of odour. In practice with the production of the pre-wet material remaining in the pre-wet sheds for the full cycle it is possible that the estimation of total emissions generated from each stack are likely to be varied with more odour emitted from the bio-scrubber #2 stack and less from the bio-scrubber #1 stack.

Odour emissions from the existing operations are substantially below those estimated in previous assessments and are currently less than 60% of the licence limit. The emissions are estimated to be just above the licence limit with the proposed expansion to Stage 2, but in practice emissions are likely to be less than this owing to conservative assumptions in the modelling and the expected greater efficiency of the new bio-scrubber. Therefore the maximum output of Stage 2 should be achievable without exceeding the current licence limits for odour emission rates.

The estimated combined stack emission rate for Stage 3 is 64,705 ou.m^3/s. Based on the modelling presented in this assessment the DECCW criteria at the nearest sensitive receptor would be achievable provided the combined emissions from both stacks remain below this value. The odour emission rate for Stage 3 is considered conservative as the methods for composting applied at Elf Farm Supplies are continually being innovated to reduce odour emissions and the efficiency of the proposed bio-scrubber is not yet known. The emission estimation in this assessment is based on odour measurements taken at the existing operations.

Elf Farm Supplies will monitor the performance of the additional odour control infrastructure to be introduced in Stage 2. It is understood that the rate of substrate production will at all times remain within a range for which it is predicted that the odour license limit of 55,400 ou.m^3/s will not be exceeded. Conformance to the licence limit will be verified by ongoing monitoring of stack emissions, which will ensure compliance with the odour criteria.

The company has elected to review measured odour emissions from both bio-scrubber stacks prior to advancing beyond the maximum Stage 2 production rate. The measured data will allow odour emission levels for Stage 3 production levels to be accurately predicted.

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APPENDIX A: Peak-to-Mean Ratios

PEAK-TO-MEAN RATIOS

The following table shows recommended factors for estimating peak concentrations from different source types, stabilities and distances.

Source Type	Pasquill-Gifford stability class	Near field P/M60*	Far field P/M60
Area	A, B, C, D	2.5	2.3
	E, F	2.3	1.9
Line	A-F	6	6
Surface point	A, B, C	12	4
	D, E, F	25	7
Tall wake-free point	A, B, C	17	3
	D, E, F	35	6
Wake-affected point	A-F	2.3	2.3
Volume	A-F	2.3	2.3

*Ratio of peak 1-second average concentrations

APPENDIX B: ODOUR TESTING RESULTS

TABLE 3-1 ODOUR EMISSION RESULTS – BIO-SCRUBBER INLET

Date	Location	Production Conditions	Concentration (ou)	MOER (ou. m^3/s)	Average (ou. m^3/s)
11/6/08	Bioscrubber Inlet - South	End of Day 1	1,790	23,295	37,919
11/6/08	Bioscrubber Inlet - North	End of Day 1	2,670	52,543	
13/6/08	Bioscrubber Inlet - South	Midway Day 3	2,655	30,485	51,820
13/6/08	Bioscrubber Inlet - North	Midway Day 3	3,380	73,154	

Key:
ou = odour units
ou. m^3/s = odour units per cubic metre per second

TABLE 3-2 ODOUR EMISSION RESULTS – BIO-SCRUBBER OUTLET

Date	Location	Production Conditions	Concentration (ou)	MOER (ou. m^3/s)
11/6/08	Bio-Scrubber Outlet	End of Day 1	863	16,433
13/6/08	Bio-Scrubber Outlet	Midway Day 3	866	15,536

Key:
ou = odour units
ou. m^3/s = odour units per cubic metre per second

TABLE 3-3 ODOUR EMISSION RESULTS – NOMINATED SOURCE POINTS

Date	Location	Concentration (ou)	SOER (ou. m/s)
13/6/08	No.3 Prewet	939	0.603
13/6/08	No.2 Prewet	1,413	0.907
13/6/08	No.1 Prewet	1,303	0.837
13/6/08	Chicken Manure	799	0.513
16/6/08	Bale Wetting	121	0.078
16/6/08	Main Water Pit	301	0.193

Note: Sweep Gas Rate is 5L/min & Velocity is $6.42 * 10^{-4}$ m/s

Key:
ou = odour units
ou. m/s = odour units metres per second

TABLE 3-3 ODOUR EMISSION RATES OVER A TYPICAL SEVEN DAY CYCLE PERIOD

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Date	28/09/09	29/9/09	30/9/09	1/10/09	2/10/09
ORLA Sample No.	2255	2256	2261	2270	2273
Time of Odour Sample	1715-1725	0512-0522	0524-0534	1644-1656	1245-1258
Odour Concentration (ou)	1,859	1,709	2,000	1,482	2,183
Operating Conditions	7 tunnels	7 tunnels	7 tunnels	6 tunnels	6 tunnels
Stack Velocity (m/s)	13.4	14.5	14.7	15.1	13.9
Stack Cross Sectional Area (m^2)	1.272	1.272	1.272	1.272	1.272
MOER (ou.v/s)	27,814	27,642	34,070	24,655	34,019
EPL MOER Limit (ou/s)	55,400*	55,400*	55,400*	55,400*	55,400*

Key:

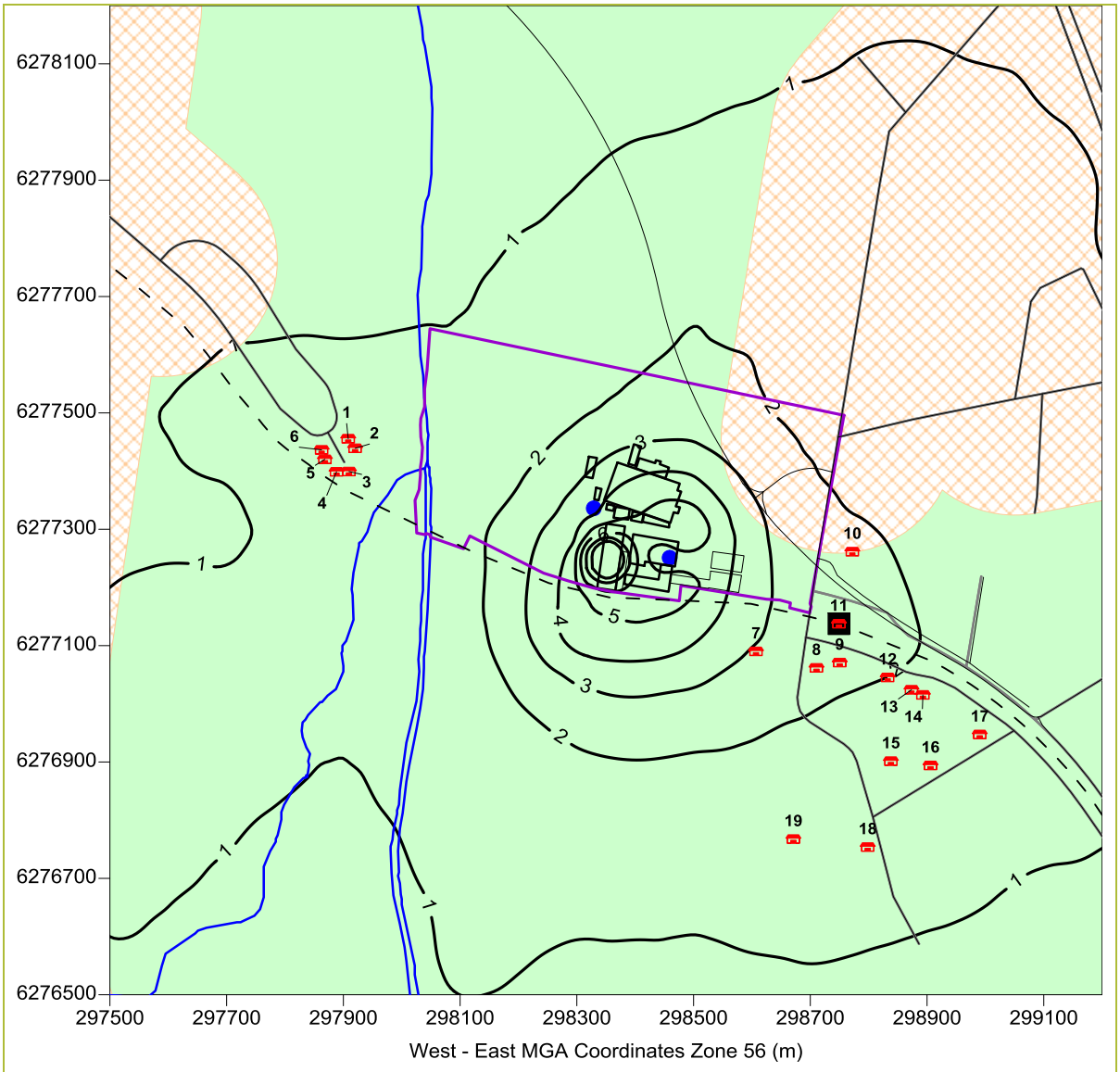
*	=	Rolling annual averaging period			
MOER	=	Mass Odour Emission Rate	m/s	=	metres per second
ou.v/s	=	Odour Unit volumes per second	m^2	=	square metres
ou/s	=	Odour Units per second	t	=	tonnes

TABLE 3-3 ODOUR EMISSION RATES OVER A TYPICAL SEVEN DAY CYCLE PERIOD

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Date	19/3/07	20/3/07	14/3/07	15/3/07	16/3/07
ORLA Sample No.	1056	1057	1051	1052	1054
Time (hours)	0530	0430	1730	0523	1548
Odour Concentration (OU)	457	1,528	1,380	1,475	1,518
Operating Conditions	3 tunnels - start of day 6	3 tunnels - start of day 7	3 tunnels - end of day 1	3 tunnels - start of day 2	3 tunnels - midway of day 3
Stack Velocity (m/s)	13.1	12.6	13.8	13.4	12.8
Stack Cross Sectional Area (m^2)	1.27	1.27	1.27	1.27	1.27
MOER (OUv/s)	6,920	22,626	21,967	23,088	22,632
EPL MOER Limit (OU/s)	55,400*	55,400*	55,400*	55,400*	55,400*

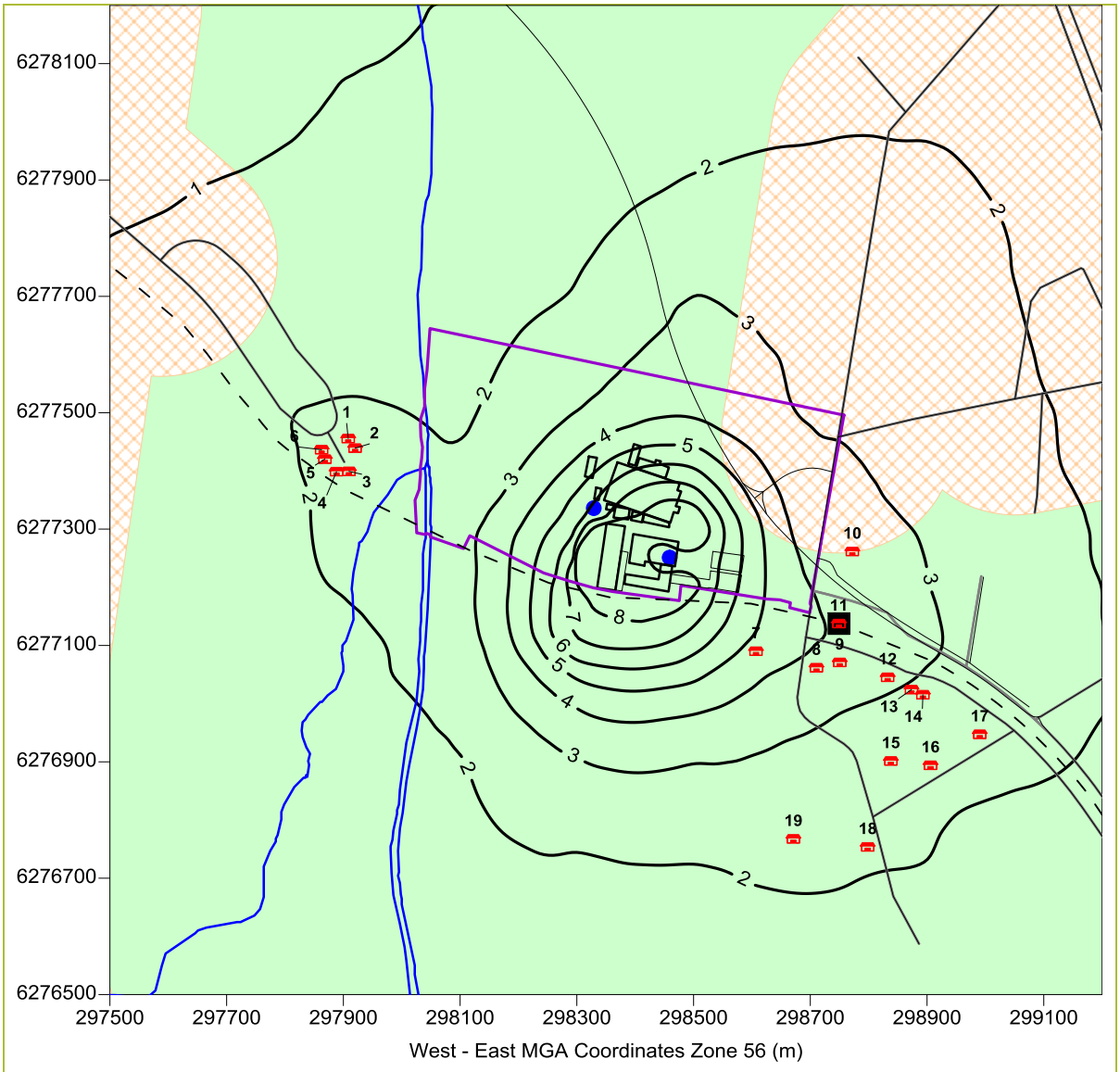
Key:
* = Rolling annual averaging period
MOER = Mass Odour Emission Rate m/s = meters per second
OUv/s = Odour Unit volumes per second m^2 = square metres
OU/s = Odour Units per second

APPENDIX C: CONTOUR PLOTS



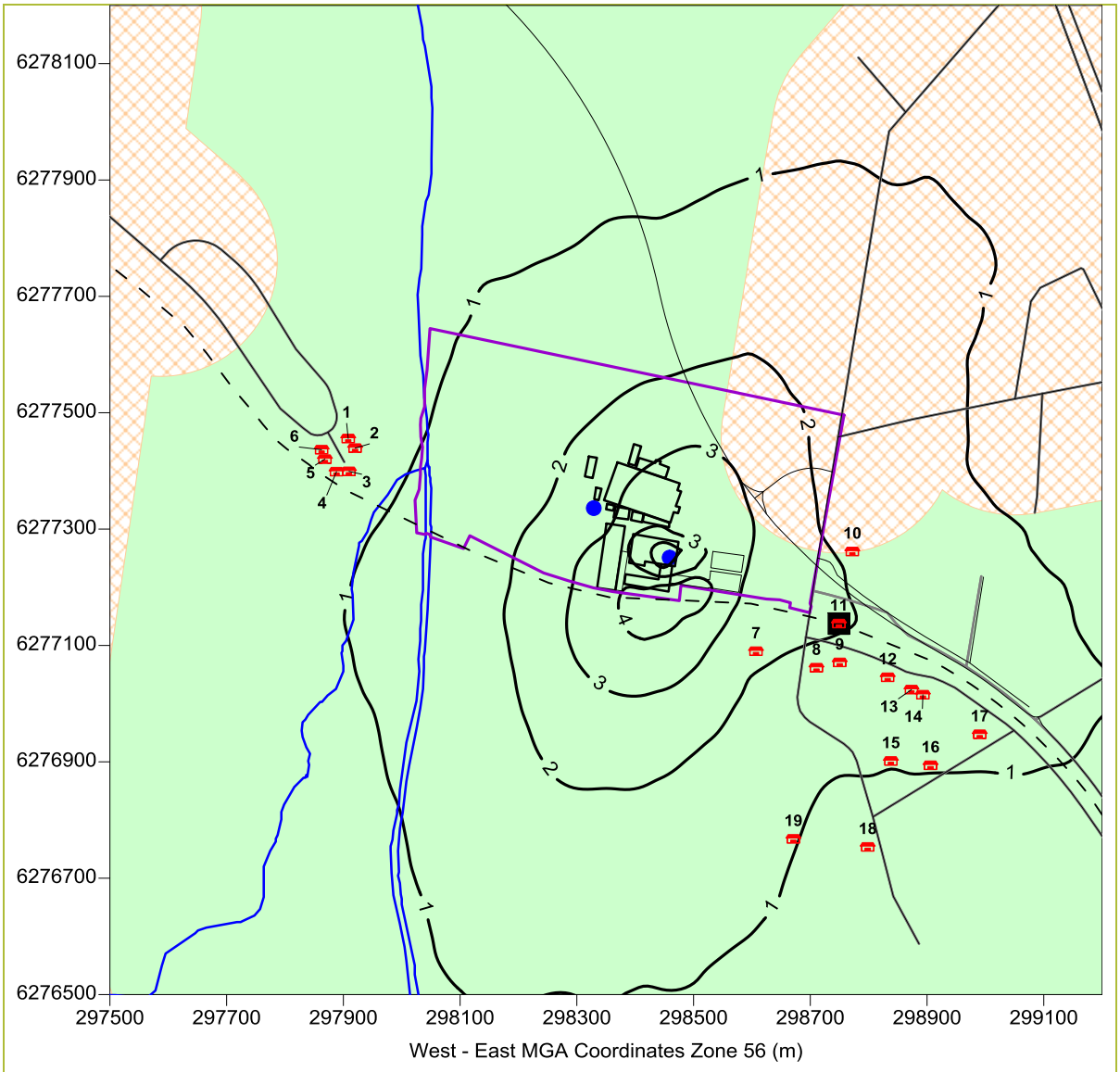
Species:	Location:	Scenario:	Percentile:	Averaging Time:
Odour	Mulgrave	Stage 0	99th	1-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF v6.326	OU	NA	2001-2002 CALMET-Generated	P Henschke

Figure 8: 99th percentile odour concentration for the existing operation at Mulgrave, 1,000 tonnes of Phase 1 production (Stage 0). Far-field P/M Ratios



Species:	Location:	Scenario:	Percentile:	Averaging Time:
Odour	Mulgrave	Stage 1	99th	1-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF v6.326	OU	NA	2001-2002 CALMET-Generated	P Henschke

Figure 9: 99th percentile odour concentration for proposed operation at Mulgrave, 1,600 tonnes production (Stage 1). Far-field P/M Ratios



Species:	Location:	Scenario:	Percentile:	Averaging Time:
Odour	Mulgrave	Stage 2	99th	1-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF v6.326	OU	NA	2001-2002 CALMET-Generated	P Henschke

Figure 10: 99th percentile odour concentration for proposed operation at Mulgrave, 2,400 tonnes production (Stage 2). Far-field P/M Ratios

Appendix Q

SUBSTRATE PLANT FLOOD IMPACT ASSESSMENT

Perram and Partners
12 Clanwilliam St
EASTWOOD NSW 2122

29010/PP_090312_SG

6 August 2010

Attention: Terry Perram

Dear Terry,

Re: Flood Impact Assessment – Mulgrave Road, Mulgrave

In response to your email of 19 February 2009 and our preceding discussions we are happy to provide reporting on the flood impact of the proposed extension to the existing mushroom substrate plant on Mulgrave Road, Mulgrave. The site is located on the South Creek floodplain, approximately 2 km upstream of Windsor Road. The assessment is to satisfy the Director General's Requirements for the proposed development.

Modelling work which examined the proposed developments impact on the 1 in 100 Y Average Recurrence Interval (ARI) flood event has been carried out. The result of the analysis is that the proposed development has no impact on flood levels.

The background to the study along with the methodology and results for the analysis are presented in the ensuing document.

INTRODUCTION

An extension to an existing industrial building is proposed at Mulgrave Road, Mulgrave. The site is located on the South Creek floodplain, approximately 2 km upstream of Windsor Road. The study area is shown below in Figure 1.

In order to satisfy Director General's requirements, Perram and Partners Pty Ltd requested that WMAWater Pty Ltd carry out an assessment of the impact of the proposed development on flood behaviour during the critical duration 1 in 100 Year flood event.

Webb, McKeown & Associates Pty Ltd (trading as WMAwater)

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Figure 1: South Creek in vicinity of study site

BACKGROUND

Introduction

The South Creek catchment drains a significant portion of western Sydney which includes parts of the municipalities of Blacktown, Camden, Fairfield, Hawkesbury, Liverpool and Penrith. The main channel of South Creek is in a predominantly natural state and the major tributaries include Eastern Creek, Ropes Creek and Kemps Creek. South Creek flows into the Hawkesbury River east of Windsor. The catchment area of South Creek is approximately 570 km^2 to the railway bridge and 640 km^2 to the confluence with the Hawkesbury River at Windsor.

South Creek can be affected by flooding from two possible mechanisms. The first involves backwater flooding from the Hawkesbury River, and the second results from flooding of the local South Creek catchment. The Hawkesbury Nepean Flood Study has shown that backwater flooding is the dominant flood mechanism in the lower reaches of South and Eastern Creeks. The confluence of South Creek and the Hawkesbury River is immediately downstream of Windsor.

There are three (3) separate stages of flooding experienced by the study area during main (Hawkesbury River) flood events. Initially floodwaters from the local South Creek catchment, which has a shorter response time, flow down to the Hawkesbury River. As main (Hawkesbury River) flooding increases, the floodwaters back up and flow direction reverses along South Creek to fill the floodplain upstream of the proposed crossings. Once the peak level in the Hawkesbury River has been reached and floodwaters begin to recede, the flow reverses again and the third stage occurs as the floodplain storage drains back out of South Creek.

Land use in the catchment comprises a mixture of semi-rural, urban residential, industrial/commercial with various open space and special uses. Urban development in the catchment is concentrated in a narrow band surrounding the major western transport corridor incorporating the Main Western Railway, Great Western Highway, and the M4 Motorway.

The residential development in the catchment is relatively new with most of the housing less than 40 years old. There is a significant amount of new subdivision activity presently occurring within the catchment.

Previous Studies

A number of previous studies have dealt with flooding in the South Creek catchment. The studies most relevant to the present investigation are:

- Flood Study Report South Creek,
- South Creek Floodplain Management Study,
- Warragamba Dam Auxiliary Spillway Environmental Impact Study, Flood Study,
- Flood Study Report Eastern Creek; and
- Windsor Flood Evacuation Route South Creek High Level Crossing Hydraulic Assessment.

The last report listed above examined the likely impact of the proposed evacuation route on flood behaviour in South Creek. As part of this study a refinement of the pre-existing RUBICON model was carried out. It is this modelling which is built upon in order to conduct the assessment reported upon herein.

RUBICON Modelling

Given that the RUBICON model used herein is central to the flood analysis some further description of this is provided below.

A RUBICON model of the Hawkesbury/Nepean from Wallacia and Warragamba Dam to the ocean at Broken Bay was developed for the Sydney Water Auxiliary Spillway EIS Flood Study. This model has been used to estimate design flood levels from Penrith to Sackville, incorporating Windsor and the lower reaches of South Creek.

METHODOLOGY

Summary

The methodology for the study was the following:

- The RUBICON model utilised in the flood evacuation route study was extracted from the archive and run for the base "existing" case 1 in 100 year ARI event. Note that this is the 1 in 100 year ARI flood event in the Hawkesbury River as it is this event which causes the worst case flooding at the site;
- Following the establishment of "existing" flood levels for the site the model was then modified in order to represent the proposed development at the Mulgrave Road site (i.e. the "proposed" case). This was done by removing part of the cross-section that was, in the "existing" case, available for flow and storage;
- The model was then re-run for the 100 year ARI flood event; and
- Results for "existing" and "proposed" scenarios were then compared in order to ascertain the degree and extent of any impact.

The existing cross-section 4 and the new cross-section 4 – option 1b may be seen in Figure 2. The two areas of fill associated with the development (one existing, one proposed) have been modeled. The combined area of the two fill areas is 7 ha. The model overestimates the filled area in order to account for the cumulative impact on flood levels, using an area of approximately 30 ha. As such the impact analysis carried out is highly conservative.

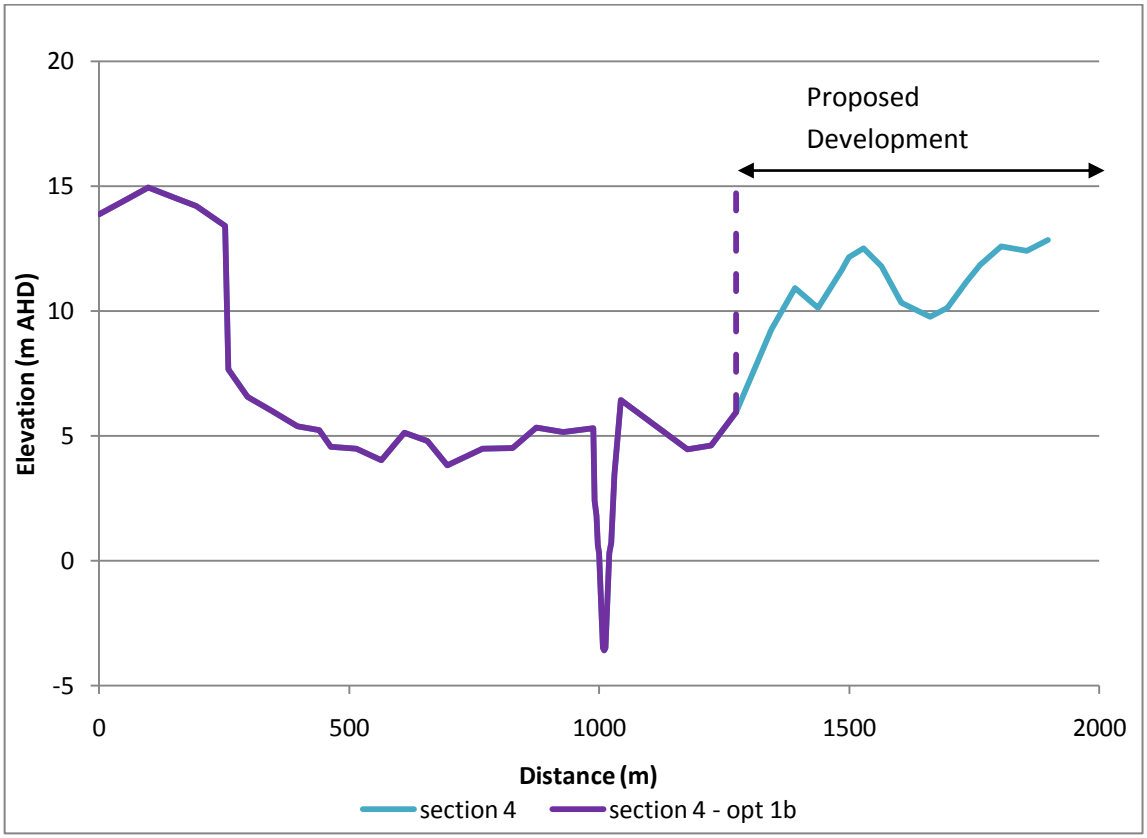


Figure 2: Comparison of Cross-section 4

RESULTS

Results are presented in Table 1 for the existing and proposed 100 year ARI peak flood levels. Please note that results are referenced by cross-section number and the location of these section numbers is shown in Figure 3. Note that the section located at the site of the proposed development is Section 4. Direction of flow is Section 7 (upstream) to Section 1 (downstream) near the confluence with the Hawkesbury River.

	Peak Water Level (mAHD)	
Section	**Existing**	**Proposed**
7	17.28	17.28
6	17.28	17.28
5	17.28	17.28
railway	17.28	17.28
4	17.28	17.28
3	17.28	17.28
2	17.28	17.28
1	17.28	17.28

Table 1: Summary of Impact Results

A plot comparing the discharge hydrograph at Section 3 for the two modeled scenarios (ie. Existing and proposed), may be seen in Figure 4. This demonstrates the similarity of the South Creek flood hydrographs for the existing and proposed conditions.

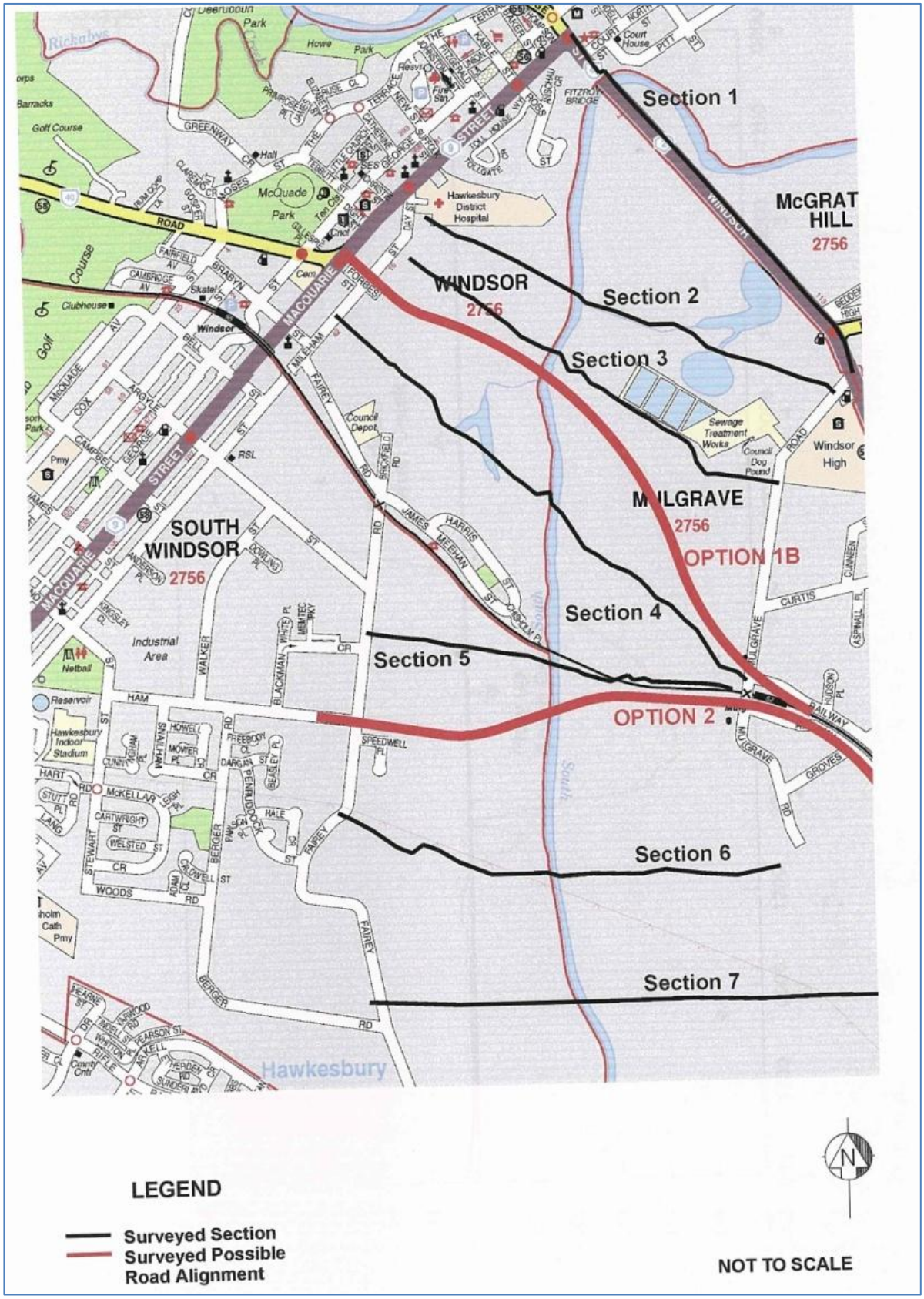


Figure 3: Cross-Section Locations

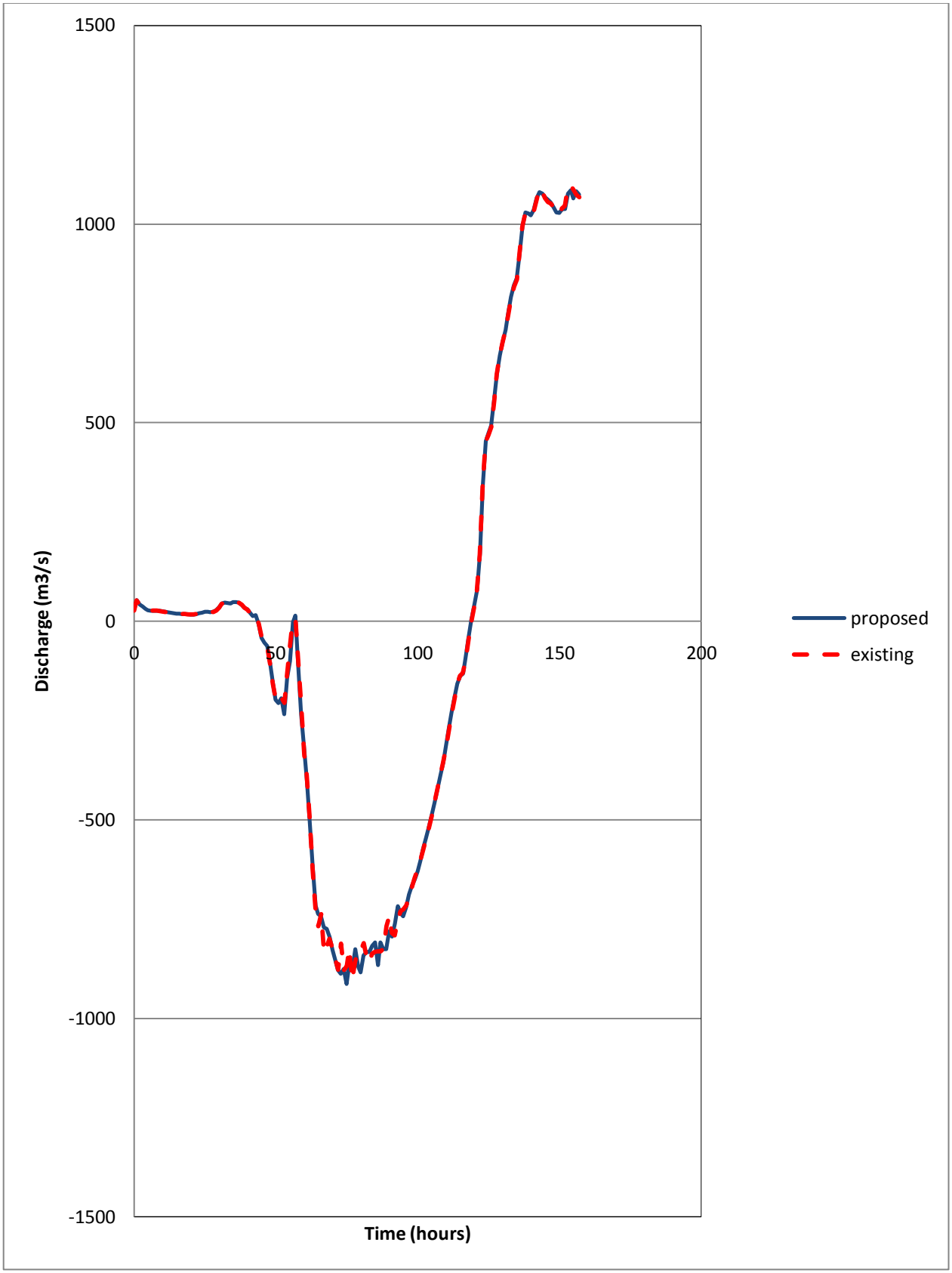


Figure 4: Comparison of discharge at Section 3

HYDRAULIC IMPACTS

Results indicate no impact due to the proposed extension of the existing mushroom substrate plant at Mulgrave Rd, Mulgrave. This is explained by the fact that the extension to the plant will remove only a very small fraction of flood storage from the overall floodplain of the Hawkesbury at Windsor. The location of the plant downstream of the railway structure on South Creek means that conveyance is a non-issue.

CONCLUSION

The proposed extension to the existing mushroom substrate plant on Mulgrave Road, Mulgrave which lies on the Hawkesbury River floodplain does not have any impact on 100 year ARI flood levels.

Yours faithfully,

WMAwater



Stephen Gray

Associate

Appendix R

SUBSTRATE PLANT NOISE ASSESSMENT

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Consulting Acoustical & Vibration Engineers

OPERATION AND CONSTRUCTION NOISE IMPACT ASSESSMENT MUSHROOM SUBSTRATE PLANT MULGRAVE

40.6411.R1:CFCD4
Rev 03

Prepared for: ELF FARM SUPPLIES
C/- Perram & Partners
12 Clanwilliam Street
EASTWOOD NSW 2122

Prepared by: Atkins Acoustics and Associates Pty Ltd.
8-10 Wharf Road
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June 2010

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APPENDIX 1: AMBIENT NOISE MEASUREMENT RESULTS
APPENDIX 2: WIND ROSES - MULGRAVE

1.0 INTRODUCTION

Atkins Acoustics was engaged by Perram & Partners on behalf of Elf Farm Supplies Pty Ltd to prepare an operation and construction noise assessment for the expansion of the existing mushroom substrate plant at Mulgrave. The site is located within a portion of land bounded by South Creek to the west, Hawkesbury Valley Way to the north, Mulgrave Road to the east and Richmond Rail Line to the south (*Figure 1*).

This report presents the results, findings and recommendations of the construction and operational noise assessment. The methodology adopted for the assessment included:

- site inspections;
- measurement and assessment of existing ambient noise levels at representative noise receiver locations;
- establishment of noise assessment goals in accordance with *DECCW,* Industrial Noise Policy *(INP)*, Noise Guide for Local Government *(NGLG)*, Draft Construction Noise Guideline (*CNG*) and the Environmental Criteria for Road Traffic Noise *(ECRTN);*
- prediction and assessment of construction noise;
- prediction and assessment of operational noise emissions;
- prediction and assessment of road traffic noise; and
- recommendation of noise controls, where required.

The information presented in this report has been prepared for the investigation described herein, and is not intended for use in any other context or for any other purpose.

Figure 1: Site Location



2.0 THE PROPOSAL

2.1 The Site

The subject site is located on the southern side of Hawkesbury Valley Way and to the west of Mulgrave Road, Mulgrave (*Figure 1*). The site is roughly triangular in shape and comprises Lot 14 DP 1138749 and part of Lot 13 DP 1138749.

The substrate plant at Mulgrave has been operating for approximately three (3) decades. During this time Elf Farm Supplies has continued to refine and redesign the substrate production processes to become a world-class leader with best management practices in the production of high quality Phase 1, 2 and 3 substrate.

The adjacent land use to the west across South Creek is a residential area (South Windsor), to the north on the opposite side of Hawkesbury Valley Way is an isolated residence on a rural property, to the east is the Mulgrave Industrial Area whilst to the south are some isolated residential properties and a market garden with associated residential dwelling.

2.2 Overview of Proposal

The substrate production at Mulgrave is currently limited by its development consent to a maximum of 1,000 tonnes/week of Phase 1 substrate, regardless of whether this is the final product or further processed to produce Phase 2 or 3 products. Due to efficiencies and refinement of processing operations, increased production utilising the current plant is possible. In addition, with the advent of Phase 2 and 3 processing, demand for substrate by mushroom growers has increased and production levels at Mulgrave have operated maximum levels for the last 3 to 4 years.

Accordingly, increased production capacity is required to meet market demand and assist in the supply of substrate for a new mushroom growing farm (subject to a separate acoustic assessment) proposed by Elf Mushrooms at Londonderry and other new farms.

The proposal for the expansion of the existing substrate plant is intrinsically linked with the development of the proposed mushroom farm at Londonderry. If approval for increased production and expansion at Mulgrave substrate plant is not forthcoming the development of the mushroom farm at Londonderry is unlikely to proceed. An increase in the current approval to 1,600 tonnes/week of Phase 1 substrate is the minimum required to cover existing commitments and requirements of the proposed farm at Londonderry. Taking into account projected growth in the industry, Elf Farm Supplies is seeking to secure the opportunity for future higher production levels with staged increases up to a maximum of 3,200 tonnes/week of Phase 1 substrate.

An increased production capacity of 1,600 tonnes/week can be accommodated utilising the existing substrate production plant and would not require any additional plant and equipment with the exception on an additional shed for the storage of straw.

In terms of increased production up to 3,200 tonnes/week it is proposed to expand the facility in three (3) stages over ten (10) years. The main components of the expansion are presented below:

Stage	Description	Plant Capacity (tonnes/week*)
1	Additional straw bale storage shed. Fill final small area on western side	1,600
2	Pre-wet shed extension with new conveyor, new bio scrubber with chimney, extra bale wetting area, extra bale storage shed, relocate weighbridge, new Phase 2/3 building with 9 tunnels and overhead supply conveyor	2,400
3	Extra Phase 1 tunnels and 13 Phase 2/3 tunnels	3,200

* Tonnes of Phase 1 substrate (1,000t Phase 1 reduces to 600t Phase 3)

A graphical representation of the proposed expansion of the substrate plant is presented in *Figure 2*.

Figure 2: Proposed Site Layout - Substrate Plant Expansion

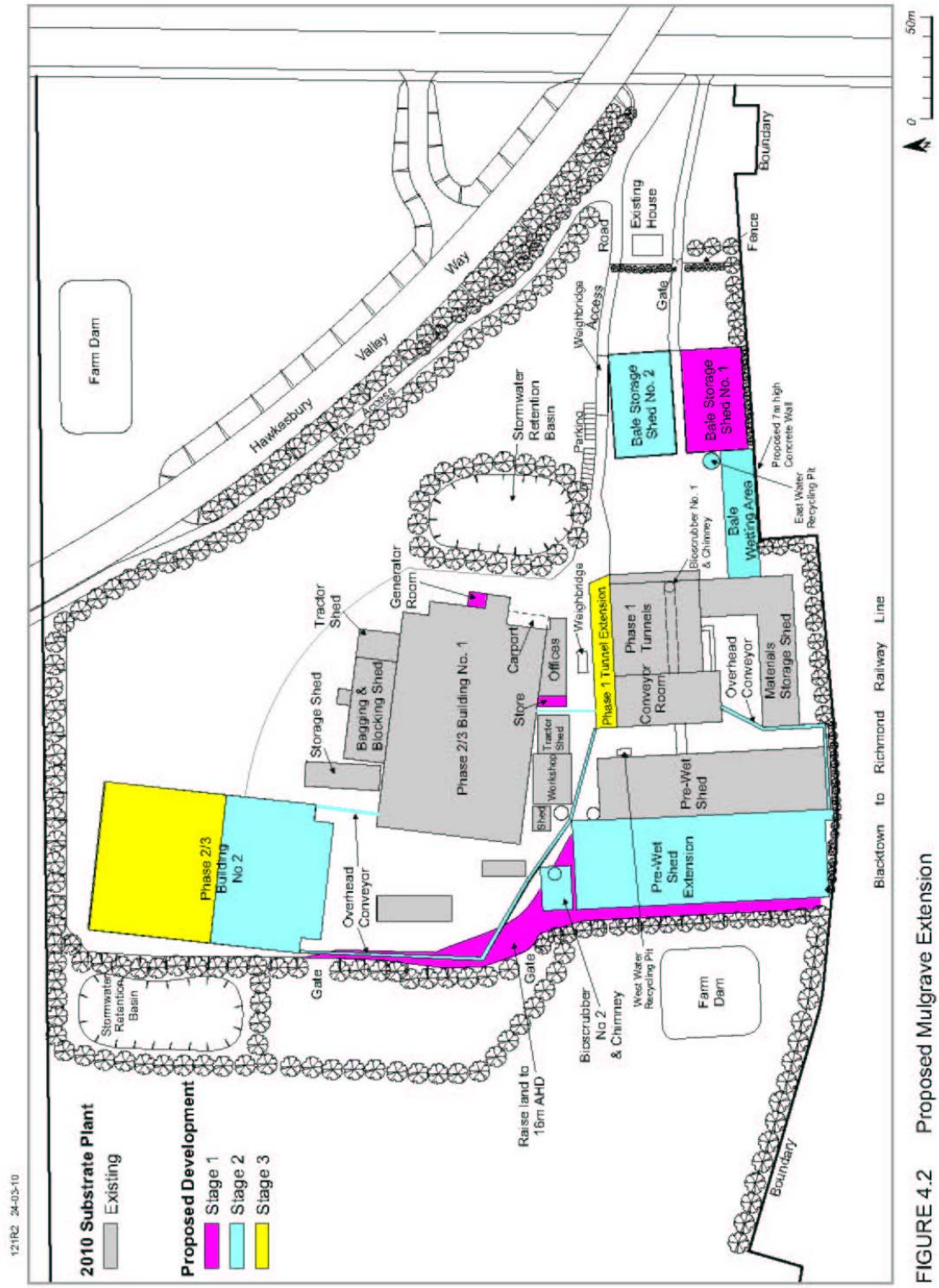


FIGURE 4.2 Proposed Mulgrave Extension

In terms of vehicle trips associated with the development, the following numbers have been projected for the staged tonnage increases:

1,000 tonne/week	16 trucks/day
	29 cars/day
1,600 tonne/week	24 trucks/day (
	32 cars/day
3,200 tonne/week	50 trucks/day
	36 cars/day

The above projections relate vehicle trips. In terms of vehicle *movements* the numbers presented have been doubled for modelling traffic noise.

Utilising the projected numbers, the hourly generation has identified the following day and night traffic *movements* for final design level of 3,200tonne/week:

Day (7.00am to 10.00pm)	70 trucks (5/hr)
	50 cars (3/hr)
Night (10.00pm to 7.00am)	30 trucks (3/hr)
	22 cars (2/hr)

2.2.1 Plant and Equipment

The plant and equipment used at the facility is consistent with existing plant and includes front end loaders, mobile blender and tunnel loading machines.

Fixed plant and equipment include exhaust and supply air fans, bio-scrubber, conveyors, chillers, compressors and pumps.

2.3 Operating Hours

The proposed hours of operation for the facility are twenty-four (24) hours, seven (7) days a week consistent with current use of the site.

2.4 Site Development (Construction)

The expansion of the substrate site would be accommodated within the south-east, south-west and north-west portions of the site. The north-west area has previously been subject to approved filling operations under a previous development approval forming a platform level in the order of RL16m. Major earthworks are already completed thus main construction works assessed include preparation of hardstand areas, concrete works, building erection, installation and commissioning of plant and equipment.

2.4.1 Hardstand, Building Erection & Fit out

The main civil and construction works include drainage, roads, concrete works/hardstand, erection of buildings and installation of plant and equipment. The main noise generating activities would be associated with the concrete works. For these works the following plant has been considered:

- concrete truck/pump
- cranes

Some minor filling / compacting activities would be required for the new Pre Wet Shed and would involve use of dozer and compactor.

The building erection would be conducted with cranes, scissor lifts and associated minor plant and equipment. It is expected that noise emissions for these activities would be significantly less than the earth and concrete works. However for noise assessment purposes the following schedule of plant and equipment has been considered:

- cranes
- scissor lifts

2.5 Construction Hours

The main civil earthworks and building construction would be undertaken between:

- 7.00am to 6.00pm - Monday to Friday
- 8.00am to 1.00pm - Saturday.

Works associated with the building fit out and plant commissioning could be undertaken twenty-four (24) hours, seven (7) days a week where noise is inaudible at residential premises, subject to conditions of approval.

It is proposed to develop the substrate plant in three (3) main stages, however for assessment and development purposes these stages have been further broken down into nine (9) key components. The envisaged total duration of the construction works and commissioning is in the order of sixty (60) months, albeit works are envisaged to be conducted on a campaign basis with significant breaks between stages and accordingly the total development is anticipated to take up to ten (10) years to complete.

3.0 LOCAL ENVIRONS

Site measurements and inspections confirmed that the noise environment at potentially sensitive noise receivers is influenced by local and distant traffic (Hawkesbury Valley Way), domestic activities and industry within the South Windsor Industrial Precinct and under the definitions of the *INP* would generally be classified as *Urban*.

3.1 Noise Assessment Locations

The nearest potentially affected residential dwellings are located to the north (46 Mulgrave Road – feedlot and associated residence) and south-east (commercial market garden - 124 Mulgrave Road and isolated residential dwellings - 2 Railway Road) and west (Chisholm Place, South Windsor) of the development. The closest residential dwellings are located approximately 460m north, 170-280m south-east and 390m to the west of the facility. *Table 1* and *Figure 3* identifies the receiver locations selected for noise assessment.

Table 1: Assessment Locations

Reference	Description	Location
R1*	46 Mulgrave Road, Mulgrave	North
R2	Mulgrave Industrial Area	East
R3	2 Railway Road, Mulgrave	South-east
R4*	126 Mulgrave Road, Mulgrave	
R5*	Chisholm Place, South Windsor	West

* Noise monitoring locations

Figure 3: Reference Assessment Locations



3.2 Local Meteorology

For the purpose of noise assessment meteorological data for *Mulgrave 2008-2009* provided by PAE Holmes established from raw meteorological data recorded at Elf Farms Supplies, Mulgrave.

3.2.1 Stability Classifications (Temperature Inversions)

Table 2 shows the frequency of occurrence of the different stability classes for night hours (6pm to 7am – *INP Section 5.2*) during Winter.

Table 2: Frequency of occurrence of stability classes (Mulgrave 2001-2002)

Stability Class	Percentage Frequency of Occurrence
A	0.0
B	0.0
C	0.0
D	35.8
E	36.2
F	28
Total	**100**

Holmes data show that F stability class conditions (temperature inversions) are not a feature of the area. Referenced to the requirements of the *DECCW, INP* the effected of temperature inversions have not been considered for noise modelling.

3.2.2 Prevailing Wind Data

Wind data was compiled into annual and seasonal roses *(Holmes)* for day, evening and night assessment periods (*Appendix 2*). A review of the data has shown that wind effects are a feature of the area and require assessment referenced to the *DECCW, INP*. Specifically north-north-east wind during the day (autumn and winter), south-west winds in the evening (autumn) and south-south-west winds and north-east winds at night (summer and winter respectively).

3.2.3 Review

The *INP* recommends that wind effects be considered when it is a feature of the area. Where winds blow in the direction from the source to the receiver at speeds up to 3m/s for more than 30% of the time in any season, wind is considered to be a feature of the area and noise level predictions must be made under these conditions.

Hence meteorological effects considered for operational noise modelling include:

- North-north-east wind (Day): 22.5º at 3m/s
- South-west wind (Evening): 225.5º at 3m/s
- South-south-west wind (Night): 202.5º at 3m/s
- North-east wind (Night): 45º at 3m/s

4.0 EXISTING AMBIENT NOISE LEVELS

For the purpose of assessing noise impacts from the proposal and establish project specific noise assessment goals, the ambient noise environment was monitored from Friday 20 March 2009 to Friday 27 March 2009.

The reference noise monitoring locations selected (*Table 1*) and shown on *Figure 3* were:

M1 46 Mulgrave Road, Mulgrave (R1)

M2 126 Mulgrave Road, Mulgrave (R4)

M3 3 Chisholm Place, South Windsor (R5)

Site observations during installation of monitoring equipment confirmed that the ambient noise was generally affected by local and distant traffic (Hawkesbury Valley Way), domestic activities and industry within the South Windsor Industrial Precinct. Previous studies for the Mulgrave Substrate Plant have also identified that night-time ambient noise levels are typically controlled by activities or operations within the South Windsor Industrial Precinct. For noise assessment purposes, the residential assessment locations were considered as receiver 'areas' for the purpose of developing noise goals.

The noise monitoring instrumentation consisted of RTA Technology environmental noise loggers. The loggers were set to A-weighting, fast response and programmed to calculate and record statistical noise levels at every 15-minute interval. The instruments were calibrated before and after the measurements using a Bruel & Kjaer sound level calibrator Type 4230 and no significant drift was detected.

Table 3 presents a summary of the measurement results with a graphical presentation presented in *Appendix 1*.

Table 3: Measured RBL and L_{Aeq} Noise Levels

dB(A) re: 20 × 10^{-6} Pa

Date	Assessment Background Level L_{A90}			Equivalent Continuous Level L_{Aeq}		
	Day	**Evening**	**Night**	**Day**	**Evening**	**Night**
Reference Location M1: 126 Mulgrave Road, Mulgrave						
Fri 20/3/09	-	43	38	-	49	45
Sat 21/3/09	40	43	35	50	49	43
Sun 22/3/09	39	40	36	51	48	45
Mon 23/3/09	43	41	37	*66*	50	48
Tue 24/3/09	43	42	37	53	47	46
Wed 25/3/09	42	47	37	55	*61*	47
RBL	**42**	**43**	**37**			
Ambient L_{Aeq}				**53**	**49**	**46**
Reference Location M2: 46 Mulgrave Road, Mulgrave						
Fri 20/3/09	-	42	40	-	58	54
Sat 21/3/09	41	43	37	52	56	47
Sun 22/3/09	41	43	38	53	56	54
Mon 23/3/09	44	42	38	52	58	52
Tue 24/3/09	46	44	37	52	57	48
Wed 25/3/09	44	42	40	54	*61*	56
Thu 26/3/09	41	42	35	53	*68*	49
RBL	**42**	**42**	**38**			
Ambient L_{Aeq}				**53**	**57**	**53**
Reference Location M3: 3 Chisholm Place, South Windsor						
Fri 20/3/09	-	44	41	-	58	55
Sat 21/3/09	40	43	38	*61*	58	56
Sun 22/3/09	41	42	39	58	58	55
Mon 23/3/09	42	42	38	57	58	56
Tue 24/3/09	43	42	39	56	57	56
Wed 25/3/09	42	44	41	57	*61*	54
Thu 26/3/09	39	39	38	57	58	55
RBL	**41**	**42**	**39**			
Ambient L_{Aeq}				**57**	**58**	**55**

Noise levels in *Italics* excluded

NOTE: *Daytime: (7.00am to 6.00pm Monday to Saturday, 8.00am to 6.00pm Sunday and Public Holidays)*
Evening: (6.00pm to 10.00pm)
Night: (10.00pm to 7.00am Monday to Saturday, 10.00pm to 8.00am Sunday and Public Holidays)

5.0 ENVIRONMENTAL NOISE ASSESSMENT GOALS

The development site is located within the Hawkesbury City Council (HCC) LGA. From a review of HCC Local Environment Plan 1989, Council has no specific noise policy for assessing noise from industry or development generated traffic.

With this understanding we have referenced the DECCW, Interim Construction Noise Guideline *(ICNG)*, Industrial Noise Policy *(INP),* Noise Guide for Local Government (*NGLG*), and the Environmental Criteria for Road Traffic Noise *(ECRTN)* to develop project specific noise goals for site and traffic noise during construction and operation.

5.1 DECCW, Interim Construction Noise Guideline (*ICNG*)

The *DECCW* released the *Interim Construction Noise Guideline* in July 2009 following an extension period of review of a Draft version of the guideline issued in August 2008. The *Interim Construction Noise Guideline (ICNG)* was developed by the *DECCW* in response to concerns raised with respect to construction noise impacts and the practicability and feasibility of achieving stringent numeric noise levels established from procedures developed for permanent industrial noise sources. In accordance with the *DECCW* procedures, and practicability and feasibility concerns with respect to assessing and controlling construction noise impacts, the objectives of the *ICNG* guideline have been considered.

The main objectives of the *ICNG* are to:

- identify and minimise noise from construction sites,
- focus on applying all 'feasible and reasonable' work practices to minimise construction noise impacts, and

- provide flexibility in selecting site-specific feasible and reasonable work practices in order to minimise noise impacts.

For residential properties exposed to construction noise, the *ICNG* recommends that the $L_{Aeq,15min}$ noise levels should not exceed the rating background noise level (RBL) by more than 10dB(A) for standard hours, and 5dB(A) outside the recommended hours.

For works outside the recommended standard hours, the *DECCW* recommends that:

- all feasible and reasonable work practices should be applied with the aim to meet the recommended noise levels; and
- where feasible and reasonable work practices have been applied and the noise levels exceed the recommended levels, the proponent should consult with the community.

The *DECCW* recognise that no single approach can minimise noise from all types of construction. The level of effort and the sophistication of methods to minimise construction noise are guided by factors such as the practicality of reducing noise exposure, duration of the works and extent of the noise.

5.1.1 Recommended Standard Hours for Construction

The *ICNG* recommends the following standard hours for construction works:

- 7:00am – 6:00pm, Monday to Friday;
- 8:00am – 1:00pm, Saturday;
- No work on Sundays or Public Holidays

For construction outside the above recommended standard hours, the *ICNG* recommends that prior approval(s) would be required.

5.1.2 Construction Noise Assessment Goals

A summary of the adopted construction noise goals are presented in *Table 4*.

Table 4: Construction Noise Assessment Goals – DECCW:ICNG
dB(A) re 20 × 10^{-6} Pa

Reference Assessment Location	Rating Background L_{A90} Noise Level (RBL)	Noise Assessment Goal ($L_{Aeq,15min}$)
	Day	Day
R1	42	52
R2	Industrial	65
R3	42	52
R4	42	52
R5	41	51

Note: Construction noise goals for standard hours of 7.00am to 6.00pm Monday to Friday and 8.00am to 1.00pm Saturday

5.2 Operational Noise (*INP*)

The objectives of the *INP* are to protect the community from intrusive noise and preserve amenity. For assessment of intrusive noise, the *INP* recommends that the $L_{Aeq,15min}$ source noise should not exceed the existing L_{A90} Rating Background Level *(RBL)* by more than 5dB(A). The assessment goal for preservation of amenity requires noise levels with the introduction of new sources to be within the acceptable levels for the locality and land-use. *Table 5* present a summary of the *INP* acceptable and recommended maximum amenity assessment goals.

Table 5: INP Amenity Goals

Receiver Description	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended Maximum
Residence (1)	Urban	Day	60	65
		Evening	50	55
		Night	45	50
Industrial	All	When in use	70	75

NOTE: Daytime: (7.00am to 6.00pm Monday to Saturday, 8.00am to 6.00pm Sunday and Public Holidays)
Evening: (6.00pm to 10.00pm)
Night: (10.00pm to 7.00am Monday to Saturday, 10.00pm to 8.00am Sunday and Public Holidays)

(1) In assessing noise levels at residences, the noise is assessed at the most affected point on or within the residential property boundary or, if this is more than 30 m from the residence, at the most-affected point within 30m of the residence.

Table 6 presents the calculated *RBL's*, the ambient L_{Aeq} noise level, the intrusive and amenity noise goals and the project specific noise assessment goals. Amenity goals have assumed contributions of industry and traffic to the measured L_{Aeq} noise levels.

Table 6: Operational Noise Assessment Goals
dB(A) re: 20 x 10^{-6} Pa

Period (1)	Recommended L_{Aeq} Noise Level	Existing RBL	Existing L_{Aeq} Noise Level	Intrusive Criterion L_{Aeq} Noise Level	Amenity Criterion L_{Aeq} Noise Level	Project Assessment Goals L_{Aeq} Noise Level
Reference Location R1 – north (M2)						
Day	60	42	53	47	60	**47**
Evening	50	42	57	47	47	**47**
Night	45	38	53	43	43	**43**
Reference Location R2: Mulgrave Industrial (east)						
When in use	65-70					**65-70**
Reference Location R3 & 4 – southeast (M1)						
Day	60	42	53	47	60	**47**
Evening	50	43	49	48	50	**47***
Night	45	37	46	42	43**	**42**
Reference Location R5 –west (M3)						
Day	60	41	57	46	57	**46**
Evening	50	42	58	47	48	**46***
Night	45	39	55	44	45	**44**

NOTE: Daytime : 7.00am to 6.00pm Monday to Saturday, 8.00am to 6.00pm Sunday and Public Holidays.
Evening : 6.00pm to 10.00pm.
Night : 10.00pm to 7.00am Monday to Saturday, 10.00pm to 8.00am Sunday and Public Holidays.
* Application Notes – NSW Industrial Noise Policy: RBL levels for evening should be no higher than day, and night RBL no higher than evening or day
** Based on Industrial noise contribution of <40dB(A)

The principles underpinning the establishment of noise assessment goals are that the goals are best regarded as planning tools, *"They are not mandatory, and an application for a noise-producing development is not determined purely on the basis of compliance or otherwise with the noise criteria. Numerous factors need to be taken into account in the determination. These include economic consequences, other environmental effects and the social worth of the development. The criteria help to determine consent/licence conditions because they provide information on the likely effect of any environmental noise associated with the development." INP Section 1.4.1*

5.2.1 Night-time Disturbance (NGLG)

The Substrate Plant currently operates twenty-four (24) hours a day, seven (7) days a week. The expansion of the facility proposes to continue with 24/7 production and distribution, accordingly intermittent night-time activities need to be addressed. To avoid disturbance during night-time hours, the *NGLG* recommends that the $L_{A1,1min}$ noise levels when assessed outside a bedroom window, should not exceed the background L_{A90} noise level by more than 15dB(A).

In accordance with the *NGLG* assessment procedures and the background measurement results, intermittent noise levels from site activities during the night-time (10.00pm to 7.00am) period should not exceed:

Location R1:	53dB(A) (L_{A90} 38 +15dB(A))
Location R3&4:	52dB(A) (L_{A90} 37 +15dB(A))
Location R5:	54dB(A) (L_{A90} 39 +15dB(A))

5.3 Road Traffic Noise (ECRTN)

The *ECRTN* recommends that the traffic noise from land use developments with the potential to create additional road traffic on arterial roads (including Hawkesbury Valley Way), where feasible and reasonable should be limited to $L_{Aeq,15hr}$ 60dB(A) (day) and $L_{Aeq,9hr}$ 55dB(A). Where the existing traffic noise levels exceed the recommended level, traffic noise resulting from the proposal should not increase the existing traffic noise levels by more than 2dB(A). In assessing traffic noise at residential dwellings, the noise is measured or assessed at 1m from the exposed building facade and a height of 1.5m above floor level.

6.0 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

The main site works requiring noise assessment include hardstand and foundation preparation, drainage, concrete works, erection of buildings and installation of plant and equipment.

Considering the distances to residential buildings are greater than 170m, ground vibration from excavation or compaction activities and other on-site plant is not considered to be an issue and has not been assessed any further.

6.1 Noise Assessment Locations

Potentially affected residential properties to the envisaged construction activities are identified in *Table 1* and *Figure 3*.

6.2 Construction Noise

The main plant and equipment of acoustical significance envisaged during site preparation and construction includes compactor, trucks, concrete trucks and cranes. A summary of typical plant and equipment envisaged for construction works is listed in *Table 7*.

Table 7: Construction Plant & Equipment

Item	Description	Purpose
1	Compactor	Compacting site works
2	Cranes	Concrete hardstand & building erection
3	Trucks	Filling, on-site transport of material
4	Water Cart	Filling of site
5	Concrete trucks/pumps	Concrete hardstand
6	Generator/s	Building erection

For noise modelling and assessment purposes *Table 8* presents a summary of equipment sound power levels established from field measurements and manufacturers specifications and reference to AS2436-1981.

Table 8: Plant/Equipment Sound Power Levels
L_{A10} re: 10^{-12} Watts

Plant Description	Sound Power Level								
	dB(A)	63	125	250	500	1k	2k	4k	8k
Dozer	112	108	115	112	108	109	103	95	87
Compactor	110	107	110	105	107	105	104	96	94
Cranes	106	90	98	98	102	101	100	97	88
Trucks	109	104	105	102	104	103	103	98	93
Water Cart	105	100	101	98	100	99	99	94	89
Concrete trucks/pumps	112	107	108	105	107	106	106	101	96
Scissor Lift	95	92	91	88	90	89	89	84	79

6.2.1 Construction Noise Modelling

Noise emissions from the filling/compaction, hardstand/concrete pouring and building erection have been predicted taking into account of noise attenuation due to distance separation and potential site shielding where relevant.

The construction stages were selected to represent a range of scenarios that are representative of the envisaged site activities. The scenarios modelled include:

Scenario 1 *Stage 1 - Pre Wet Landfill*: dozer, compactor, 30t dump truck and water cart.

Scenario 2 *Stage 1 - Bale Storage Shed*: concrete truck/pump, crane and scissor lift.

Scenario 3 *Stage 2 - Bioscrubber*: concrete truck/pump, crane and scissor lift.

Scenario 4 *Stage 2 - Pre Wet Building*: concrete truck/pump, crane and scissor lift.

Scenario 5 *Stage 2 - Bale Wetting Area & Courtyard*: concrete truck/pump and crane.

Scenario 6 *Stage 2 - Bale Storage Shed*: concrete truck/pump, crane and scissor lift.

Scenario 7 *Stage 2 - Phase 2/3 & Overhead Conveyor 13 Tunnels*: concrete truck/pump, crane and scissor lift.

Scenario 8 *Stage 3 - Phase 2/3 Building 9 Tunnels*: concrete truck/pump, crane and scissor lift.

Scenario 9 *Stage 3 - Phase 1 Building & 2 Tunnels*: concrete truck/pump, crane and scissor lift.

Table 9 presents a summary for each scenario and the predicted noise levels.

Table 9: Predicted Construction Noise Levels

Reference Location	Description	Assessment Goal L_{Aeq}	Predicted Sound Pressure Level L_{Aeq}	Compliance
Scenario 1				
R1	46 Mulgrave Road, Mulgrave	52	48	√
R2	Mulgrave Industrial Area	65	45	√
R3	2 Railway Road, Mulgrave	52	50	√
R4	126 Mulgrave Road, Mulgrave	52	52	√
R5	Chisholm Place, South Windsor	51	55	x
Scenario 2				
R1	46 Mulgrave Road, Mulgrave	52	44	√
R2	Mulgrave Industrial Area	65	54	√
R3	2 Railway Road, Mulgrave	52	56	x
R4	126 Mulgrave Road, Mulgrave	52	60	x
R5	Chisholm Place, South Windsor	51	39	√
Scenario 3				
R1	46 Mulgrave Road, Mulgrave	52	44	√
R2	Mulgrave Industrial Area	65	38	√
R3	2 Railway Road, Mulgrave	52	38	√
R4	126 Mulgrave Road, Mulgrave	52	45	√
R5	Chisholm Place, South Windsor	51	52	x

Table 9: Predicted Construction Noise Levels (cont.)

Reference Location	Description	Assessment Goal L_{Aeq}	Predicted Sound Pressure Level L_{Aeq}	Compliance
Scenario 4				
R1	46 Mulgrave Road, Mulgrave	52	46	√
R2	Mulgrave Industrial Area	65	42	√
R3	2 Railway Road, Mulgrave	52	47	√
R4	126 Mulgrave Road, Mulgrave	52	50	√
R5	Chisholm Place, South Windsor	51	53	x
Scenario 5				
R1	46 Mulgrave Road, Mulgrave	52	48	√
R2	Mulgrave Industrial Area	65	56	√
R3	2 Railway Road, Mulgrave	52	53	x
R4	126 Mulgrave Road, Mulgrave	52	57	x
R5	Chisholm Place, South Windsor	51	39	√
Scenario 6				
R1	46 Mulgrave Road, Mulgrave	52	44	√
R2	Mulgrave Industrial Area	65	56	√
R3	2 Railway Road, Mulgrave	52	54	x
R4	126 Mulgrave Road, Mulgrave	52	50	√
R5	Chisholm Place, South Windsor	51	39	√
Scenario 7				
R1	46 Mulgrave Road, Mulgrave	52	50	√
R2	Mulgrave Industrial Area	65	50	√
R3	2 Railway Road, Mulgrave	52	46	√
R4	126 Mulgrave Road, Mulgrave	52	48	√
R5	Chisholm Place, South Windsor	51	51	√
Scenario 8				
R1	46 Mulgrave Road, Mulgrave	52	50	√
R2	Mulgrave Industrial Area	65	44	√
R3	2 Railway Road, Mulgrave	52	42	√
R4	126 Mulgrave Road, Mulgrave	52	44	√
R5	Chisholm Place, South Windsor	51	53	x
Scenario 9				
R1	46 Mulgrave Road, Mulgrave	52	40	√
R2	Mulgrave Industrial Area	65	50	√
R3	2 Railway Road, Mulgrave	52	44	√
R4	126 Mulgrave Road, Mulgrave	52	46	√
R5	Chisholm Place, South Windsor	51	41	√

In terms on internal fit-out and commissioning, noise levels are expected to be more than 8-10dB(A) lower than the results presented in *Table 9* comply with construction noise goals and unlikely to result in significant noise impacts on residential properties.

6.2.2 Construction Noise Assessment

The noise modelling results show that the recommended construction noise goals are generally satisfied at the reference assessment locations. The main noise exceedances are associated with dozer and compactor use during filling activities represented in Scenario 1. The noise modelling assumed simultaneous operation of the referenced plant, and if dozer and compactor were not operated simultaneously a reduction in the predicted noise level by 1-3dB(A) could be expected. For other construction scenarios a number of noise exceedances at residential receiver locations have been identified associated with concrete works specifically in Scenarios 2 and 5. To minimise potential noise exposure during construction activities and establish compliance with the construction noise goals, the following controls should be considered:

- Consideration of located concrete trucks/pumps within a specified area that provided localised acoustic screening to residential properties to the south and west;
- Development of the southern boundary wall adjacent the bale storage shed (Stage 1) and bale wetting area early in the construction program would reduce construction noise levels at residential receivers to the south (R3 & R4) by 5-8dB(A).
- Adoption of Best Management Practice (BMP) and Best Available Technology Economically Achievable (BATEA) practices as encouraged by the *DECCW*;
- selection of site plant and equipment with due consideration to controlling noise emissions;

- selection of plant and equipment with effective mufflers and engine covers;
- selection of mobile plant to minimise reversing alarm noise;
- where practical noisy activities would be scheduled during periods of the day when general ambient noise levels are higher;
- regular audits at receiver locations to confirm noise emissions from the construction activities;
- the current contact telephone number is available to the public so that information can be received or complaint made in relation to noise. A log of complaints is maintained and actioned by the operator; and,
- construction activities would be undertaken in accordance with AS 2436-1981 *Guide to Noise Control on Construction, Maintenance and Demolition Sites*. All equipment used on site would be required to demonstrate compliance with the noise levels recommended in AS 2436-1981 and *Table 9*.

7.0 OPERATIONAL NOISE ASSESSMENT

Operational noise from the Mulgrave Substrate Facility activities including both mobile (FEL, trucks, blenders) and fixed mechanical plant (compressors, condensers, fans) has been predicted with the *ENM* environmental noise computer model. The computer model takes account of noise attenuation due to distance, ground effect (and *Flat Terrain Category* specified in ENM), atmospheric absorption, shielding from intervening structures and topography. Atmospheric conditions assumed for the noise modelling included calm conditions with 15°C air temperature and 70% relative humidity. Additional weather conditions considered in the operational noise assessment included:

- North-north-east wind (Day): 22.5º at 3m/s
- South-west wind (Evening): 225.5º at 3m/s
- South-south-west wind (Night): 202.5º at 3m/s
- North-east wind (Night): 45º at 3m/s

Table 10 presents a summary of the external plant/equipment sound power levels adopted for the noise modelling to represent Stage 3 final design level of 3,200t/week. Sound power levels and octave band spectrum presented were established from site attended noise audits of the existing plant and equipment at Mulgrave, audits of similar equipment and manufacturer data. In terms of conveyor drives and belts, final selections have not been confirmed and the levels presented are from similar installations. It is not anticipated that noise from the conveyor system would be a significant source.

Table 10: External Plant/Equipment Sound Power Levels
L_{Aeq} re: 10^{-12} Watts

Plant Description	Sound Power Level								
	dB(A)	63	125	250	500	1k	2k	4k	8k
Super Chill Condensers EWK-D680 (x6)	83	79	81	81	78	75	73	76	72
Compressor Room (external door) x2	80	79	75	77	76	76	70	69	63
Bioscrubber 2 Fans – each (x2)	107	-	106	104	107	100	98	92	-

Table 10: External Plant/Equipment Sound Power Levels (cont.)
L_{Aeq} re: 10^{-12} Watts

Plant Description	Sound Power Level								
	dB(A)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Conveyor Drive – New Phase 3 (E-W)	80	72	74	72	77	76	72	63	55
Conveyor Belt – New Phase 3 (E-W)	70*	75	75	70	70	63	59	52	43
Conveyor Drive – New Phase 3 (N-S)	80	72	74	72	77	76	72	63	55
Conveyor Belt – New Phase 3 (N-S)	70*	75	75	70	70	63	59	52	43
Conveyor Drive – Pre Wet	80	72	74	72	77	76	72	63	55
Conveyor Belt – Pre Wet	70*	75	75	70	70	63	59	52	43
FEL – Volvo L90E	102	115	104	100	98	99	92	92	87
FEL – Volvo L150E	105	120	104	103	102	99	97	95	91
FEL – Komatsu WA320	104	114	102	100	102	99	96	93	86
Traymaster Blender	110	109	110	109	108	104	102	99	96
Pre-Wet Shed (average in shed)	85	84	85	84	83	79	77	74	71
Truck (moving)	101	98	102	101	97	94	94	91	80
Loading Activities (Phase 2/3 average in loading hall)	86	81	84	85	85	81	78	73	65
Loading Activities (Phase 2/3 external facade)	63	66	68	63	61	60	49	43	37

* sound power level per metre of conveyor

Fixed mechanical plant including condensers and compressors presented in *Table 10* are for noise assessment purposes and based on audit measurements of the existing plant servicing the current Phase 2/3 building. Existing compressor room and condensers are located on the eastern façade of the existing Phase 2/3 building. The compressors and condensers servicing the new Phase 2/3 building on the north-west corner of the site are proposed to be located along the southern façade of the new building. Noise levels from conveyors and drive are based on data established from audit measurements of similar systems.

The proposed facility would operate twenty-four (24) hours a day, seven (7) days a week consistent with current operations. Accordingly, night-time intermittent activities need to be considered to assess potential sleep disturbance. To provide an assessment of night-

time intermittent activities the modelling has considered a worse case of airbrake release and the sound power levels presented in *Table 11* established from audit measurements.

Table 11: Night-time Intermittent Noise Source
$L_{A1,1min}$ re: 10^{-12} Watts

Plant Description	Sound Power Level									
	dB(A)	63	125	250	500	1k	2k	4k	8k	16k
Airbrake Release	116	99	94	94	97	108	109	111	111	107

7.1 Noise Modelling

The results summarised in *Tables 12-14*, represent the calculated noise levels from site operations and fixed mechanical plant. In terms on onsite trucks for Phase 2/3 dispatch, the noise model assumed a worse case of two (2) trucks within a 15 minute assessment period. For modelling purposes, trucks were broken into a number of source points to represent entry and exit to building, traversing the site and site access road.

Considering the envisaged activities, for the assessment of site operational noise over fifteen (15) minute assessment periods ($L_{Aeq,15min}$), different scenarios were considered for day/evening and night operations as follows:

Day /Evening *2 x trucks - 4 movements (base Lw101dB(A) adjusted for total 3min duration on access road and 3min duration for entry/exit paths to building)*
1 x Existing Phase 2/3 Building (exit & entry points)
1 x New Phase 2/3 Building (exit & entry points)
2 x Access Road
3 x FEL (Komatsu WA320, Volvo L90E and Volvo L150E)
1 x Bale Storage Area - Komatsu WA320
1 x Materials Storage Area - Volvo L90E
1 x Pre Wet (between Pre Wet and Conveyor Building) - Volvo L150E

1 x Traymaster Blender within Pre Wet Shed

Loading in both Phase 2/3 Buildings

Night *2 x trucks - 4 movements (base Lw101dB(A) adjusted for 3min duration on access road and 3min duration for entry/exit paths to building)*

1 x Existing Phase 2/3 Building (exit & entry points)

1 x New Phase 2/3 Building (exit & entry points)

2 x Access Road

3 x FEL (Komatsu WA320, Volvo L90E and Volvo L150E)

1 x Bale Storage Area - Komatsu WA320

1 x Materials Storage Area - Volvo L90E

1 x Pre Wet (between Pre Wet and Conveyor Building) - Volvo L150E

Loading in both Phase 2/3 Buildings

The noise modelling is based on envisaged activities presented above with the simultaneous operation of conveyors and conveyor drives, cooling towers and compressors that represent operations for the Stage 3 final design level of 3,200t/week.

The noise modelling results presented are based on a site layout with the new Phase 2/3 building rotated 90 degrees with plantroom on western façade and loading and truck movements within the northern portion of the new Phase 2/3 building. Since the modelling was completed, the building has been rotated with plantroom located adjacent southern façade and all loading occurring within the existing Phase 2/3 building. Accordingly the noise modelling results presented are considered conservative, as the revised layout results in reduced noise exposure resulting from relocated plantroom and isolating loading activities and truck movements to the existing building.

Table 12: Predicted Operational Noise Levels (Day)
$L_{Aeq(15min)}$ dB(A) re: 20 x 10^{-6} Pa

Reference Location	Description	Assessment $L_{Aeq,15min}$ Goal (Day)	Predicted $L_{Aeq,15min}$ Sound Pressure Level	Compliance
Operational Noise - Calm				
R1	46 Mulgrave Road, Mulgrave	47	35	√
R2	Mulgrave Industrial Area	65-70	36	√
R3	2 Railway Road, Mulgrave	47	35	√
R4	126 Mulgrave Road, Mulgrave	47	38	√
R5	Chisholm Place, South Windsor	46	36	√
Operational Noise - NNE wind				
R1	46 Mulgrave Road, Mulgrave	47	31	√
R2	Mulgrave Industrial Area	65-70	36	√
R3	2 Railway Road, Mulgrave	47	36	√
R4	126 Mulgrave Road, Mulgrave	47	39	√
R5	Chisholm Place, South Windsor	46	36	√

Table 13: Predicted Operational Noise Levels (Evening)
$L_{Aeq(15min)}$ dB(A) re: 20 x 10^{-6} Pa

Reference Location	Description	Assessment $L_{Aeq,15min}$ Goal (Evening)	Predicted $L_{Aeq,15min}$ Sound Pressure Level	Compliance
Operational Noise - Calm				
R1	46 Mulgrave Road, Mulgrave	47	35	√
R2	Mulgrave Industrial Area	65-70	36	√
R3	2 Railway Road, Mulgrave	42	35	√
R4	126 Mulgrave Road, Mulgrave	42	38	√
R5	Chisholm Place, South Windsor	46	36	√
Operational Noise - SW wind				
R1	46 Mulgrave Road, Mulgrave	47	42	√
R2	Mulgrave Industrial Area	65-70	38	√
R3	2 Railway Road, Mulgrave	42	35	√
R4	126 Mulgrave Road, Mulgrave	42	37	√
R5	Chisholm Place, South Windsor	46	35	√

Table 14: Predicted Operational Noise Levels (Night)
$L_{Aeq(15min)}$ dB(A) re: 20 x 10^{-6} Pa

Reference Location	Description	Assessment $L_{Aeq,15min}$ Goal (Night)	Predicted $L_{Aeq,15min}$ Sound Pressure Level	Compliance
Operational Noise - Calm				
R1	46 Mulgrave Road, Mulgrave	43	35 (35)	√
R2	Mulgrave Industrial Area	65-70	36 (36)	√
R3	2 Railway Road, Mulgrave	42	34 (35)	√
R4	126 Mulgrave Road, Mulgrave	42	37 (38)	√
R5	Chisholm Place, South Windsor	44	32 (36)	√
Operational Noise - SSW wind				
R1	46 Mulgrave Road, Mulgrave	43	42 (42)	√
R2	Mulgrave Industrial Area	65-70	36 (37)	√
R3	2 Railway Road, Mulgrave	42	32 (34)	√
R4	126 Mulgrave Road, Mulgrave	42	35 (37)	√
R5	Chisholm Place, South Windsor	44	31 (36)	√
Operational Noise - NE wind				
R1	46 Mulgrave Road, Mulgrave	43	32 (32)	√
R2	Mulgrave Industrial Area	65-70	35 (35)	√
R3	2 Railway Road, Mulgrave	42	34 (35)	√
R4	126 Mulgrave Road, Mulgrave	42	38 (39)	√
R5	Chisholm Place, South Windsor	44	33 (38)	√

Levels in brackets () with use of mobile blender in Pre Wet Shed

The modelling scenarios selected represent a range of activities, situations and noise levels likely to be emitted from the site activities. The modelling assumed all plant and equipment operating simultaneously and typical operations that are consistent for day/evening and night operations. Whilst these situations would not occur all of the time, the noise modelling represents the likely worst-case operating scenarios.

In terms of intermittent activities during night-time hours, the modelling considered the noise level presented in *Table 11* and considered typical likely locations for airbrake release at the entry and exit of the loading halls. *Table 15* presents the predicted $L_{A1,1min}$ noise levels and assessment goals for reference receiver locations.

Table 15: Predicted Intermittent Noise Levels
$L_{A1, 1min}$ dB(A) re: 20 x 10^{-6} Pa

Reference Location	Description	Assessment $L_{A1,1min}$ Goal (Night)	Predicted $L_{A1,1min}$ Sound Pressure Level	Compliance
Intermittent Noise - Calm				
R1	46 Mulgrave Road, Mulgrave	53	49	√
R2	Mulgrave Industrial Area	n/a	43	√
R3	2 Railway Road, Mulgrave	52	48	√
R4	126 Mulgrave Road, Mulgrave	52	30	√
R5	Chisholm Place, South Windsor	54	48	√

7.2 Assessment

The noise predictions for Stage 3 final design level of 3,200t/week show that during calm and specific adverse meteorological conditions the predicted operational (L_{Aeq}) noise levels during day/evening and night scenarios (*Tables 12-14*) satisfy the recommended assessment goals at all reference receiver locations. Notwithstanding the modelling scenarios assessed, additional calculations confirmed that operation of the mobile blender in Pre Wet shed could also occur during night hours if required. In terms of night-time intermittent activities, the predicted (L_{A1}) noise levels (*Table 15*) satisfy the recommended assessment goals.

7.3 Road Traffic Noise

The road traffic noise assessment has been based on traffic projections reported by Halcrow MWT (Doc. CTLCXY201-v04), data provided by Elf Farms Supplies Pty Ltd and existing traffic volumes on Hawkesbury Valley Way and Mulgrave Road recorded by The Centre for Excellence (*CFE*) 13 May 2009 and 19 May 2009. The *CFE* data confirms that the existing traffic volumes on Hawkesbury Valley Way between Mulgrave Industrial Area and South Windsor are in the order of 17,720 vehicles per day whilst for Mulgrave Road between Railway Road and Curtis Road in the order of 2,110 vehicles per day.

Considering the traffic data recorded, the modelling and assessment of road traffic noise has adopted the following vehicle counts and compositions. For calculation purposes the average speeds recorded for Hawkesbury Valley Way (72km/h) and Mulgrave Road (52km/h) were utilised. It is noted that the an alternate route of trucks from the proposal on Mulgrave Road and Curtis Road to access Windsor Road is through an industrial area, therefore road traffic noise for this route has not been considered further.

Table 16: Existing Traffic Volumes (Daily)

Description	Traffic Volumes			Heavy Vehicle Percentage (%)
	Light	Heavy	Total	
Hawkesbury Valley Way				
- Day	14231	1481	15711	9
- Night	1711	298	2009	15

Based on the existing traffic data (*Table 16*) and the CORTN modelling procedures, *Table 17* presents a summary of predicted road traffic noise levels at a reference distance of ten (10) metres from the edge of the road. It is noted that the CORTN procedures were utilised to determine the change in road traffic noise levels, rather than definitive noise levels.

Table 17: Predicted Existing Traffic Noise Levels @ 10m
L_{Aeq} dB(A) re: 20 x 10^{-6} Pa

Description	Predicted Traffic Noise Levels L_{Aeq}	
	Day $L_{Aeq,15hr}$	Night $L_{Aeq,9hr}$
Hawkesbury Valley Way	70.2	64.3

The predicted road traffic noise levels in the absence of the Mulgrave Substrate Plant at a reference distance of ten (10) metres show that the *ECRTN* baseline goals ($L_{Aeq,15hr}$ 60dB(A) and $L_{Aeq,9hr}$ 55dB(A)) would be exceeded.

Elf Farms Supplies Pty Ltd have provided projected heavy vehicle numbers for the operation of the facility at proposed capacity (3200t/week) as follows:

Day 35 trucks (70 trips)

Night 15 trucks (30 trips)

In addition staff vehicle number for each shift are assumed as follows:

Day 25 (50 trips)

Night 11 (22 trips)

Considering the above projected traffic volumes and assuming a 50/50 spilt of traffic east / west on Hawkesbury Valley Way, *Table 18* presents a summary of the projected vehicle numbers incorporating the proposed development.

Table 18: Vehicle Volumes + Substrate Plant

Description	Traffic Volumes			Heavy Vehicle Percentage (%)
	Light	Heavy	Total	
Hawkesbury Valley Way				
- Day	974	102	1076	9.5
- Night	201	35	236	14.8

Based on the projected traffic volumes summarised in *Table 18* and CORTN modelling procedures, *Table 19* presents a summary of the predicted road traffic noise levels at a reference distance of ten (10) metres from the edge of the road together with the predicted increase in traffic noise levels.

Table 19: Predicted Future Traffic Noise Levels @ 10m with Substrate Plant
L_{Aeq} dB(A) re: 20 x 10^{-6} Pa

Description	Predicted Traffic Noise Levels L_{Aeq}	
	Day $L_{Aeq,15hr}$	Night $L_{Aeq,9hr}$
Hawkesbury Valley Way	70.4 (+0.2)	64.6 (+0.3)

() Predicted increase in noise levels shown in () brackets

The predicted road traffic noise levels incorporating the operation of the substrate facility at a reference distance of ten (10) metres from the edge of Hawkesbury Valley Way and Mulgrave Road show that the proposal would not result in an increase to the existing traffic noise levels by more than 2dB(A).

7.4 Operational Noise Control Recommendations and Management

The results of the noise modelling show that predicted operational noise levels from the proposed expansion of the existing substrate facility satisfy the recommended assessment goals. To mitigate potential noise impacts, the following conceptual control measures have been adopted and considered in the noise modelling. Prior to construction all noise control measures shall be reviewed and assessed in accordance with Development Approval Conditions and in consultation with Acoustic Consultant.

- Site layout generally in accordance with *Figure 2*;
- Finished site levels approximately RL16-17 with building heights of approximately eight to twelve (8-12) metres for Pre Wet Shed, seven to ten (7-10) metres for Bale Storage Shed and eleven (11) metres for new Phase 2/3 building;
- The plant sound power levels nominated in *Table 11*;
- Cooling towers, compressors, conveyor drives, and mobile plant and equipment selected to satisfy the referenced acoustic performance.
- Details of all mechanical plant and equipment shall be subject to review by Acoustic Consultant prior to final specification;
- Seven (7.0) metre high wall adjacent southern side of Stage 1 Bale Storage Shed and Bale Wetting Area should be constructed during Stage 1 works;
- Building walls (Bale Storage and Pre Wet) consist of concrete to a height of two (2) metres above FFL followed by galvanised steel frame and galvanised wall / roof sheeting nominally 0.6mm BMT and a minimum Rw22. Final details subject to review prior to final specification;
- Internal walls and roof of tunnels within Phase 2/3 building constructed of concrete blockwork and/or Hebel panels/blocks;
- Building wall cladding (Phase 2/3building) consisting of insulated colorbond sandwich panels consistent with existing Phase 2/3 building providing a nominal installed noise reduction in the order of 23dB(A) (Rw28 or greater). Final details subject to review prior to final specification;

- Building roof cladding consisting of sheet metal (min. 0.42BMT) over fibreglass building blanket and medium duty thermofoil or similar and insulated colorbond sandwich panel (ceiling) consistent with existing Phase 2/3 building providing a nominal installed noise reduction in the order of 28dB(A) (Rw34 or greater). Final details subject to review prior to final specification;
- Truck drivers instructed and contracted to operate trucks on the site access roads at less than 20kph;
- Where practical mobile plant shall be fitted with low level or broadband 'quacker' reversing alarms; and
- The existing Environmental Management Plan should be amended and updated to ensure the following items are incorporated:
    - procedures for residents to contact site management in regard to complaints or additional information;
    - follow-up procedures to inform residents of actions implemented following any noise complaints;
    - regular inspections of all site plant including trucks to ensure that the installed noise suppression units are functioning and require no maintenance; and,
    - regular audits at sensitive receiver locations to identify additional procedures to minimise noise emissions from the site.

8.0 CONCLUSION

Elf Farm Supplies Pty Ltd (*ELF*) propose to expand the existing mushroom substrate plant at Mulgrave. The site is located within a portion of land bounded by South Creek to the west, Hawkesbury Valley Way to the north, Mulgrave Road to the east and Richmond Rail Line to the south (*Figure 1*).

Atkins Acoustics was engaged by Perram & Partners on behalf of Elf Farm Supplies Pty Ltd to prepare an operation and construction noise assessment for the proposal.

Site inspections and noise measurements confirmed that the noise environment at potential exposed receiver locations are subjected to noise from road traffic on Hawkesbury Valley Way, Blacktown Richmond Railway, existing industrial and commercial operations within Mulgrave and South Windsor Industrial Precincts and domestic activities. Referenced to the *INP* the areas potentially exposed to noise from the subject development would be described as *Urban*.

The nearest potentially affected residential dwellings are located to the north (46 Mulgrave Road – feedlot and associated residence) and south-east (commercial market garden - 124 Mulgrave Road and isolated residential dwellings - 2 Railway Road) and west (Chisholm Place, South Windsor) of the development. The closest residential dwellings are located approximately, 460m north, 170-280m south-east and 390m to the west of the facility. *Table 1* and *Figure 3* identifies the receiver locations selected for noise assessment.

Goals for the assessing environmental noise impacts from the proposal have been developed from procedures documented in the DECCW, Interim Construction Noise Guideline *(ICNG)*, Industrial Noise Policy *(INP),* Noise Guide for Local Government *(NGLG)* and the Environmental Criteria for Road Traffic Noise *(ECRTN)*.

Construction noise modelling for the proposal has shown that the recommended construction noise goals are generally satisfied at the reference receiver locations. Additional measures have been recommended to further reduce construction noise from the proposal.

Noise modelling for the operating scenarios representing day/evening and night and represents a range of activities, situations and noise levels likely to be emitted from the site and with all plant and equipment operating simultaneously. Whilst these situations will not occur all of the time, the noise modelling represents typical worst-case operating scenarios. The noise predictions conducted in accordance with *INP* procedures for Stage 3 final design level of 3,200t/week show that during calm and specific adverse meteorological conditions the operational noise levels satisfy the recommended project assessment goals.

Noise modelling for envisaged night-time activities (airbrake release) has shown that the likely intermittent noise sources satisfy the *NGLG* disturbance goals.

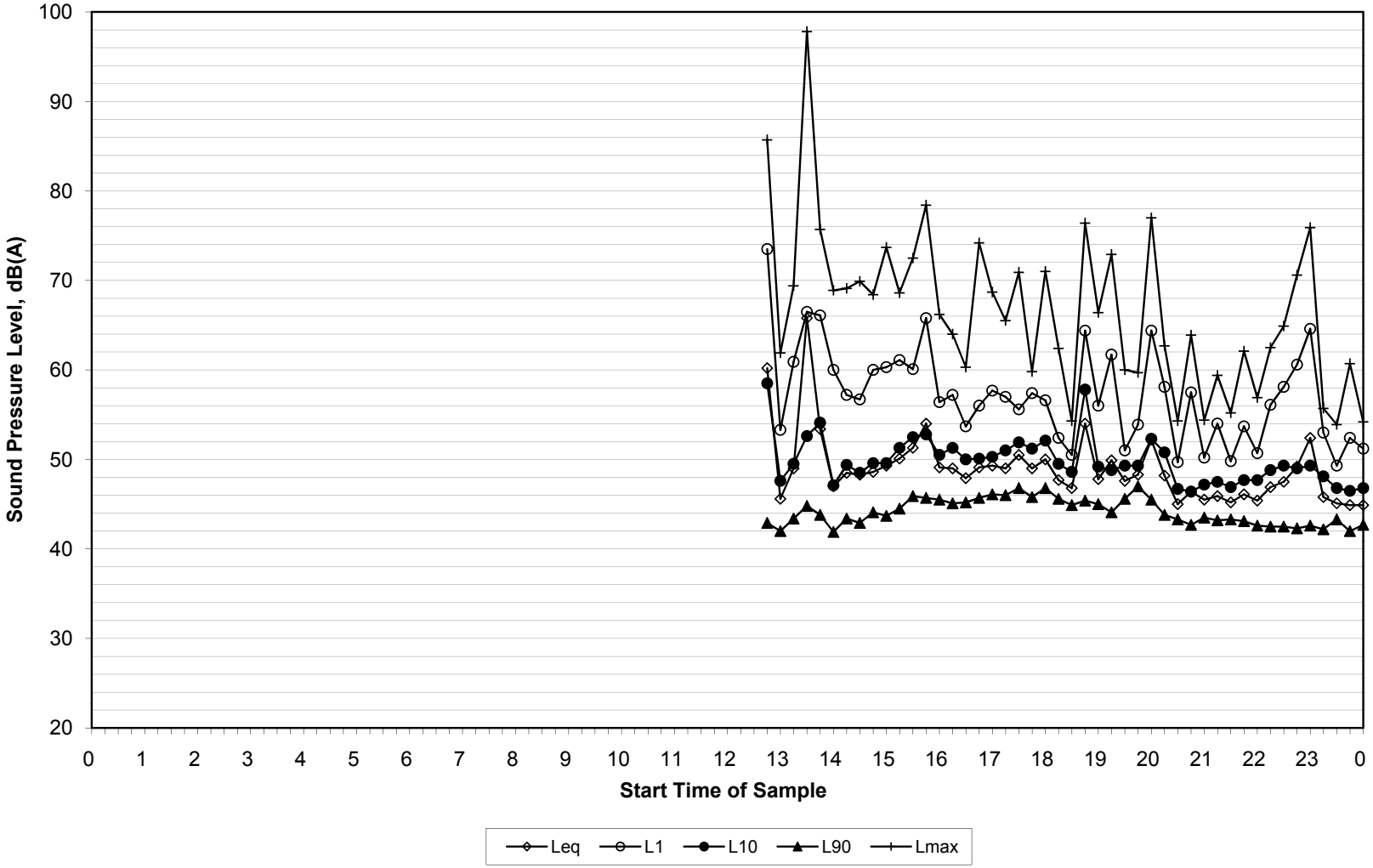
The results and findings presented in this report are based on the understanding that effective noise mitigation controls (*Section 7.4*) are incorporated into the design and operation of the proposed facility and that noise limits imposed by any pending Development Approval are satisfied.

The predicted road traffic noise levels incorporating the substrate facility show that the proposal would not result in an increase to the existing traffic noise levels on Hawkesbury Valley Way or Mulgrave Road by more than 2dB(A) and satisfy the *ECRTN* assessment goals.

APPENDIX 1: AMBIENT NOISE MEASUREMENT RESULTS

Ambient Sound Pressure Levels

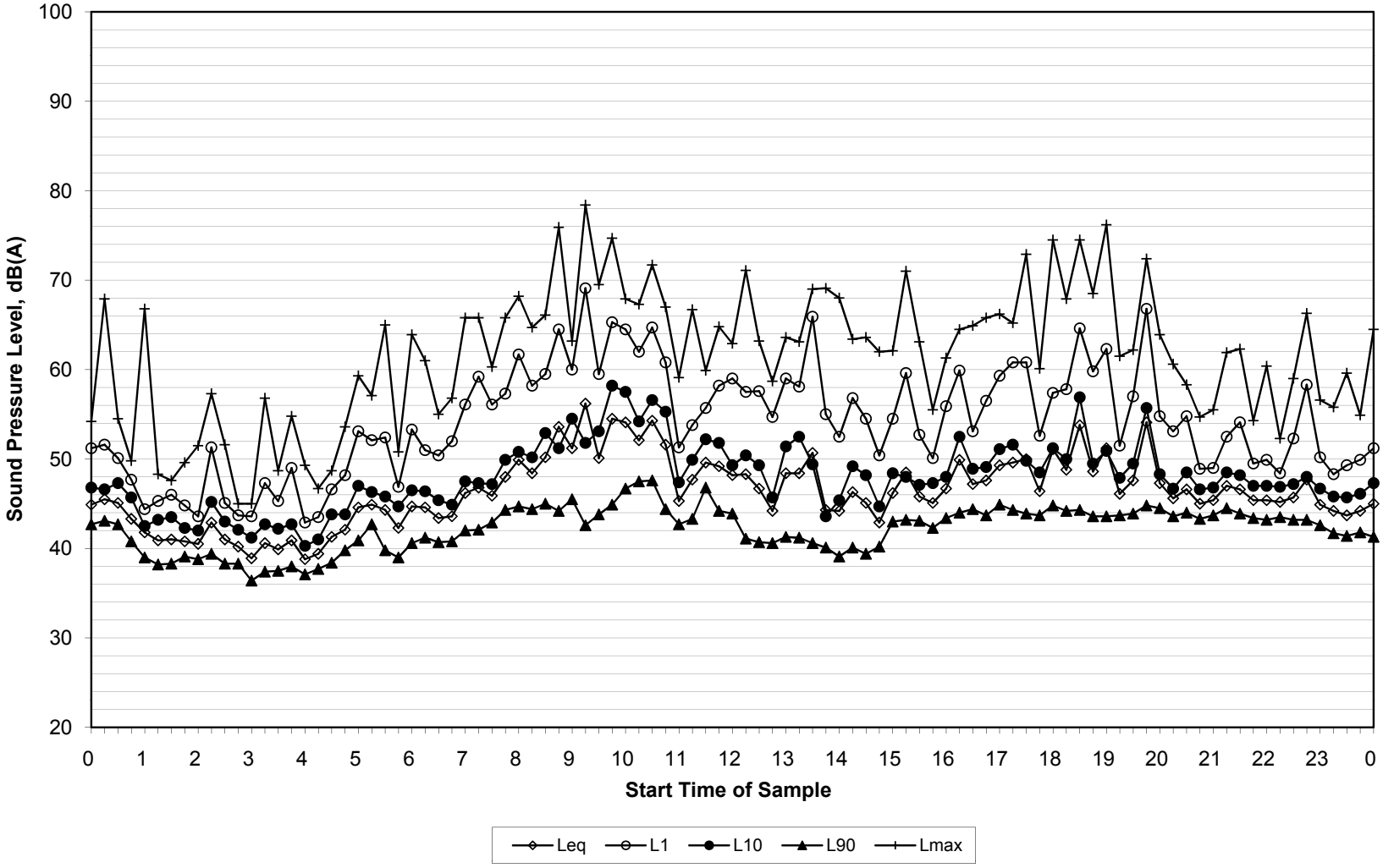
Friday, 20 March 2009



Location 1 - north
46 Mulgrave Road, Mulgrave

Ambient Sound Pressure Levels

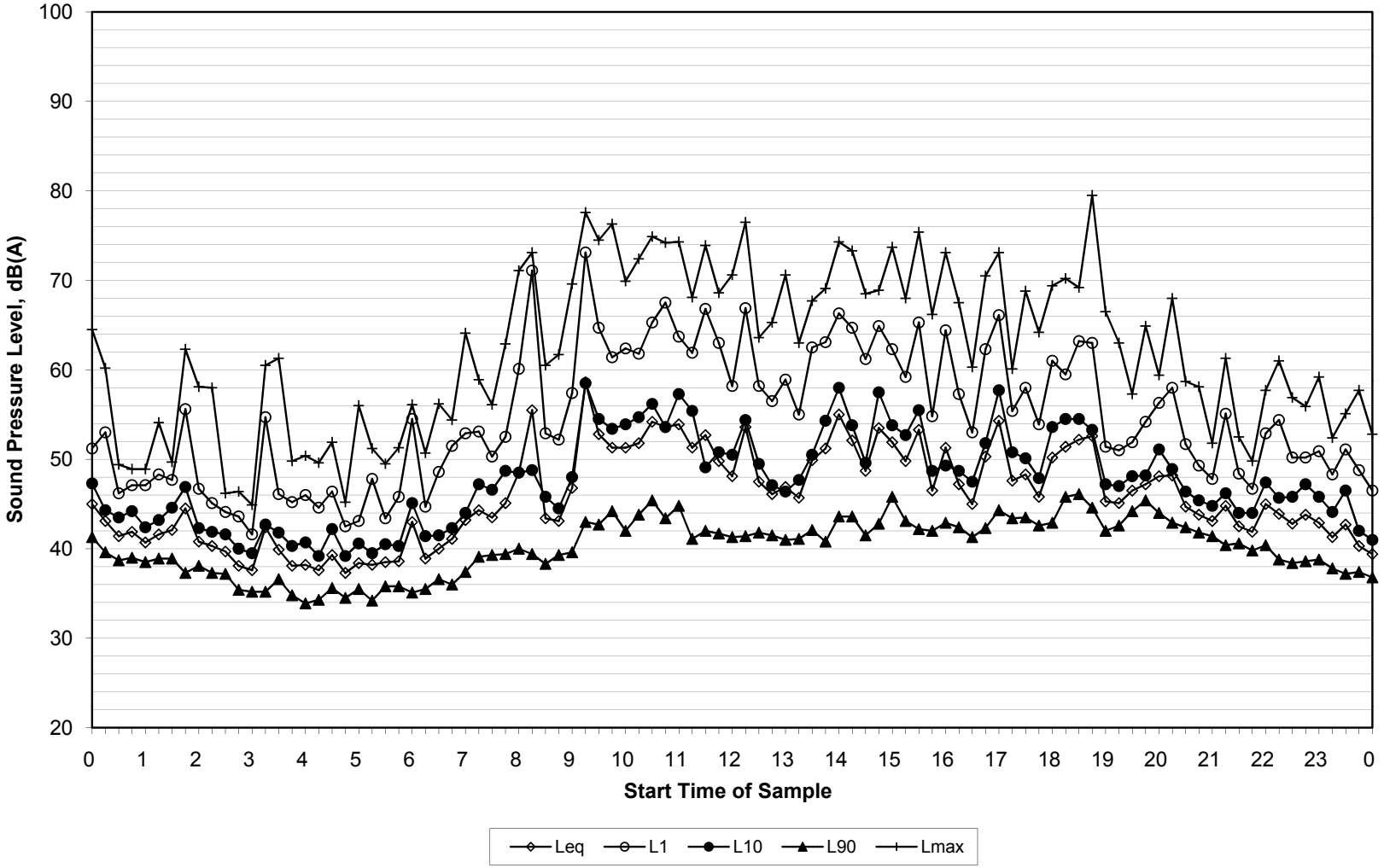
Saturday, 21 March 2009



Location 1 - north
46 Mulgrave Road, Mulgrave

Ambient Sound Pressure Levels

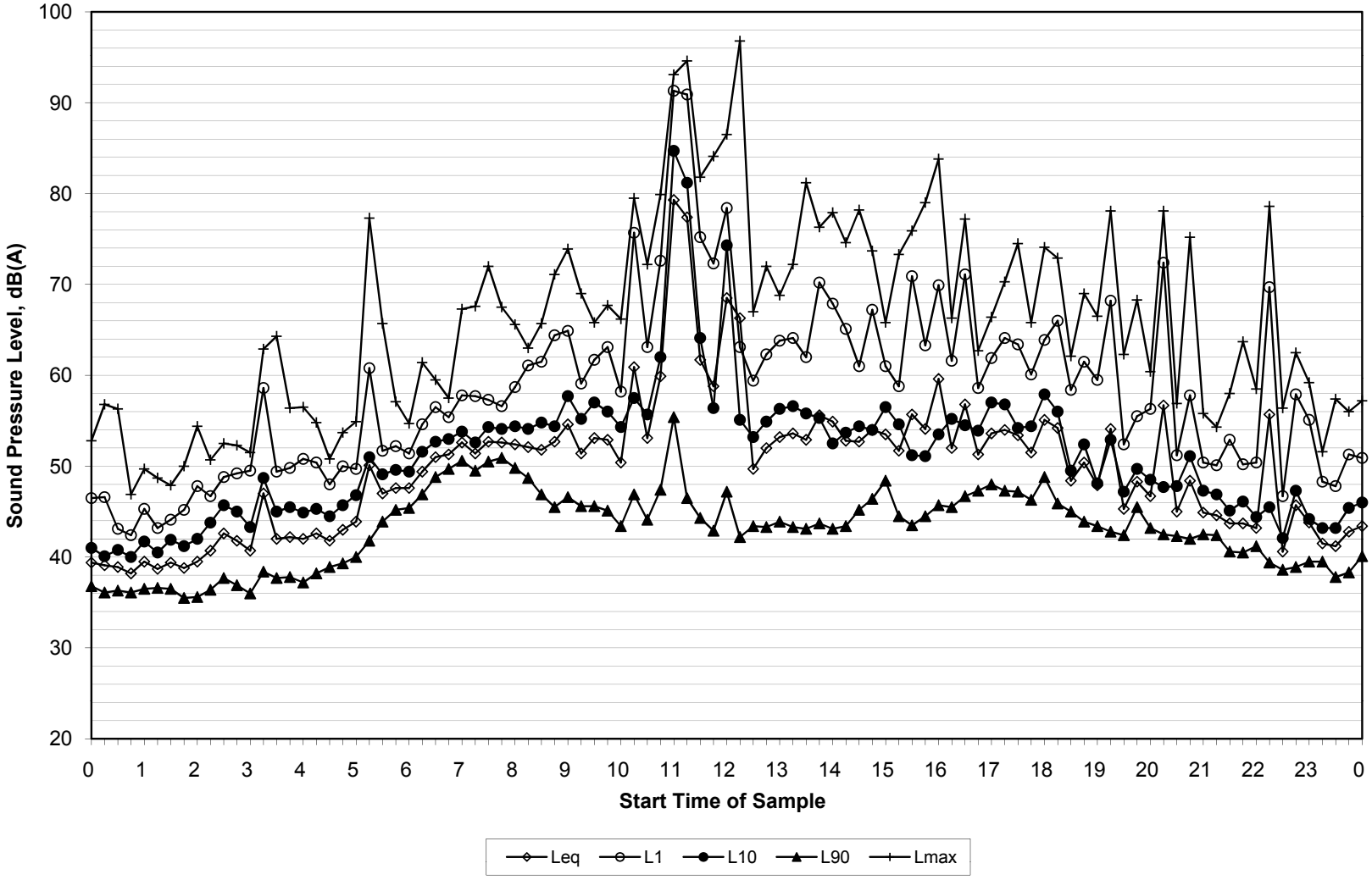
Sunday, 22 March 2009



Location 1 - north
46 Mulgrave Road, Mulgrave

Ambient Sound Pressure Levels

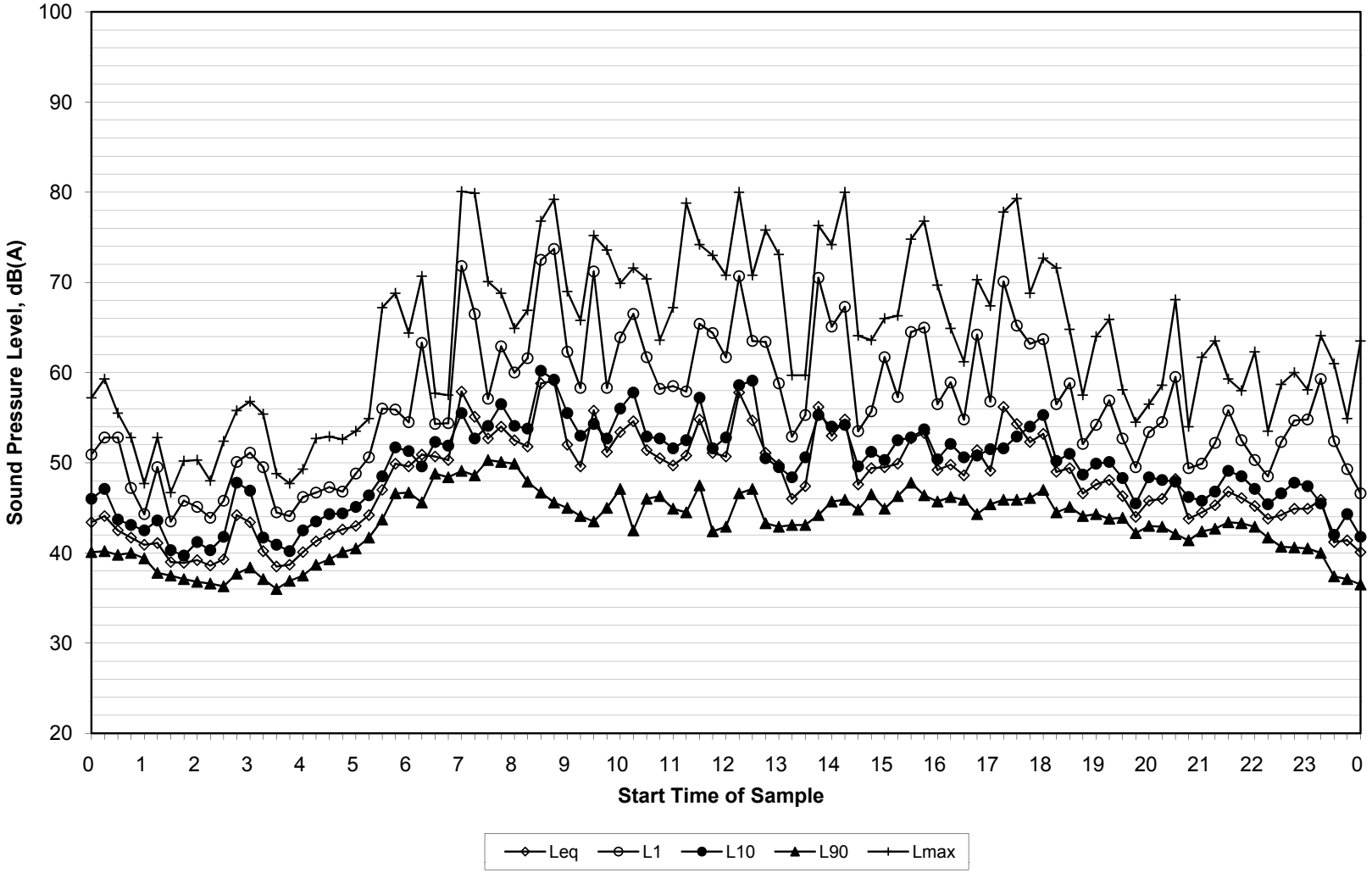
Monday, 23 March 2009



Location 1 - north
46 Mulgrave Road, Mulgrave

Ambient Sound Pressure Levels

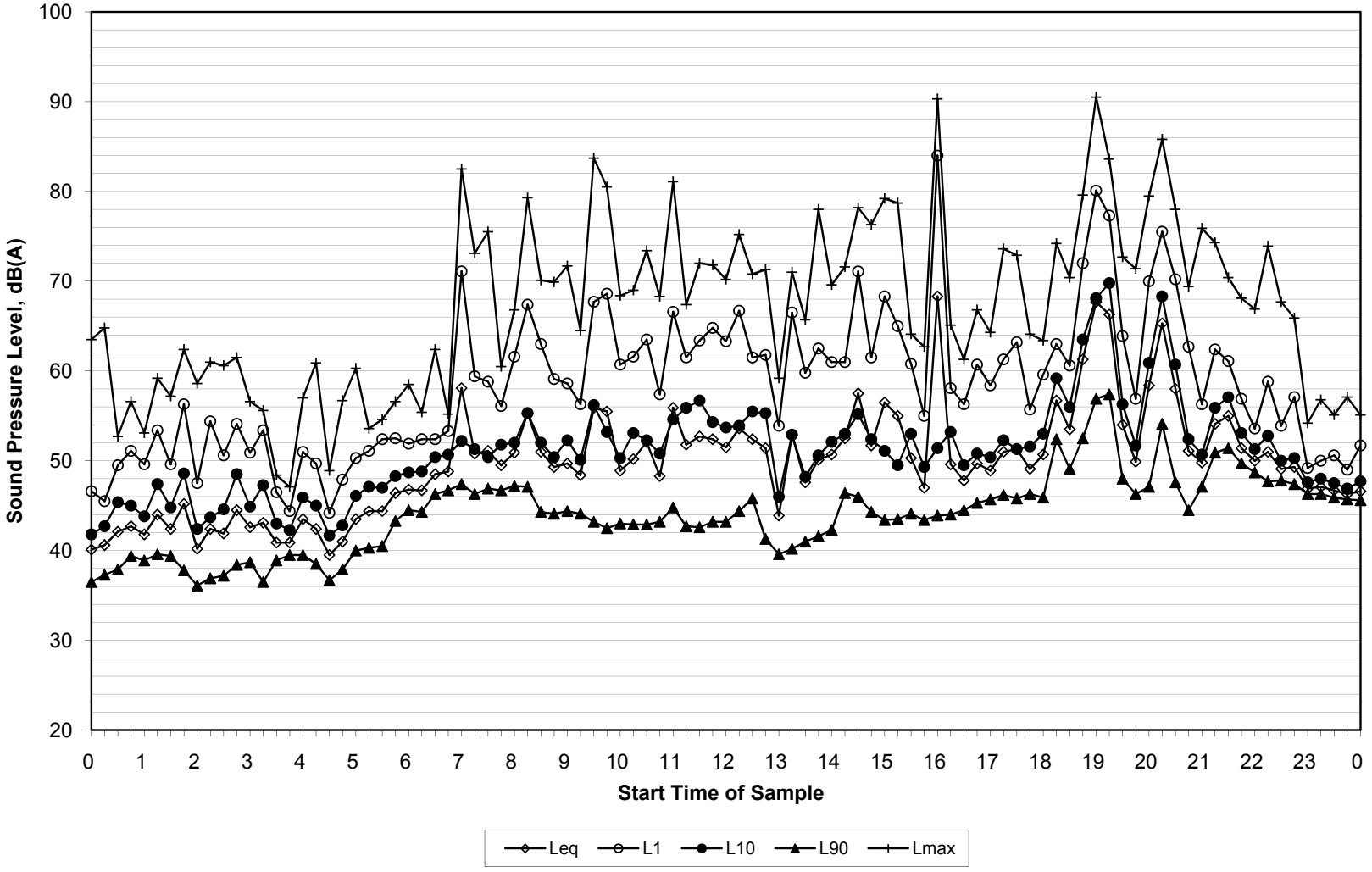
Tuesday, 24 March 2009



Location 1 - north
46 Mulgrave Road, Mulgrave

Ambient Sound Pressure Levels

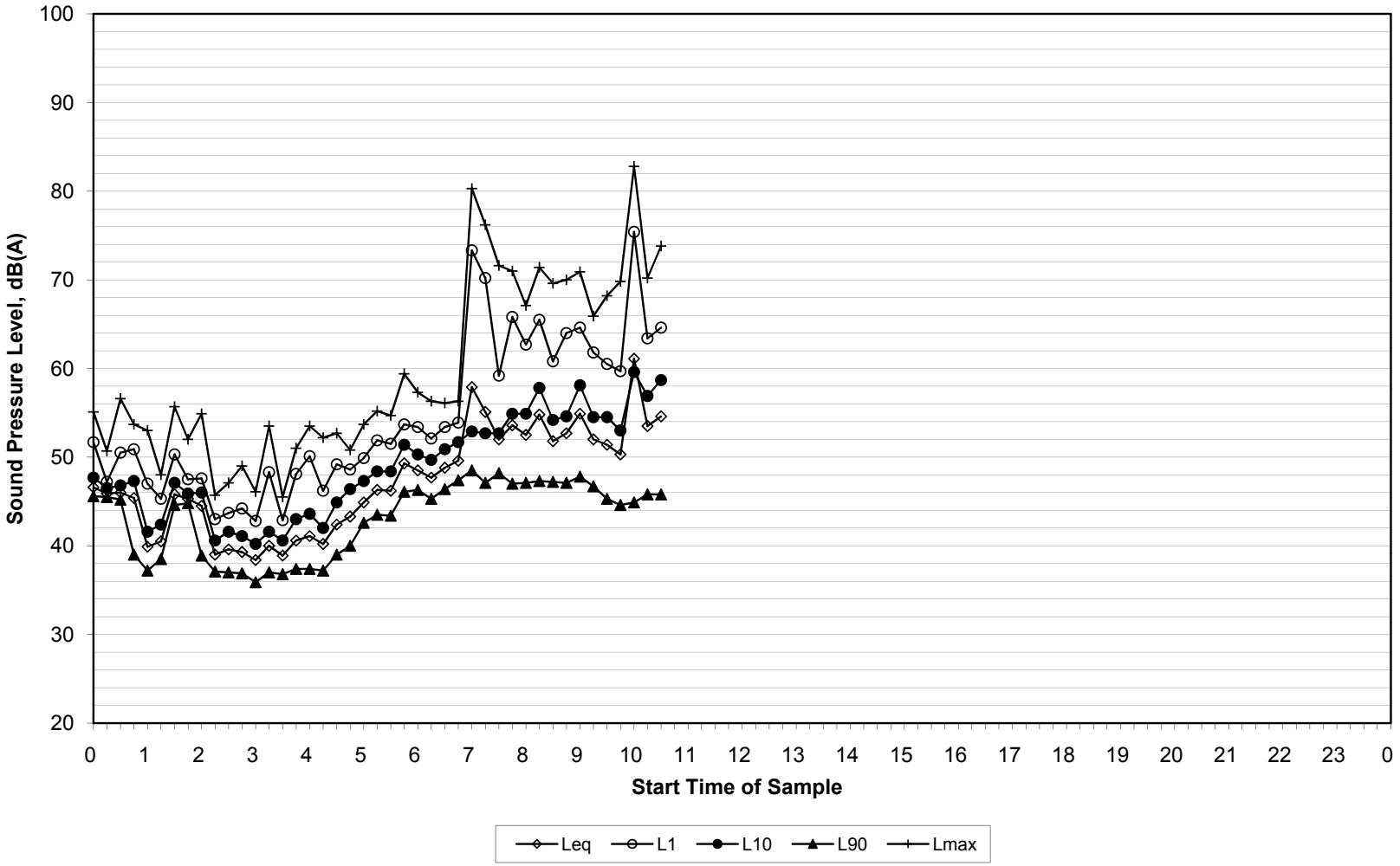
Wednesday, 25 March 2009



Location 1 - north
46 Mulgrave Road, Mulgrave

Ambient Sound Pressure Levels

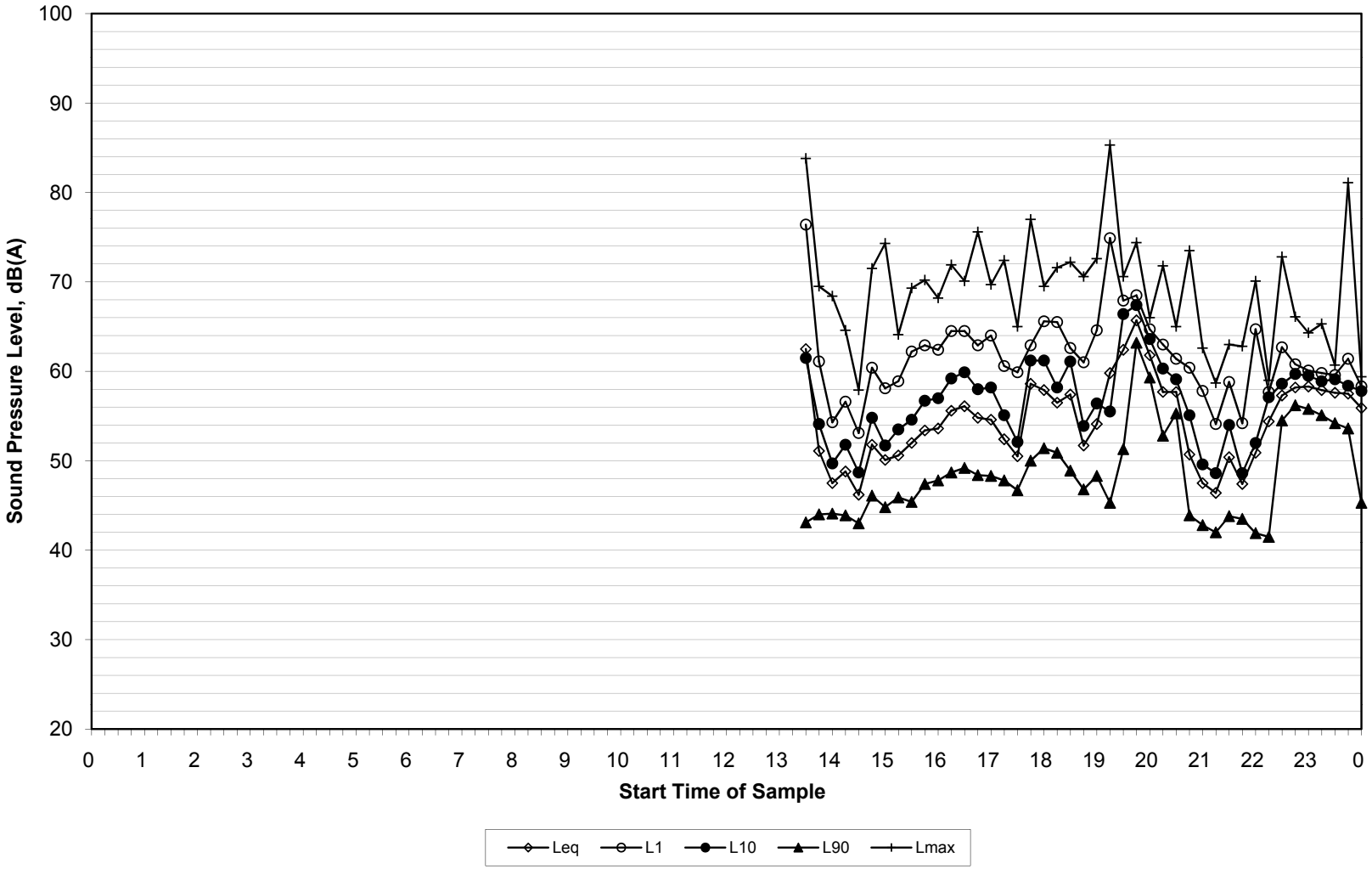
Thursday, 26 March 2009



Location 1 - north
46 Mulgrave Road, Mulgrave

Ambient Sound Pressure Levels

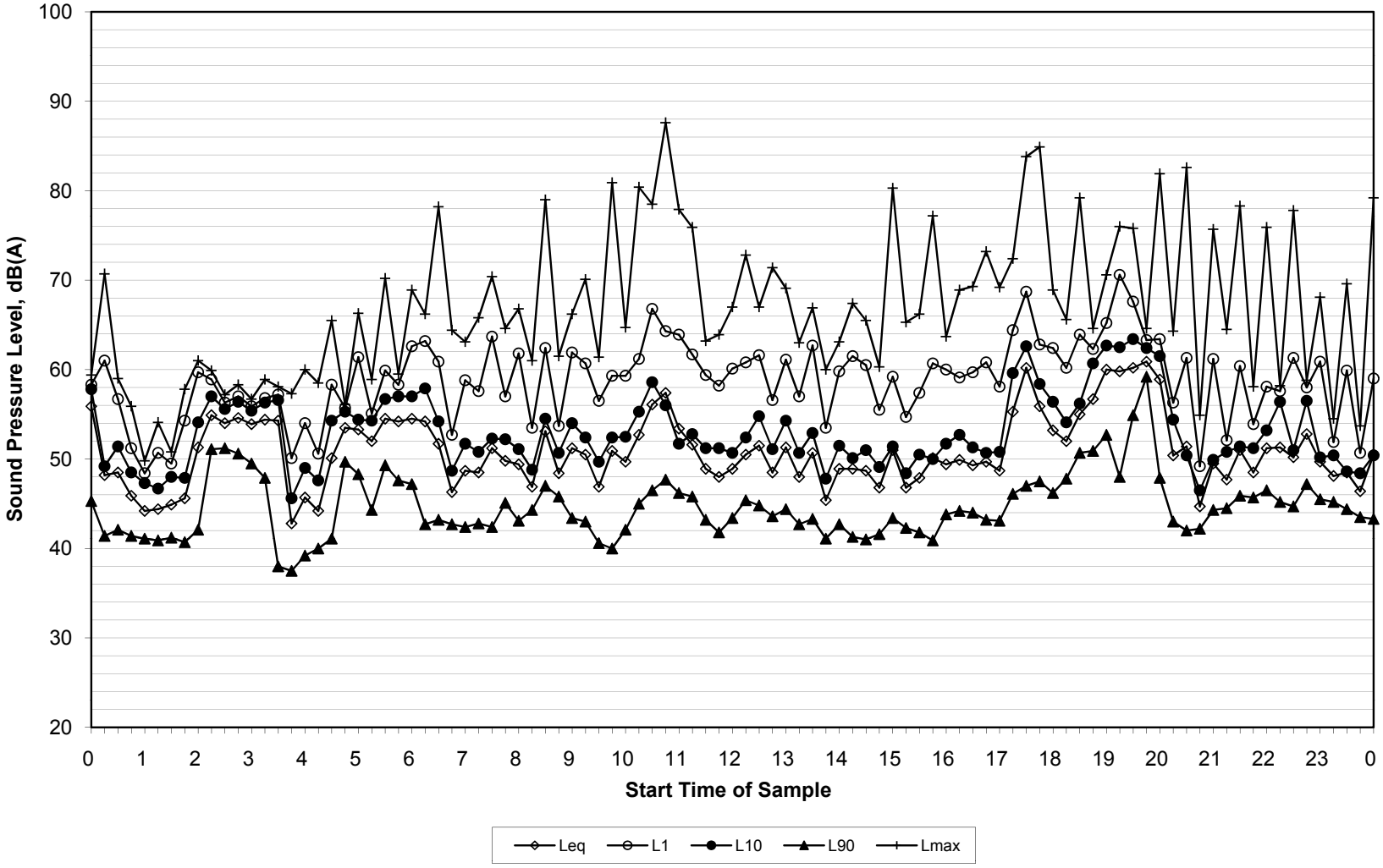
Friday, 20 March 2009



Location 2 - south
124 Mulgrave Road, Mulgrave

Ambient Sound Pressure Levels

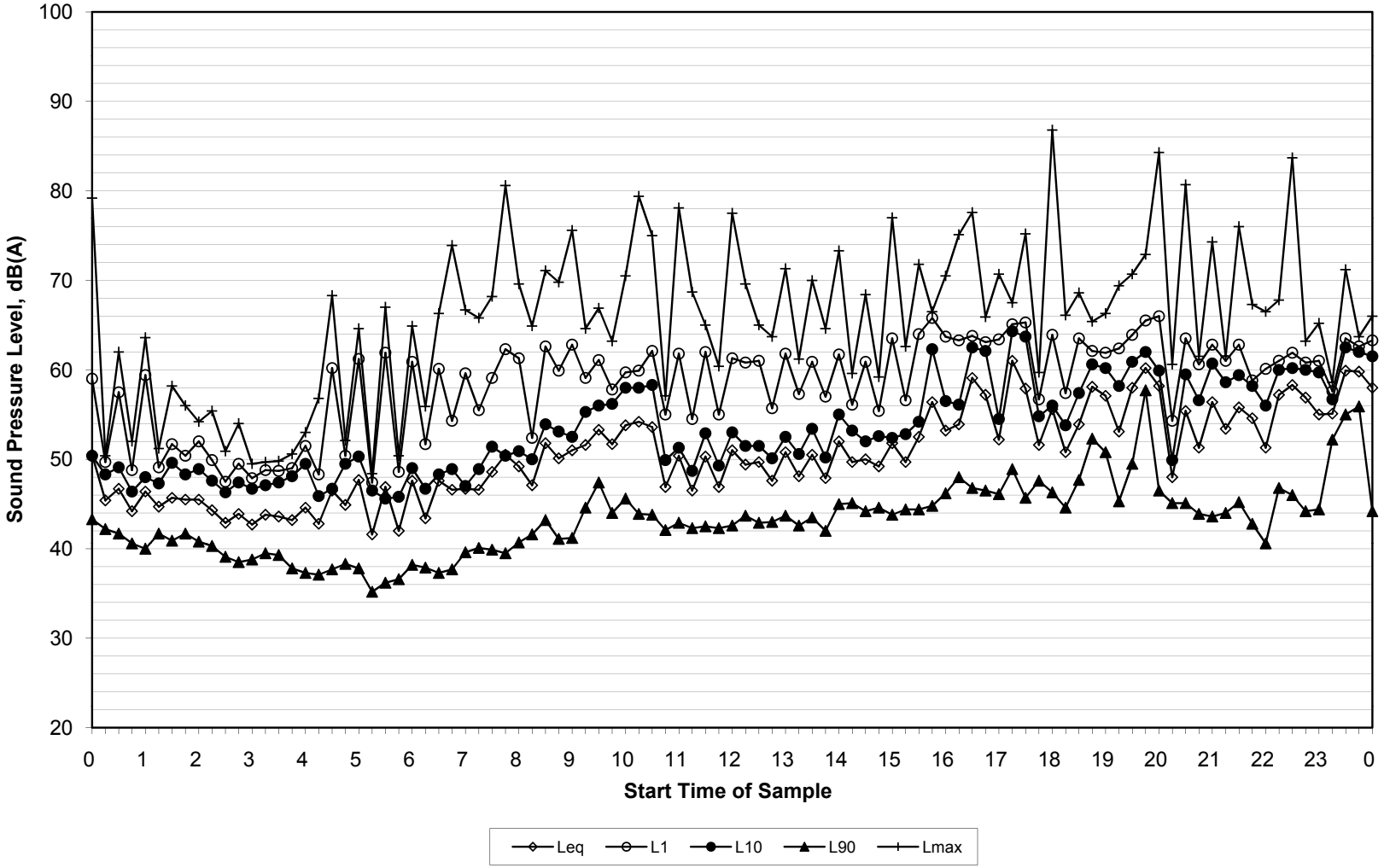
Saturday, 21 March 2009



Location 2 - south
124 Mulgrave Road, Mulgrave

Ambient Sound Pressure Levels

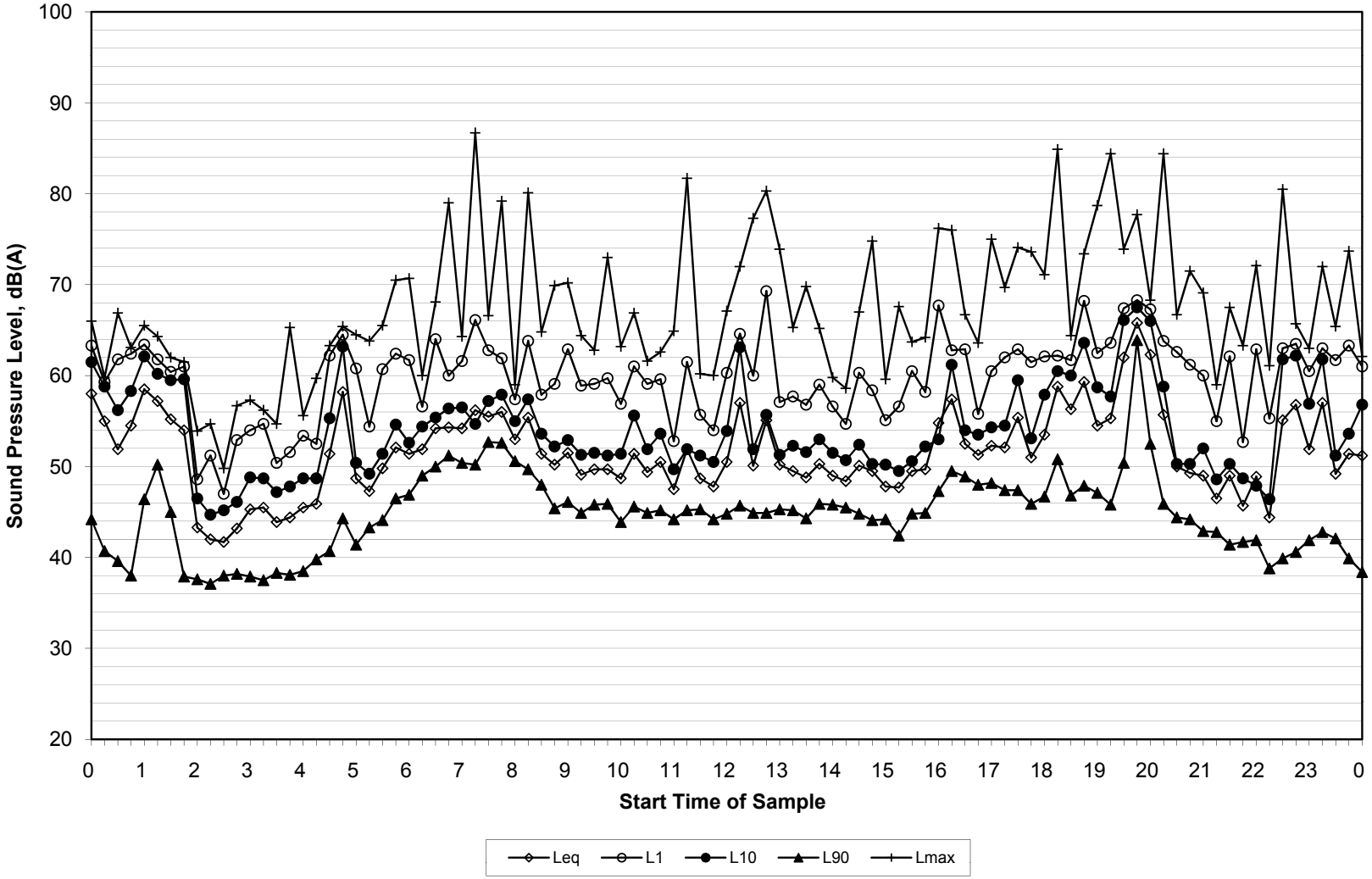
Sunday, 22 March 2009



Location 2 - south
124 Mulgrave Road, Mulgrave

Ambient Sound Pressure Levels

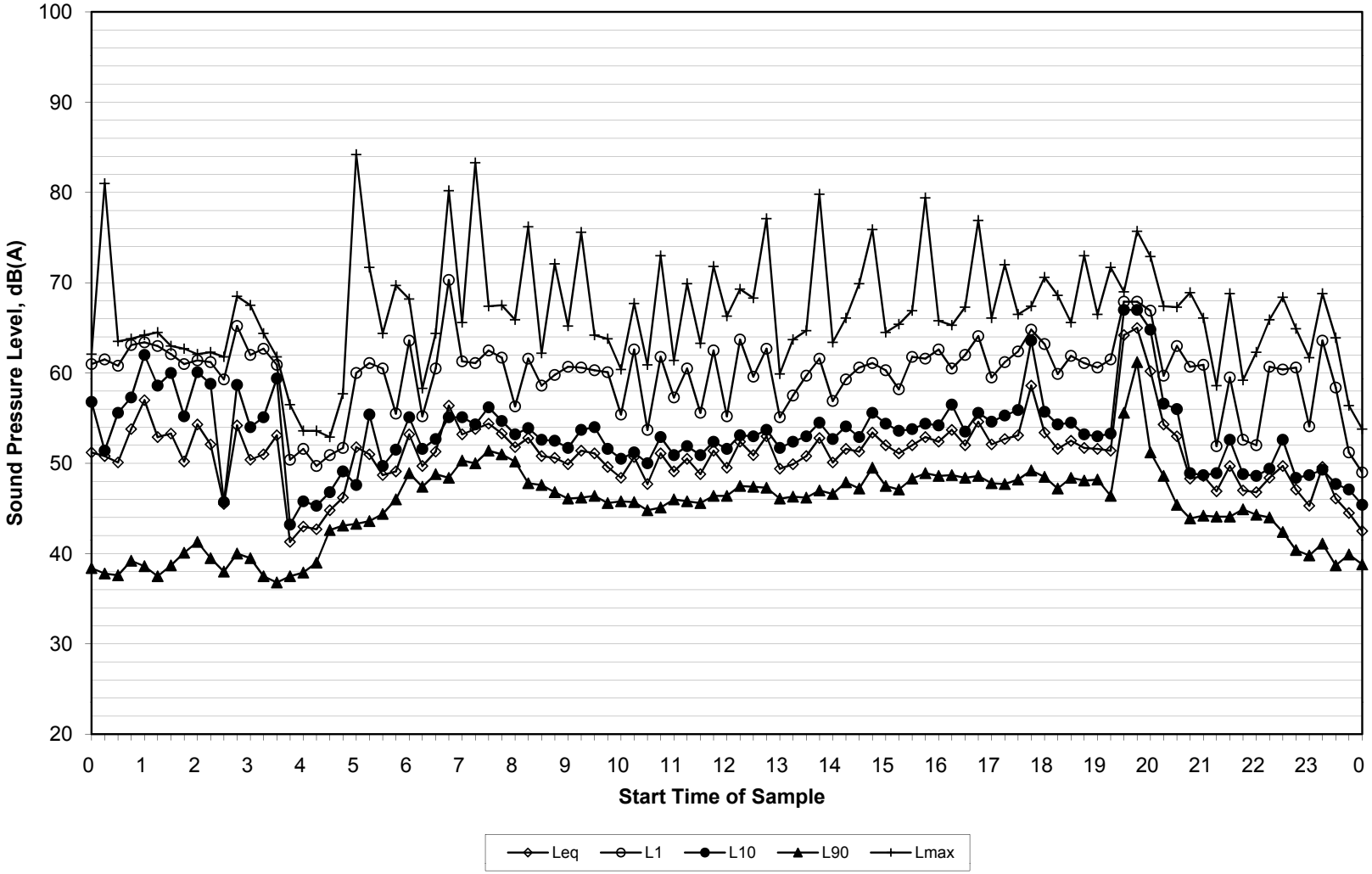
Monday, 23 March 2009



Location 2 - south
124 Mulgrave Road, Mulgrave

Ambient Sound Pressure Levels

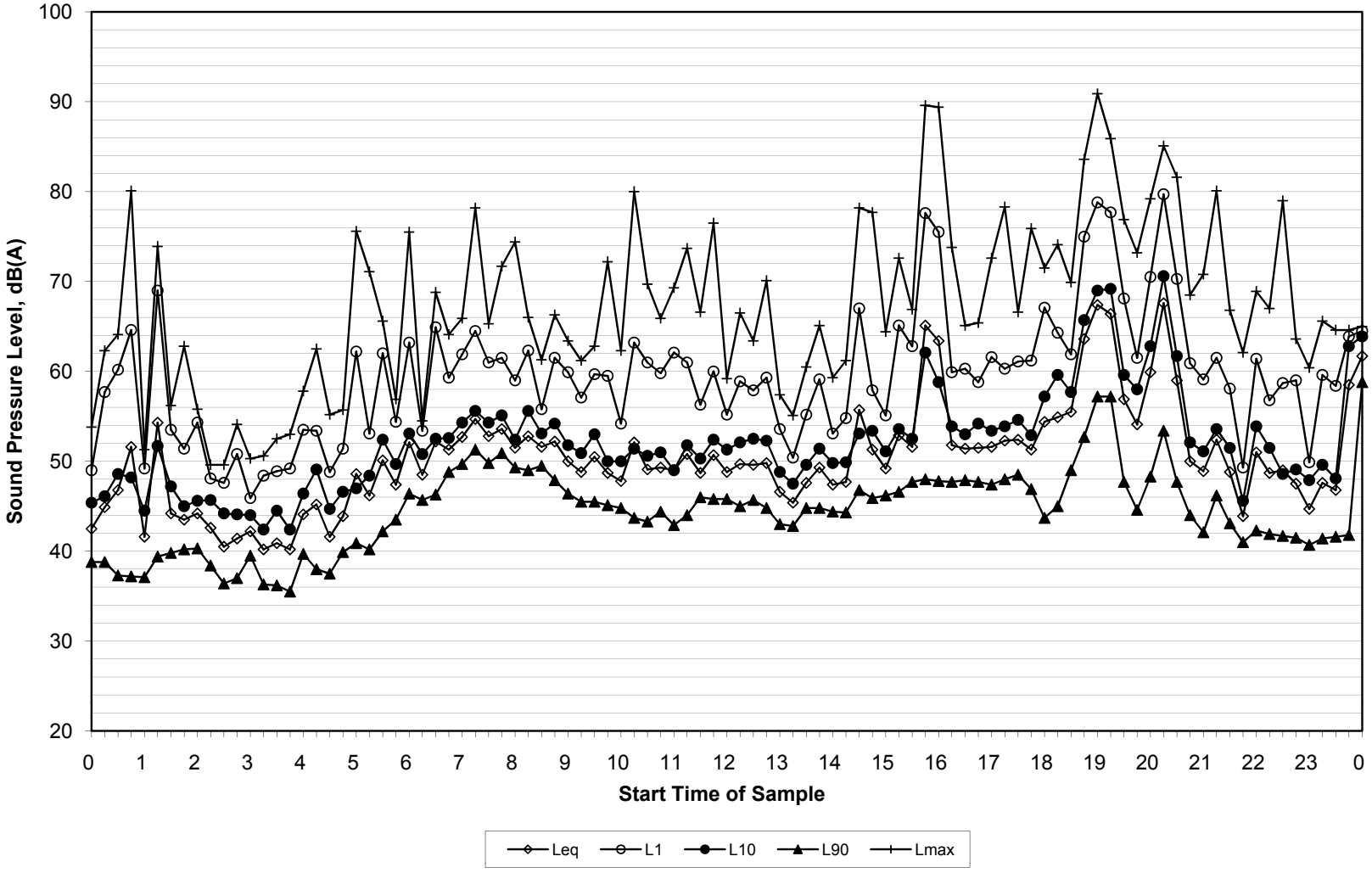
Tuesday, 24 March 2009



Location 2 - south
124 Mulgrave Road, Mulgrave

Ambient Sound Pressure Levels

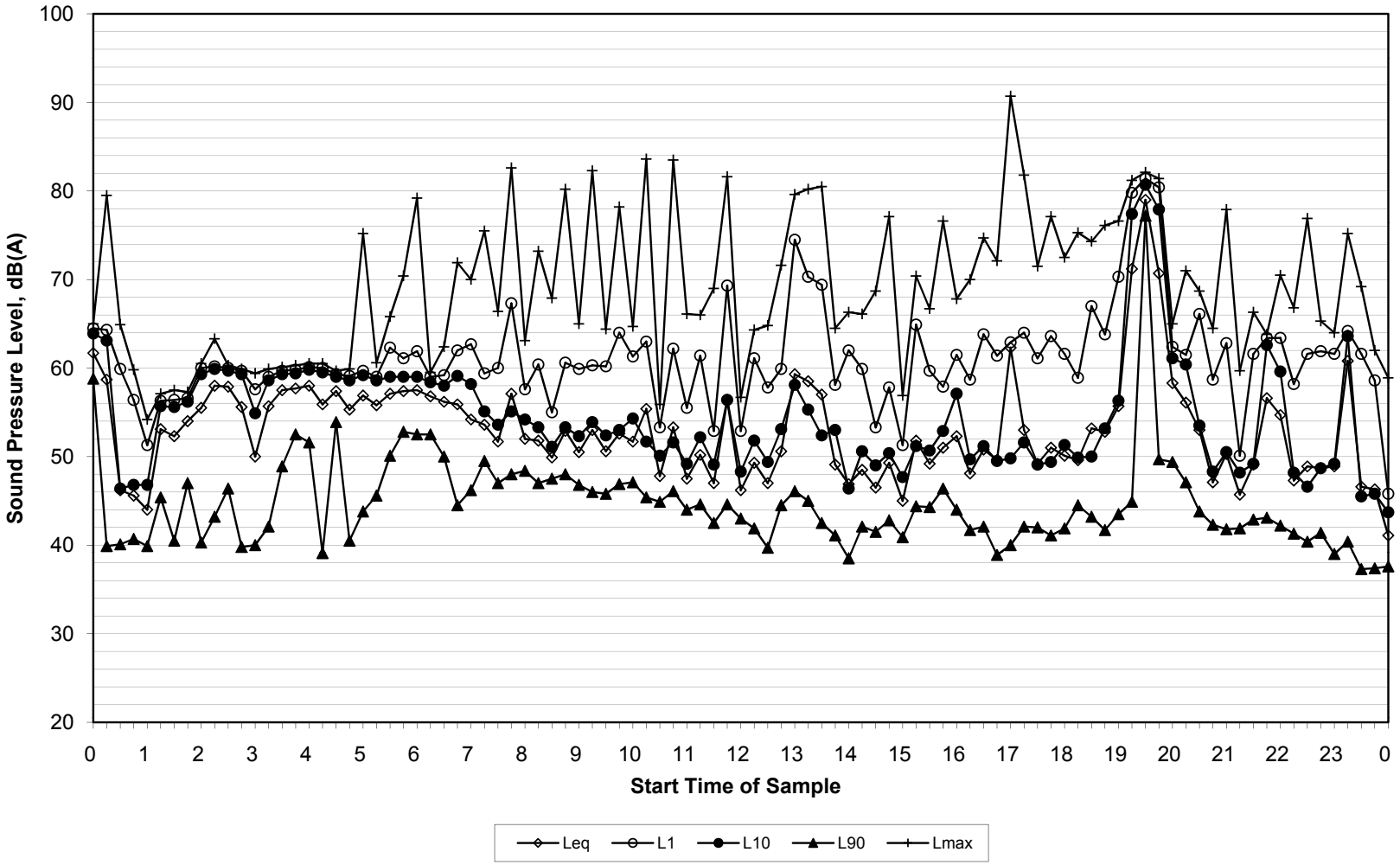
Wednesday, 25 March 2009



Location 2 - south
124 Mulgrave Road, Mulgrave

Ambient Sound Pressure Levels

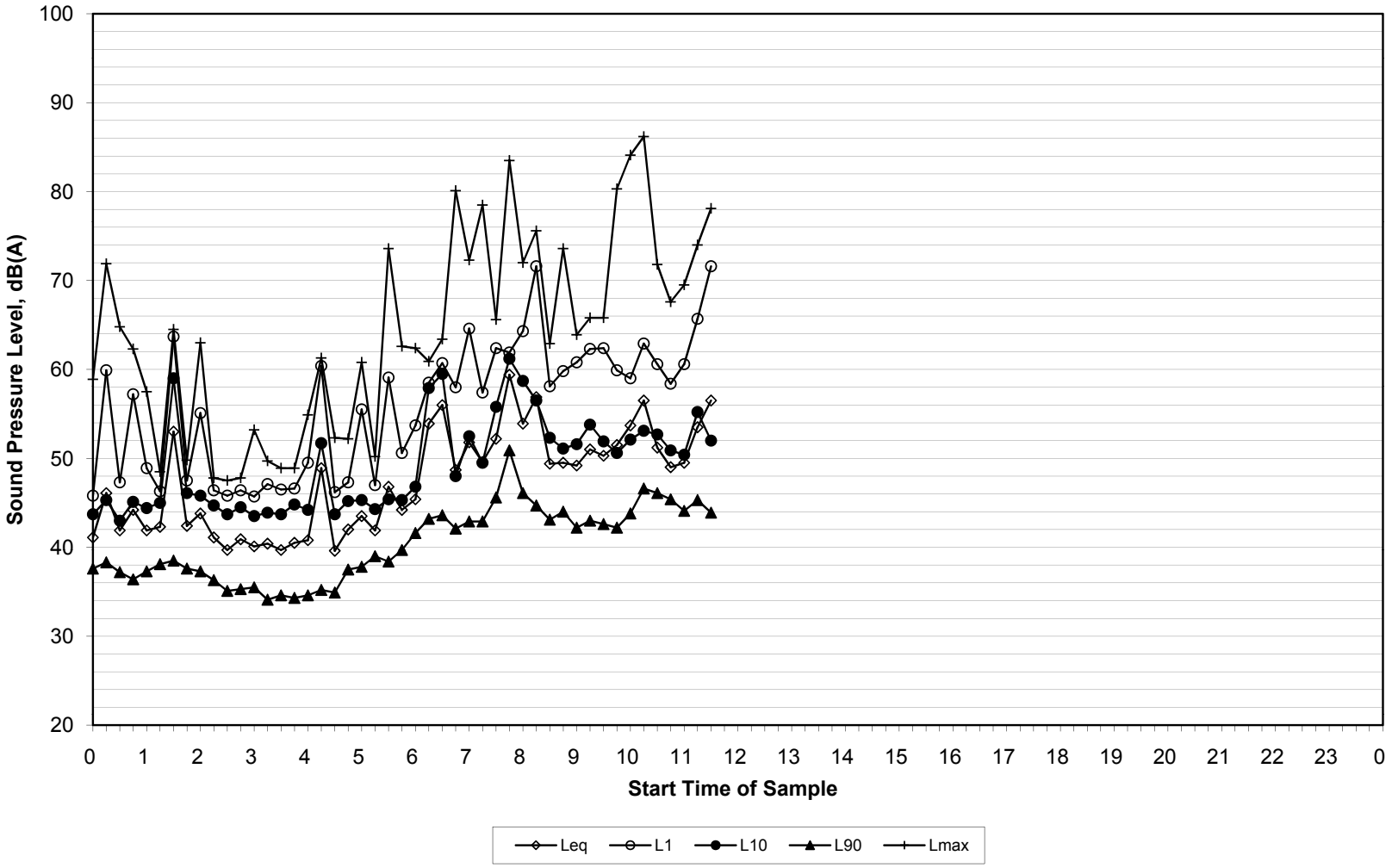
Thursday, 26 March 2009



Location 2 - south
124 Mulgrave Road, Mulgrave

Ambient Sound Pressure Levels

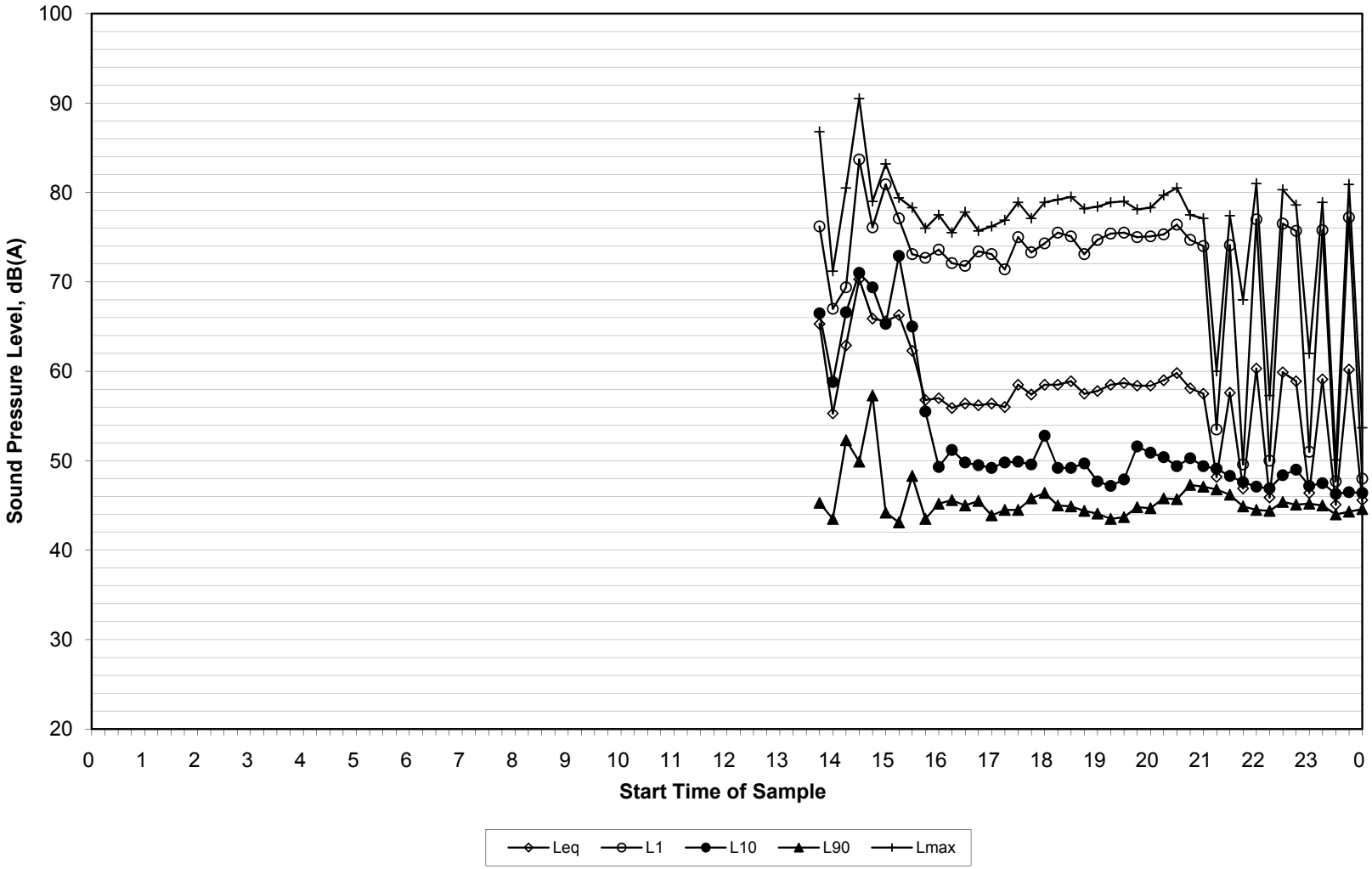
Friday, 27 March 2009



Location 2 - south
124 Mulgrave Road, Mulgrave

Ambient Sound Pressure Levels

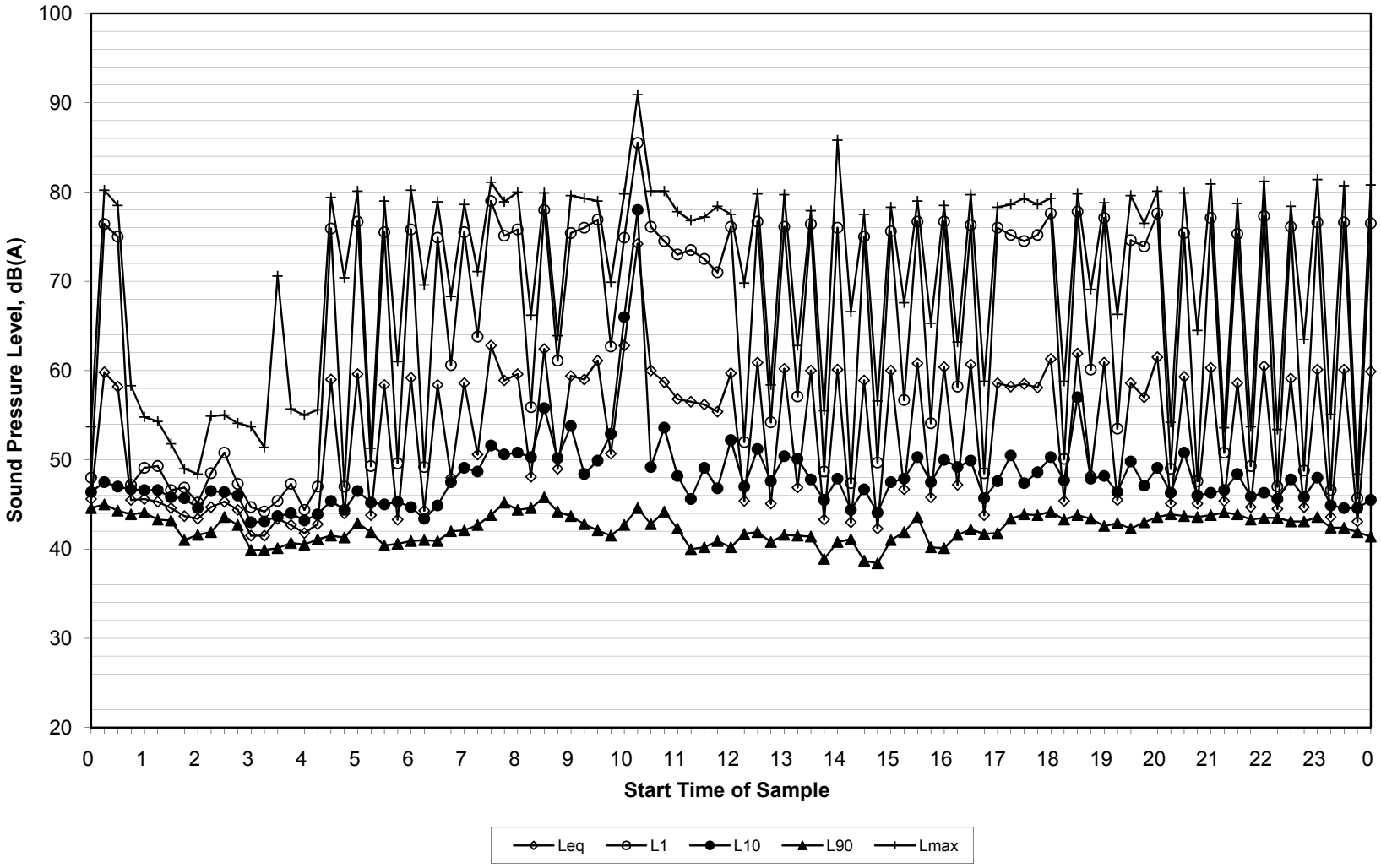
Friday, 20 March 2009



Location 3 - west
3 Chisholm Place, South Windsor

Ambient Sound Pressure Levels

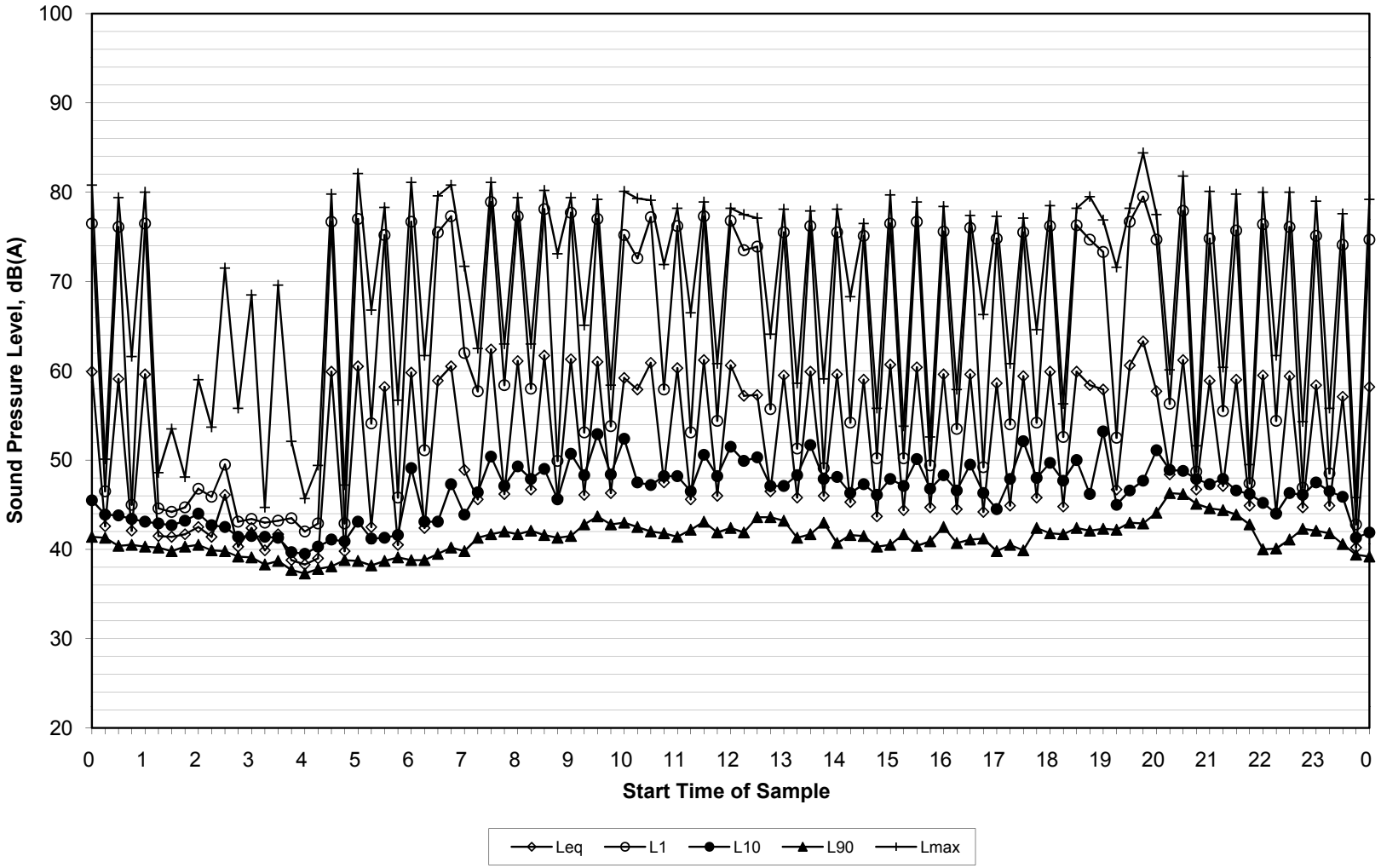
Saturday, 21 March 2009



Location 3 - west
3 Chisholm Place, South Windsor

Ambient Sound Pressure Levels

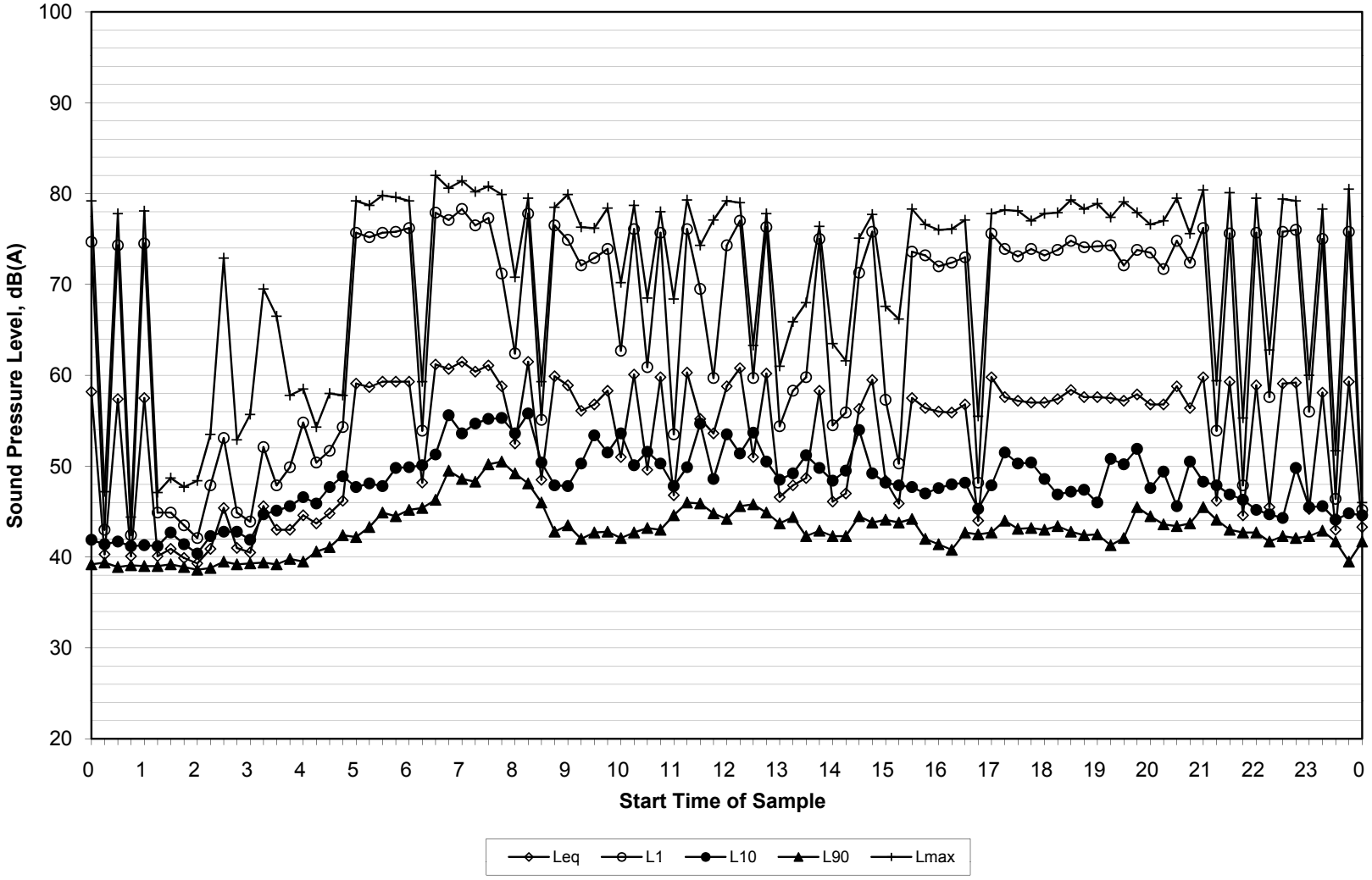
Sunday, 22 March 2009



Location 3 - west
3 Chisholm Place, South Windsor

Ambient Sound Pressure Levels

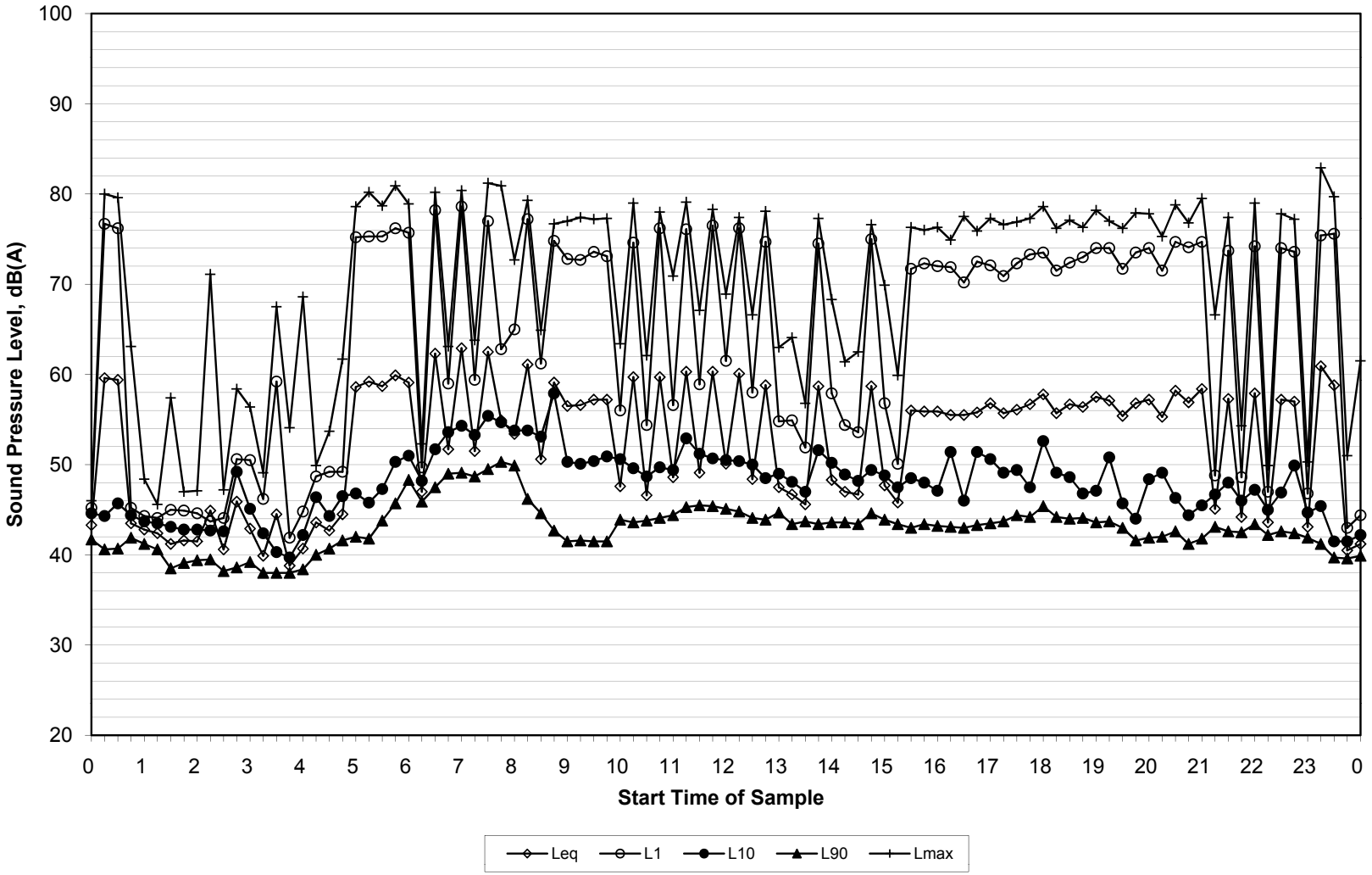
Monday, 23 March 2009



Location 3 - west
3 Chisholm Place, South Windsor

Ambient Sound Pressure Levels

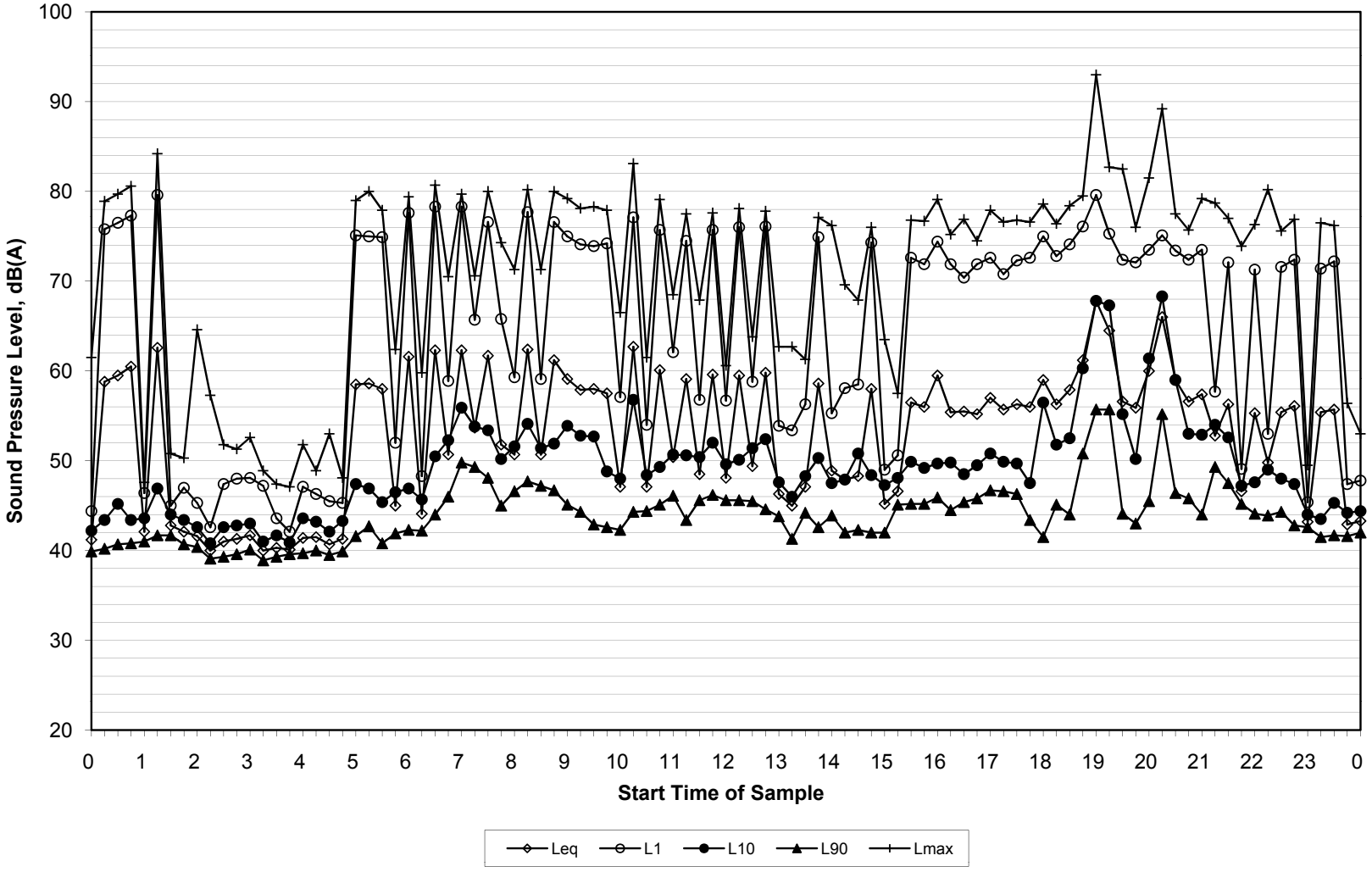
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Location 3 - west
3 Chisholm Place, South Windsor

Ambient Sound Pressure Levels

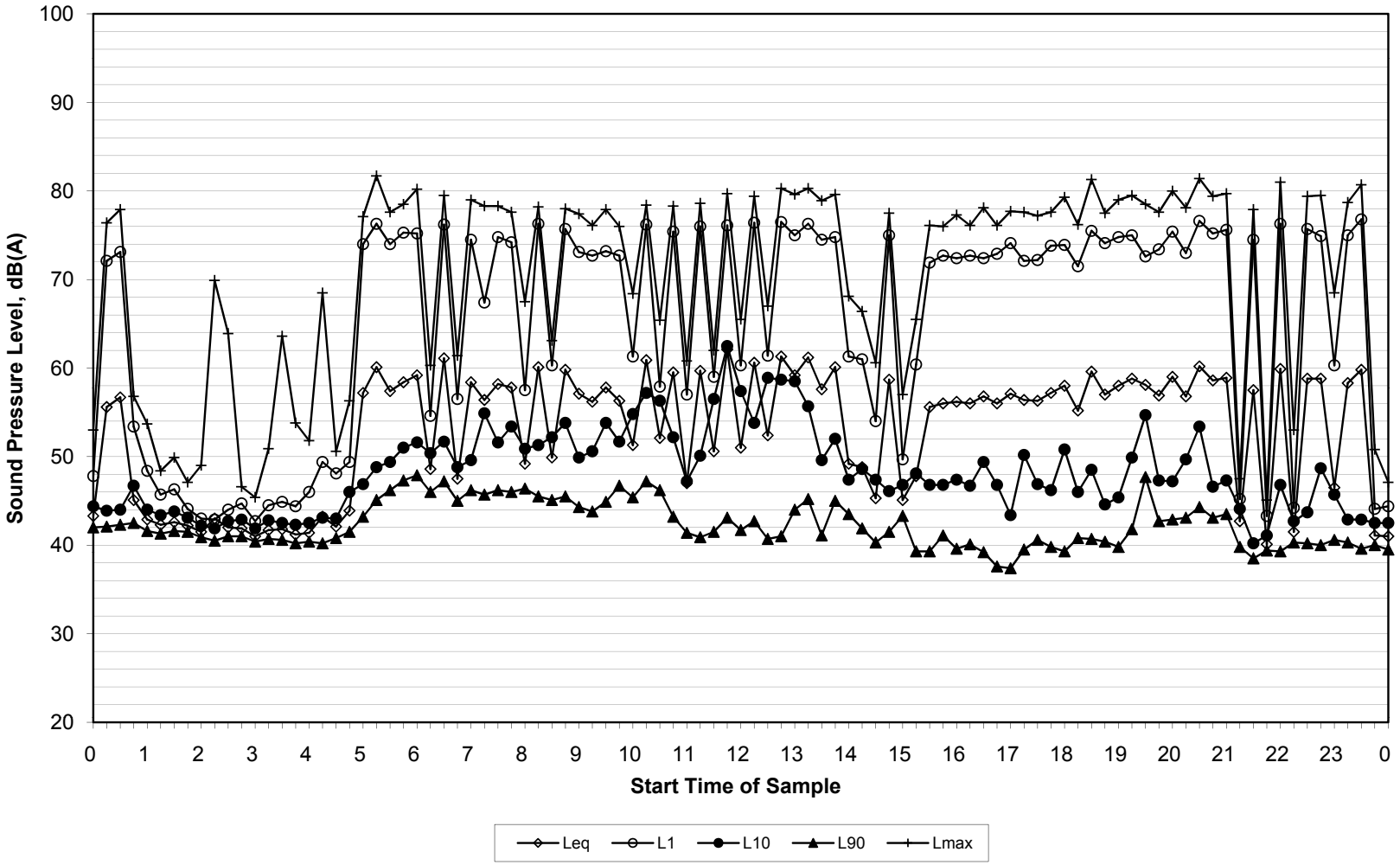
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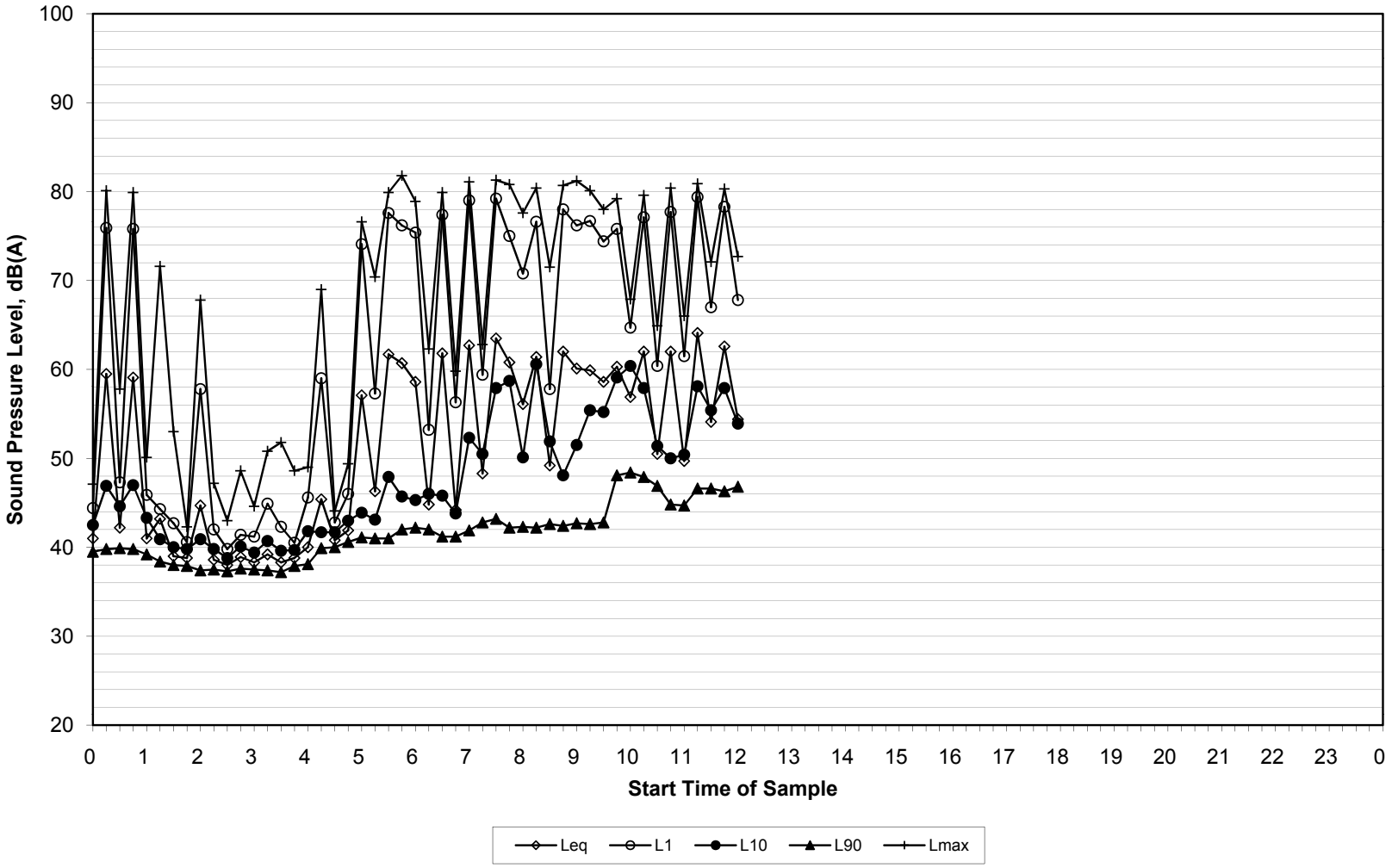
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Ambient Sound Pressure Levels

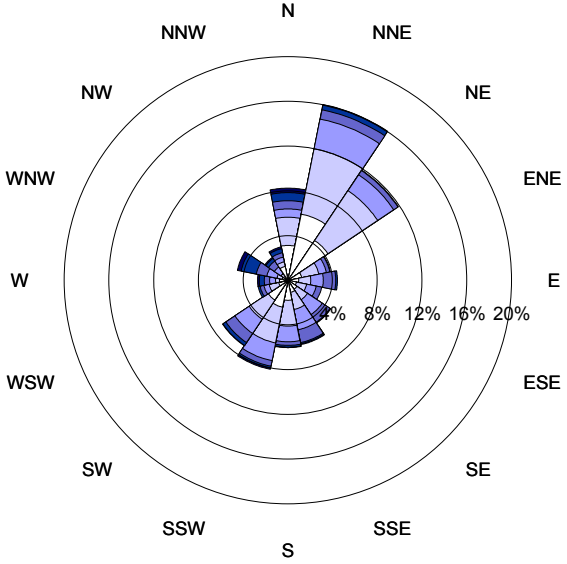
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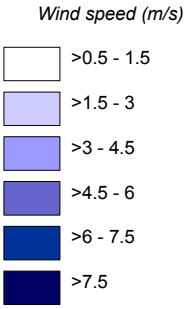
Location 3 - west
3 Chisholm Place, South Windsor

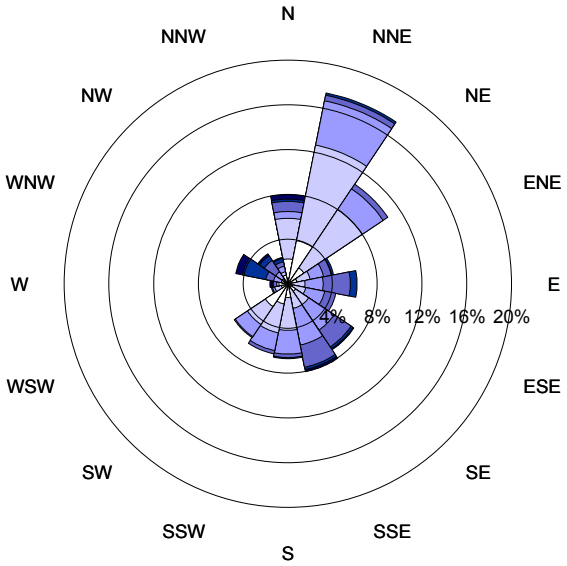
APPENDIX 2: WIND ROSES - MULGRAVE

Annual and seasonal windroses for Mulgrave (Day, April 2008 - March 2009)

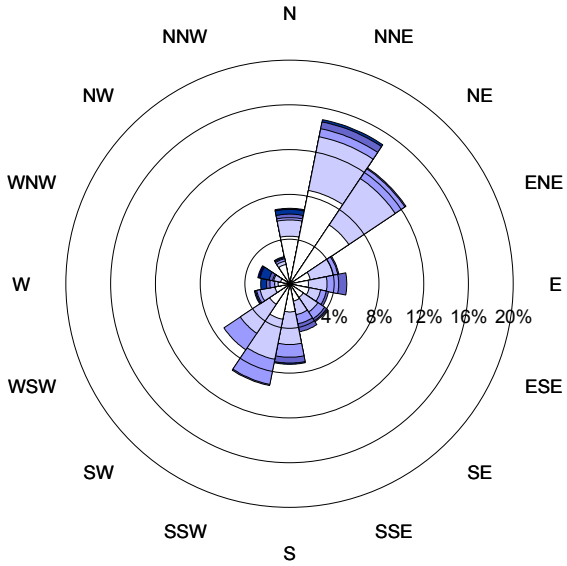


Annual
Calms = 5.4%

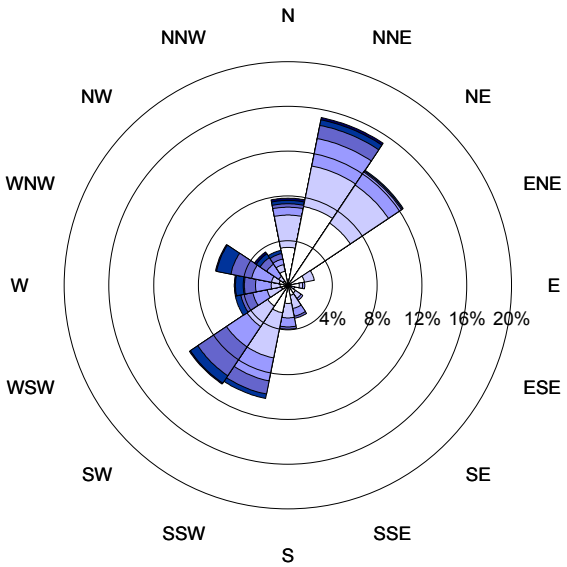




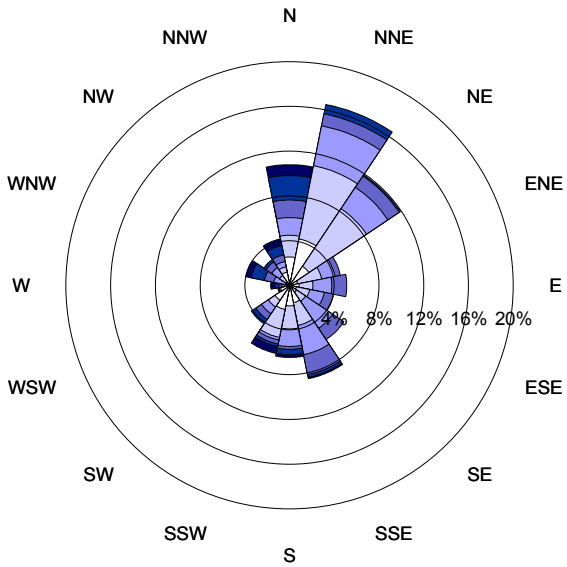
Summer
Calms = 1.8%



Autumn
Calms = 9.3%

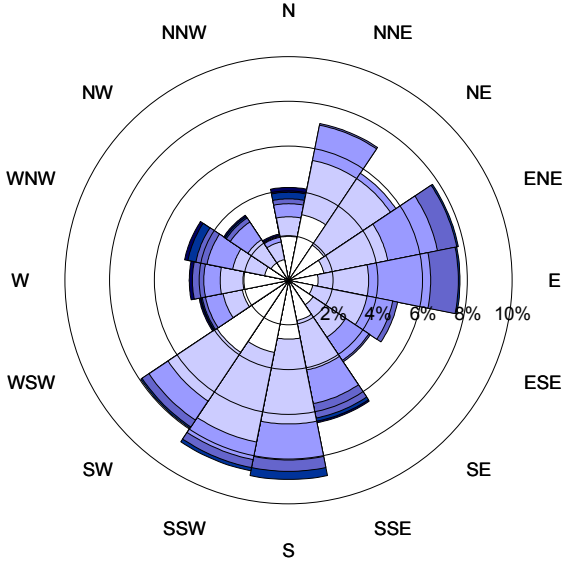


Winter
Calms = 7.7%

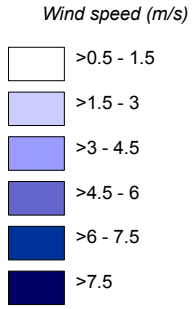


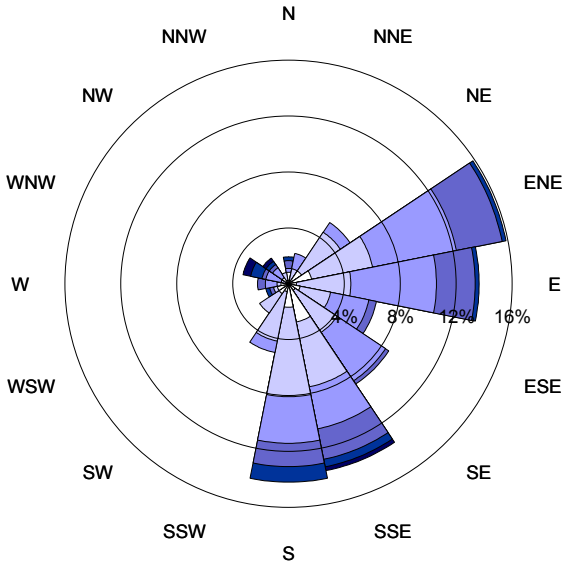
Spring
Calms = 2.3%

Annual and seasonal windroses for Mulgrave (Evening, April 2008 - March 2009)

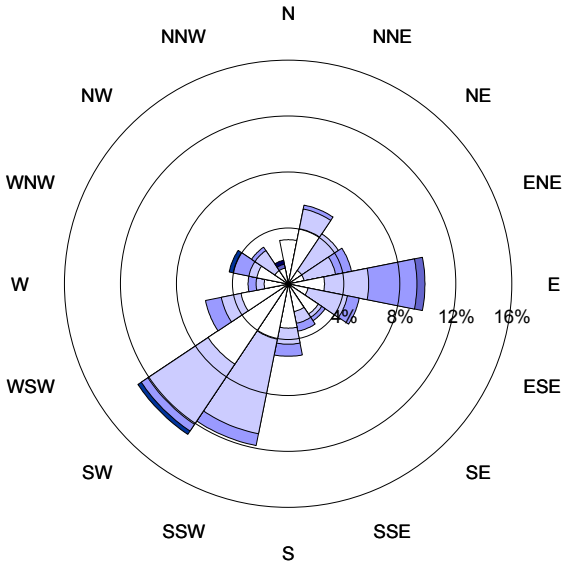


Annual
Calms = 7.4%

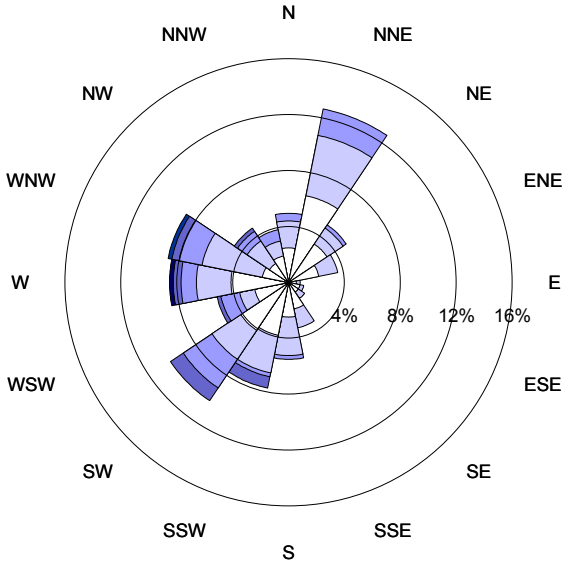




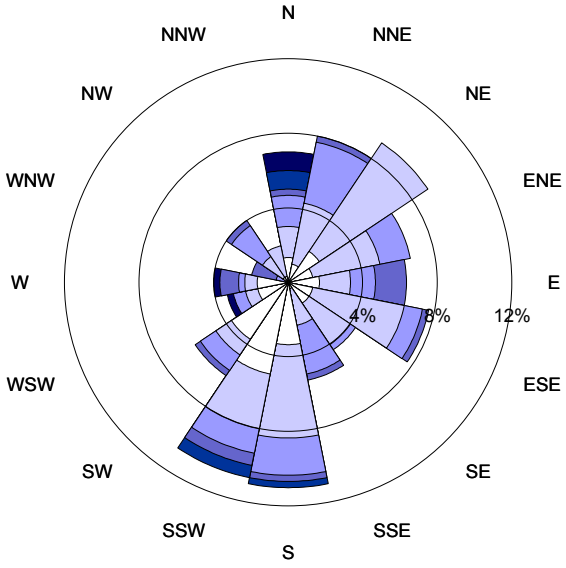
Summer
Calms = 0.6%



Autumn
Calms = 12.6%

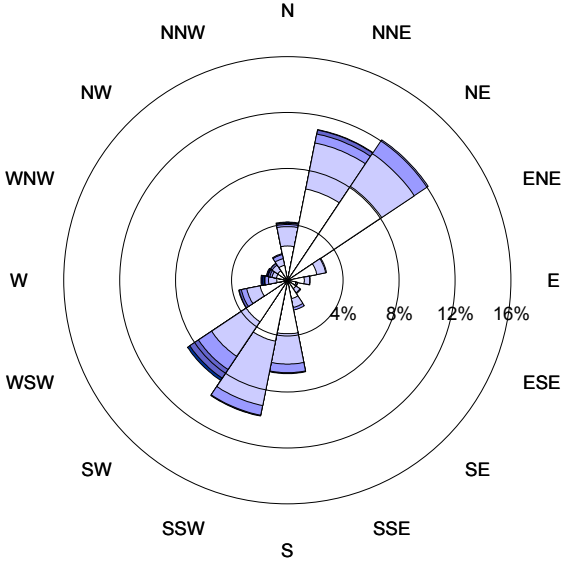


Winter
Calms = 12.9%

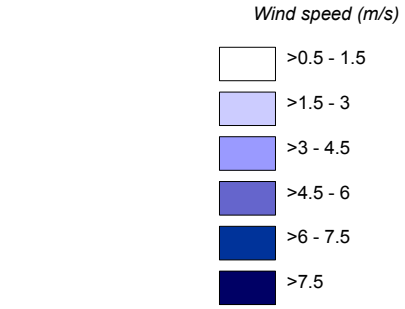


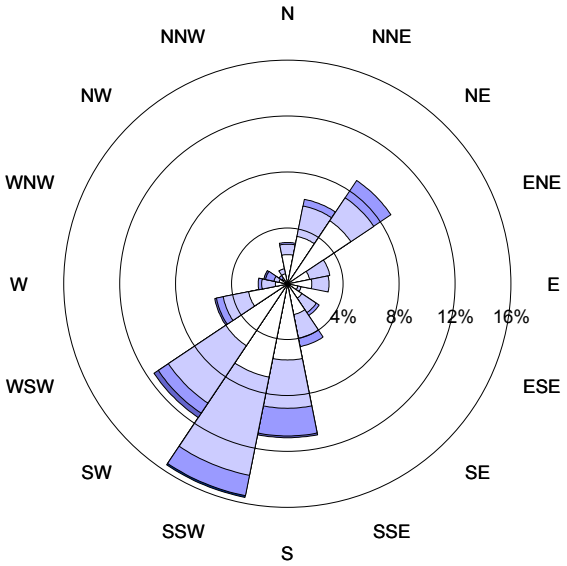
Spring
Calms = 2.7%

Annual and seasonal windroses for Mulgrave (Night, April 2008 - March 2009)

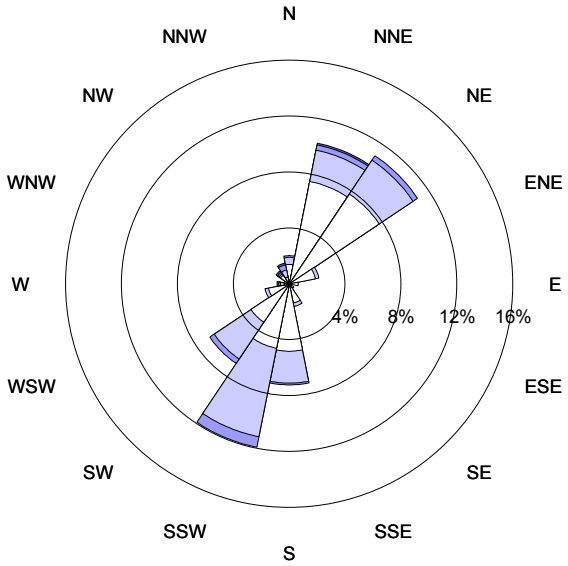


Annual
Calms = 28.7%

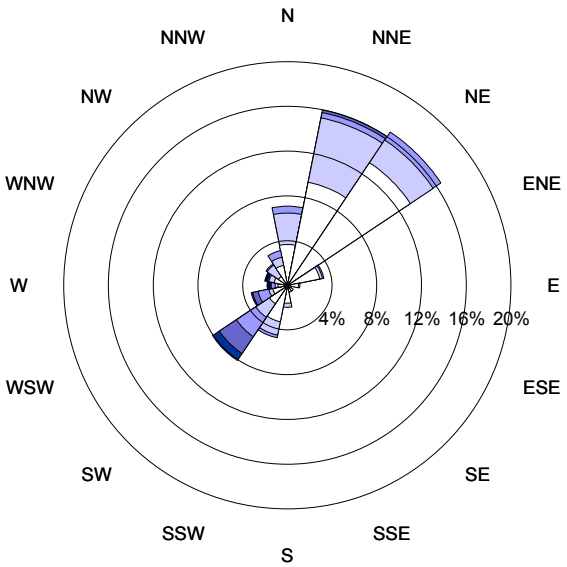




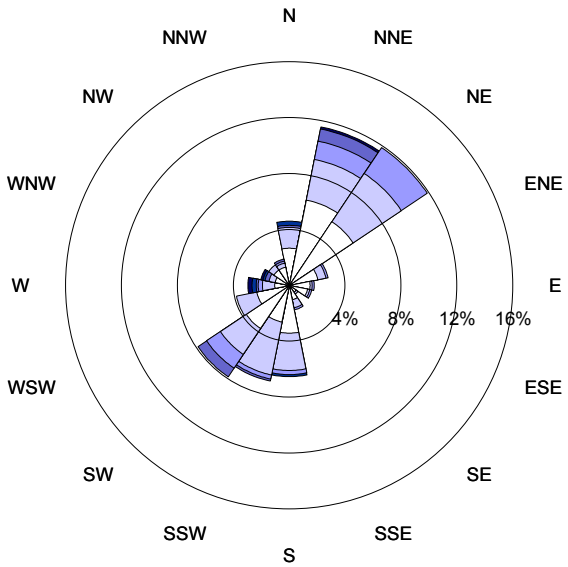
Summer
Calms = 18.6%



Autumn
Calms = 40.1%



Winter
Calms = 27.0%



Spring
Calms = 29.3%

Appendix S

SUBSTRATE PLANT STORMWATER MANAGEMENT PLAN

Barker Ryan Stewart

Planning • Sustainability • Infrastructure • Development • Certification

Proposed Substrate Plant Extension

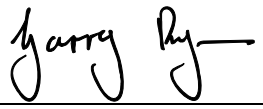
108 Mulgrave Road

Mulgrave

Stormwater Management Plan

Barker Ryan Stewart

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Project No.	20070166
Author	GJ
Checked	GJ
Approved	GR
Signature	

Rev No.	Status	Date	Comments
A	initial	23/11/2010	Response to DG's comments

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1 Introduction

This report has been prepared to consider the stormwater management options for the future expansion of the mushroom substrate plant located at 108 Mulgrave Road, Mulgrave. The proposal in conjunction with the development of a new mushroom growing facility to be located at 521 The Northern Road, Londonderry, have been submitted to the department of Planning for assessment under Part 3A of the EP&A Act. Initial feedback from the department has indicated that the quantity and quality of stormwater generated at the site due to the extension of the site facilities needs to be considered as part of the development.

Barker Ryan Stewart has been engaged to develop a response to the Director Generals comments and investigate the management of stormwater on the site.

In determining stormwater management options for the site, this report will consider the following:

1. The pre-development site conditions;

2. The extent and nature of the site catchment area;

3. The storage requirements for detention;

4. Water quality modelling of the pre and post extension proposals, and

5. The configuration of the site stormwater drainage system.

2 Existing Site

2.1 Site Location

The site of the mushroom substrate plant is described as 108 Mulgrave Road, Mulgrave and is located within the Hawkesbury City Council local government area. The site adjoins an industrial area to its east and the floodplain of South Creek on its northern and southern boundaries with South Creek forming its Westerly boundary. The site has the Hawkesbury Valley Way traversing through the north eastern part of it and has the Richmond to Blacktown railway line located immediately to the sites south. The embankment of the railway line extends into the floodplain forming a ridge protruding into the floodplain to the sites south. The property area is approximately 22 hectares in size, of which 12.4 hectares is taken up by the substrate plant. The locality is shown in

Figure 2-1 below and a site plan is located in Appendix A.



Figure 2-1 Site Location of 108 Mulgrave Road, Mulgrave

2.2 Existing Site Conditions

Currently the site has a filling operation under way, associated with a previous consent granted by Hawkesbury Council, which involves filling areas of the site up to RL16.00 metres AHD. Associated with this, sediment control basins have been constructed and are in operation during the filling on site. These basins will be converted into small wetlands at the completion of the filling operations. It is proposed to use the filled land pasture for cattle (which are currently run on the premises), hardstand areas and for the proposed plant expansions. Design plans associated with the filling works are found in Appendix B.

It is to be noted that the only open air works undertaken during the substrate preparation (known as the operational areas) are contained in an area which has a capture and recycle water facility. This area drains to a pit and pipe system, which directs surface water (both stormwater and wash down water) to the west water recycle pit with an approximate storage volume of 29 cubic metres. From this pit it is then reused to wet straw bales as part of the substrate production. Stormwater overflows from this system are directed into an existing farm dam located between the plant and South Creek floodplain which has an approximate capacity of 4030 cubic metres.

Currently under EPA requirements, the storage capacity of the west water recycle pit is to contain 10mm of runoff from the operational area while the dam plus the recycle pit are to have the capacity to store the 24 hour, 10 year ARI rainfall event. It has been calculated that this is in the order of 134 cubic metres. Over flow water from the collection pit is directed into the dam and is used for irrigation on pasture. The area of land that is irrigated is located between to the west of the site in the floodplain. The dam only takes overflow water from the recycle pit as there are diversion drains directing overland flow around its high side.

The existing plant is located on a crest that runs out into the South Creek floodplain. Stormwater that is collected on the site is disposed of in five different directions. These can be described as;

- To the south under the railway line and onto the south creek floodplain, which drains roof area only,
- To the south east under the railway line and onto a market garden dam on the adjoining property which drains the existing residence at the front of the site and the accompanying grassed areas,
- To the north via a stormwater drainage line that picks up runoff from some roofs, hardstand areas and paddock and discharges it under the Hawkesbury Valley Way into a dam on the site. This dam when full will overtop and discharge back onto the floodplain before entering south creek.
- To the north west onto the floodplain of south creek which drains roof, hardstand and pasture, and
- To the south west onto the floodplain of south creek which drains roof, hardstand and existing pasture.

The runoff from the driveway located to the east of the plant is directed via a pit and pipe system into the front sediment basin, shown as Basin 1 in Appendix A. Basin 2 has stormwater directed to it again from a pit and pipe system and caters for the area of the plant that drains towards the north west. Both basins have been designed to act as soil

erosion and sediment control basins during the earthworks operation with a retrofit once these works are complete changing the basin into two chambered systems comprising a sediment basin at the front and wetland system behind this. The basins have no on site detention capacity, as to date council has not required on site detention due to its proximity to South Creek and the Hawkesbury River.

The drainage system that conveys flows out of basin 1 directs stormwaters under the Hawkesbury Valley Way and discharges into a small reed bed before it enters a farm dam. This farm dam has a surface area of some 3200 square metres and is some several metres deep. This dam when full overflows into an adjacent watercourse that meanders over the floodplain and into south Creek.

Overflows from Basin 2 discharge directly onto the floodplain, then meander along an existing depression before they enter South Creek.

3 Proposed Development

3.1 General

The proposal consists of constructing additional hardstand areas and buildings as shown in Appendix C. This will incorporate a second bale wetting area in which organic material will be handled in the open and so an associated increase in the water recycling and collection pit is planned.

The proposal will maintain the existing flow regime, with no redirection of flows between any of the proposed discharge points as mentioned in section 2.2. All non-operational hardstand areas will be directed into a sediment basin with the operational areas being collected in a recycle pit.

The sediment basins will be modified to ensure that they have a retention component as well as a water quality function.

3.2 Stormwater Management

The catchment areas and resulting stormwater discharges that currently drain under the railway line from the roof of the most southerly located building and from the front area of the property will remain as they are currently, that is no increase in impervious area or increase in area.

Stormwaters that are directed through the drainage system that discharges to the sites north east will follow the same path with hardstand areas discharging into sediment Basin 1 (which will serve also as an on-site detention facility) and directed into the farm dam, while roof areas either discharging into the sediment basin or directly into the farm dam. The detention facility will overcompensate for any increase in impervious area. Any increase in pollutants resulting from the hardstand and roof areas will be treated by the upgrading of the sediment basin and also an increase in size of the reed bed that is currently located between the outlet pipe and farm dam.

The areas that drain to South Creek will be treated in a similar manner with the hardstand areas being directed into the combined sediment basin / on site detention facility located to the north west of the plant with roof waters discharging either directly out onto the floodplain or into the Basin 2 facility. The combined peak discharges resulting from the catchments that drain in this westerly direction will not be increased as a result of the increase in impervious areas due to the proposed on-site detention facility proposed to be incorporated into Basin 2. Stormwaters from the proposed hardstand areas to the west of the existing plant and those originating from half of the proposed pre wet shed will need to be directed back into Basin 2.

Due to an increase in the operation area, an increase in the recycled stormwater collection pit size and accompanying minimum dam overflow storage will be required. The existing overflow farm dam will be utilised for this as it currently has a large surplus volume associated with it. A catchment plan is located in Appendix D.

3.3 Hydraulic Calculations

3.3.1 Rainfall Data

The discharge volumes for the pre and post development (uncontrolled) have been calculated using the design rainfall events in the Australian Rainfall & Runoff. The rainfall intensities used have been taken from Table A1 of Hawkesbury City Councils development Control Plan – Part 1 Design Specification.

3.3.2 Peak Discharge Rates

The discharge volumes were determined using the modelling program DRAINS. The design storms for the 100, 20, 5 and 1 year Average recurrence Intervals (ARI) events have been modelled for the existing development and are shown in Table 3.1 while Table 3.2 shows the results for the proposed situation.

The DRAINS model was set up to model the proposed sediment basins as on site detention facilities to show how the site will operate during storm events once the existing works are completed. These models were then amended to incorporate the proposed impervious areas associated with the future development of the site. Orifices were then modelled in the basins to determine adequate restrictions on the outlets that will ensure that the peak post flows will not be greater than the pre peak flows for both the north eastern catchment and the combined western catchments that discharge out onto the floodplain and directly into South Creek. Revised engineering plans are shown in Appendix E.

In order to reduce the volume of water leaving the site it is proposed to take advantage of the existing river sand that is located in the vicinity of the north west basin (Basin 2) and allow as much water as possible to infiltrate into this strata. This will be possible by instead of filling the area to construct the basin (and in so doing line it with clay) the area will be worked with local material and positioned in the sand layer. To ensure that there are no impermeable lenses locally the sand below the base of the basin will need to be ripped and then compacted. This will have the result of creating a bio basin instead of the proposed wetland system. The infiltration has been modelled in the DRAINS package to simulate the loss of storm waters during design storm events. It was found that the permeable basin had the capacity to reduce the discharge from the smaller events but had a much smaller impact during the larger 100 year ARI events. No provision for infiltration has been included in the model for Basin 1 as this is in clay.

The stormwaters that are directed to the south of the site and under the existing railway line are not modelled as they are not touched and remain the same.

Following are the pre and post development flows from the north eastern catchment that are directed by pipe under the Hawkesbury Valley Way and released into the dam before being discharged from the site out onto the floodplain.

Table 3-1 North Eastern Catchment Pre & Post Development Peak Discharges

Storm Duration	Pre Development Peak Flow				Post Development Peak Flow With OSD			
(minutes)	1 year ARI	5 year ARI	20 year ARI	100 year ARI	1 year ARI	5 year ARI	20 year ARI	100 year ARI
	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s
10	0.109	0.256	0.450	0.580	0.108	0.217	0.306	0.429
15	0.128	0.337	0.516	0.604	0.124	0.264	0.366	0.477
20	0.126	0.391	0.530	0.627	0.122	0.258	0.355	0.466
25	0.122	0.430	0.560	0.633	0.139	0.305	0.409	0.494
30	0.129	0.397	0.537	0.618	0.125	0.284	0.385	0.469
45	0.107	0.353	0.508	0.595	0.103	0.228	0.318	0.410
60	0.125	0.434	0.546	0.633	0.125	0.267	0.365	0.450
90	0.149	0.483	0.565	0.653	0.147	0.303	0.391	0.483
120	0.132	0.480	0.567	0.651	0.130	0.285	0.370	0.456

The following results are taken from the combined flow that is discharged onto the floodplain from the section of the development that discharges to the west.

Table 3-2 Western Catchment Pre & Post Development Peak Discharges

Storm Duration	Pre Development Peak Flow				Post Development Peak Flow – With OSD			
(minutes)	1 year ARI	5 year ARI	20 year ARI	100 year ARI	1 year ARI	5 year ARI	20 year ARI	100 year ARI
	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s
10	0.176	0.433	0.651	0.949	0.149	0.325	0.463	0.620
15	0.196	0.525	0.806	1.028	0.162	0.379	0.517	0.666
20	0.212	0.582	0.854	1.087	0.166	0.404	0.542	0.688
25	0.191	0.625	0.893	1.103	0.175	0.418	0.557	0.678
30	0.209	0.594	0.861	1.069	0.159	0.394	0.531	0.654
45	0.201	0.543	0.794	1.008	0.142	0.357	0.487	0.615
60	0.222	0.607	0.853	1.051	0.144	0.367	0.491	0.608
90	0.243	0.692	0.865	1.066	0.159	0.39	0.508	0.629
120	0.255	0.709	0.895	1.091	0.165	0.407	0.529	0.649

An estimation of climate change has been undertaken in accordance with guidelines presented in the document, Practical Consideration of Climate Change, DECC, 2007. This estimates that for the Sydney Basin a likely maximum increase in rainfall intensities will be in the order of 10 percent. Accordingly when the 100 year ARI storm event is run with an intensity that is 10 percent greater than that of the current rainfall intensity, it was found that the basins are of sufficient size to cater and retard the flows back to less than that of the comparative model for the pre development scenario. The results also show that as a result

of an increase in ponding within the basins that the site will not flood, as the corresponding water levels within the basins will remain well below 1 meter from any adjoining plant floor level.

In order to achieve reductions in peak flows sufficient to ensure that the discharges from the site remain at or below the existing peak discharges, it has been found that the two sediment basins will need to be upgraded in the following ways;

Basin 1 – located at the centre of the site

- Orifice plate incorporated into outlet system of size, 180mm diameter
- Centre of orifice – RL 11.2
- Outlet pipe 450 dia (existing)
- Basin to have a volume of 880 cubic metres above the wetland volume at RL 13.12 – top water level (existing)
- This basin will need only the outlet pit system to have an orifice plate installed above that of the existing proposal.

Basin 2 – located to the sites north west

- Orifice plate incorporated into outlet system of size, 350mm diameter,
- Centre of orifice – RL 11.6
- Outlet pipe is to be a 525mm diameter pipe
- Basin to have a volume of 615 cubic metres above the wetland volume at RL 12.30m AHD - top water level
- Basin to have a sandy base at RL 10.5m AHD
- This basin will need minor earthworks to be undertaken together with a new outlet pit and pipe system above that of the existing proposal

3.3.3 Recycled Pit and Overflow Storage

The existing recycled pit and overflow system will not be altered due to these works. A new recycled pit and pipe system will be constructed to account for the new bale wetting area that will be constructed as a result of the expansion of the plant. This will involve the construction of a pit of size that is capable of capturing the first 10mm of runoff from the designated area and storing it for reuse in the production of substrate. Any overflow greater than this volume will be directed to the same farm dam as currently receives overflow waters from the existing recycled pit. The minimum volumes associated with new recycled pit and overflow storage size are calculated in accordance with previous approvals are as follow;

New East Water Recycle Pit:

- Capture the first 10mm of runoff
- Area of bale wetting area = 3500 square metres
- Volume needed is 35 cubic metres

Overflow Dam

- Capture volume of 24Hr, 10 year ARI storm event
- Average rainfall for that event is 6.87mm/hr
- Volume needed from wetting area is 580 cubic metres
- Volume needed from water falling on dam is 6.87mm by 24 hours by the surface area of 80m x 80m = 1055m^3

- Volume needed from existing stage 1 works is 130m^3
- Total volume needed is 1765 m^3
- Available volume is approximately 4030 m^3

The water recycle pit will be comprised of an underground storage tank of minimum 35 cubic metres with an overflow pipe system directing waters into the overflow dam.

In considering the possible impacts of climate change, a 10% increase in rainfall intensity has been adopted as a likely maximum impact (Practical Consideration of Climate Change, DECC, 2007). This would result in a minimum storage volume of 1940 cubic metres, still well below the estimated combined volume of the dam and recycle pits.

Preliminary design plans showing the capture and reuse pit for the eastern wetting area are shown in Appendix E.

4 Music Modelling

4.1 Site Analysis

4.1.4 General

Water Quality modelling requires the use of continuous rainfall data at a 6 minute to 6 hourly interval. For the concept design of the water sensitive urban design elements MUSIC modelling was utilised. The recorded rainfall from pluviograph number 067105, located at the RAAF base in Richmond, as supplied by the Bureau of Meteorology was imported into MUSIC. This data was simulated for a 6 minute rainfall period interval from 1985 until 1995 to ensure a long-term assessment was conducted on the expected water quality.

Modelling was undertaken for the two different catchments as detailed above, as used for the water quantity modelling. All the subcatchments were modelled according to the Western Sydney Draft MUSIC guidelines, inputting the respective variables for the appropriate land use. A catchment plan is shown in Appendix D.

The following values have been adopted as the Rainfall Runoff parameters for the impervious and pervious scenarios;

Table 4-1 Rainfall Runoff Parameters

	Built Up Area	Agriculture
Impervious Area Parameters		
Rainfall Threshold (mm/day)	1.4	1.4
Pervious Area Parameters		
Soil Storage Capacity	170	210
Initial Storage	30	30
Field Capacity	70	80
Infiltration Capacity – Coeff a	210	175
Infiltration Capacity – Coeff b	4.7	3.1
Groundwater Properties		
Initial Depth	10	10
Daily Recharge Rate	50	35
Daily Baseflow Rate	4	20
Daily Deep Seepage rate	0	0

The north eastern catchment was divided into seven distinct runoff areas with two wetland systems. The areas and their respective classifications are shown in Table 4.2.

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Table 4-2 Pre Development MUSIC Model Inputs North Eastern catchment

Catchment	Area (ha)	Classifications	Impervious
Hardstand 2 –Entry Drive	0.101	Sealed Road	100%
Pasture 2 – future Bale Shed & Wetting Area	1.060	Pasture	0%
Hardstand 1 – Site Access Driveway	0.215	Sealed Road	100%
Pasture 1	1.382	Pasture	0%
Roof 1 - Phase 2/3 Blg	0.442	Roof	100%
Hardstand 3 – Access Drive to Blocking Shed	0.201	Sealed Road	100%
Pasture 3	0.283	Pasture	0%

With the increase in impervious area from the hardstand and roof areas, the model was altered and rerun to estimate the change in pollutant runoff associated with the proposal. The post development Music models consisted of same catchment areas with the Pasture 2 catchment being divided into an area that drains into a collection pit for reuse and an area of hardstand. The catchments are detailed below in Table 4.3.

Table 4-3 Post Development MUSIC Model Inputs North Eastern Catchment

Catchment	Area (ha)	Classifications	Impervious
Hardstand 2 –Entry Drive	0.101	Sealed Road	100%
Bale Shed & Wetting Area	1.060	Pasture	0%
Hardstand 1 – Site Access Driveway	0.215	Sealed Road	100%
Pasture 1	1.382	Pasture	0%
Roof 1 - Phase 2/3 Blg	0.442	Roof	100%
Hardstand 3 – Access Drive to Blocking Shed	0.201	Sealed Road	100%
Pasture 3	0.283	Pasture	0%

The western catchment was also divided into nine distinct runoff areas and one wetland. The areas and their respective classifications are show in Table 4.4.

.

Table 4-4 Pre Development MUSIC Model Inputs Western catchment

Catchment	Area (ha)	Classifications	Impervious
Roof 2 – Pre Wet Shed	0.326	Roof	100%
Pasture 4 – future Pre Wet Shed	0.542	Pasture	0%
Pasture 5 – future Hardstand Area	0.215	Pasture	0%
Hardstand 3	0.185	Sealed Road	100%
Roof 3 - Part Phase 2/3 Blg, Conveyor Blg	0.47	Roof	100%
Pasture 6 – Future Phase 2/3 Blg	0.766	Pasture	0%
Pasture 7	1.724	Pasture	0%
Roof 4 – Part Phase 2/3 Blg	0.125	Roof	100%
Hardstand 4 - driveway	0.352	Sealed Road	100%

With the increase in impervious area from the hardstand and roof areas, the model was altered and rerun to estimate the change in pollutant runoff associated with the proposal. The post development MUSIC models consisted of the same eight areas, which are detailed on the next page in Table 4.5.

Table 4-5 Post Development MUSIC Model Inputs Western Catchment

Catchment	Area (ha)	Classifications	Impervious
Roof 2 – Pre Wet Shed	0.326	Roof	100%
Roof 5 - New Pre Wet Shed	0.542	Roof	100%
Hardstand 5	0.215	Sealed Road	100%
Hardstand 3	0.185	Sealed Road	100%
Roof 3 - Part Phase 2/3 Blg, Conveyor Blg	0.47	Roof	100%
Roof - Phase 2/3 Blg	0.766	Roof	100%
Pasture 7	1.724	Pasture	0%
Roof 4 – Part Phase 2/3 Blg	0.125	Roof	100%
Hardstand 4 - driveway	0.352	Sealed Road	100%

4.1.5 Pre Development Results

The pre-development model was simulated for 6 minute rainfall intervals, the mean annual water quality results of which are summarised below in Table 4.6 and Table 4.7.

Table 4-6 Pre-Development Water Quality Results – North Eastern Catchment

		Pre Development Loading
Flow	**(ML/yr)**	11.0
Total Suspended Solids	**(kg/yr)**	481
Total Phosphorus	**(kg/yr)**	1.8
Total Nitrogen	**(kg/yr)**	18.6
Gross Pollutants	**(kg/yr)**	0

Table 4-7 Pre-Development Water Quality Results – Western catchment

		Pre Development Loading
Flow	**(ML/yr)**	16.0
Total Suspended Solids	**(kg/yr)**	914
Total Phosphorus	**(kg/yr)**	3.02
Total Nitrogen	**(kg/yr)**	29.5
Gross Pollutants	**(kg/yr)**	187

The flow weighted daily mean criteria for both catchment models are shown below in Tables 4.8 and 4.9. These figures were used as a general target for the post development scenario. This will ensure that the works associated with the proposal will be well below the minimum requirements of the Western Sydney water quality reduction requirements, being reductions in the post development runoff from an untreated site.

Table 4-8 Water Quality Benchmark for Post Development North eastern catchment

		Mean	Maximum
Flow	**(m^3/s)**	$350x10^{-6}$	$46.9x10^{-3}$
Total Suspended Solids	**(mg/L)**	5.49	122
Total Phosphorus	**(mg/L)**	$31.2x10^{-3}$	0.429
Total Nitrogen	**(mg/L)**	0.456	2.86
Gross Pollutants	**(kg/Day)**	0	0

Table 4-9 Water Quality Benchmark for Post Development Western Catchment

		Mean	Maximum
Flow	**(m^3/s)**	$508x10^{-6}$	$63.5x10^{-3}$
Total Suspended Solids	**(mg/L)**	18	184
Total Phosphorus	**(mg/L)**	$63.9x10^{-3}$	0.441
Total Nitrogen	**(mg/L)**	0.734	3.87
Gross Pollutants	**(kg/Day)**	0.512	7.85

4.1.6 Upgrading Works

In order to reduce the post development pollutant loadings back to that of the pre development state, it has been found that the following additional upgrading works will be required,

North Eastern Catchment
Works will involve the expansion of the existing small reed bed located between the discharge dam and the pipe outlet system. The reed bed will need to increase from its current size of approximately 50 square metres to 450 square metres. This can be done by fencing off an area of the width of the dam (50metres) by 10 metres and undertaking minor earthworks to form a level area that will have a 250mm deep ponded area and planting it out with suitable reeds. This will need to be undertaken in conjunction with the proposed works associated with the filling and sediment basin construction works.

Western Catchment
With the construction of the hardstand area and roof to the south west of the plant (incorporating the proposed wet shed extension) it will be necessary to direct the stormwater drainage from this building and the associated new hardstand area back to the On Site Detention / wetland system.

A Bio Basin of surface area 100 square metres will need to be constructed below this. The filler medium is to be at least 600mm deep and the maximum detention depth is 250mm. The area of infiltration has been determined to be $235m^2$ and the filter medium is designed to have the following specifications (FAWB, 2008):

- Hydraulic Conductivity of 5×10^{-5} m/s;
- Particle size of 0.45mm;
- Organic Matter Content is to be less than 5% (w/w);

- The filter has to have a ph between 5.5 and 7.5;
- The electrical conductivity (EC) is to be below 1.2dS/m; and
- Phosphorus concentration should be less than 100 mg/kg.

Engineering plans showing the location, size and minimum requirements of the basin are shown in Appendix E.

The hardstand and roof areas that drain to the south west of the plant will need to have a gross pollutant trap fitted to the outlet of the system. This is also shown in Appendix E.

Appendix F shows the soil erosion and sediment control measures that will need to be implemented during the course of the new works. As per the current works, the basins will need to be constructed in two stages, the first being in the form of a sediment basin with the second being the transformation of the sediment basins into the combined on-site detention facility and water quality control structures and systems.

4.1.7 Post Development Results

The post development scenario was simulated for 6 minute rainfall intervals, the results of which are summarised in Tables 4.10 and 4.11.

Table 4-10 North Eastern Catchment Water Quality Results & Comparison

		Pre Development	Post Development	% Reduction
Flow	**(ML/yr)**	11.0	11.2	(1.8)
Total Suspended Solids	**(kg/yr)**	481	301	37.4
Total Phosphorus	**(kg/yr)**	1.8	1.37	23.8
Total Nitrogen	**(kg/yr)**	18.6	17.6	5.3
Gross Pollutants	**(kg/yr)**	0	0	-

Table 4-11 Western Catchment Water Quality Results & Comparison

		Pre Development	Post Development	% Reduction
Flow	**(ML/yr)**	16.0	18.9	(18.1)
Total Suspended Solids	**(kg/yr)**	914	827	9.5
Total Phosphorus	**(kg/yr)**	3.02	2.15	28.8
Total Nitrogen	**(kg/yr)**	29.5	26	11.9
Gross Pollutants	**(kg/yr)**	187	184	1.6

The data from the 6 minute storm has been compared with the values extracted from the pre development model.

Table 4-11 Summary of North Eastern Pre and Post Development Quality Results

Pollutant Type		Mean		Maximum	
		Pre	Post	Pre	Post
Flow	(m^3/s)	$350x10^{-6}$	$355x10^{-6}$	$46.9x10^{-3}$	$48.3x10^{-3}$
Total Suspended Solids	(mg/L)	5.49	2.04	122	102
Total Phosphorus	(mg/L)	$31.2x10^{-3}$	$14.6x10^{-3}$	0.429	0.299
Total Nitrogen	(mg/L)	0.456	0.237	2.86	2.46
Gross Pollutants	(kg/Day)	0	0	0	0

Table 4-12 Summary of Western Pre and Post Development Quality Results

Pollutant Type		Mean		Maximum	
		Pre	Post	Pre	Post
Flow	(m^3/s)	$508x10^{-6}$	$599x10^{-6}$	$63.5x10^{-3}$	$74.3x10^{-3}$
Total Suspended Solids	(mg/L)	18	9.84	184	164
Total Phosphorus	(mg/L)	0.064	0.02	0.441	0.245
Total Nitrogen	(mg/L)	0.734	0.260	3.87	2.29
Gross Pollutants	(kg/Day)	0.512	0.505	7.85	9.44

The above tables show that the annual average loads and the mean concentrations are all either below the current corresponding figures or marginally higher. This shows that the proposal meets the minimum reduction requirements as required in the DECCW draft guidelines, Managing Urban Stormwater: Environmental targets (2007).

5 Conclusions

This report has considered the stormwater management options for the proposed upgrade of the mushroom substrate plant at Mulgrave. The upgrade works required to ensure stormwaters will not increase from the plant will involve the following components:

Basin 1 – located in the centre of the site

- Orifice plate incorporated into outlet system of size, 180mm diameter
- Centre of orifice – RL 11.2
- Outlet pipe 450 dia (existing)
- Basin to have a volume of 880 cubic metres at RL 13.12 – top water level (existing)
- This basin will need only the outlet pit system to have an orifice plate installed above that of the existing form.

Basin 2 – located at the site's north west

- Orifice plate incorporated into outlet system of size, 350mm diameter,
- Centre of orifice – RL 11.2
- Outlet pipe is to be a 525mm diameter pipe
- Basin to have a volume of 615 cubic metres at RL 11.95m AHD - top water level
- Basin to have a sandy base at RL 10.5m AHD
- This basin will need minor earthworks to be undertaken together with a new outlet pit and pipe system above that of the existing form

The stormwater from the new operation area will need a capture pit with a minimum volume of 35 cubic metres with the overflow being directed into the overflow dam. No additional works will need to be undertaken on the dam itself.

The works that will be needed to be undertaken to ensure compliance with the water aspect of the requirements are as follows,

North Eastern Catchment

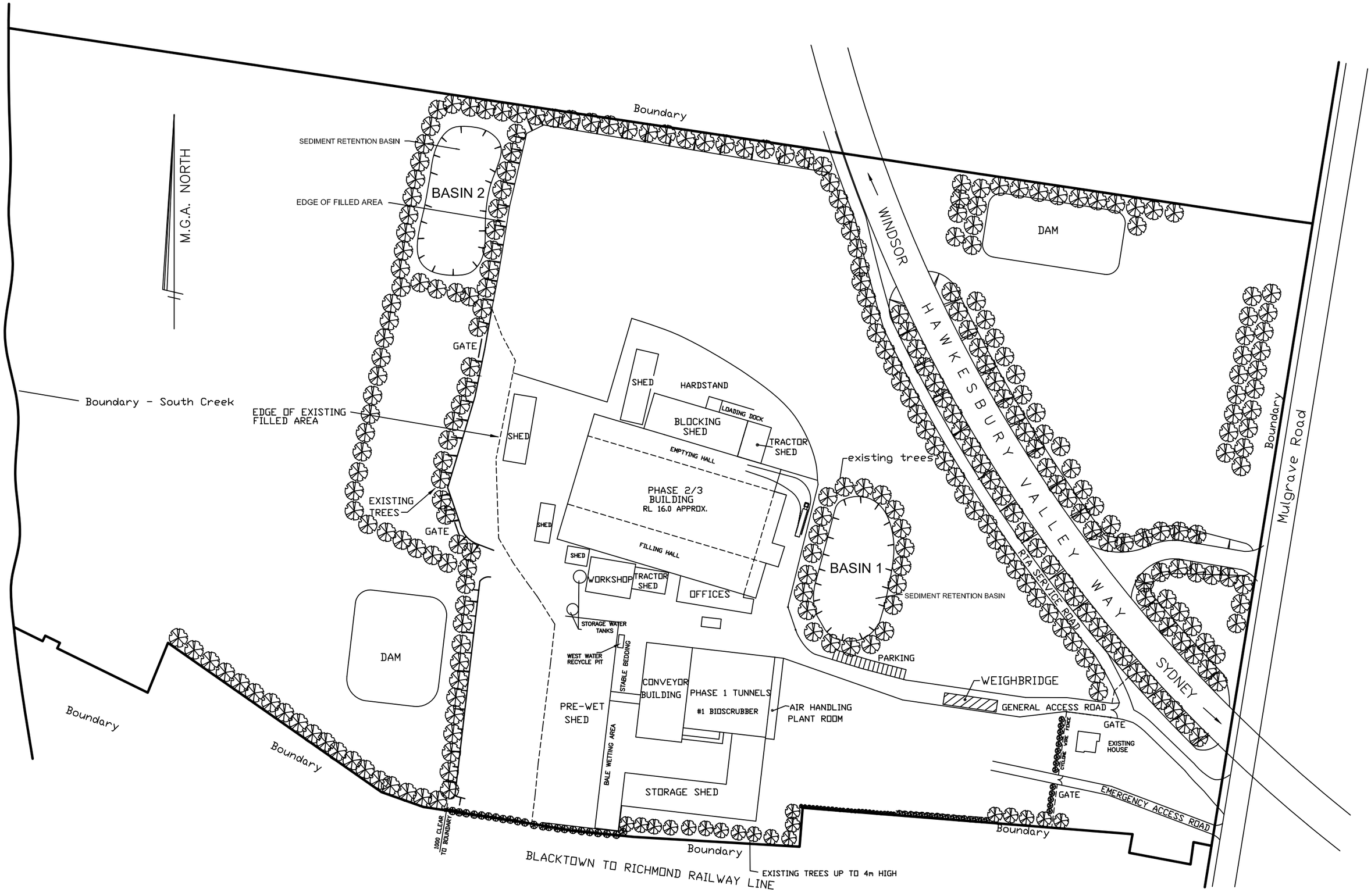
- A reed bed of 450 square metres will need to be established between the pipe outlet and the existing farm dam,
- The reed bed will need to be 250mm deep and have an operating water level such that it will spill at a depth of greater than this 250mm

Western Catchment

- The creation of a bio basin with a minimum surface area of 100 square metres
- Retro fit a gross pollutant trap to the end of the existing drainage outlet discharging waters to the south west of the site.
- Direct storm waters from the new hardstand area and part of the proposed roof of the pre wet shed to the wetland / On Site detention facility.

Once these requirements are constructed on the site the post development stormwater quality and quantity discharge from the site will remain at or below the current volumes and concentrations.

Appendix A. Site Plan



SITE PLAN

ABODE DESIGN
PO BOX 767 RICHMOND
PH. 4776 1125 0419 405006

DRAWN	DATE DRAWN	SCALE
I.S.	6.8.2010	1:1000

SITE LAYOUT

ELF FARM SUPPLIES PTY LTD
P.O.BOX 615 WINDSOR NSW 2756
108 MULGRAVE ROAD MULGRAVE NSW 2756
TEL.ISD (61)02 45775000 FAX.ISD (61)0245878002

DRAWING NO.	ISSUE
200648	

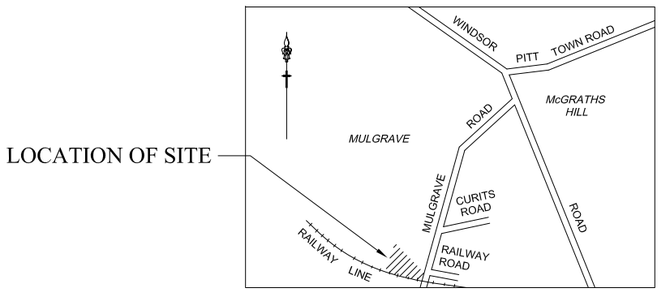
Appendix B. Existing Engineering Plans

HAWKESBURY CITY COUNCIL

PROPOSED SITE FILLING
MULGRAVE ROAD, MULGRAVE

FILLING & DRAINAGE PLANS

Prepared for: Elf Farm Supplies



LOCALITY SKETCH
NOT TO SCALE

LEGEND

- PROPOSED DRAINAGE LINE
- EXISTING DRAINAGE LINE
- NATURAL SURFACE CONTOUR
- DESIGN SURFACE CONTOUR
- PROPOSED HEADWALL
- LIMIT OF WORKS
- PIT NUMBER

SHEET INDEX

SHEET No.	DESCRIPTION
0	COVER SHEET - GENERAL NOTES, SHEET INDEX AND LEGEND
1	OVERALL PLAN SHEET
2	DETAIL PLAN SHEET 1
3	DETAIL PLAN SHEET 2
4	SECTIONS
5	DRAINAGE LONGITUDINAL SECTIONS
6	SEDIMENT DETAILS AND NOTES

GENERAL NOTES

1. ALL WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH HAWKESBURY CITY COUNCIL'S CIVIL WORKS SPECIFICATION, PART 2 CONSTRUCTION.
2. THE CONTRACTOR IS TO IDENTIFY, LOCATE AND LEVEL ALL EXISTING SERVICES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION WORKS AND WHERE NECESSARY MAKE ARRANGEMENTS WITH THE RELEVANT AUTHORITY TO RELOCATE OR ADJUST WHERE NECESSARY.
3. COUNCIL'S TREE PRESERVATION ORDER MUST BE OBSERVED AND NO TREE SHALL BE FELLED, LOPPED OR REMOVED WITHOUT THE PRIOR APPROVAL OF COUNCIL.
4. THE CONTRACTOR IS NOT TO ENTER UPON NOR DO ANY WORK WITHIN ADJACENT LANDS WITHOUT THE PRIOR APPROVAL OF THE SUPERINTENDENT AND THE WRITTEN PERMISSION OF THE OWNERS.
5. ALL NEW WORK IS TO MAKE A SMOOTH JUNCTION WITH EXISTING WORKS.
6. ALL WORKS SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE OCCUPATIONAL HEALTH & SAFETY ACT 2000 AND ALL RELEVANT OCCUPATIONAL HEALTH & SAFETY POLICIES AND REGULATIONS.

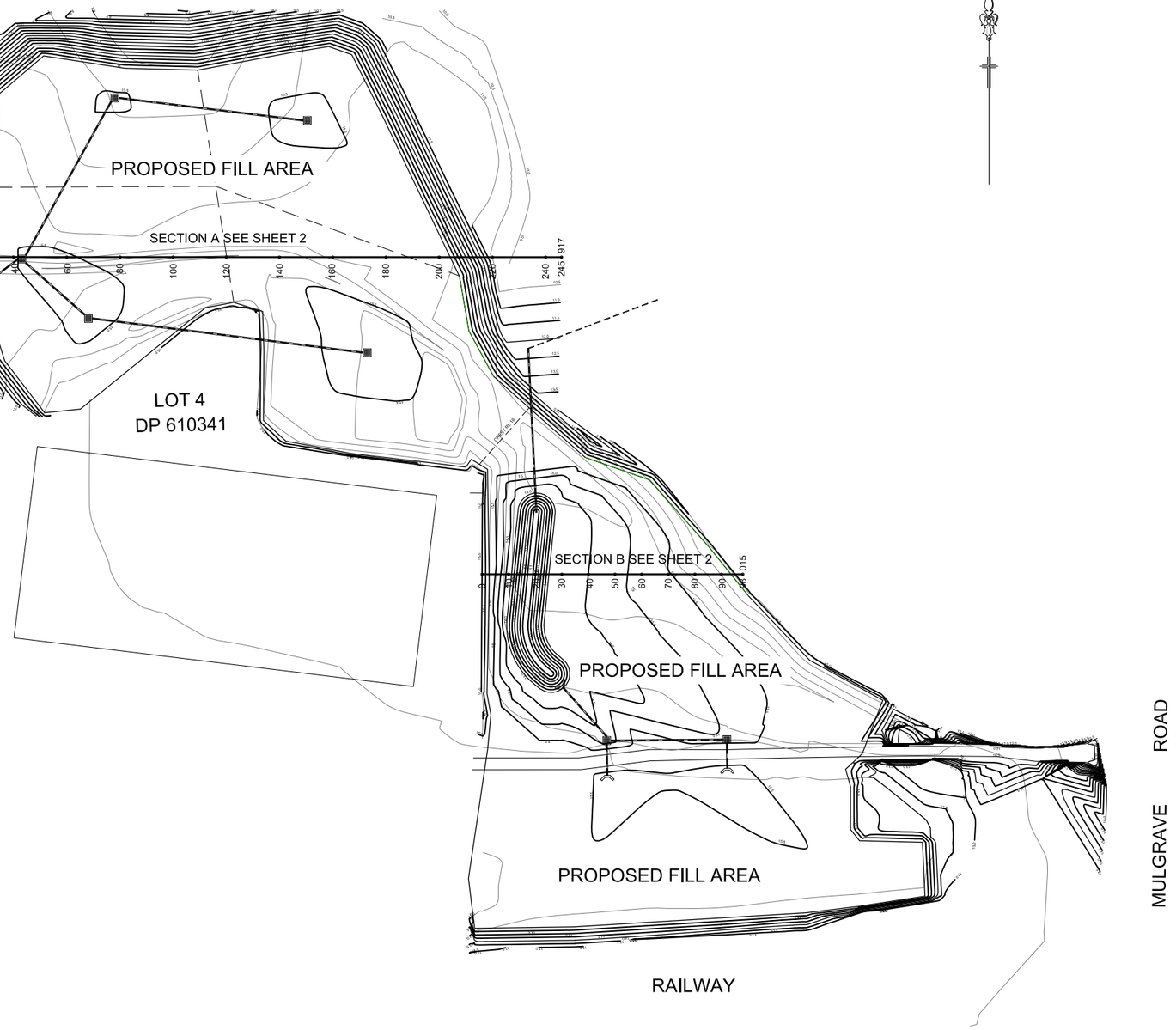
Prepared by:

BARKER RYAN CONSULTING

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MEMBER

A1



GENERAL NOTES

1. ALL WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH HAWKESBURY CITY COUNCIL'S CIVIL WORKS SPECIFICATION, PART 2 CONSTRUCTION.
2. THE CONTRACTOR IS TO IDENTIFY, LOCATE AND LEVEL ALL EXISTING SERVICES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION WORKS AND WHERE NECESSARY MAKE ARRANGEMENTS WITH THE RELEVANT AUTHORITY TO RELOCATE OR ADJUST WHERE NECESSARY.
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METRES
1:1000

VOLUME OF MATERIAL REQUIRED TO ATTAIN PROPOSED DESIGN PAD 163,500m³

No.	DATE	AMENDMENT
B	5/6/07	PIPES ADDED AND DESIGN AMENDED
A	7/5/07	CONSTRUCTION CERTIFICATE ISSUE

BARKER RYAN CONSULTING
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Designed: GJR
Drawn: JB
Checked: GJR
Approved: ...../...../.....

Scales: Plan 1:1000
Horiz. -
Vert. -
X-Sect. -

Datum: A.H.D.

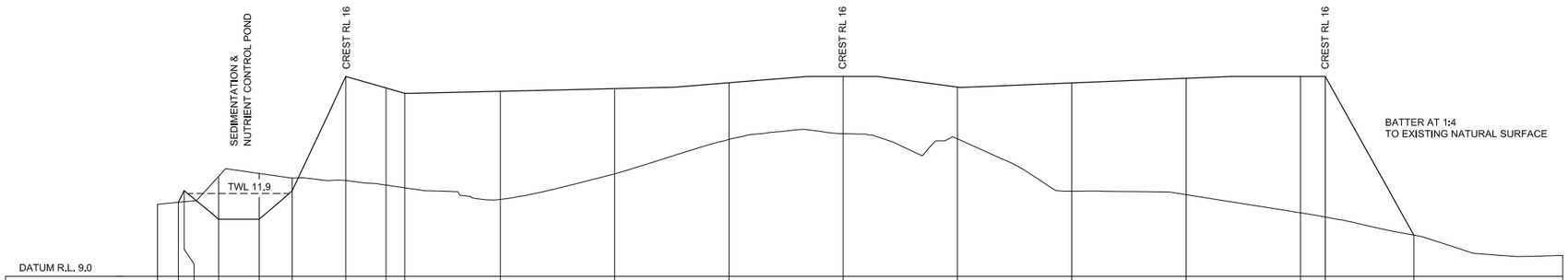
Client: ELF FARM SUPPLIES

LGA: HAWKESBURY
Council Ref:

MULGRAVE ROAD MULGRAVE PROPOSED SITE FILLING OVERALL PLAN SHEET

Plan No. 07043E1 REV. B
File Ref. 07043E1f.dwg
SHEET 1 OF 6 SHEETS

A1

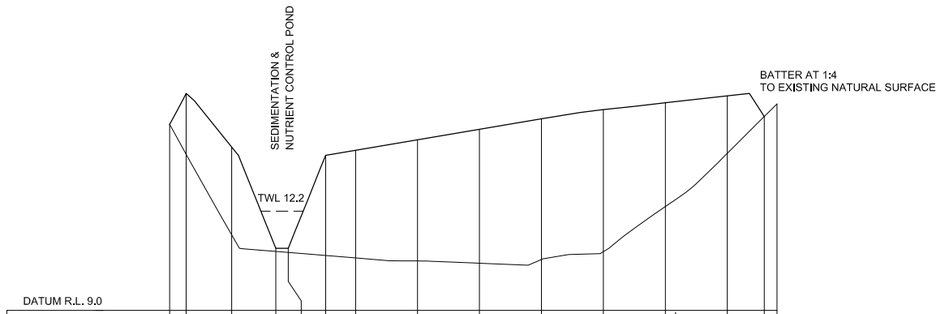


DATUM R.L. 9.0

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CHAINAGE	0	3.644	4.869	10.688	17.793	23.574	32.938	40	43.275	60	80	100	120	140	160	180	200	204.368	219.859	245.917		

LONGITUDINAL SECTION A

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V 1:100



DATUM R.L. 9.0

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LONGITUDINAL SECTION B

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V 1:100

No.	DATE	AMENDMENT
A	7/5/07	CONSTRUCTION CERTIFICATE ISSUE

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Drawn: JB
Checked: GJR
Approved: ..../...../.....

Scales: Plan -
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Vert. 1:100
X-Sect. -

Datum: A.H.D.

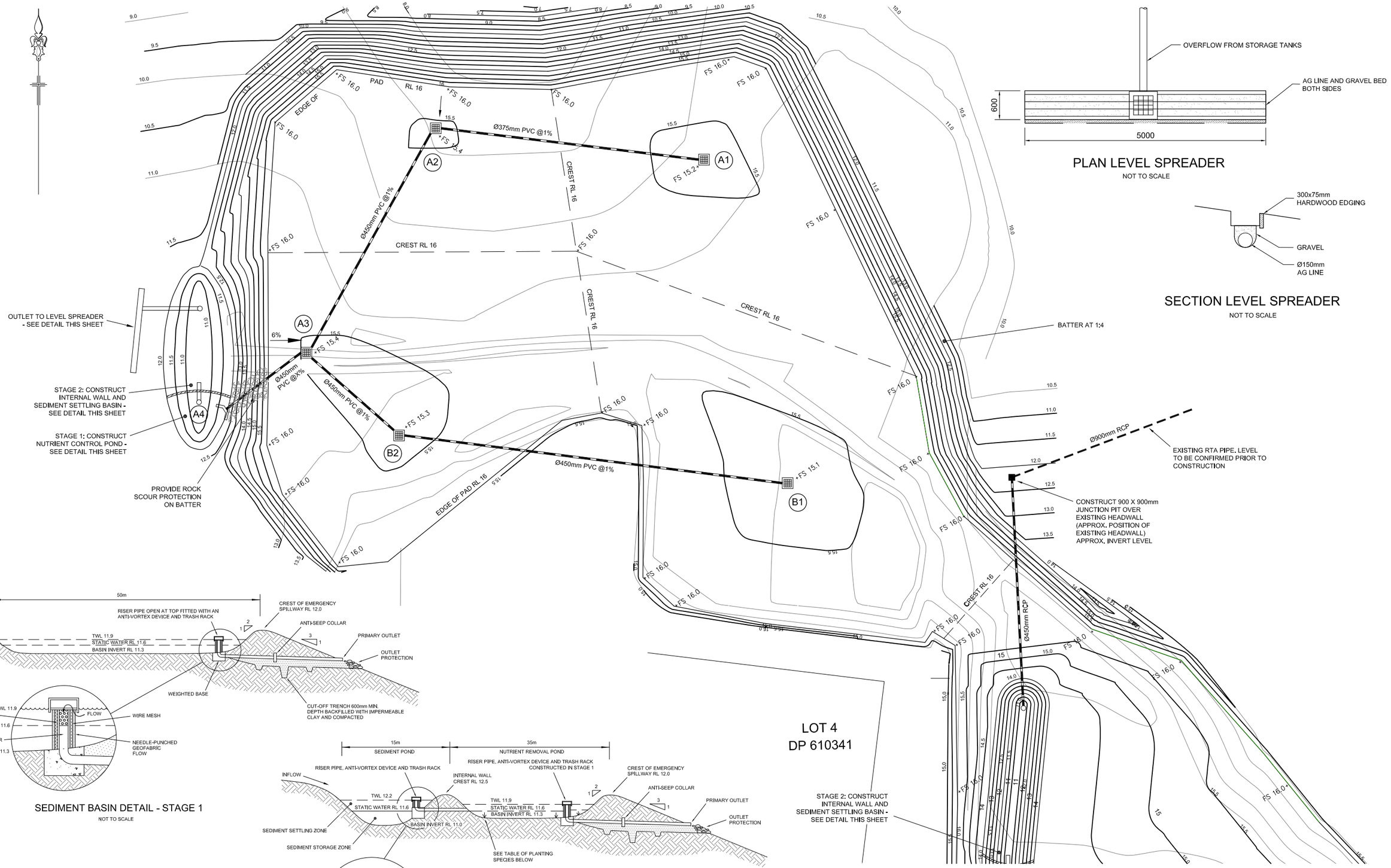
Client: ELF FARM SUPPLIES

LGA: HAWKESBURY
Council Ref:

MULGRAVE ROAD
MULGRAVE
PROPOSED SITE FILLING
SECTIONS

Plan No. 07043E2 REV. A
File Ref. 07043E1d.dwg
SHEET 2 OF 6 SHEETS

A1

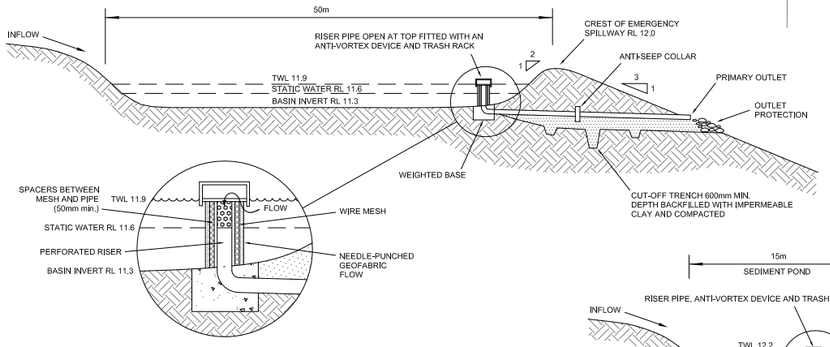


PLAN LEVEL SPREADER

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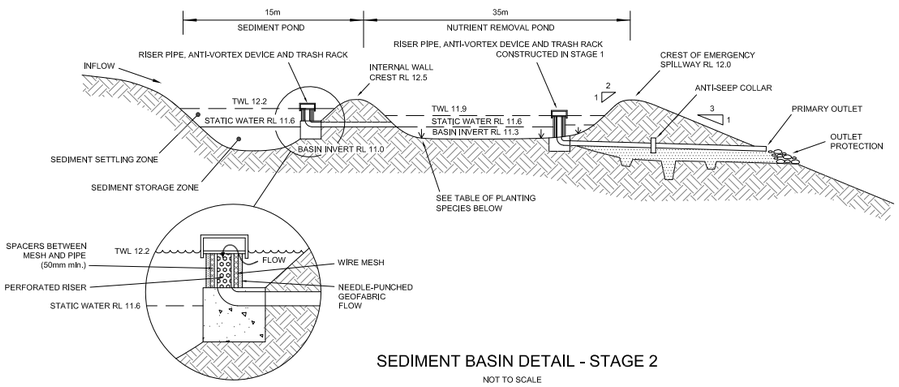
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SEDIMENT BASIN DETAIL - STAGE 1

NOT TO SCALE



SEDIMENT BASIN DETAIL - STAGE 2

NOT TO SCALE

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No.	DATE	AMENDMENT
B	4/6/07	PIPES ADDED AND DESIGN AMENDED
A	7/5/07	CONSTRUCTION CERTIFICATE ISSUE

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Designed: GJR
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Scales: Plan 1:500
Horiz. -
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X-Sect. -

Datum: A.H.D.

Client: ELF FARM SUPPLIES

LGA: HAWKESBURY
Council Ref:

MULGRAVE ROAD MULGRAVE PROPOSED SITE FILLING PLAN SHEET 1

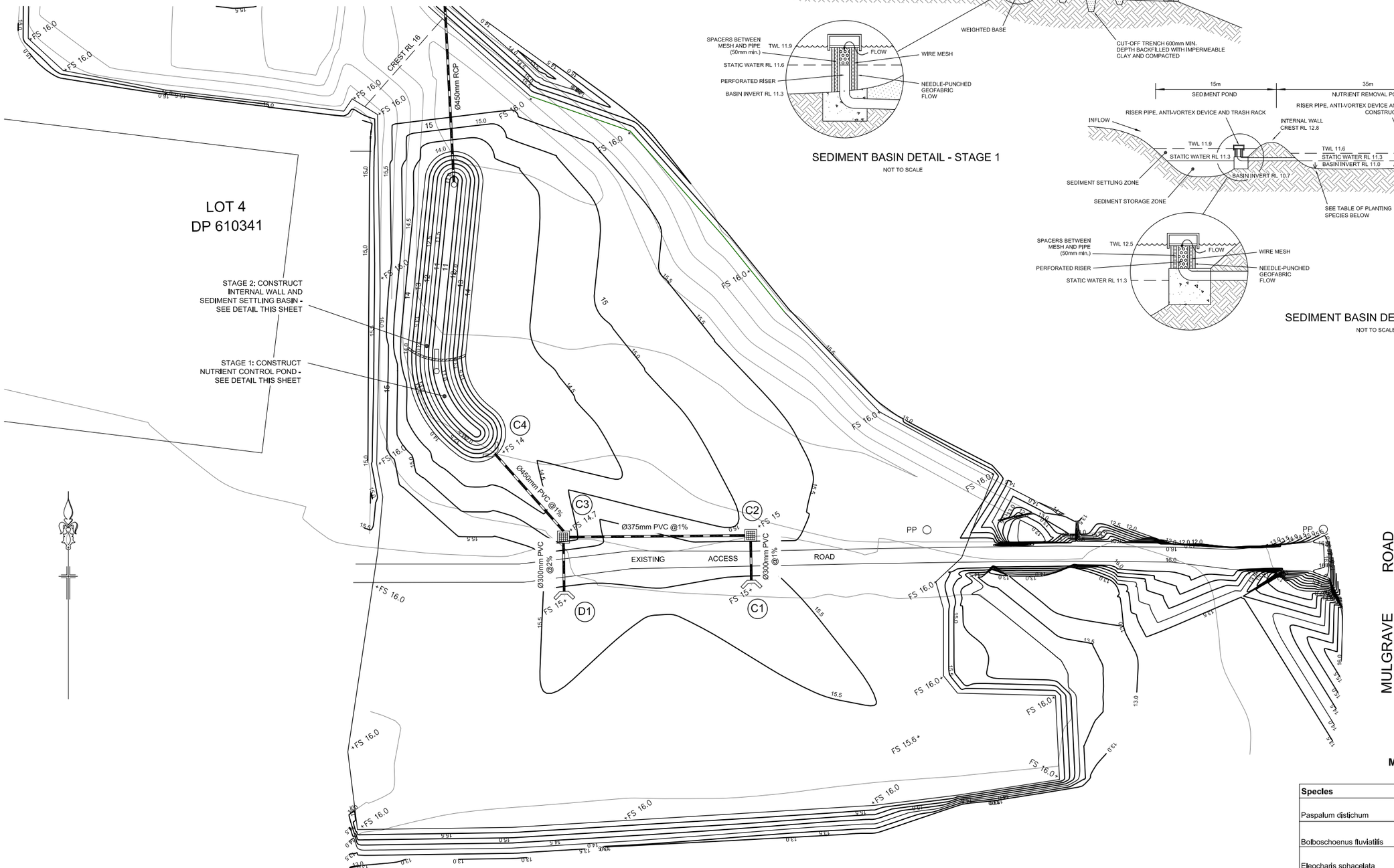
Plan No. 07043E3 REV. B

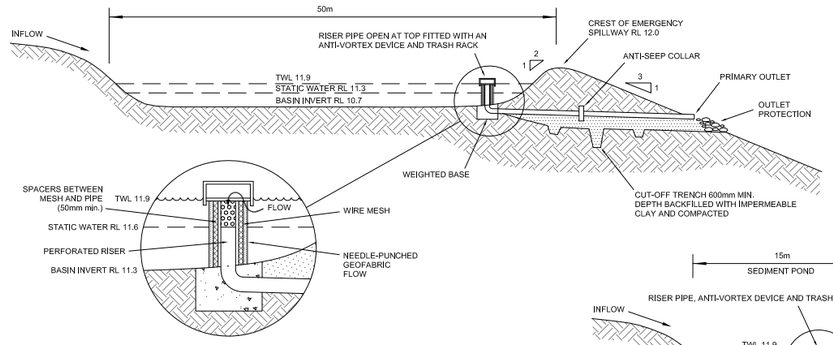
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SHEET 3 OF 6 SHEETS

A1

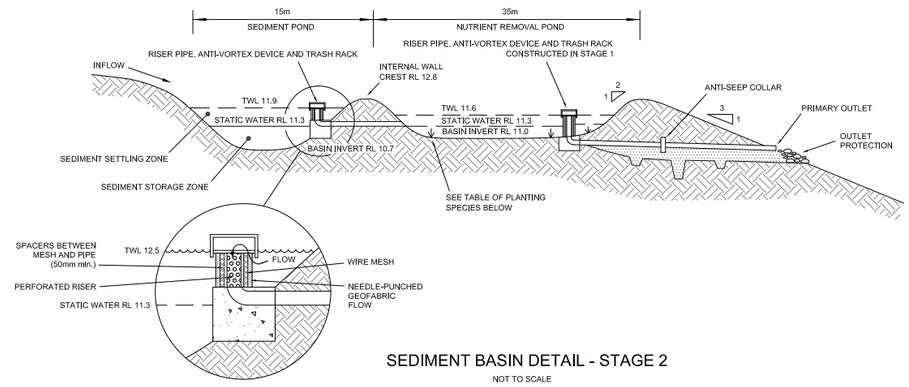
SEE SHEET 2





SEDIMENT BASIN DETAIL - STAGE 1

NOT TO SCALE



SEDIMENT BASIN DETAIL - STAGE 2

NOT TO SCALE

Macrophyte Planting Schedule

Species	Common Name	Planting Location
Paspalum distichum	Water Couch	Edges of pond, beneath static water level
Bolboschoenus fluviatilis	Marsh Clubrush	Below static water level,within 3-5m of edge
Eleocharis sphacelata	Tall Spikerush	Centre of pond
Eleocharis acuta	Common spikerush	Below static water level,within 1-2m of edge
Lomandra Longifolia	Lomandra	Edge of pond, above static water level

10 5 0 5 10 15 20 25 30 35 40 45 50 1:500

METRES

No.	DATE	AMENDMENT
B	5/6/07	PIPES ADDED AND DESIGN AMENDED
A	7/5/07	CONSTRUCTION CERTIFICATE ISSUE

BARKER RYAN CONSULTING
LEVEL 1, 409B GEORGE STREET
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Fax. (02) 4587 9761
ASSOCIATION OF CONSULTING ENGINEERS AUSTRALIA MEMBER

Designed: GJR
Drawn: JB
Checked: GJR
Approved: ...../...../.....

Scales: Plan 1:500
Horiz. -
Vert. -
X-Sect. -

Datum: A.H.D.

Client: ELF FARM SUPPLIES

LGA: HAWKESBURY
Council Ref:

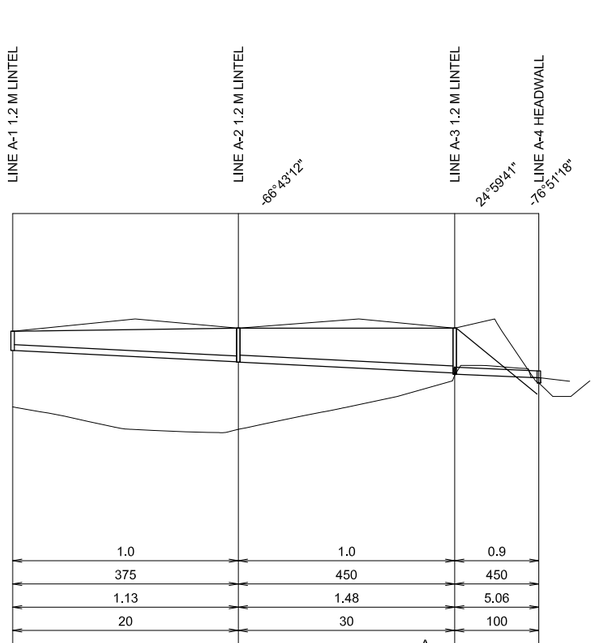
MULGRAVE ROAD MULGRAVE PROPOSED SITE FILLING PLAN SHEET 2 & PLANTING SCHEDULE

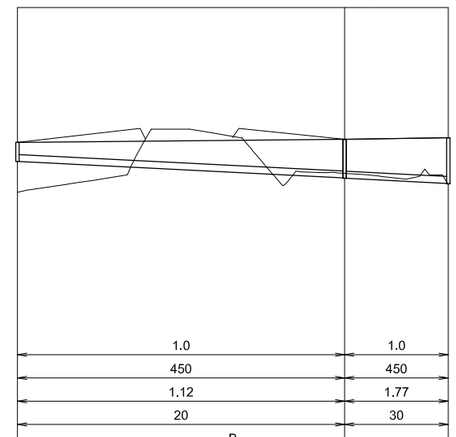
Plan No. 07043E4 REV. B

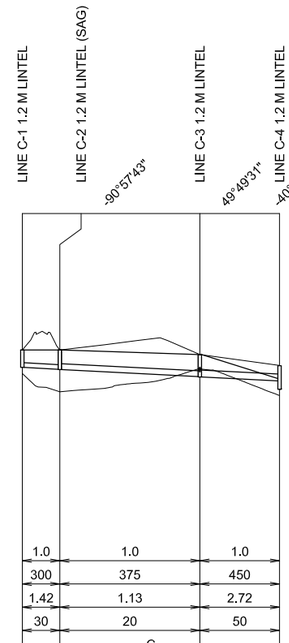
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SHEET 4 OF 6 SHEETS

A1

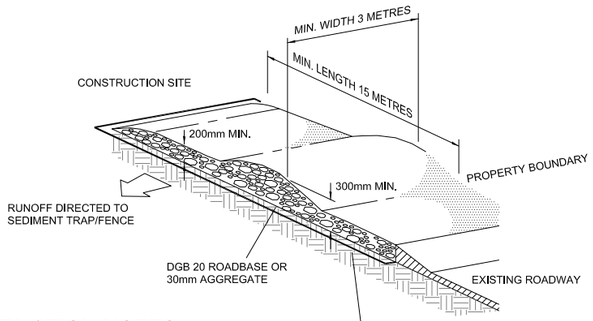

LINE A-1 1.2 M LINTEL
LINE A-2 1.2 M LINTEL
-66°43'12"
LINE A-3 1.2 M LINTEL
24°59'41"
-76°51'18"
LINE A-4 HEADWALL


LINE B-1 1.2 M LINTEL
LINE B-2 1.8 M LINTEL
-34°47'56"
LINE A-3 1.2 M LINTEL


LINE C-1 1.2 M LINTEL
LINE C-2 1.2 M LINTEL (SAG)
-90°57'43"
LINE C-3 1.2 M LINTEL
49°49'31"
-40°37'37"
LINE C-4 1.2 M LINTEL
-18°19'31"

| | | |

A1



CONSTRUCTION NOTES

1. STRIP TOPSOIL AND LEVEL SITE.

2. COMPACT SUBGRADE.

3. COVER AREA WITH NEEDLE-PUNCHED GEOTEXTILE.

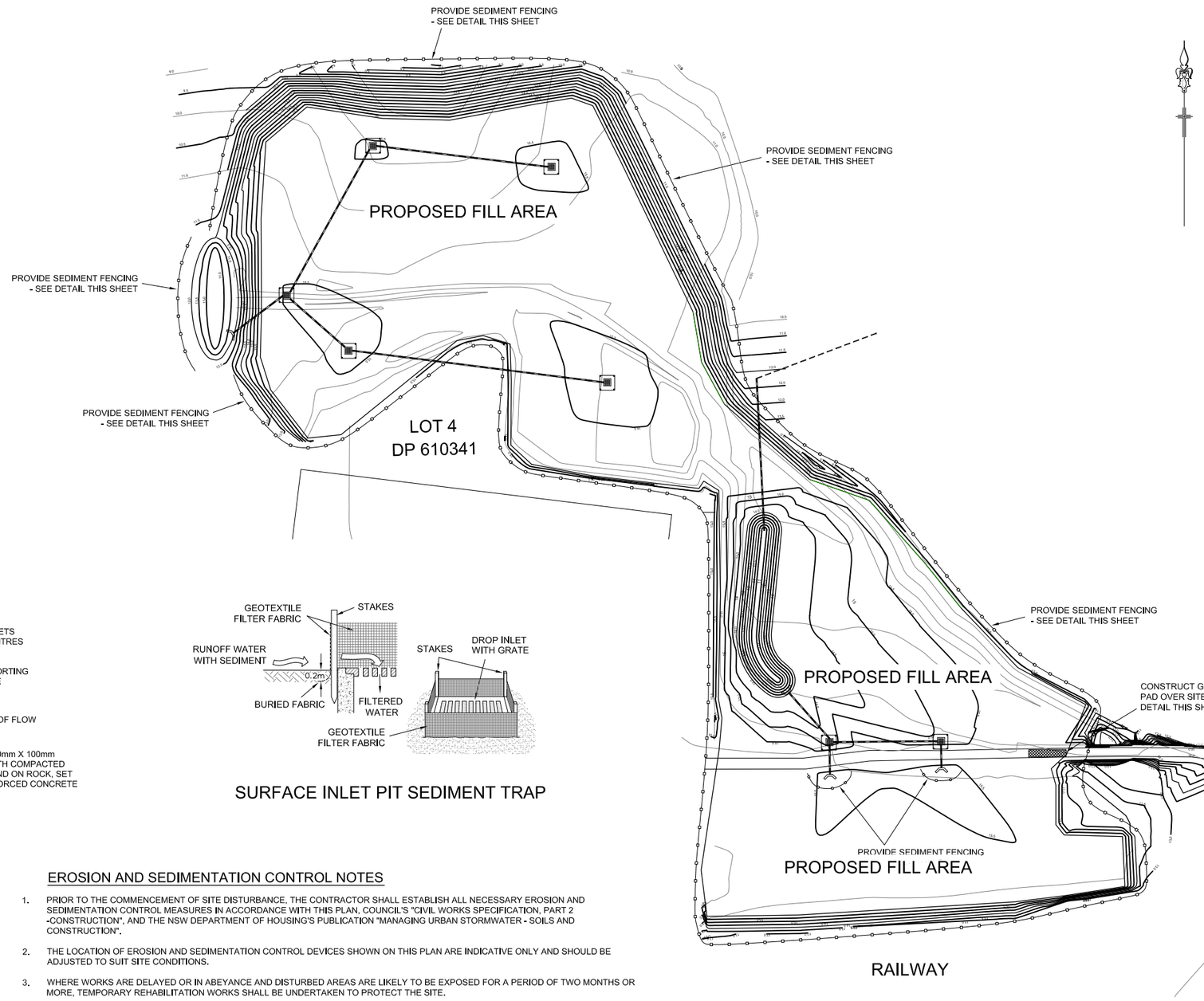
4. CONSTRUCT 200mm THICK PAD OVER GEOTEXTILE USING ROADBASE OR 30mm AGGREGATE. MINIMUM LENGTH 15 METRES OR TO BUILDING ALIGNMENT. MINIMUM WIDTH 3 METRES.

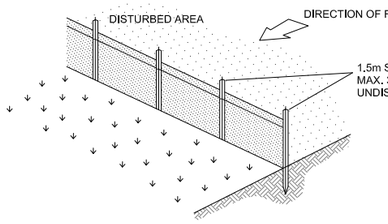
5. CONSTRUCT HUMP IMMEDIATELY WITHIN BOUNDARY TO DIVERT WATER TO A SEDIMENT FENCE OR OTHER SEDIMENT TRAP.

GEOTEXTILE FABRIC DESIGNED TO PREVENT INTERMIXING OF SUBGRADE AND BASE MATERIALS AND TO MAINTAIN GOOD PROPERTIES OF THE SUB-BASE LAYERS.

GEOFABRIC MAY BE A WOVEN OR NEEDLE PUNCHED PRODUCT WITH A MINIMUM CBR BURST STRENGTH (AS3706.4-90) OF 2500 N

STABILISED SITE ACCESS





CONSTRUCTION NOTES

1. CONSTRUCT SEDIMENT FENCE AS CLOSE AS POSSIBLE TO PARRALLEL TO THE CONTOURS OF THE SITE.

2. DRIVE 1.5m LONG STAR PICKETS INTO GROUND 2.5 METRES APART (MAX.)

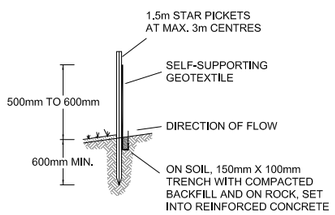
3. DIG A 150mm DEEP TRENCH ALONG THE UPSLOPE LINE OF THE FENCE FOR THE BOTTOM OF THE FABRIC TO BE ENTRENCHED.

4. FIX SELF-SUPPORTING GEOTEXTILE TO UPSLOPE SIDE OF POSTS WITH WIRE TIES OR AS RECOMMENDED BY GEOTEXTILE MANUFACTURER.

5. JOIN SECTIONS OF FABRIC AT A SUPPORT POST WITH A 150mm OVERLAP.

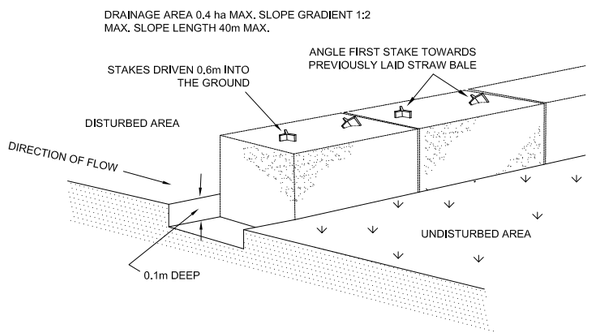
6. BACKFILL THE TRENCH OVER THE BASE OF THE FABRIC AND COMPACT IT THOROUGHLY OVER THE GEOTEXTILE.

SEDIMENT FENCE



SECTION DETAIL

SURFACE INLET PIT SEDIMENT TRAP



STRAW BALE SEDIMENT FILTER

EROSION AND SEDIMENTATION CONTROL NOTES

1. PRIOR TO THE COMMENCEMENT OF SITE DISTURBANCE, THE CONTRACTOR SHALL ESTABLISH ALL NECESSARY EROSION AND SEDIMENTATION CONTROL MEASURES IN ACCORDANCE WITH THIS PLAN, COUNCIL'S "CIVIL WORKS SPECIFICATION, PART 2 -CONSTRUCTION", AND THE NSW DEPARTMENT OF HOUSING'S PUBLICATION "MANAGING URBAN STORMWATER - SOILS AND CONSTRUCTION".

2. THE LOCATION OF EROSION AND SEDIMENTATION CONTROL DEVICES SHOWN ON THIS PLAN ARE INDICATIVE ONLY AND SHOULD BE ADJUSTED TO SUIT SITE CONDITIONS.

3. WHERE WORKS ARE DELAYED OR IN ABEYANCE AND DISTURBED AREAS ARE LIKELY TO BE EXPOSED FOR A PERIOD OF TWO MONTHS OR MORE, TEMPORARY REHABILITATION WORKS SHALL BE UNDERTAKEN TO PROTECT THE SITE.

4. ALL AREAS WITH SLOPES STEEPER THAN 12% (1 in 8) SHALL BE STRAW MULCHED IN CONJUNCTION WITH SEEDING, OR TURFED.

5. SILT BARRIERS LOCATED AROUND KERB INLET AND ROAD PITS SHALL BE REINSTATED FOLLOWING ROAD PAVING WORKS IF IT IS LIKELY THAT UNDISTURBED AREAS WILL STILL DRAIN TO THE PIT.

6. THE CONTRACTOR SHALL CONDUCT WEEKLY INSPECTIONS OF THE SITE TO ENSURE THAT ALL DEVICES AND REHABILITATION AREAS HAVE BEEN ADEQUATELY MAINTAINED. THE CONTRACTOR SHALL ALSO KEEP A LOG BOOK DETAILING SUCH INSPECTIONS, AND RECORDING RAINFALL EVENTS AND OTHER RELEVANT EVENTS.

7. ALL REVEGETATION WORKS ARE TO BE MAINTAINED, INCLUDING WATERING AND MOWING WHERE NECESSARY UNTIL THE COMPLETION OF THE MAINTENANCE PERIOD.

8. THE MOVEMENT OF VEHICULAR TRAFFIC ON THE SITE SHALL BE CONFINED TO DESIGNATED AREAS DURING CONSTRUCTION WORKS. VEHICULAR ACCESS SHALL BE DENIED TO AREAS TO BE LEFT UNDISTURBED.

9. SITE ACCESS SHALL BE LIMITED TO THE LOCATIONS SHOWN ON THIS PLAN. SHAKE-DOWN AREAS SHALL BE CONSTRUCTED AS SHOWN.

10. DURING CONSTRUCTION WORKS, DUST CONTROL MEASURES SHALL BE IMPLEMENTED TO MINIMISE THE AMOUNT OF DUST GENERATED FROM THE SITE. THESE MEASURES TO BE IMPLEMENTED TO COUNCIL'S SATISFACTION.

11. MAINTENANCE AND CLEANING OF CONSTRUCTION PLANT SHALL BE CARRIED OUT IN AN AREA WHERE RUNOFF CAN BE CONTAINED AND APPROPRIATELY TREATED AND DISPOSED OF.

12. ALL EROSION AND SEDIMENTATION CONTROL DEVICES SHALL REMAIN IN PLACE UNTIL ALL DISTURBED AREAS HAVE ADEQUATELY REGENERATED. THIS STAGE SHALL BE DETERMINED BY THE CERTIFIER.

LEGEND

- SILT FENCE
- STRAW BALE BARRIER
- GRAVEL SHAKER PAD AT ENTRANCE TO WORKS

20 10 0 10 20 30 40 50 60 70 80 90 100 1:1000
METRES

No.	DATE	AMENDMENT
B	5/6/07	PIPES ADDED AND DESIGN AMENDED
A	7/5/07	CONSTRUCTION CERTIFICATE ISSUE

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Fax. (02) 4587 9761
ASSOCIATION OF CONSULTING ENGINEERS AUSTRALIA MEMBER

Designed: GJR
Drawn: JB
Checked: GJR
Approved: ...../...../.....

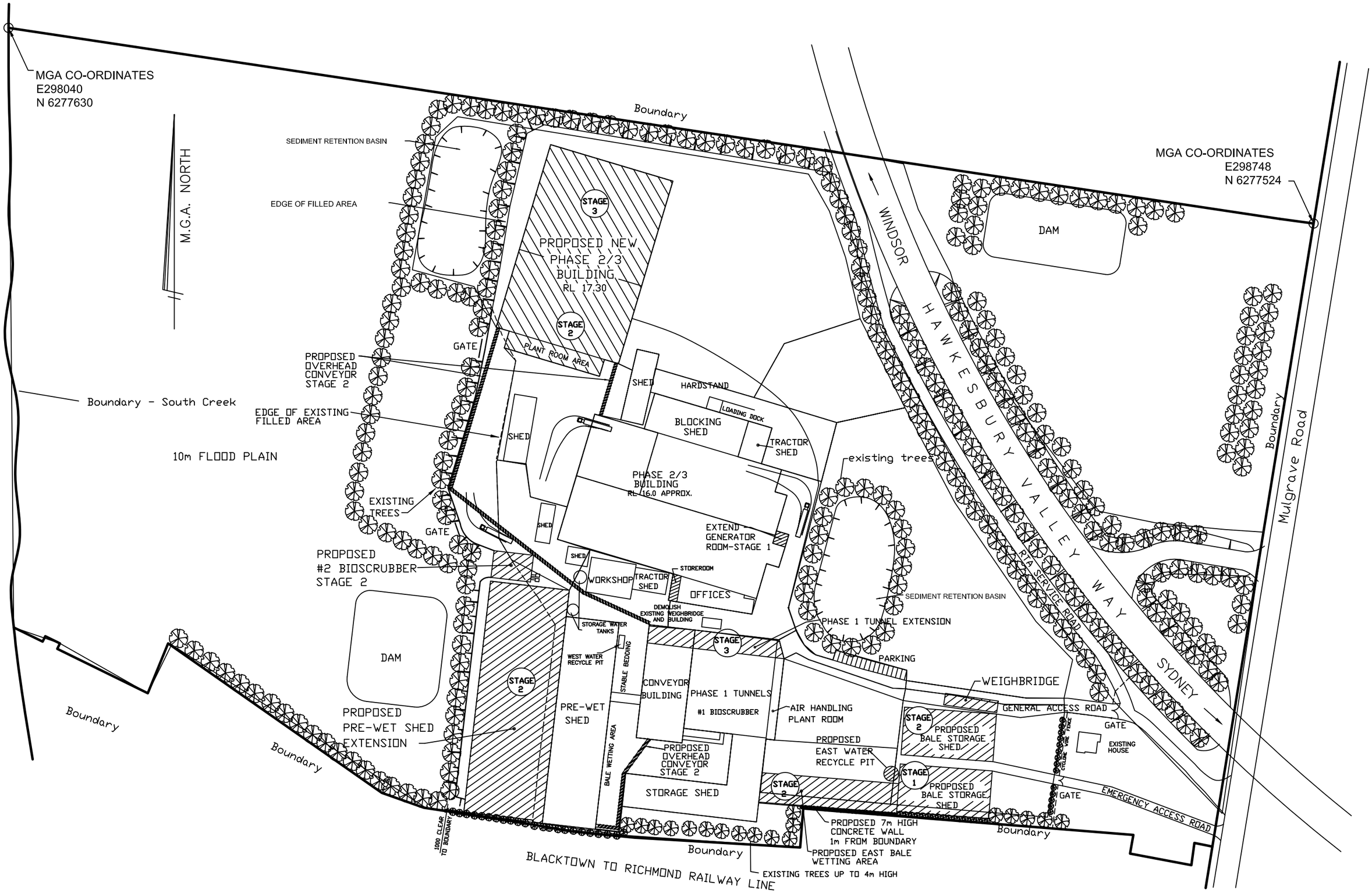
Scales: Plan 1:1000
Horiz. -
Vert. -
X-Sect. -
Datum: A.H.D.

Client: ELF FARM SUPPLIES
LGA: HAWKESBURY
Council Ref:

MULGRAVE ROAD MULGRAVE PROPOSED SITE FILLING SEDIMENT DETAILS & NOTES

Plan No. 07043E6 REV. B
File Ref. 07043E1f.dwg
SHEET 6 OF 6 SHEETS

Appendix C. Site Proposal



(D. A. DRAWING ONLY - NOT FOR CONSTRUCTION)

ABODE DESIGN
PO BOX 767 RICHMOND
PH. 4776 1125 0419 405006

DRAWN	DATE DRAWN	SCALE
I.S.	20.6.2007	1:1000

MUSHROOM SUBSTRATE PLANT EXTENSIONS DEVELOPMENT APPLICATION

ELF FARM SUPPLIES PTY LTD
P.O.BOX 615 WINDSOR NSW 2756
108 MULGRAVE ROAD MULGRAVE NSW 2756
TEL.ISD (61)02 45775000 FAX.ISD (61)0245878002

DRAWING NO.	ISSUE
200608	I

Appendix D. Catchment Plan

A3

40 20 0 20 40 60 80 100 120 140 160 180 200

METRES

1:2000

CONSTRUCT CATCH DRAIN ALONG TOP OF EMBANKMENT TO DIVERT 100 YR FLOW INTO BASIN

BASIN 2

7660m²

STAGE 3

PROPOSED NEW PHASE 2/3 BUILDING RL 17.30

STAGE 2

17240m²

GRASS

WINDSOR

Ø900

REED BED

DAM

DAM OVERFLOW

HAWKESBURY

VALLEY

WAY

SYDNEY

RTA SERVICE ROAD

Mulgrave Road

RTA LAND

LAND CURRENTLY FALLS TO FLOOD PLAIN. WHEN DIVERTED WILL FALL TO BASIN 2

GATE

PLANT ROOM AREA

SHED

480m²

3520m²

HARDSTAND

LOADING DOCK

2830m²

Ø450

EDGE OF EXISTING PAVEMENT

SHED

BLOCKING SHED

1250m²

3000m²

PHASE 2/3 BUILDING RL 16.0 APPROX.

3940m²

GATE

4700m²

1850m²

BASIN 1

13820m²

GRASS

OFFICES

PART ROOF

5420m²

STORAGE WATER TANKS

EXISTING CATCH DRAINS

DAM

WEST WATER RECYCLE PIT

STAGE 3

CONVEYOR BUILDING

1530m²

PARKING

STAGE 2

PRE-WET SHED

PRE-WET SHED

4740m²

BALE WETTING AREA

3260m²

5090m² PRE

2640m² POST

STAGE 2

3930m²

PROPOSED BALE STORAGE SHED

GATE

EXISTING HOUSE

PROPOSED EAST WATER RECYCLE PIT

STAGE 1

PROPOSED BALE STORAGE SHED

GATE

EMERGENCY ACCESS ROAD

STORAGE SHED 4470m²

STAGE 2

AREA CURRENTLY PASTURE DRAINS TO FLOODPLAIN. NEW BUILDING WILL HAVE 4000m² DIRECTED TO BASIN 2 AND 1420m² ONTO FLOODPLAIN

BLACKTOWN TO RICHMOND RAILWAY LINE

DISCHARGE TO ADJOINING PROPERTY

PROPOSED EAST BALE WETTING AREA. CURRENTLY DRAINS TO BASIN 1. AREA DRAIN TO EAST WATER RECYCLE PIT. A = 2450m²

No.	DATE	AMENDMENT
A	18/11/10	FIRST ISSUE

Barker Ryan Stewart
Planning • Sustainability • Infrastructure • Development • Certification
ABN: 26 134 067 842
barkerryanstewart.com.au
mail@barkerryanstewart.com.au
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Central Coast P: 02 4304 1144
Hunter P: 02 4929 3639
Brisbane P: 07 3118 5158
CONSULT AUSTRALIA

Designed: GJ
Drawn: JB
Checked: GJ
Approved: ...../...../.....

Scales: Plan 1:2000
Horiz.
Vert.
X-Sect.

Datum: A.H.D.

Client: ELF FARM SUPPLIES PTY LTD

LGA: HAWKESBURY
Council Ref:

108 MULGRAVE ROAD MULGRAVE MUSHROOM SUBSTRATE PLANT EXTENSIONS CATCHMENT PLAN

Plan No. 07166E20
REV. A
File Ref. 07166E20.dwg
SHEET 1 OF 1 SHEETS

Appendix E. Engineering Drainage Plans

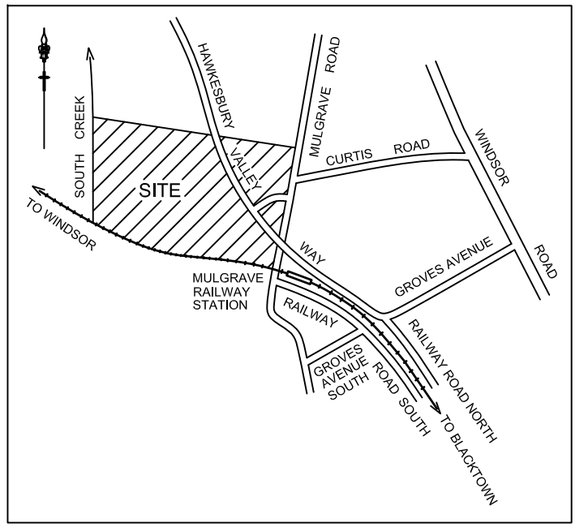
A3

HAWKESBURY CITY COUNCIL
108 MULGRAVE ROAD, MULGRAVE
MUSHROOM SUBSTRATE PLANT EXTENSIONS
DRAINAGE DESIGN PLANS

Prepared for: Elf Farm Supplies Pty Ltd

GENERAL NOTES

1. ALL WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH HAWKESBURY CITY COUNCIL'S CIVIL WORKS SPECIFICATION, PART 2 CONSTRUCTION AND/OR AS DIRECTED BY THEIR REPRESENTATIVE.
2. THE CONTRACTOR IS TO IDENTIFY, LOCATE AND LEVEL ALL EXISTING SERVICES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION WORKS AND WHERE NECESSARY MAKE ARRANGEMENTS WITH THE RELEVANT AUTHORITY TO RELOCATE OR ADJUST WHERE NECESSARY.
3. COUNCIL'S TREE PRESERVATION ORDER MUST BE OBSERVED AND NO TREE SHALL BE FELLED, LOPPED OR REMOVED WITHOUT THE PRIOR APPROVAL OF COUNCIL.
4. ALL WORKS SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE OCCUPATIONAL HEALTH & SAFETY ACT 2000 AND ALL RELEVANT OCCUPATIONAL HEALTH & SAFETY POLICIES AND REGULATIONS.
5. DIMENSIONS SHALL NOT BE SCALED FROM THE PLANS. CLARIFICATION OF DIMENSIONS SHALL BE SOUGHT FROM THE SUPERINTENDENT OR REFERRED TO THE DESIGNER.
6. SURVEY MARKS SHOWN THUS ▲ SHALL BE MAINTAINED AT ALL TIMES. WHERE RETENTION IS NOT POSSIBLE THE ENGINEER SHALL BE NOTIFIED AND CONSENT RECIEVED PRIOR TO THEIR REMOVAL.
7. ALL NEW WORK IS TO MAKE A SMOOTH JUNCTION WITH EXISTING CONDITIONS.
8. THE CONTRACTOR IS NOT TO ENTER UPON NOR DO ANY WORK WITHIN OR ON ADJACENT LANDS WITHOUT THE PRIOR APPROVAL OF THE SUPERINTENDENT AND THE WRITTEN PERMISSION OF THE OWNERS.
9. SEDIMENT MEASURES SHALL BE IMPLEMENTED PRIOR TO SOIL DISTURBANCE IN KEEPING WITH THE 4th EDITION OF LANDCOMS "SOILS AND CONSTRUCTION - MANAGING URBAN STORMWATER" MARCH 2004 TO THE SATISFACTION OF COUNCIL'S REPRESENTATIVE AND AS SHOWN IN THESE DRAWINGS.
10. THE CONTRACTOR SHALL CLEAR AND DISPOSE OF ONLY THOSE TREES THAT ARE CONDEMNED BY THE PLANS. COUNCIL'S TREE PRESERVATION ORDER SHALL BE OBSERVED AND NO TREE SHALL BE FELLED, LOPPED OR REMOVED WITHOUT PRIOR APPROVAL.
11. THE CONTRACTOR SHALL CLEAR THE SITE BY REMOVING ALL RUBBISH, FENCES, OUT HOUSES, CAR BODIES, DEBRIS, ETC. THE CONTRACTOR SHALL NOT DISPOSE OF ANY DEBRIS BY BURNING OFF IN AN OPEN FIRE.
12. UNSOUND MATERIALS AS DETERMINED BY COUNCIL'S REPRESENTATIVE SHALL BE REMOVED FROM ROADS AND LOTS PRIOR TO ANY FILLING.
13. ALL SITE REGRADING AREAS SHALL BE GRADED TO THE SATISFACTION OF COUNCIL'S REPRESENTATIVE. THE CONTRACTOR SHALL TAKE LEVELS ON THE EXISTING SURFACE AFTER STRIPPING TOPSOIL AND PRIOR TO COMMENCING ANY FILL OPERATIONS.
14. SURPLUS EXCAVATED MATERIAL SHALL BE PLACED OR DISPOSED OF IN ACCORDANCE WITH THE CONTRACT, OR AS DIRECTED BY THE SUPERINTENDENT.
15. ALL SITE FILLING SHALL BE PLACED IN LAYERS NOT EXCEEDING 300mm AND COMPACTED IN ACCORDANCE WITH COUNCIL'S SPECIFICATION AND BE TESTED AT THE REQUIRED INTERAVLS BY AN APPROVED N.A.T.A. GEOTECHNICAL LABORATORY.
16. MINIMUM 150mm THICK TOPSOIL SHALL BE SPREAD ON ALL FOOTPATHS, BERMS, BATTERS AND SITE REGRADING AREAS. EXCESS TOPSOIL SHALL BE DISPOSED OF AS DIRECTED BY THE SUPERINTENDENT.
17. ALL LAND DISTURBED BY EARTHWORKS SHALL BE SPRAY-GRASSED, OR SIMILARLY TREATED TO ESTABLISH GRASS COVER. SEED MIXTURES ARE TO BE APPROVED BY COUNCIL PRIOR TO SPRAYING. ALL GRASSED AREAS SHALL BE REGULARLY WATERED AND MAINTAINED UNTIL EXPIRATION OF THE MAINTENANCE PERIOD.
18. THE CONTRACTOR SHALL MAINTAIN DUST CONTROL THROUGHOUT THE DURATION OF THE PROJECT.
19. ALL PITS DEEPER THAN 1.2m SHALL HAVE STEP IRONS PROVIDED IN ACCORDANCE WITH COUNCIL'S STANDARDS.
20. ALL DRAINAGE LINES THROUGH LOTS SHALL BE CONTAINED WITHIN THEIR EASEMENTS AND CONFORM WITH COUNCIL'S STANDARDS.
21. ALL DRAINAGE LINES ON HIGH SIDE AND UNDER ROADS SHALL BE BACKFILLEDWITH SHARP SAND AND HAVE 3.0m OF AGRICULTURAL LINE WRAPPED IN AN APPROVED FILTER FABRIC, DISCHARGING INTO THE DOWNSTREAM PIT.
22. SUBSOIL DRAINS SHALL BE CONSTRUCTED TO THE SATISFACTION OF COUNCIL'S REPRESENTATIVE.
23. PRECAST KERB INLET LINTELS SHALL BE USED ON GULLY PITS. GRATES SHALL BE "WELDLOK" TYPE GG 78-51 OR APPROVED EQUIVALENT.
24. PROVIDE VEHICULAR ENTRIES IN KERB AND GUTTER WHERE SHOWN OR WHERE DIRECTED BY THE SUPERINTENDANT.
25. GUIDE POSTS SHALL BE 100mm X 50mm HARDWOOD, PAINTED WHITE WITH REFLECTORS.
26. ERECT STREET NAME SIGNS, CONDUIT WARNING SIGNS AND NO THROUGH ROAD SIGNS WHERE SHOWN OR WHERE DIRECTED BY COUNCIL'S REPRESENTATIVE.
27. CONDUITS SHALL BE LAID AFTER POSITIONS HAVE BEEN DETERMINED BY THE RELEVANT AUTHORITIES AND BEFORE FINAL A.C. IS LAID
28. POSITION OF CONDUITS SHALL BE MARKED ON THE KERB.
29. FELLED TREES SHALL BE SALVAGED FOR RE-USE AS WOODCHIP MULCH OR LOG FORM FOR SITE REHABILITATION. NON-SALVAGEABLE MATERIAL SUCH AS STUMPS AND ROOTS SHALL BE DISPOSED OF OFF SITE.
30. THE CONTRACTOR SHALL PROVIDE MINIMUM 24 HOURS NOTICE TO COUNCIL'S REPRESENTATIVE FOR ALL INSPECTIONS.
31. THE CONTRACTOR SHALL MAINTAIN SERVICES AND ALL WEATHER ACCESS AT ALL TIMES TO THE ADJOINING PROPERTIES.
32. THE CONTRACTOR SHALL UNDERTAKE TRAFFIC CONTROL MEASURES TO COUNCIL'S SATISFACTION AND SHALL DISPLAY ALL APPROPRIATE WARNING SIGNS THROUGHOUT THE DURATION OF CONSTRUCTION.
33. ALL NATURAL SURFACE DATA HAS BEEN DETERMINED BY TERRAIN MODELLING. ALL CONSTRUCTION SITE WORKS MUST BE CARRIED OUT USING THE BENCH MARKS SHOWN ON THESE DRAWINGS.
34. ACCESS BY CONSTRUCTION VEHICLES SHALL BE FROM RICHMOND ROAD & THORLEY STREET. NO ACCESS SHALL BE OBTAINED FROM ALEXANDER STREET WITHOUT THE APPROVAL OF THE SUPERINTENDENT.
35. CENTRELINE AND EDGE LINES ARE NOT TO BE PROVIDED FOR FLEXIBILITY OF TRAFFIC MOVEMENTS DURING EVACUATIONS.
36. INSTALLATION OF GUARDRAIL AND BARRIERS AS DETAILED ON THESE PLANS HAS BEEN REFERRED TO AND APPROVED BY RTA. SEE SHEET No 9 FOR DETAILS. NO MODIFICATIONS ARE TO BE UNDERTAKEN WITHOUT THE PRIOR APPROVAL OF THE SUPERINTENDENT.
37. SIGNPOSTING FOR SPEED CONTROL ON THE EVACUATION ROUTE SHALL BE 40kph REGULATORY TYPE AND SPEED ADVISORY SIGNPOSTING AT CURVE No 1 SHALL BE 25kph. LOCATIONS ARE DETAILED ON THE PLAN VIEWS AND ARE TO BE CONFIRMED BY THE SUPERINTENDENT.



LOCALITY SKETCH
NOT TO SCALE

LEGEND

- PROPOSED DRAINAGE LINE
- EXISTING DRAINAGE LINE
- ROAD TABLE DRAIN
- MAIN SWALE DRAIN
- FENCE
- PIT
- EXISTING PIT
- HEADWALL
- PAVEMENT AREA
- BATTERS
- ROAD SIGN
- EXISTING SEWER MANHOLE
- WATER METER
- POWER POLE
- SERVICES POLE
- GAS
- SEWER
- WATER
- TELSTRA
- OVERHEAD ELECTRICITY
- PP POWER POLE
- TREE TO BE REMOVED

SHEET INDEX

SHEET No.	REVISION	DESCRIPTION
COVER SHEET		COVER SHEET, INDEX. LOCALITY SKETCH AND LEGEND
2	A	PLAN SHEET
3	A	BASIN 1 DETAIL
4	A	BASIN 2 DETAIL
5	A	REED BED/WETLAND PLAN
6	A	BIO BASIN DETAIL

Prepared by:
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Proud Member of CONSULT AUSTRALIA

A3

CONSTRUCT CATCH DRAIN ALONG TOP OF EMBANKMENT TO DIVERT 100 YR FLOW INTO BASIN

EXISTING REED BED/WETLANDS TO BE EXTENDED - SEE DETAIL SHEET 4

BASIN 2

STAGE 3

PROPOSED NEW PHASE 2/3 BUILDING

RL 17.30

WINDSOR

Ø900

DAM

HAWKESBURY

VALLEY

WAY

DAM OVERFLOW

BIO BASIN OVERFLOW FROM BASIN 2. SPILLWAY LEVEL RL 11.1 5m WIDE SPILLING ONTO FLOODPLAIN - SEE BIO BASIN DETAIL SHEET 5

STAGE 2

GATE

PLANT ROOM AREA

SHED

PROVIDE MINIMUM 1% FALL TO BASIN 2 ALONG EDGE OF PROPOSED HARDSTAND AREA

HARDSTAND

Ø450

EDGE OF EXISTING PAVEMENT

SHED

LOADING DOCK

BLOCKING SHED

Ø450

PHASE 2/3 BUILDING

RL 16.0 APPROX.

Mulgrave Road

GATE

INSTALL A GPT TO END OF EXISTING DRAINAGE LINE

OFFICES

PART ROOF

STORAGE WATER TANKS

EXISTING CATCH DRAINS

DAM

WEST WATER RECYCLE PIT

STAGE 3

BASIN 1 TO HAVE ITS OUTLET UPGRADED AS PER SHEET 2

PARKING

CONVEYOR BUILDING

RTA SERVICE ROAD

RTA LAND

SYDNEY

STAGE 2

PRE-WET SHED

PROPOSED PRE-WET SHED

BALE WETTING AREA

STAGE 2

PROPOSED BALE STORAGE SHED

GATE

EXISTING HOUSE

PROPOSED EAST WATER RECYCLE PIT

STAGE 1

PROPOSED BALE STORAGE SHED

PART ROOF

STORAGE SHED

STAGE 2

GATE

EMERGENCY ACCESS ROAD

AREA CURRENTLY PASTURE DRAINS TO FLOODPLAIN. NEW BUILDING WILL HAVE 4000m² DIRECTED TO BASIN 2 AND 1420m² ONTO FLOODPLAIN

BLACKTOWN TO RICHMOND RAILWAY LINE

PROPOSED EAST BALE WETTING AREA. CURRENTLY DRAINS TO BASIN 1. AREA DRAIN TO EAST WATER RECYCLE PIT. A = 2450m²

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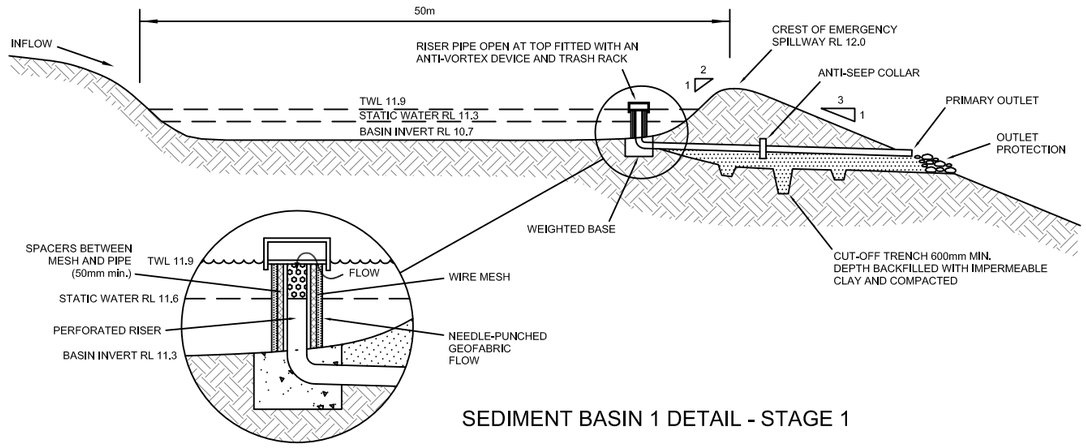
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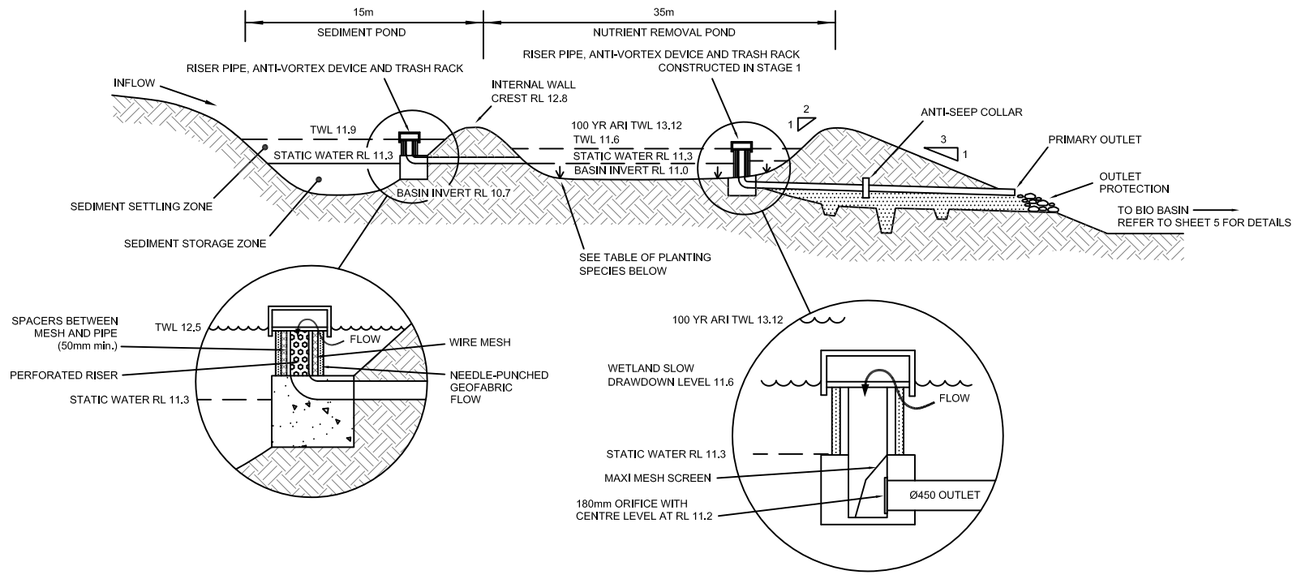
108 MULGRAVE ROAD MULGRAVE MUSHROOM SUBSTRATE PLANT EXTENSIONS ENGINEERING DESIGN PLAN

Plan No. 07166E12
REV. A
File Ref. 07166E11.dwg
SHEET 2 OF 6 SHEETS

A3



SEDIMENT BASIN 1 DETAIL - STAGE 1



SEDIMENT BASIN 1 DETAIL - STAGE 2

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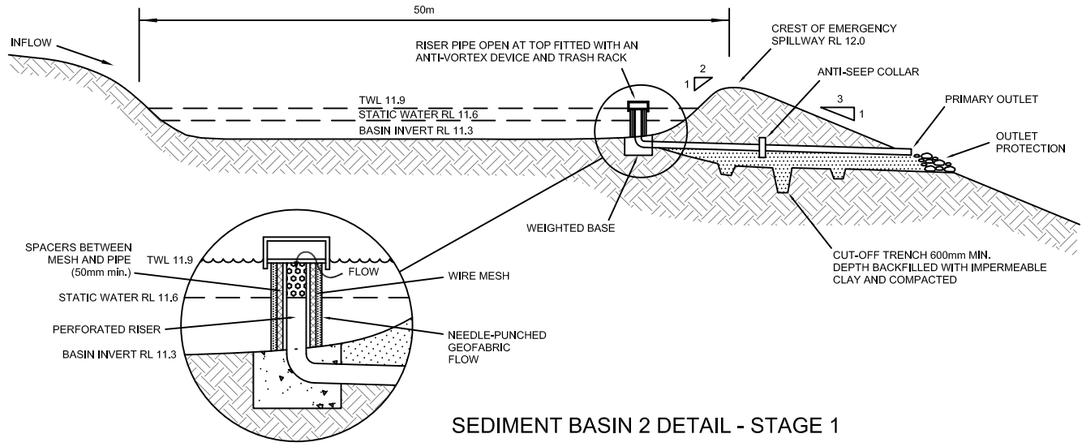
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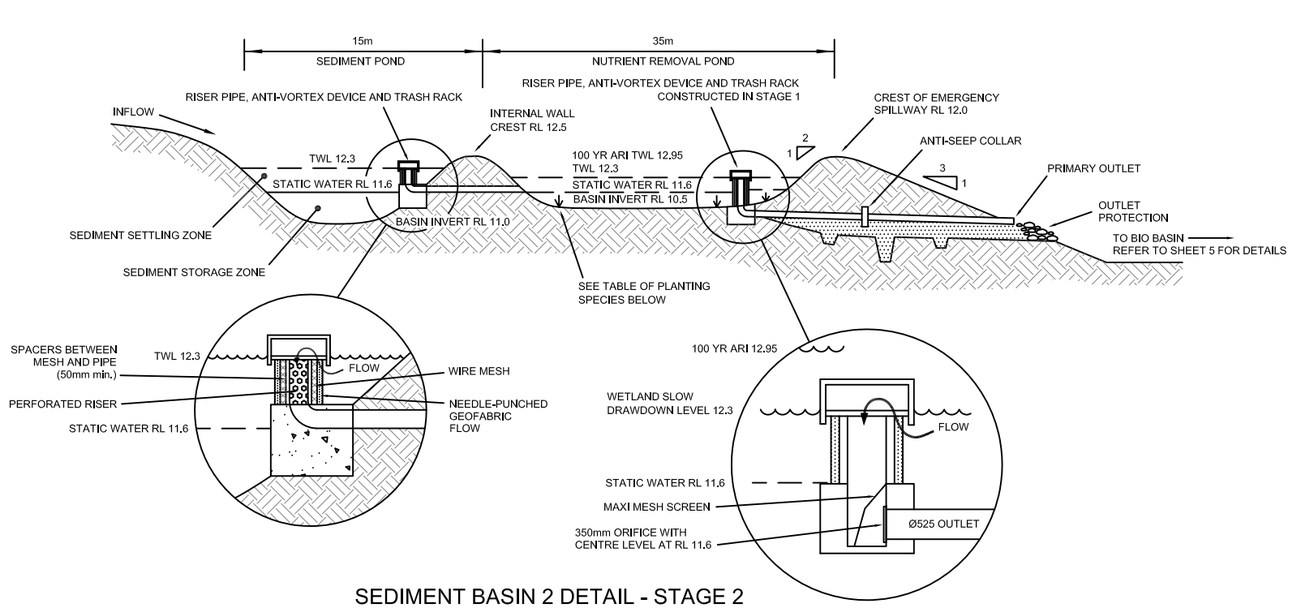
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Plan No. 07166E13
REV. A
File Ref. 07166E11.dwg
SHEET 3 OF 6 SHEETS

A3



SEDIMENT BASIN 2 DETAIL - STAGE 1



SEDIMENT BASIN 2 DETAIL - STAGE 2

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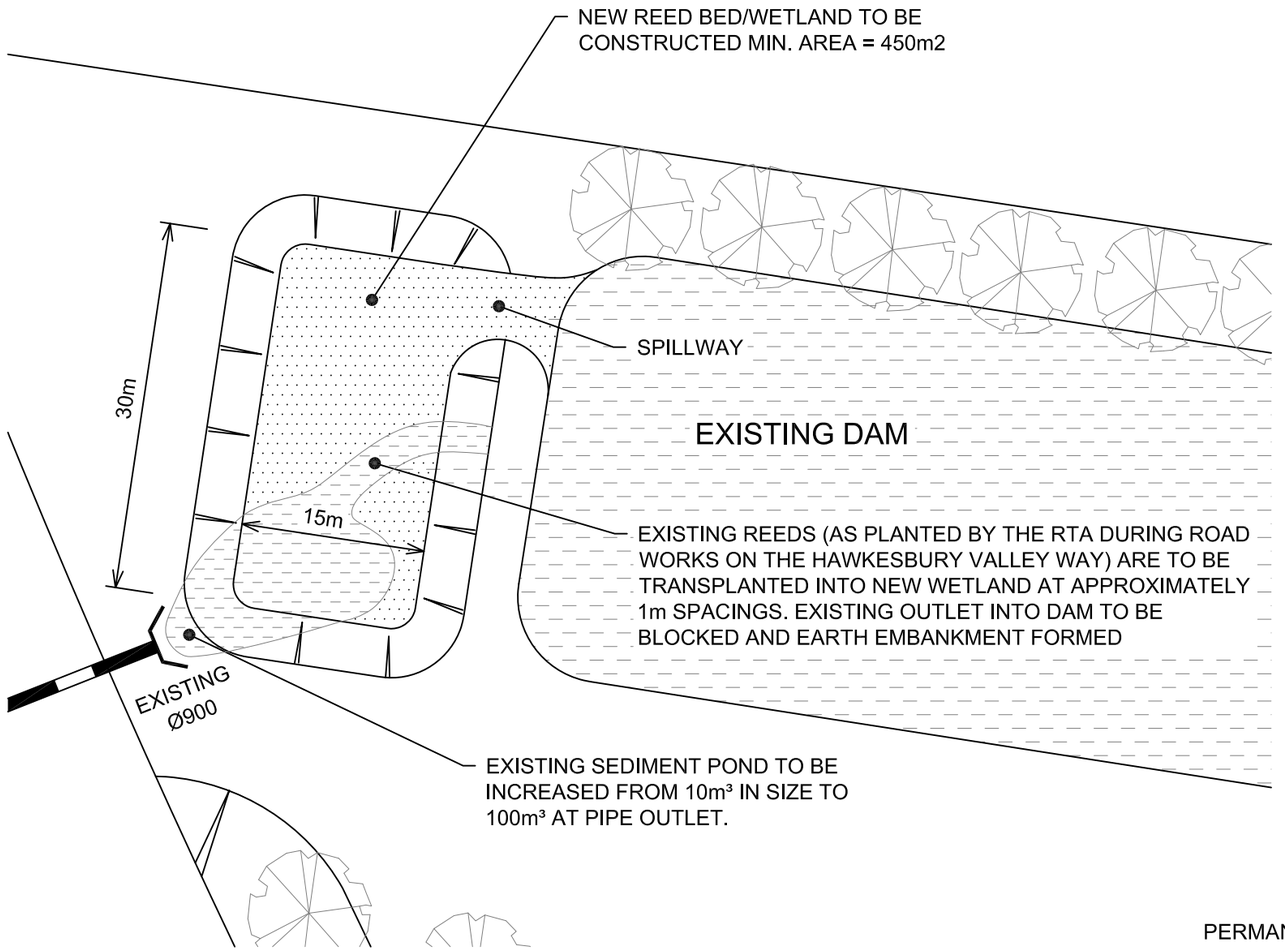
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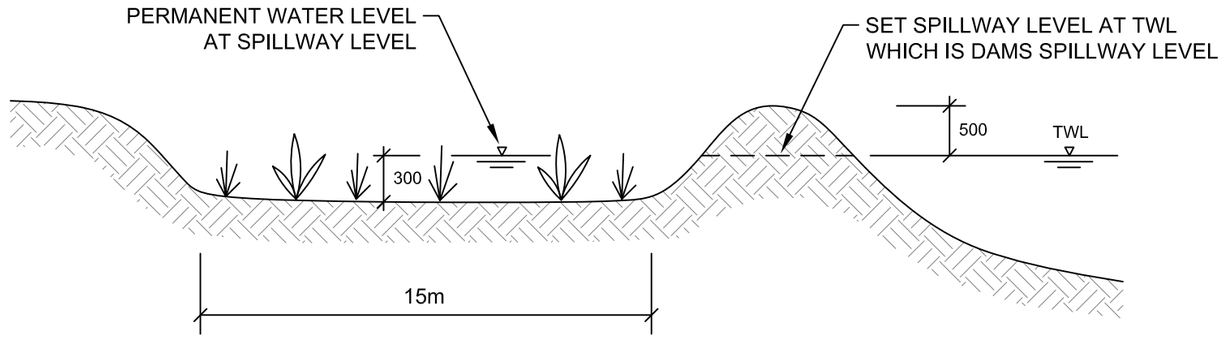
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Plan No. 07166E14
REV. A
File Ref. 07166E11.dwg
SHEET 4 OF 6 SHEETS

A3



PLAN
1:500



REED BED/WETLAND SECTION
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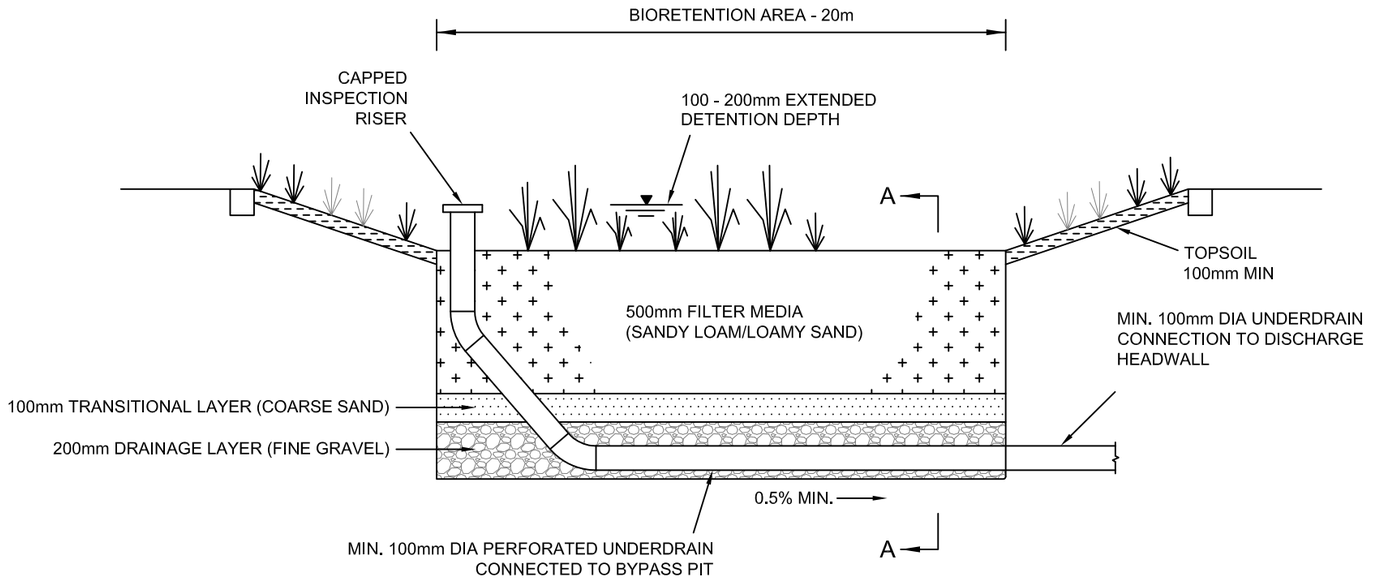
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108 MULGRAVE ROAD
MULGRAVE
MUSHROOM SUBSTRATE PLANT EXTENSIONS
REED BED/WETLAND PLAN

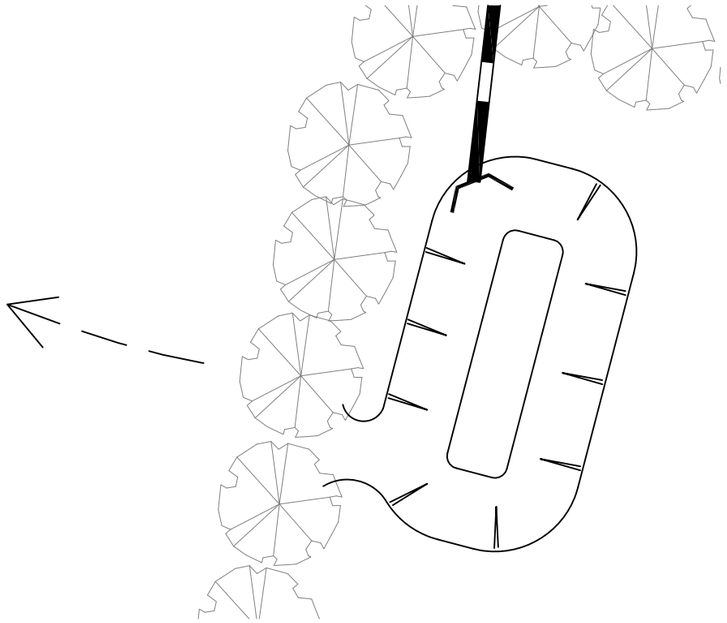
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SHEET 5 OF 6 SHEETS

A3



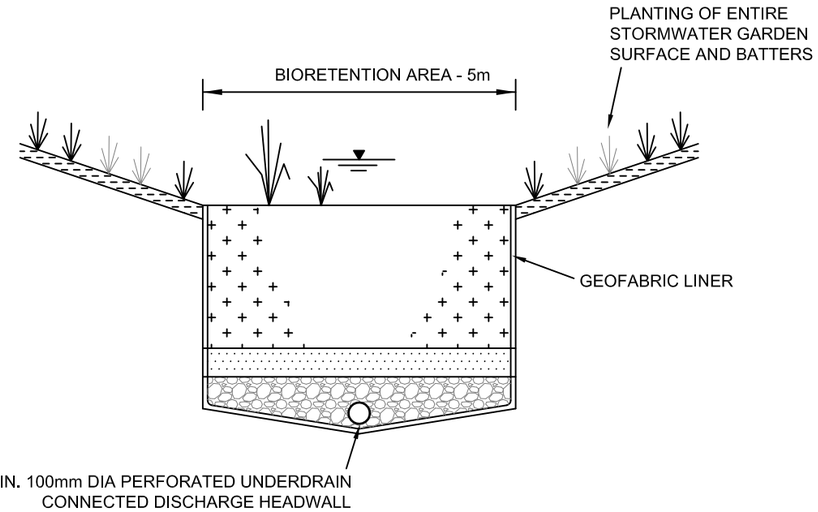
STORMWATER BIO-RETENTION TYPICAL SECTION

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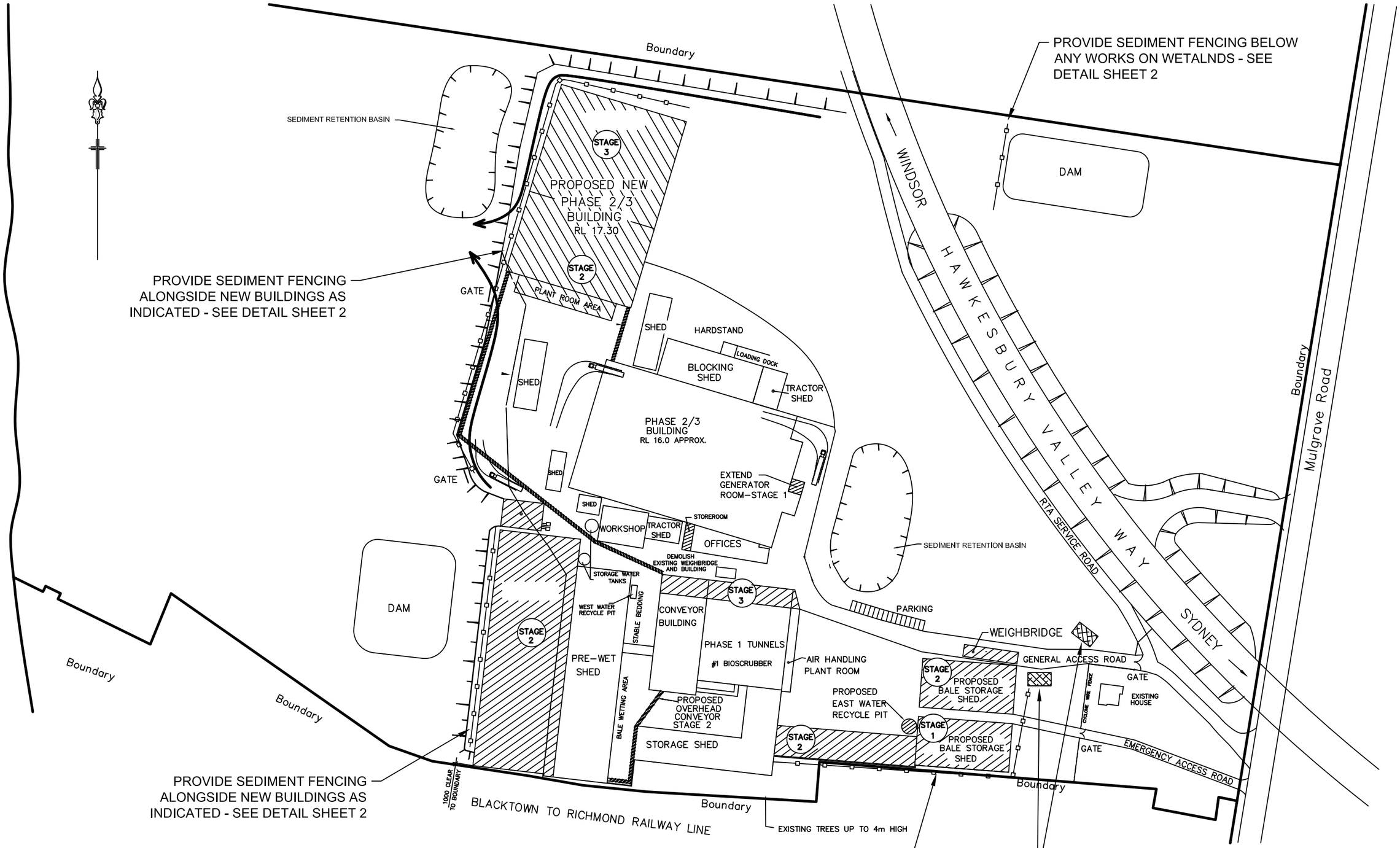
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MUSHROOM SUBSTRATE PLANT EXTENSIONS
BIO BASIN DETAIL

Plan No. 07166E16
REV. A
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Appendix F. Soil Erosion & Sediment Control Plans

A3



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LGA: HAWKESBURY
Council Ref:

MULGRAVE ROAD, MULGRAVE MUSHROOM FARM SUBSTRATE PLANT EXTENSIONS EROSION & SEDIMENT CONTROL PLAN

Plan No. 07166E21 REV. A
File Ref. 07166E21
SHEET 1 OF 2 SHEETS

A3

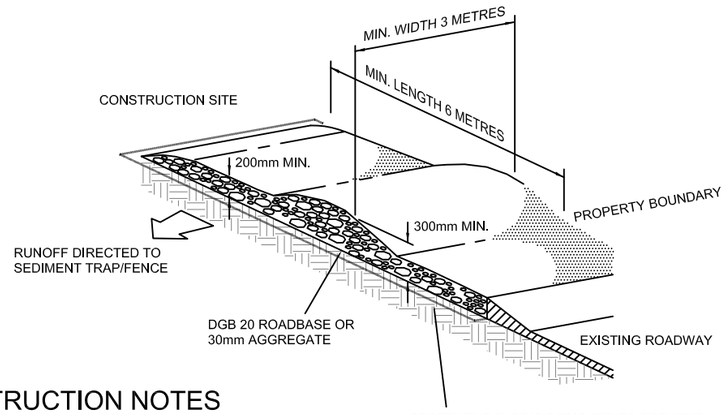
LEGEND

SEDIMENT FENCE

SHAKER PAD
AT ENTRANCE TO WORKS

EROSION AND SEDIMENTATION CONTROL NOTES

1. PRIOR TO THE COMMENCEMENT OF SITE DISTURBANCE, THE CONTRACTOR SHALL ESTABLISH ALL NECESSARY EROSION AND SEDIMENTATION CONTROL MEASURES IN ACCORDANCE WITH THIS PLAN, COUNCIL'S "CIVIL WORKS SPECIFICATION, PART 2 -CONSTRUCTION", AND THE NSW DEPARTMENT OF HOUSING'S PUBLICATION "MANAGING URBAN STORMWATER - SOILS AND CONSTRUCTION".
2. THE LOCATION OF EROSION AND SEDIMENTATION CONTROL DEVICES SHOWN ON THIS PLAN ARE INDICATIVE ONLY AND SHOULD BE ADJUSTED TO SUIT SITE CONDITIONS.
3. WHERE WORKS ARE DELAYED OR IN ABEYANCE AND DISTURBED AREAS ARE LIKELY TO BE EXPOSED FOR A PERIOD OF TWO MONTHS OR MORE, TEMPORARY REHABILITATION WORKS SHALL BE UNDERTAKEN TO PROTECT THE SITE.
4. ALL DISTURBED AREAS SHALL BE TOPSOILED, SEEDED AND MULCHED WITHIN 2O DAYS OF THE COMPLETION OF THE WORKS.
5. ALL AREAS WITH SLOPES STEEPER THAN 12% (1 in 8) SHALL BE STRAW MULCHED IN CONJUNCTION WITH SEEDING, OR TURFED.
6. SILT BARRIERS LOCATED AROUND KERB INLET AND ROAD PITS SHALL BE REINSTATED FOLLOWING ROAD PAVING WORKS IF IT IS LIKELY THAT UNDISTURBED AREAS WILL STILL DRAIN TO THE PIT.
7. SANDBAGS SHALL BE PLACED ACROSS THE END OF ROAD CONSTRUCTION AT THE COMPLETION OF EACH DAYS WORK TO PREVENT EROSION OF THE CONSTRUCTED MATERIAL.
8. THE CONTRACTOR SHALL CONDUCT WEEKLY INSPECTIONS OF THE SITE TO ENSURE THAT ALL DEVICES AND REHABILITATION AREAS HAVE BEEN ADEQUATELY MAINTAINED. THE CONTRACTOR SHALL ALSO KEEP A LOG BOOK DETAILING SUCH INSPECTIONS, AND RECORDING RAINFALL EVENTS AND OTHER RELEVANT EVENTS.
9. TOPSOIL SHALL BE STOCKPILED IN THE LOCATIONS SHOWN ON THIS PLAN OR AS DIRECTED BY COUNCIL'S ENGINEER. WHERE IT IS LIKELY THAT STOCKPILES WILL REMAIN IN PLACE FOR A PERIOD EXCEEDING 4 WEEKS, THEN THE STOCKPILE SHALL BE STABILISED BY SEEDING OR EQUIVALENT METHODS.
10. ALL REVEGETATION WORKS ARE TO BE MAINTAINED, INCLUDING WATERING AND MOWING WHERE NECESSARY UNTIL THE COMPLETION OF THE MAINTENANCE PERIOD.
11. THE MOVEMENT OF VEHICULAR TRAFFIC ON THE SITE SHALL BE CONFINED TO DESIGNATED AREAS DURING CONSTRUCTION WORKS. VEHICULAR ACCESS SHALL BE DENIED TO AREAS TO BE LEFT UNDISTURBED.
12. SITE ACCESS SHALL BE LIMITED TO THE LOCATIONS SHOWN ON THIS PLAN. SHAKE-DOWN AREAS SHALL BE CONSTRUCTED AS SHOWN.
13. DURING CONSTRUCTION WORKS, DUST CONTROL MEASURES SHALL BE IMPLEMENTED TO MINIMISE THE AMOUNT OF DUST GENERATED FROM THE SITE. THESE MEASURES TO BE IMPLEMENTED TO COUNCIL'S SATISFACTION.
14. MAINTENANCE AND CLEANING OF CONSTRUCTION PLANT SHALL BE CARRIED OUT IN AN AREA WHERE RUNOFF CAN BE CONTAINED AND APPROPRIATELY TREATED AND DISPOSED OF.
15. ALL EROSION AND SEDIMENTATION CONTROL DEVICES SHALL REMAIN IN PLACE UNTIL ALL DISTURBED AREAS HAVE ADEQUATELY REGENERATED. THIS STAGE SHALL BE DETERMINED BY THE CERTIFIER.



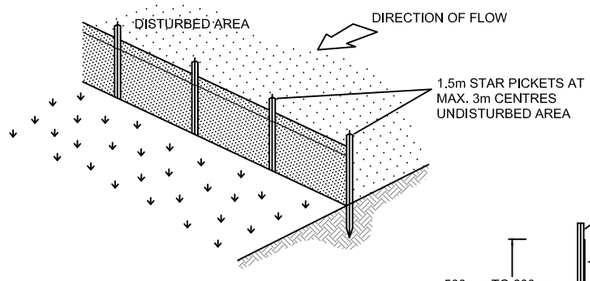
CONSTRUCTION NOTES

1. STRIP TOPSOIL AND LEVEL SITE.
2. COMPACT SUBGRADE.
3. COVER AREA WITH NEEDLE-PUNCHED GEOTEXTILE.
4. CONSTRUCT 200mm THICK PAD OVER GEOTEXTILE USING ROADBASE OR 30mm AGGREGATE. MINIMUM LENGTH 15 METRES OR TO BUILDING ALIGNMENT. MINIMUM WIDTH 3 METRES.
5. CONSTRUCT HUMP IMMEDIATELY WITHIN BOUNDARY TO DIVERT WATER TO A SEDIMENT FENCE OR OTHER SEDIMENT TRAP.

GEOTEXTILE FABRIC DESIGNED TO PREVENT INTERMIXING OF SUBGRADE AND BASE MATERIALS AND TO MAINTAIN GOOD PROPERTIES OF THE SUB-BASE LAYERS.

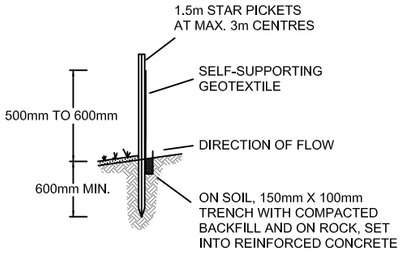
GEOFABRIC MAY BE A WOVEN OR NEEDLE PUNCHED PRODUCT WITH A MINIMUM CBR BURST STRENGTH (AS3706.4-90) OF 2500 N

SHAKER PAD



CONSTRUCTION NOTES

1. CONSTRUCT SEDIMENT FENCE AS CLOSE AS POSSIBLE TO PARRALLEL TO THE CONTOURS OF THE SITE.
2. DRIVE 1.5m LONG STAR PICKETS INTO GROUND 2.5 METRES APART (MAX.)
3. DIG A 150mm DEEP TRENCH ALONG THE UPSLOPE LINE OF THE FENCE FOR THE BOTTOM OF THE FABRIC TO BE ENTRENCHED.
4. FIX SELF-SUPPORTING GEOTEXTILE TO UPSLOPE SIDE OF POSTS WITH WIRE TIES OR AS RECOMMENDED BY GEOTEXTILE MANUFACTURER.
5. JOIN SECTIONS OF FABRIC AT A SUPPORT POST WITH A 150mm OVERLAP.
6. BACKFILL THE TRENCH OVER THE BASE OF THE FABRIC AND COMPACT IT THOROUGHLY OVER THE GEOTEXTILE.



SEDIMENT FENCE

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LGA: HAWKESBURY
Council Ref:

MULGRAVE ROAD, MULGRAVE MUSHROOM FARM SUBSTRATE PLANT EXTENSIONS NOTES, LEGEND AND DETAILS

Plan No. 07166E22 REV. A
File Ref. 07166E21
SHEET 2 OF 2 SHEETS

Appendix T

MUSHROOM FARM CONCEPT DESIGN PLANS

ADJOINING PROPERTY
RURAL RESIDENCE

WATER
TREATMENT UNIT

LANDSCAPING MOUND

CHILD CARE FACILITY

POST & WIRE FENCE

DAM 2

GROWING ROOMS
FFL 38.50m

CENTRAL CORRIDOR

EXISTING SHEDS

SUNKEN LOADING DOCK
AWNING OVER

CONCRETE

WORKSHOP

PEAT STORE

COTTAGE

EXISTING COTTAGE
TO REMAIN

DAM 6

2.5m HIGH, 17m WIDE
LANDSCAPING MOUND

21.29 ROAD
BITUMEN
WIRE
FENCE
EDGE OF
NORTHERN
THE

STAGE 1
SPENT COMPOST STORE
APPROX FF 38.5

STAGE 4
SPENT COMPOST STORE
APPROX FF 38.5

SHED

EDGE OF TREES

FENCE

WASH DOWN WATER
TREATMENT PONDS

DAM

BASE ELEVATION RL31.75

FULL STORAGE LEVEL RL35.75

TRUCK DRIVE
THROUGH

SEWER
TREATMENT
PLANT

DAM 3

WIDENING
ROAD
POST
EDGE

2.5m HIGH, 17m WIDE
LANDSCAPING MOUND

ADJOINING PROPERTY
AUTO WRECKERS

MGA

SCHEDULE OF AREAS

MAIN BUILDING -	32, 865 sq mts
COMPOST STORE STAGE 1 -	5, 821 sq mts
COMPOST STORE STAGE 4 -	7, 355 sq mts
WORKSHOP -	996 sq mts
PEAT STORE -	672 sq mts

0(M) 10 20 30 40 50 100

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3/12/09	CD	DESIGN AMENDMENTS	C
1/2/10	CD	STAGE 2 SHOWN CORRECTLY	D
1/4/10	CD	GENERAL AMENDMENTS	E
17/5/10	CD	COMPOST STORE STAGING	F
9/11/10	CD	WATER TREATMENT PONDS DETAILED	G

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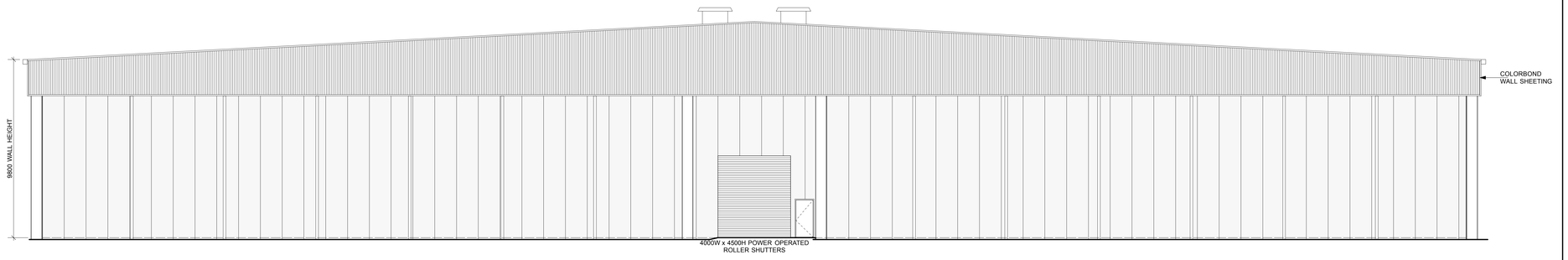
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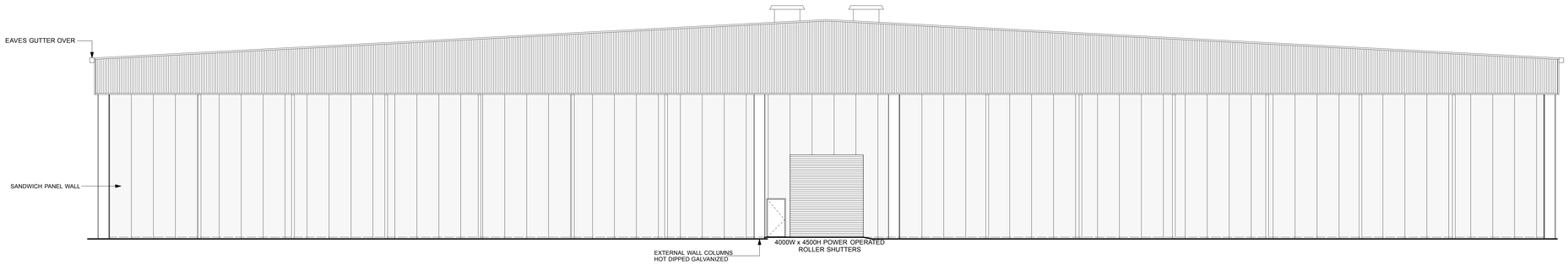
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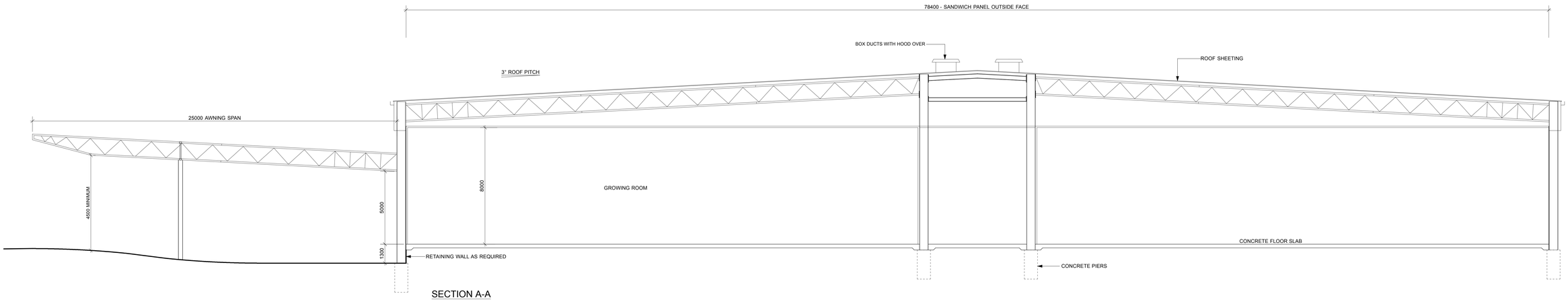
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EASTERN ELEVATION



WESTERN ELEVATION



SECTION A-A

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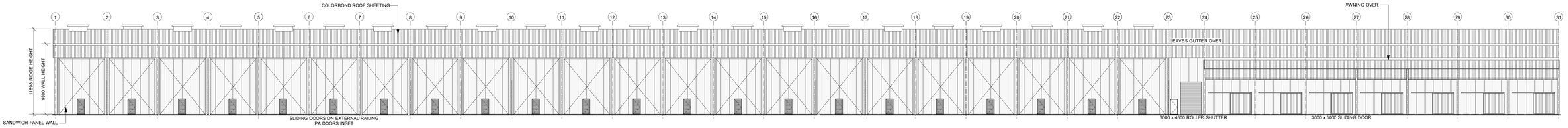
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CLIENT :
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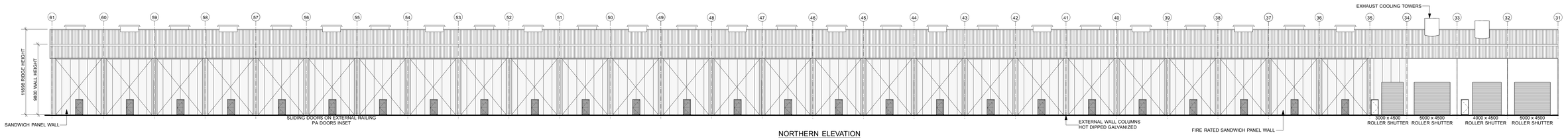
GROWING SHED ELEVATIONS

SCALE
1 : 100
@ A0

DRAWING No.
1840 / 2C



SOUTHERN ELEVATION



NORTHERN ELEVATION

0(M) 2.5 5 7.5 10

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DATE	BY	REVISION	ISSUE
7/5/09	CD	DA ISSUE	A
26/11/09	CD	DESIGN AMENDMENTS	B
3/12/09	CD	CORRECTIONS	C
9/11/10	CD	SCALE ADDED	D

APEX BUILDING SYSTEMS PTY LTD
ABN 14 003 540 252
32 Walker Street Windsor NSW 2756 (PO Box 853)
Telephone: 02 4587 7166
Fax: 02 4587 7139
E-Mail: design@apexbuildingsystems.com
Excellence in Industrial Developments

SITE DESCRIPTION:
521 THE NORTHERN ROAD
LONDONDERRY NSW

LOCAL GOVERNMENT AREA : PENRITH CITY COUNCIL

DRAWN: CHRIS DAWSON 28 APRIL 2009

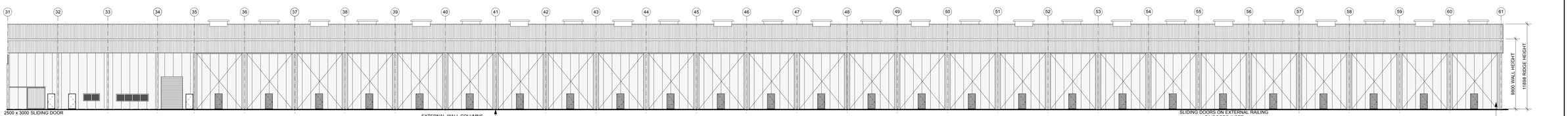
CHECKED:

CLIENT :
ELF - LONDONDERRY

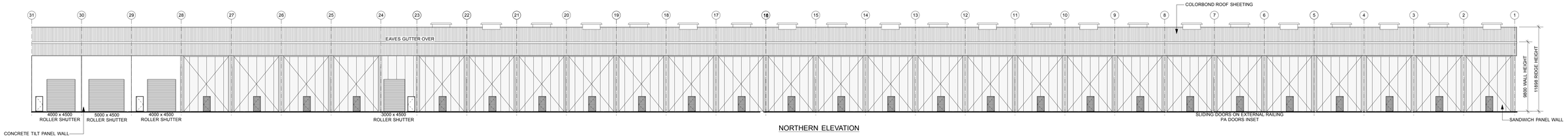
GROWING SHED ELEVATIONS (1 OF 2)

SCALE: 1 : 200 @ A0

DRAWING No.: 1840 / 3D



SOUTHERN ELEVATION



NORTHERN ELEVATION

0(M) 2.5 5 7.5 10

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DATE	BY	REVISION	ISSUE
7/5/09	CD	DA ISSUE	A
26/11/09	CD	DESIGN AMENDMENTS	B
3/12/09	CD	CORRECTIONS	C
9/11/10	CD	SCALE ADDED	D

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521 THE NORTHERN ROAD
LONDONDERRY NSW

LOCAL GOVERNMENT AREA : PENRITH CITY COUNCIL

DRAWN: CHRIS DAWSON 28 APRIL 2009

CHECKED:

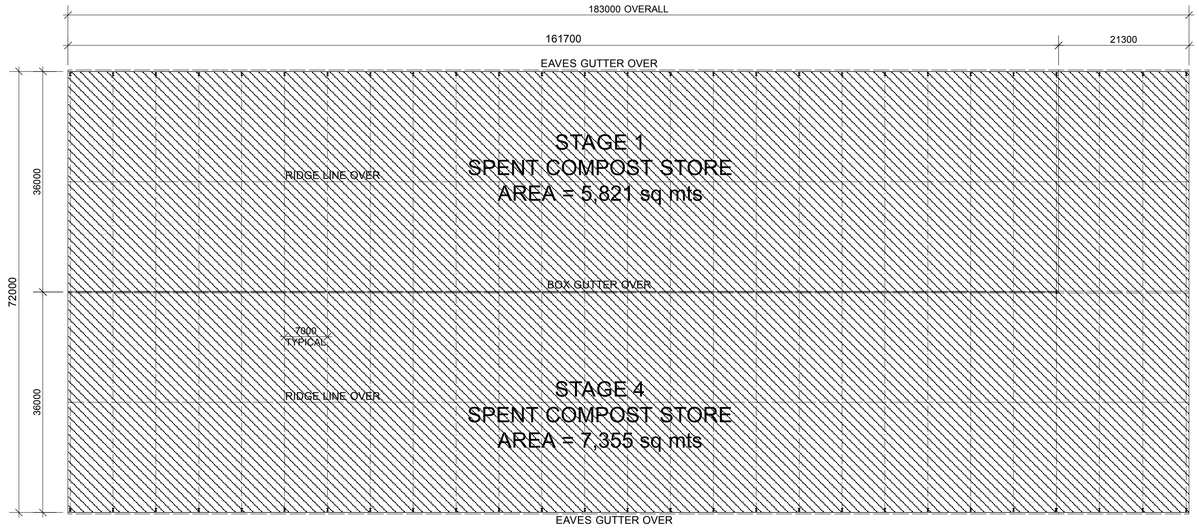
CLIENT :
ELF - LONDONDERRY

GROWING SHED ELEVATIONS (2 OF 2)

SCALE: 1 : 200 @ A0

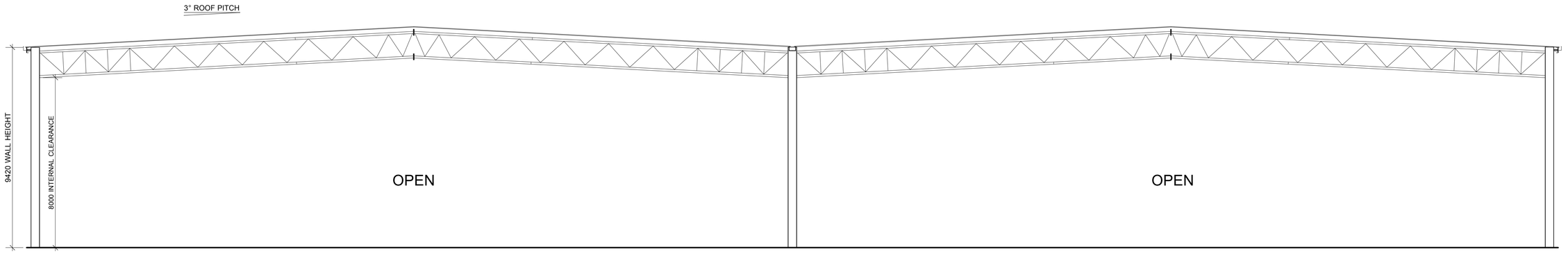
DRAWING No.: 1840 / 4D

MGA



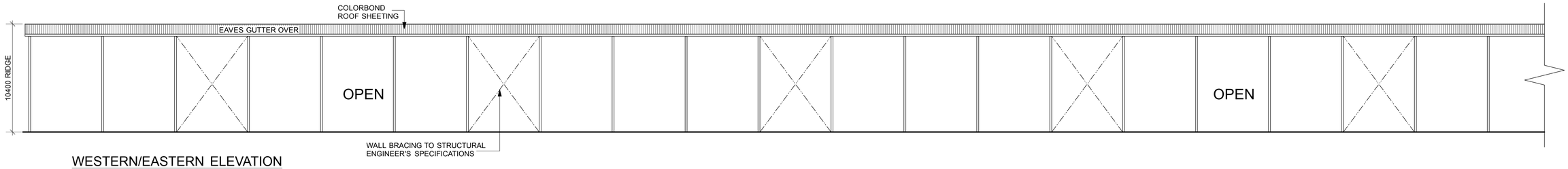
FLOOR PLAN
SCALE 1:500 @ A1

0(M) 10 20 30 40 50



NORTHERN/SOUTHERN ELEVATION
SCALE 1:100 @ A1

0(M) 2.5 5 7.5 10



WESTERN/EASTERN ELEVATION
SCALE 1:200 @ A1

0(M) 2.5 5 7.5 10

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DATE	BY	REVISION	ISSUE
7/5/09	CD	DA ISSUE	A
25/11/09	CD	ORIENTATION AMENDED	B
3/12/09	CD	DESIGN AMENDMENTS	C
1/2/10	CD	RIDGE HEIGHT CORRECTED	D
17/5/10	CD	GENERAL AMENDMENTS	E
9/11/10	CD	SCALE ADDED	F

APEX BUILDING SYSTEMS PTY LTD
ABN 14 003 540 252
32 Walker Street Windsor NSW 2756 (PO Box 853)
Telephone: 02 4587 7166
Fax: 02 4587 7139
E-Mail: design@apexbuildingsystems.com
Excellence in Industrial Developments

SITE DESCRIPTION:
521 THE NORTHERN ROAD
LONDONDERRY NSW

LOCAL GOVERNMENT AREA : PENRITH CITY COUNCIL

DRAWN
CHRIS DAWSON
21 APRIL 2009

CHECKED

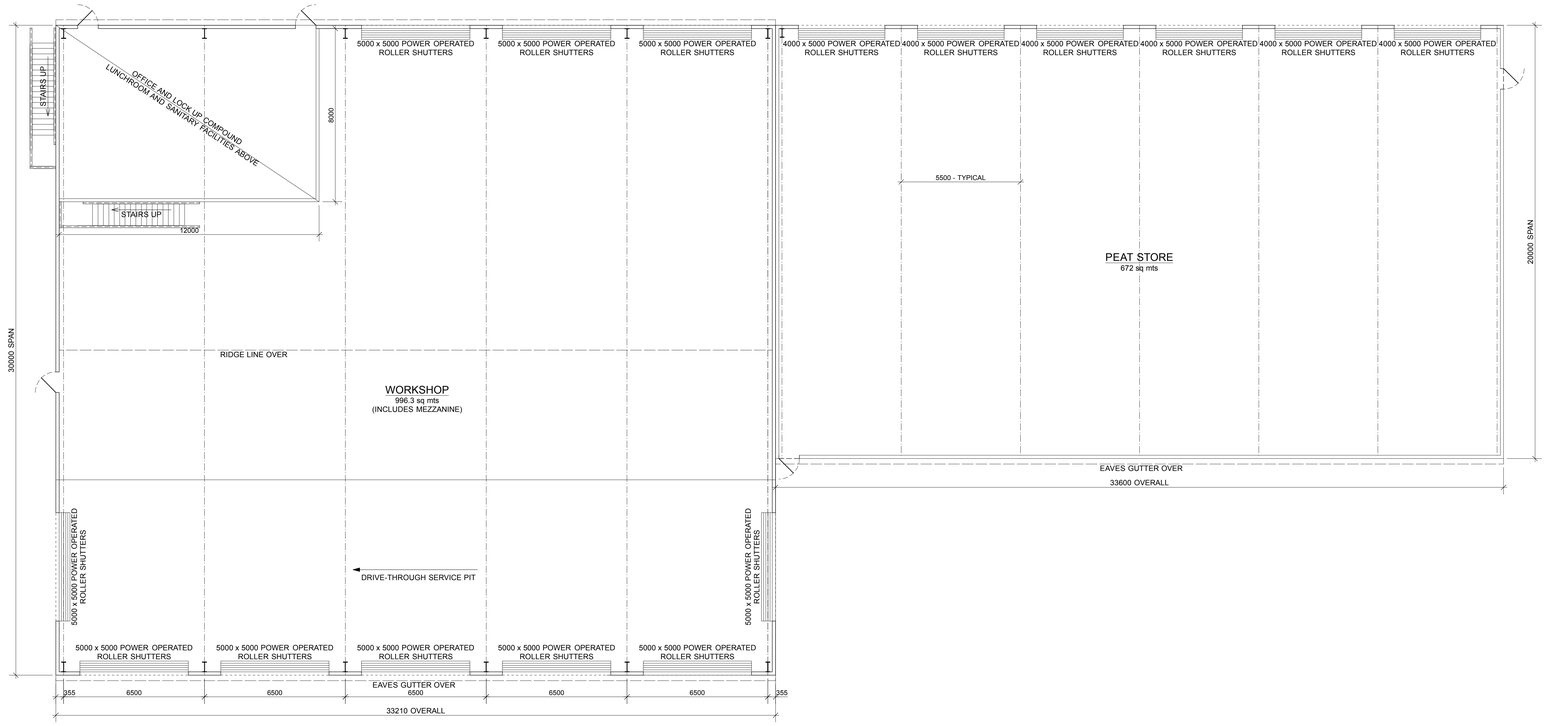
PROPOSED COMPOST STORE

CLIENT :
ELF - LONDONDERRY

SCALE
1 : 500
@ A1

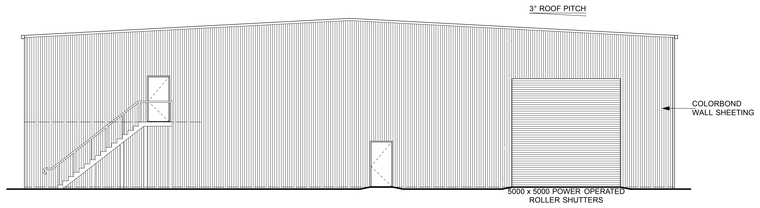
DRAWING No.
1840 / 5F

MGA

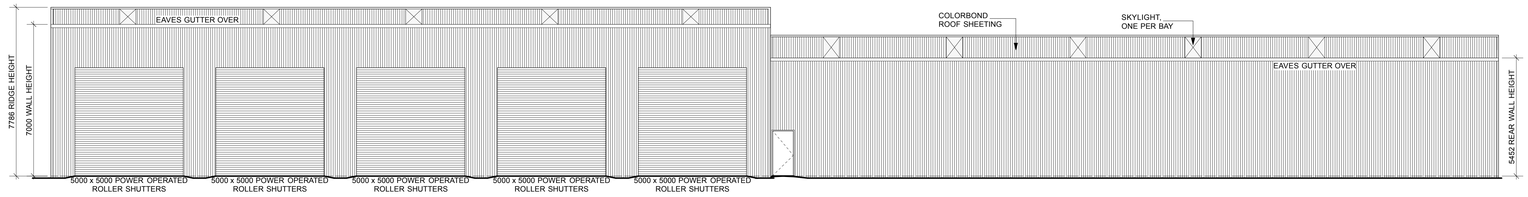


FLOOR PLAN

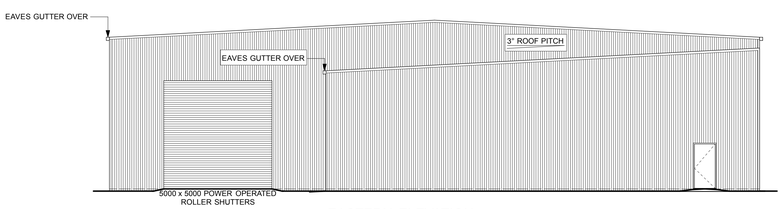
0(M) 2.5 5 7.5 10



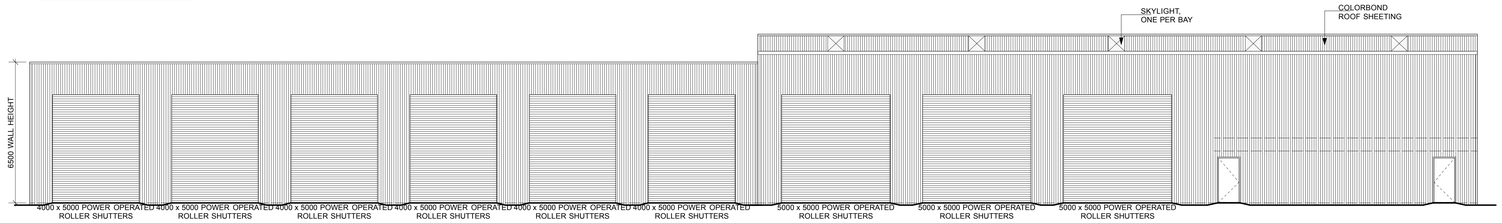
WESTERN ELEVATION



SOUTHERN ELEVATION



EASTERN ELEVATION



NORTHERN ELEVATION

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DATE	BY	REVISION	ISSUE
7/5/09	CD	DA ISSUE	A
25/11/09	CD	DESIGN AMENDMENTS	B
1/2/10	CD	PLANS 1840/06 AND 1840/07 AMALGAMATED. PLAN 1840/07 DELETED.	C
9/11/10	CD	SCALE ADDED	D

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32 Walker Street Windsor NSW 2756 (PO Box 853)
Telephone: 02 4587 7166
Fax: 02 4587 7139
E-Mail: designs@apexbuildingsystems.com
Excellence in Industrial Developments

SITE DESCRIPTION:
521 THE NORTHERN ROAD
LONDONDERRY NSW

LOCAL GOVERNMENT AREA : PENRITH CITY COUNCIL

DRAWN: CHRIS DAWSON 28 APRIL 2009

CHECKED:

PROPOSED WORK SHOP AND PEAT STORE

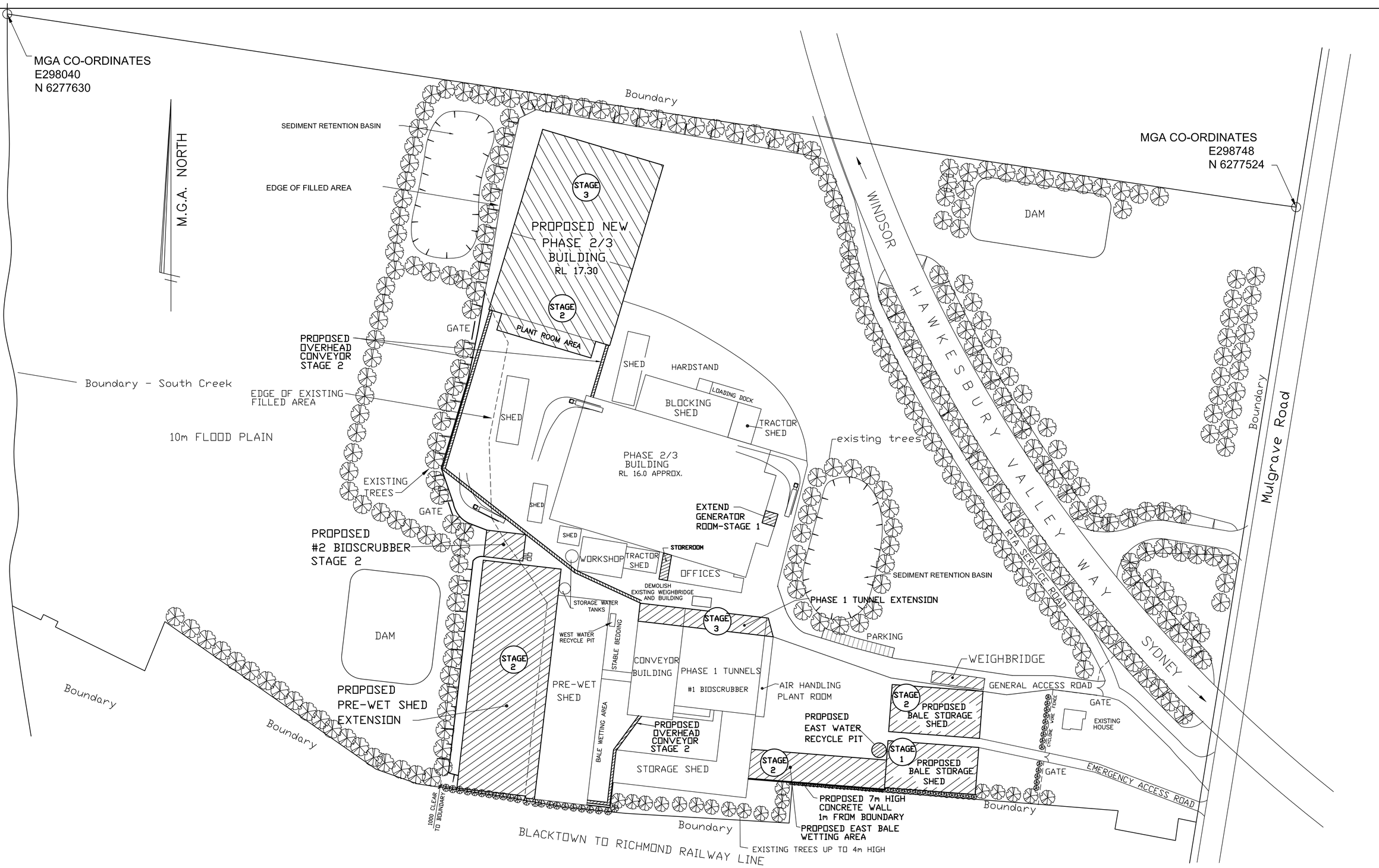
CLIENT :
ELF - LONDONDERRY

SCALE: 1 : 100 @ A0

DRAWING No.: 1840 / 6D

Appendix U

SUBSTRATE PLANT CONCEPT DESIGN PLANS



0 100m

SITE PLAN

(D. A. DRAWING ONLY - NOT FOR CONSTRUCTION)

ISSUE	DATE	AMENDMENTS
J	10.11.2010	SCALE BAR ADDED

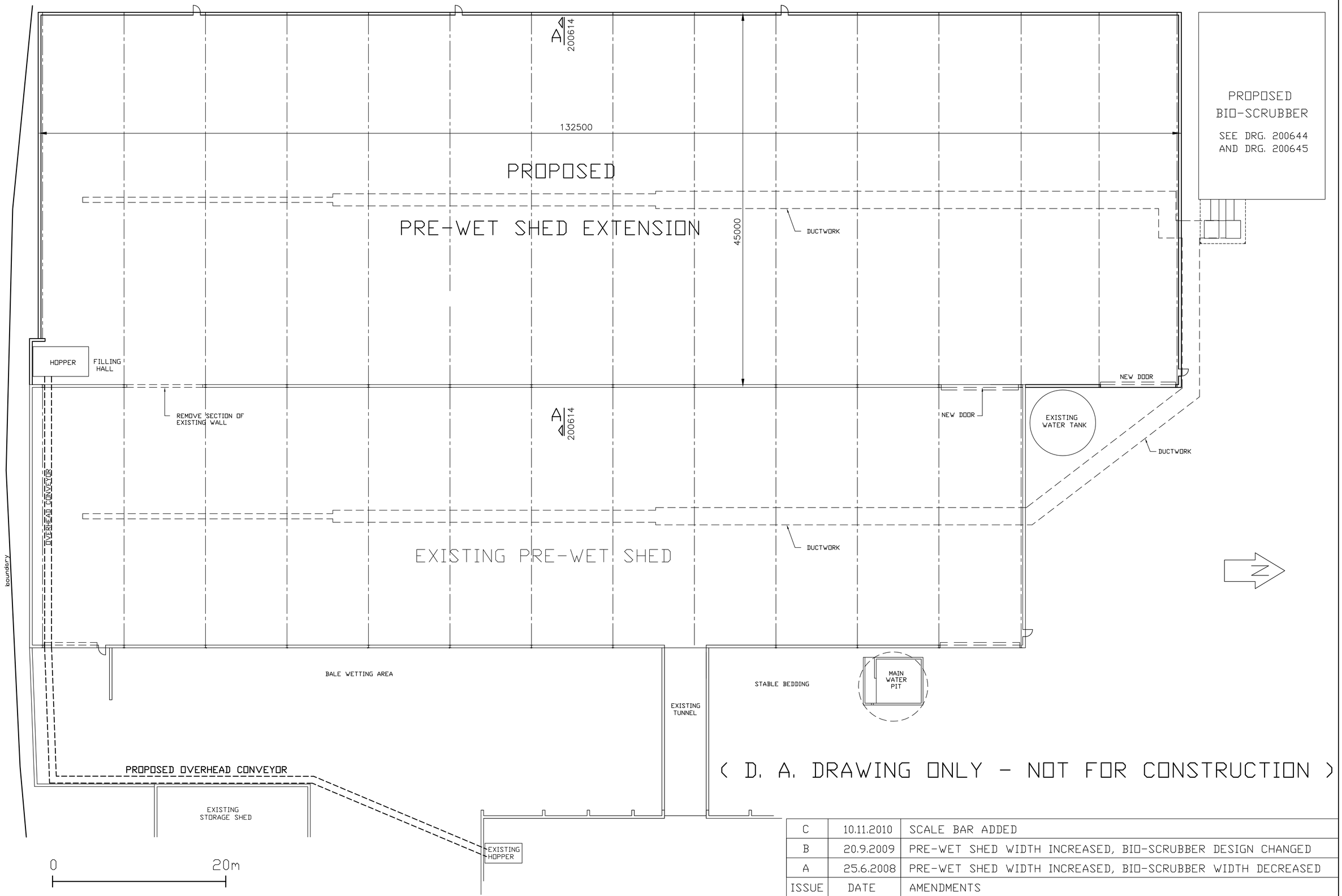
ABODE DESIGN
PO BOX 767 RICHMOND
PH. 4776 1125 0419 405006

DRAWN	DATE DRAWN	SCALE
I.S.	20.6.2007	1:1000 at A1

MUSHROOM SUBSTRATE PLANT EXTENSIONS DEVELOPMENT APPLICATION

ELF FARM SUPPLIES PTY LTD
P.O.BOX 615 WINDSOR NSW 2756
108 MULGRAVE ROAD MULGRAVE NSW 2756
TEL.ISD (61)02 45775000 FAX.ISD (61)0245878002

DRAWING NO.	ISSUE
200608	J



(D. A. DRAWING ONLY - NOT FOR CONSTRUCTION)

ISSUE	DATE	AMENDMENTS
C	10.11.2010	SCALE BAR ADDED
B	20.9.2009	PRE-WET SHED WIDTH INCREASED, BIO-SCRUBBER DESIGN CHANGED
A	25.6.2008	PRE-WET SHED WIDTH INCREASED, BIO-SCRUBBER WIDTH DECREASED

ABODE DESIGN
PO BOX 767 RICHMOND
PH. 4776 1125 0419 405006

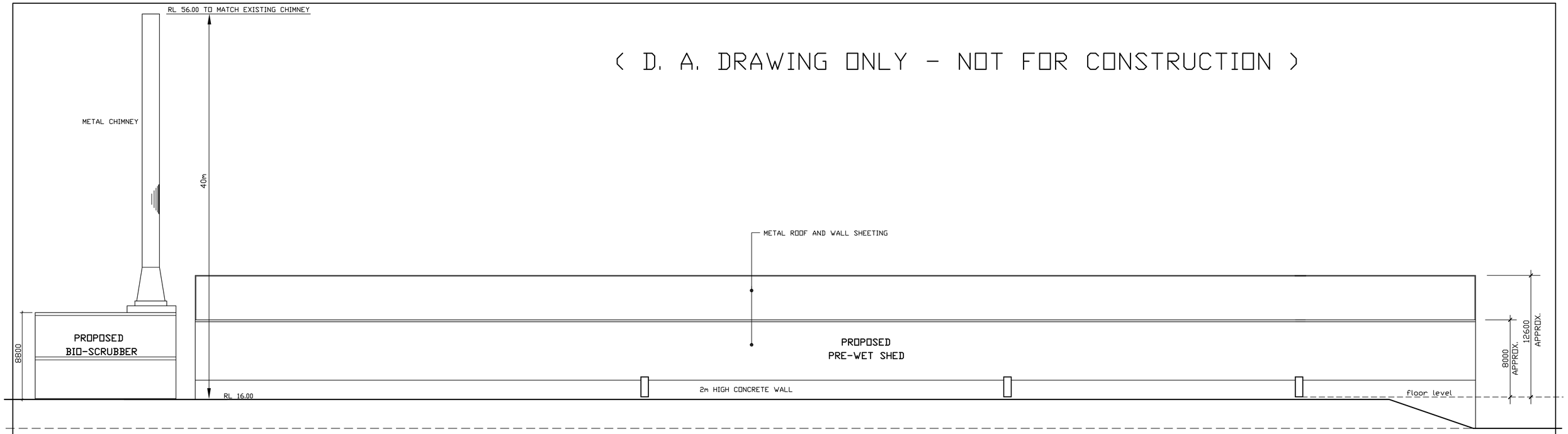
DRAWN	DATE DRAWN	SCALE
I.S.	20.6.2007	1:200 at A1

PRE WET SHED EXTENSION
DEVELOPMENT APPLICATION

ELF FARM SUPPLIES PTY LTD
P.O.BOX 615 WINDSOR NSW 2756
108 MULGRAVE ROAD MULGRAVE NSW 2756
TEL.ISD (61)02 45775000 FAX.ISD (61)0245878002

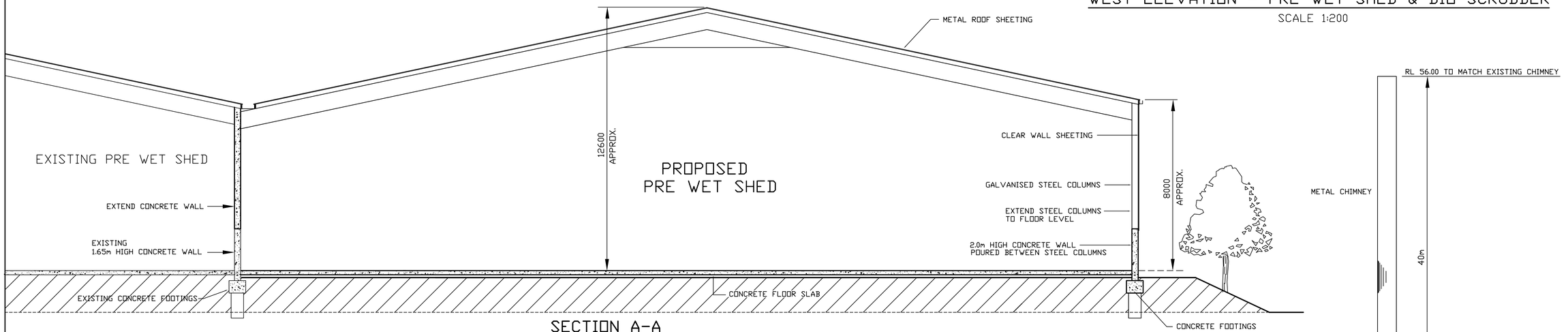
DRAWING NO.	ISSUE
200613	C

(D. A. DRAWING ONLY - NOT FOR CONSTRUCTION)



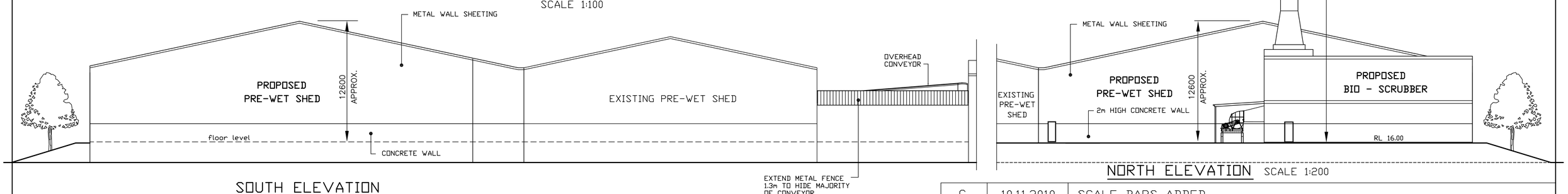
WEST ELEVATION - PRE WET SHED & BIO-SCRUBBER

SCALE 1:200



SECTION A-A

SCALE 1:100



SOUTH ELEVATION

SCALE 1:200

NORTH ELEVATION

SCALE 1:200

0 1:200 SCALE 20m

0 1:100 SCALE 10m

ISSUE	DATE	AMENDMENTS
C	10.11.2010	SCALE BARS ADDED
B	20.9.2009	PRE-WET SHED & BIO-SCRUBBER CHANGED
A	25.6.2008	PRE-WET SHED WIDTH INCREASED, BIO-SCRUBBER WIDTH DECREASED

ABODE DESIGN
PO BOX 767 RICHMOND
PH. 4776 1125 0419 405006

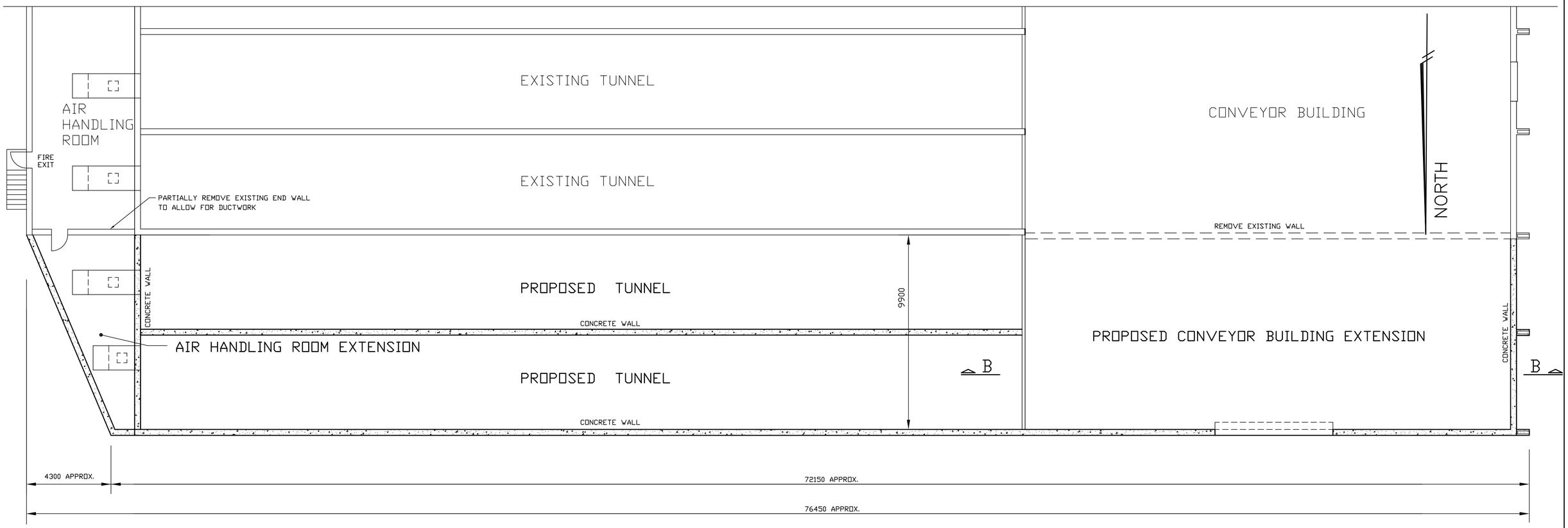
DRAWN	DATE DRAWN	SCALE
I.S.	20.6.2007	1:200 & 1:100 at A1

PRE-WET SHED, BIO SCRUBBER & CHIMNEY DEVELOPMENT APPLICATION

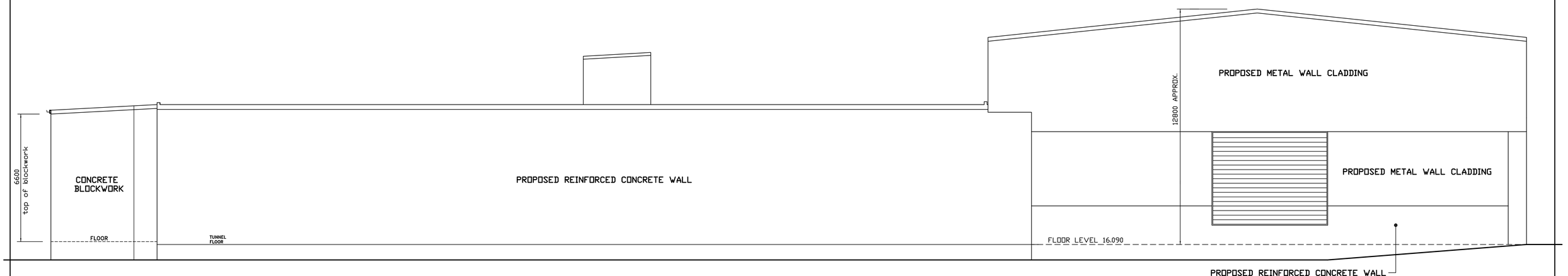
ELF FARM SUPPLIES PTY LTD
P.O.BOX 615 WINDSOR NSW 2756
108 MULGRAVE ROAD MULGRAVE NSW 2756
TEL.ISD (61)02 45775000 FAX.ISD (61)0245878002

DRAWING NO. 200614

ISSUE C



FLOOR PLAN



NORTH ELEVATION (D. A. DRAWING ONLY - NOT FOR CONSTRUCTION)

0 1:100 SCALE 10m

ISSUE	DATE	AMENDMENTS
B	10.11.2010	SCALE BAR ADDED
A	25.6.2008	GENERAL AMENDMENT

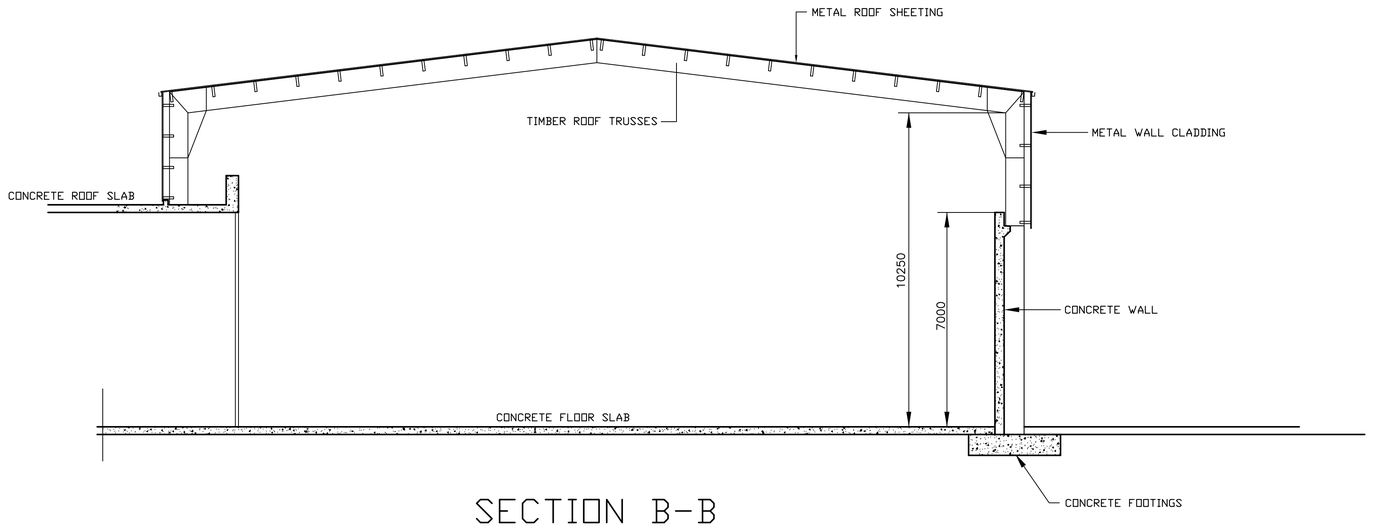
ABODE DESIGN
PO BOX 767 RICHMOND
PH. 4776 1125 0419 405006

DRAWN	DATE DRAWN	SCALE
I.S.	20.6.2007	1:100 at A1

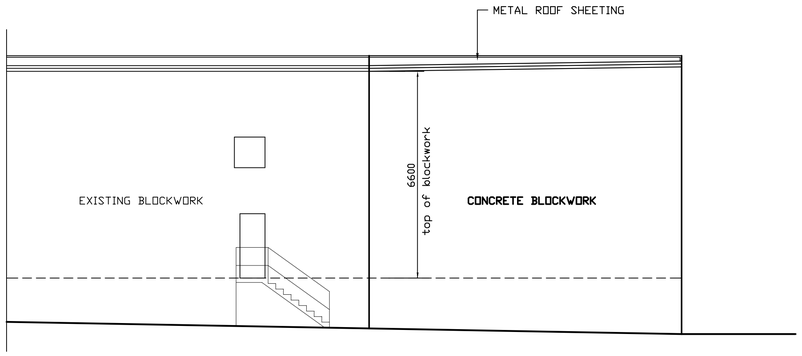
PHASE 1 TUNNEL EXTENSION
DEVELOPMENT APPLICATION

ELF FARM SUPPLIES PTY LTD
P.O.BOX 615 WINDSOR NSW 2756
108 MULGRAVE ROAD MULGRAVE NSW 2756
TEL.ISD (61)02 45775000 FAX.ISD (61)0245878002

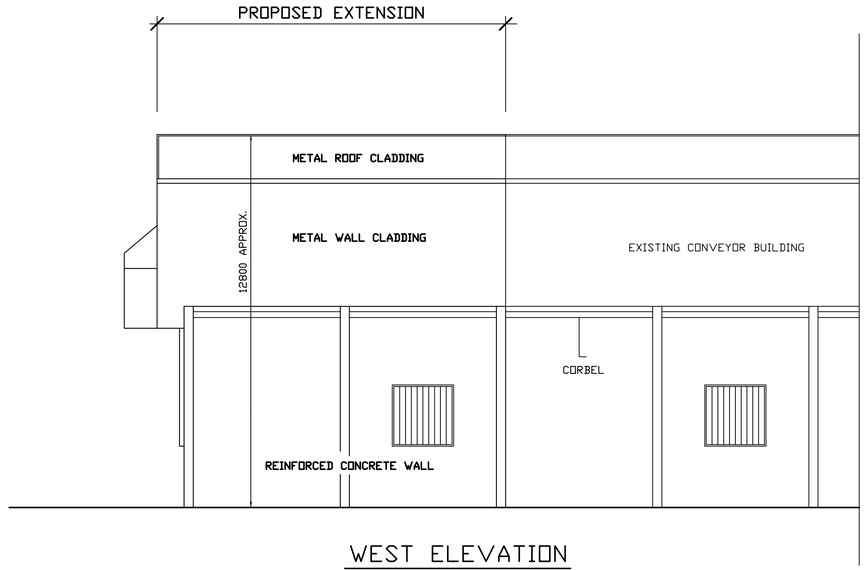
DRAWING NO.	ISSUE
200615	B



SECTION B-B



EAST ELEVATION



WEST ELEVATION

(D. A. DRAWING ONLY - NOT FOR CONSTRUCTION)

0 1:100 SCALE 10m

ISSUE	DATE	AMENDMENTS
B	10.11.2010	SCALE BAR ADDED
A	25.6.2008	GENERAL AMENDMENT

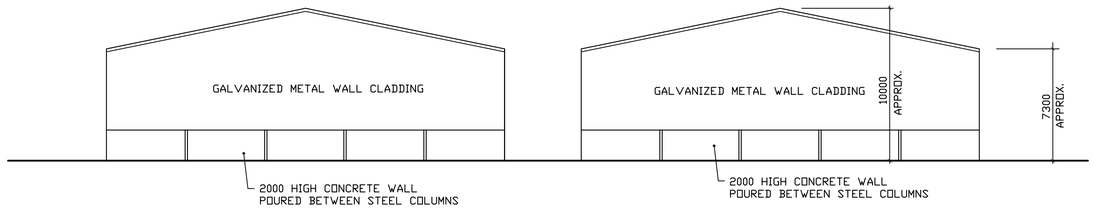
ABODE DESIGN
PO BOX 767 RICHMOND
PH. 4776 1125 0419 405006

DRAWN	DATE DRAWN	SCALE
I.S.	20.6.2007	1:100 at A1

PHASE 1 TUNNEL EXTENSION DEVELOPMENT APPLICATION

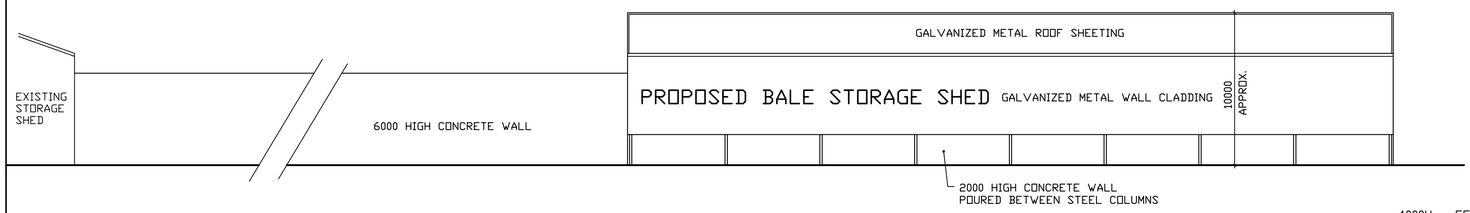
ELF FARM SUPPLIES PTY LTD
P.O.BOX 615 WINDSOR NSW 2756
108 MULGRAVE ROAD MULGRAVE NSW 2756
TEL.ISD (61)02 45775000 FAX.ISD (61)0245878002

DRAWING NO.	ISSUE
200616	B



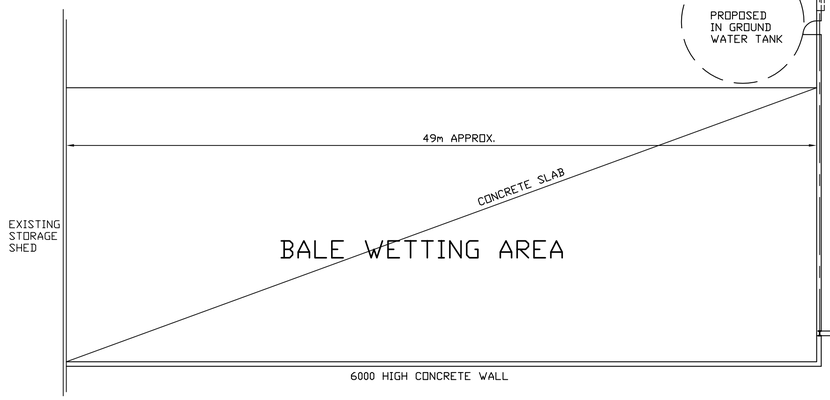
EAST AND WEST ELEVATIONS

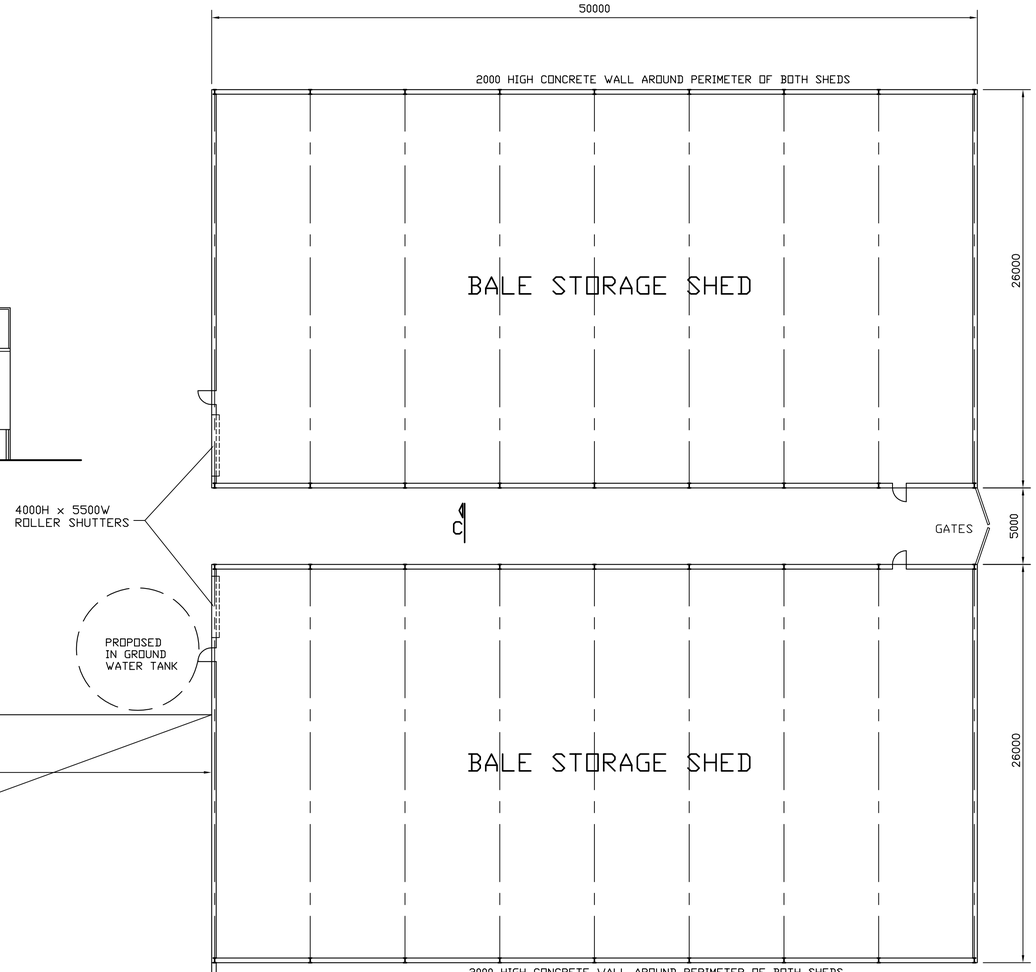
SCALE 1:200



SOUTH ELEVATION

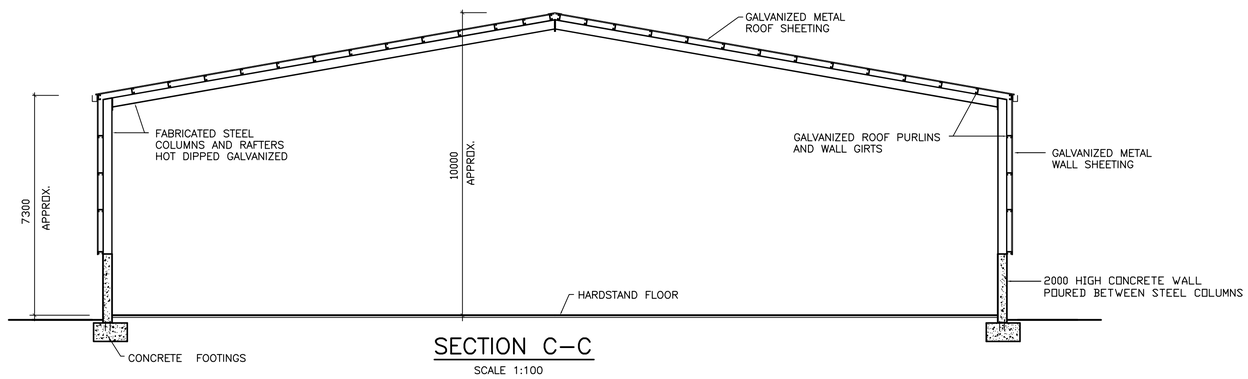
SCALE 1:200





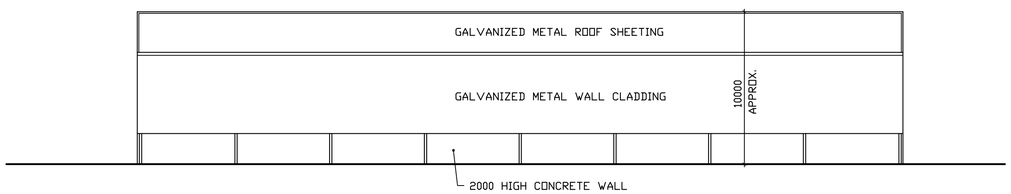
FLOOR PLAN

SCALE 1:200



SECTION C–C

SCALE 1:100



NORTH ELEVATION

SCALE 1:200

0 1:200 SCALE 20m

0 1:100 SCALE 10m

ISSUE	DATE	AMENDMENTS
D	10.11.2010	SCALE BARS ADDED
C	20.9.2009	WIDTH OF BUILDINGS CHANGED
B	23.6.2009	FLOOR CHANGED TO HARDSTAND
A	22.6.2009	GENERAL AMENDMENT

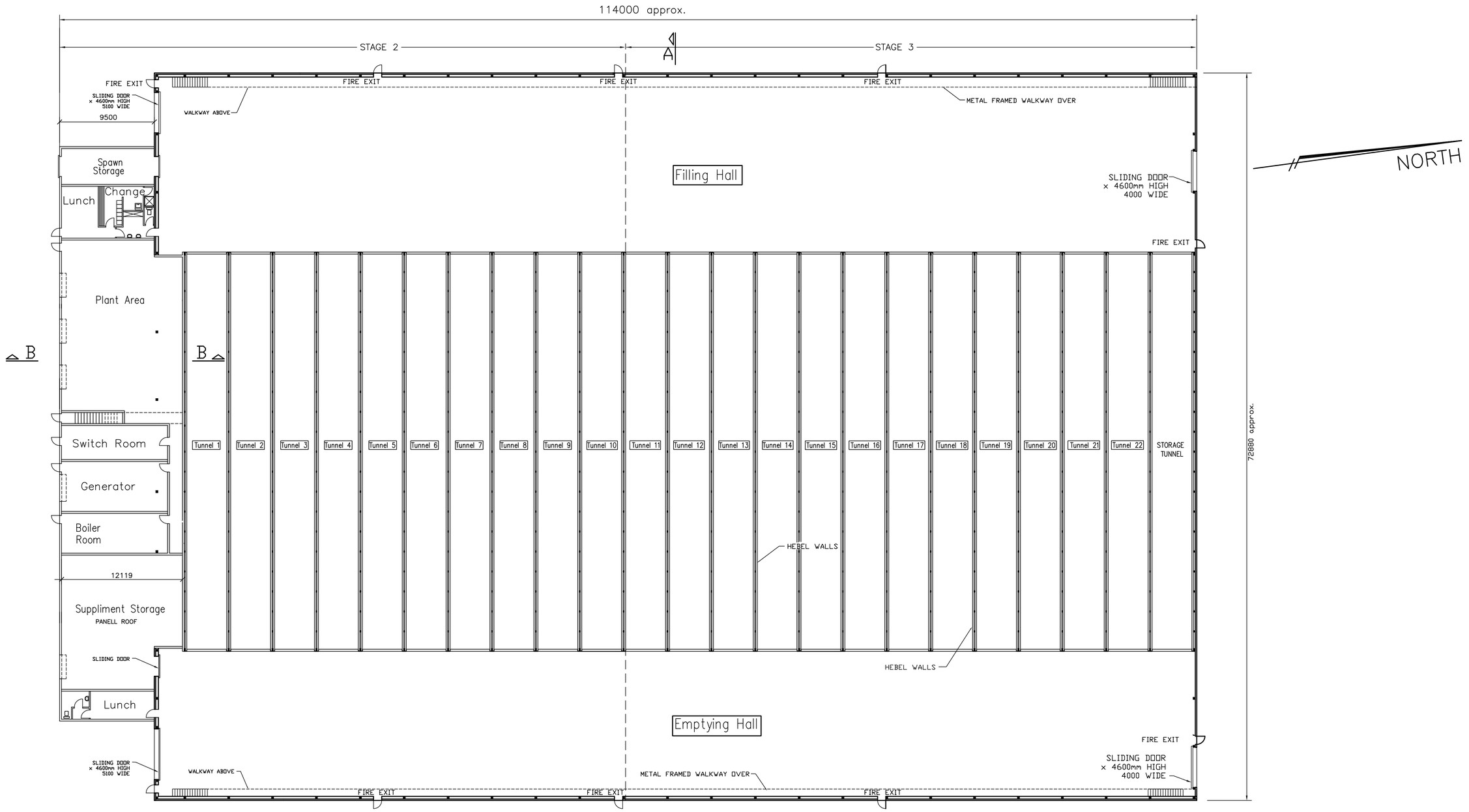
ABODE DESIGN
PO BOX 767 RICHMOND
PH. 4776 1125 0419 405006

DRAWN	DATE DRAWN	SCALE
I.S.	20.6.2007	1:200 & 1:100 at A1

PROPOSED BALE STORAGE SHEDS AND BALE WETTING AREA DEVELOPMENT APPLICATION

ELF FARM SUPPLIES PTY LTD
P.O.BOX 615 WINDSOR NSW 2756
108 MULGRAVE ROAD MULGRAVE NSW 2756
TEL.ISD (61)02 45775000 FAX.ISD (61)0245878002

DRAWING NO.	ISSUE
200617	D



GROUND FLOOR PLAN

SCALE 1:200

(D. A. DRAWING ONLY - NOT FOR CONSTRUCTION)

0 1:200 SCALE 20m

ISSUE	DATE	AMENDMENTS
D	10.11.2010	SCALE BAR ADDED
C	25.1.2010	BUILDING ORIENTATION CHANGED
B	16.3.2009	BUILDING REDUCED TO 23 TUNNELS
A	15.5.2008	GENERAL AMENDMENT

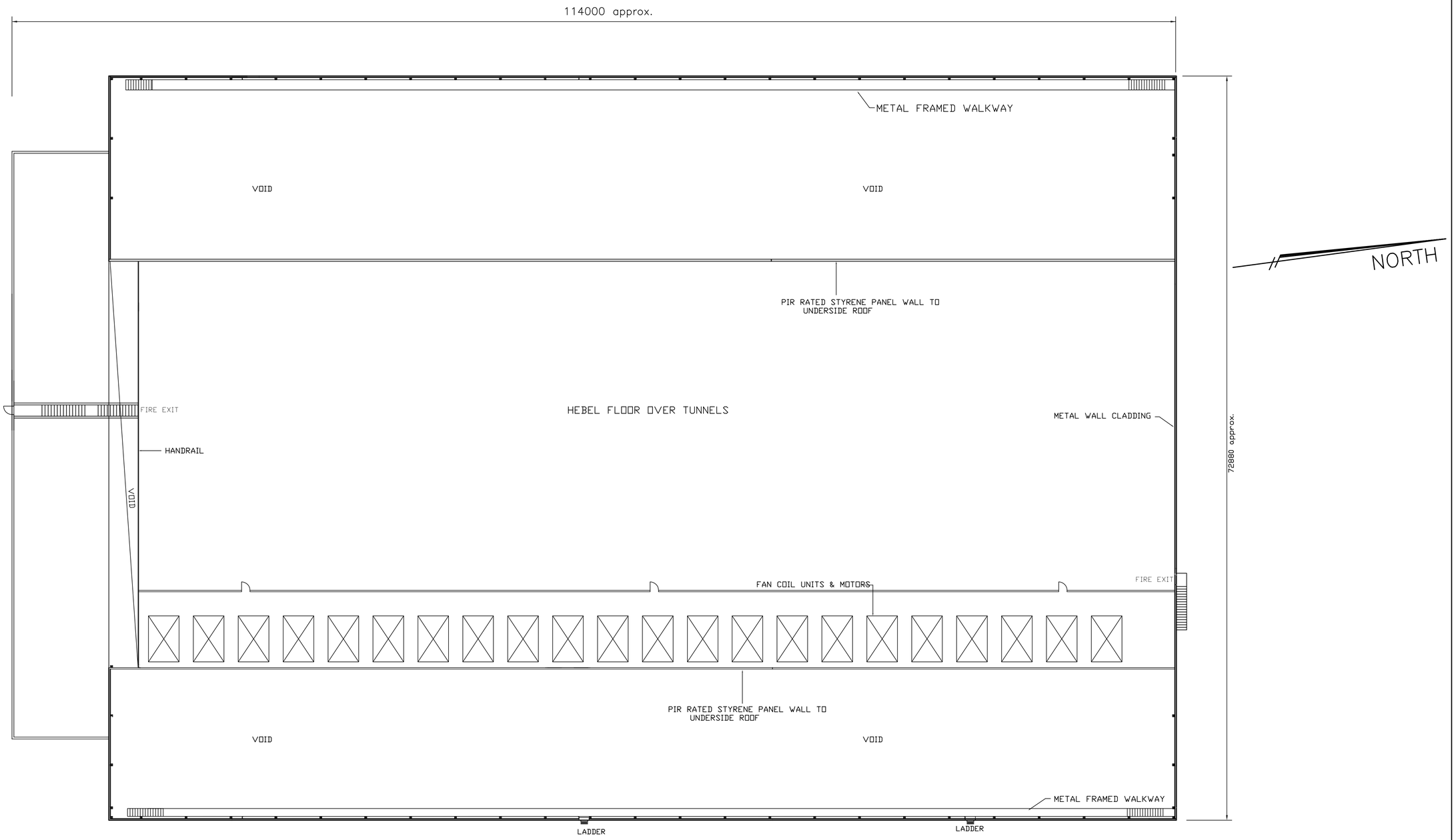
ABODE DESIGN
PO BOX 767 RICHMOND
PH. 4776 1125 0419 405006

DRAWN	DATE DRAWN	SCALE
I.S.	20.6.2007	1:200 at A1

NEW PHASE 2/3 BUILDING DEVELOPMENT APPLICATION

ELF FARM SUPPLIES PTY LTD
P.O.BOX 615 WINDSOR NSW 2756
108 MULGRAVE ROAD MULGRAVE NSW 2756
TEL.ISD (61)02 45775000 FAX.ISD (61)0245878002

DRAWING NO.	ISSUE
200621	D



FIRST FLOOR PLAN

SCALE 1:200

(D. A. DRAWING ONLY - NOT FOR CONSTRUCTION)

ISSUE	DATE	AMENDMENTS
D	10.11.2010	SCALE BAR ADDED
C	25.1.2010	BUILDING ORIENTATION CHANGED
B	16.3.2009	BUILDING REDUCED TO 23 TUNNELS
A	15.5.2008	GENERAL AMENDMENT

0 1:200 SCALE 20m

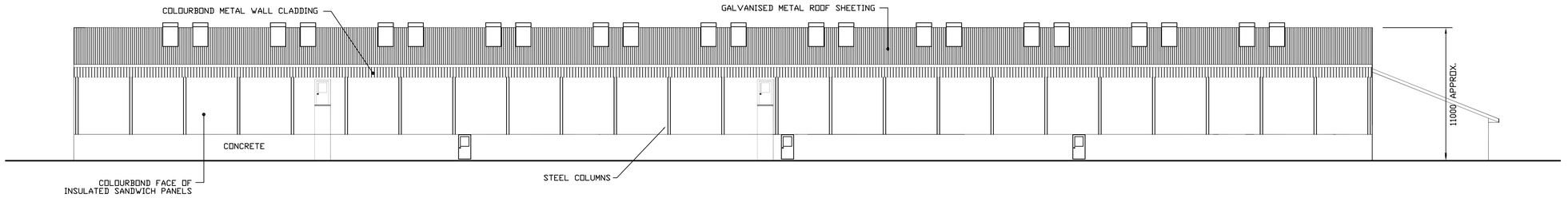
ABODE DESIGN
PO BOX 767 RICHMOND
PH. 4776 1125 0419 405006

DRAWN	DATE DRAWN	SCALE
I.S.	20.6.2007	1:200 at A1

NEW PHASE 2/3 BUILDING DEVELOPMENT APPLICATION

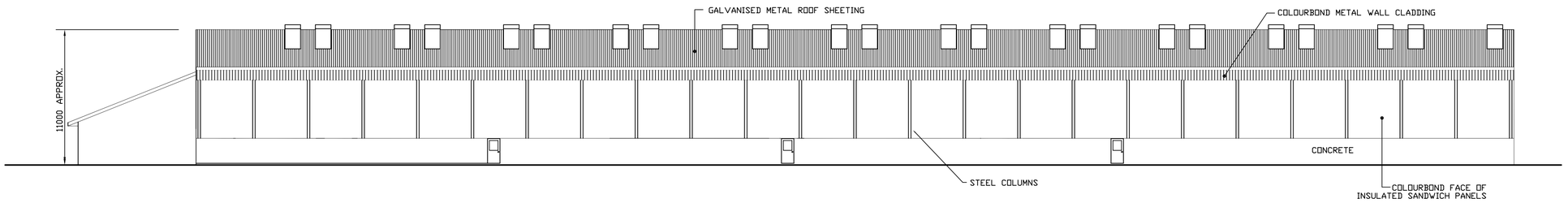
ELF FARM SUPPLIES PTY LTD
P.O.BOX 615 WINDSOR NSW 2756
108 MULGRAVE ROAD MULGRAVE NSW 2756
TEL.ISD (61)02 45775000 FAX.ISD (61)0245878002

DRAWING NO.	ISSUE
200622	D



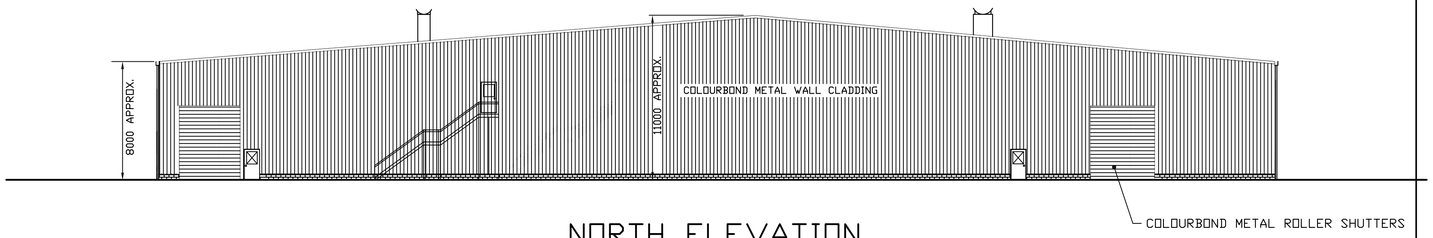
WEST ELEVATION

SCALE 1:200

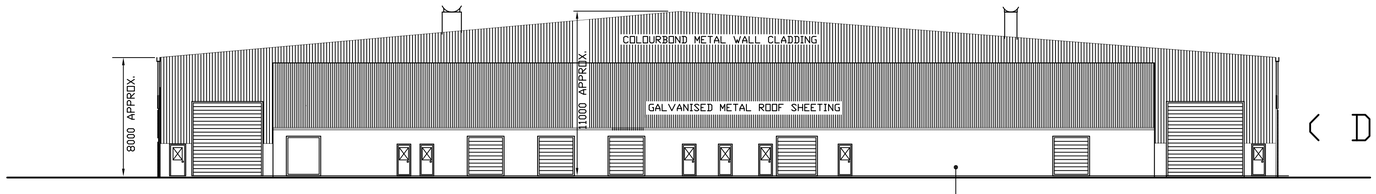


EAST ELEVATION

SCALE 1:200



NORTH ELEVATION



SOUTH ELEVATION

(D. A. DRAWING ONLY - NOT FOR CONSTRUCTION)

0 1:200 SCALE 20m

ISSUE	DATE	AMENDMENTS
D	10.11.2010	SCALE BAR ADDED
C	25.1.2010	BUILDING ORIENTATION CHANGED
B	16.3.2009	BUILDING REDUCED TO 23 TUNNELS
A	15.5.2008	GENERAL AMENDMENT

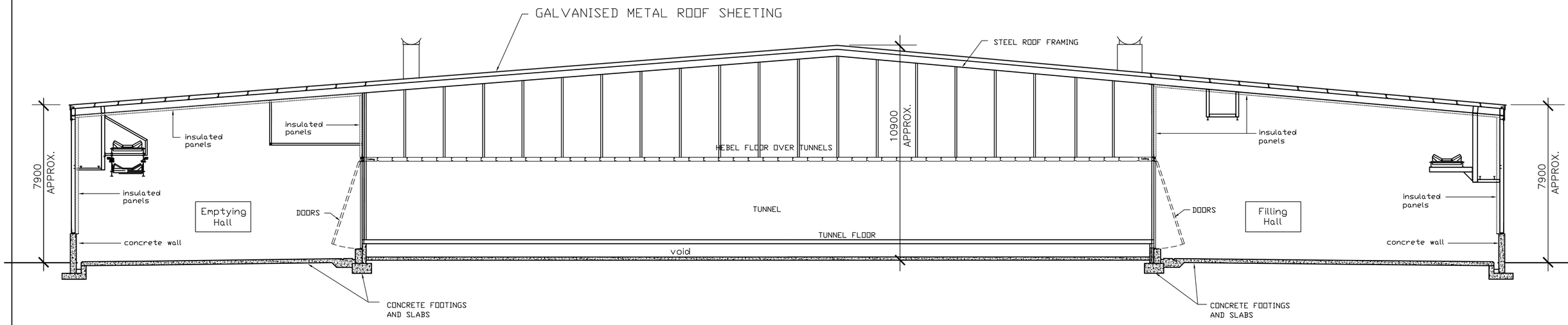
ABODE DESIGN
PO BOX 767 RICHMOND
PH. 4776 1125 0419 405006

DRAWN	DATE DRAWN	SCALE
I.S.	20.6.2007	1:200 at A1

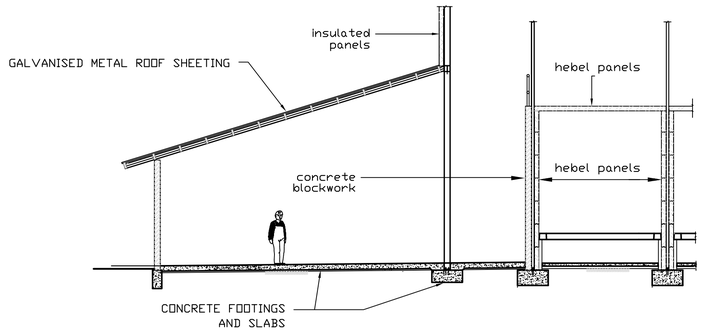
NEW PHASE 2/3 BUILDING DEVELOPMENT APPLICATION

ELF FARM SUPPLIES PTY LTD
P.O.BOX 615 WINDSOR NSW 2756
108 MULGRAVE ROAD MULGRAVE NSW 2756
TEL.ISD (61)02 45775000 FAX.ISD (61)0245878002

DRAWING NO.	ISSUE
200623	D



SECTION A-A



SECTION B-B

(D. A. DRAWING ONLY - NOT FOR CONSTRUCTION)

0 1:100 SCALE 10m

ISSUE	DATE	AMENDMENTS
B	10.11.2010	SCALE BAR ADDED
A	15.5.2008	GENERAL AMENDMENT

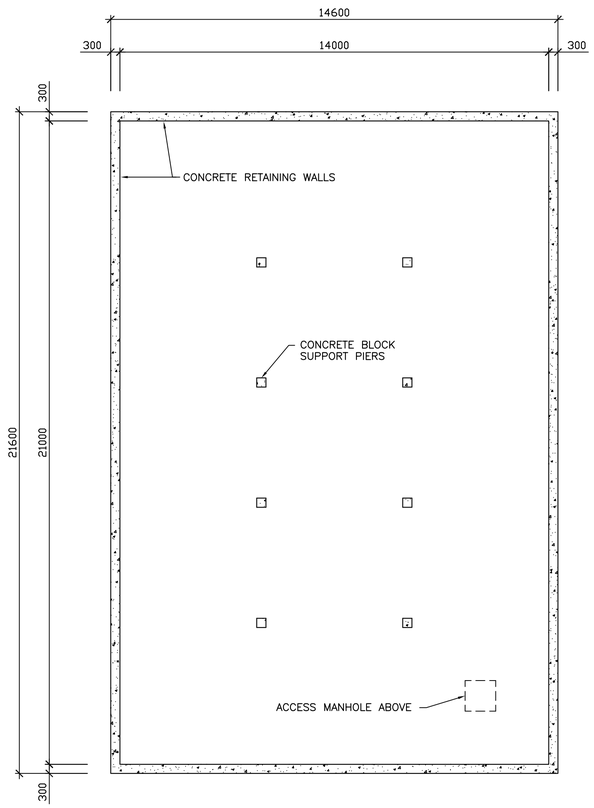
ABODE DESIGN
PO BOX 767 RICHMOND
PH. 4776 1125 0419 405006

DRAWN	DATE DRAWN	SCALE
I.S.	20.6.2007	1:100 at A1

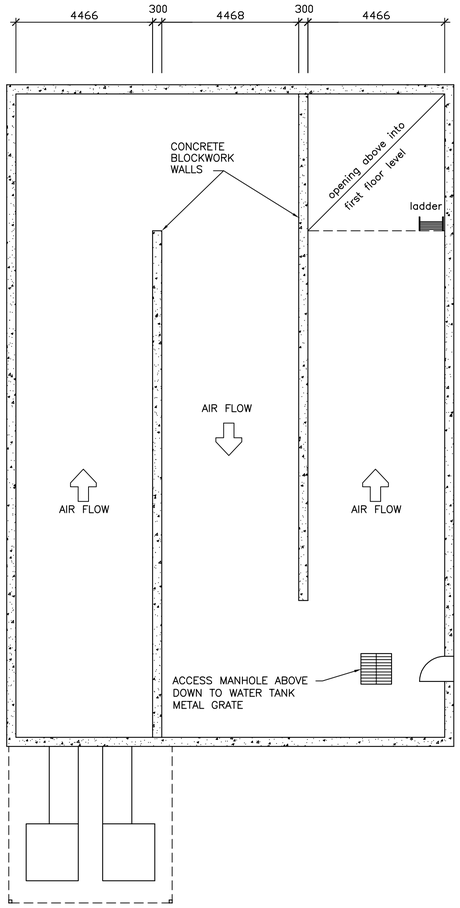
NEW PHASE 2/3 BUILDING
DEVELOPMENT APPLICATION

ELF FARM SUPPLIES PTY LTD
P.O.BOX 615 WINDSOR NSW 2756
108 MULGRAVE ROAD MULGRAVE NSW 2756
TEL.ISD (61)02 45775000 FAX.ISD (61)0245878002

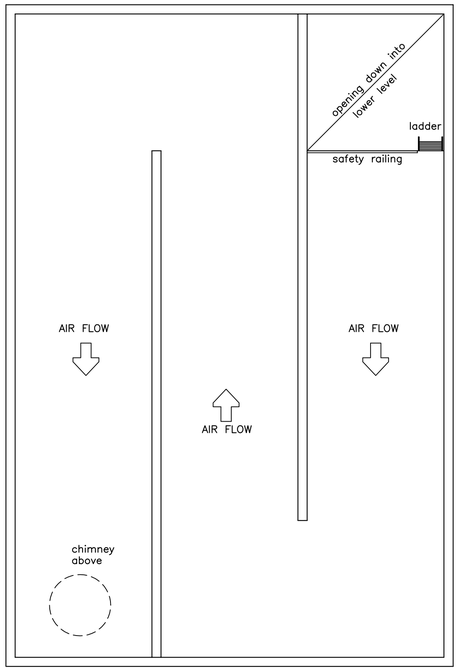
DRAWING NO.	ISSUE
200624	B



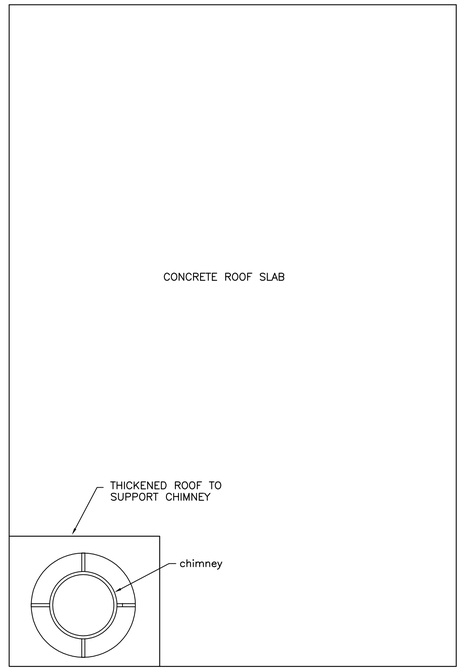
PLAN – SUB–FLOOR (WATER TANK)



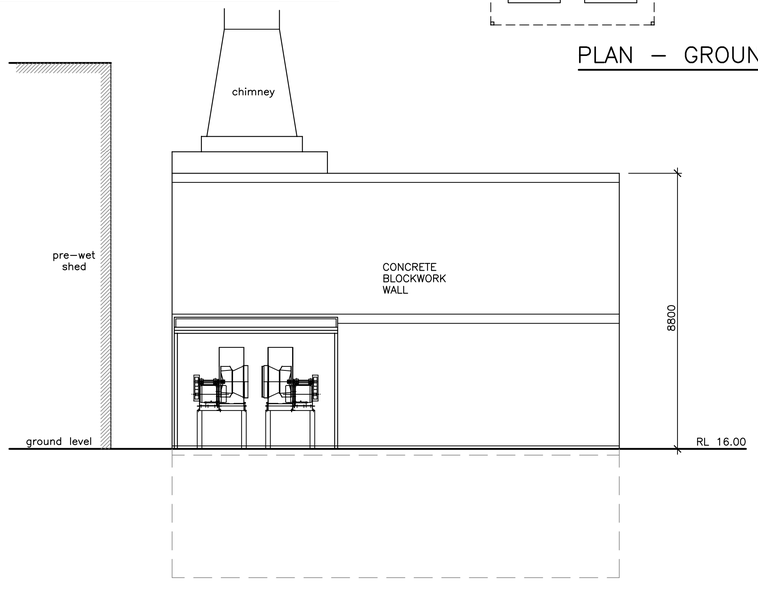
PLAN – GROUND LEVEL



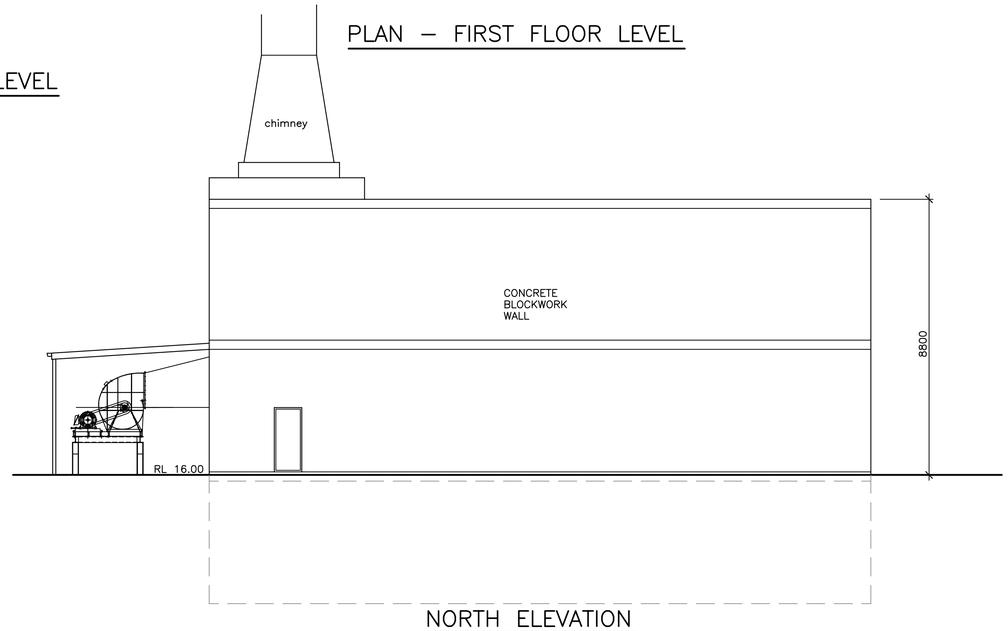
PLAN – FIRST FLOOR LEVEL



ROOF PLAN



EAST ELEVATION



NORTH ELEVATION

0 1:100 SCALE 10m

(D. A. DRAWING ONLY – NOT FOR CONSTRUCTION)

ISSUE	DATE	AMENDMENTS
A	10.11.2010	SCALE BAR ADDED

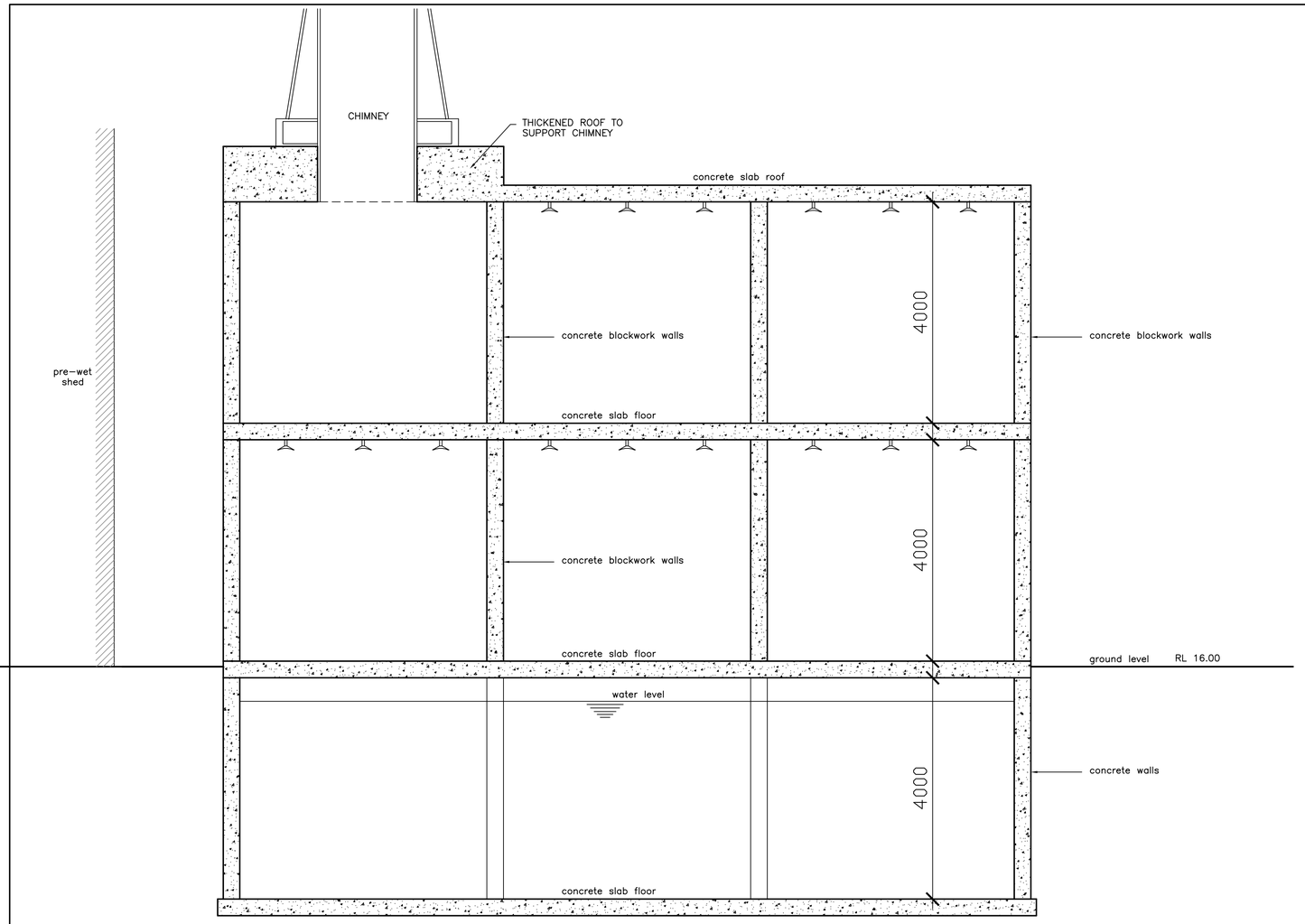
ABODE DESIGN
PO BOX 767 RICHMOND NSW 2753
PH. 4776 1125 0419 405006

DRAWN	DATE DRAWN	SCALE
I.S.	20.9.2009	1:100 at A1

PROPOSED BIO–SCRUBBER AND WATER STORAGE TANK DEVELOPMENT APPLICATION

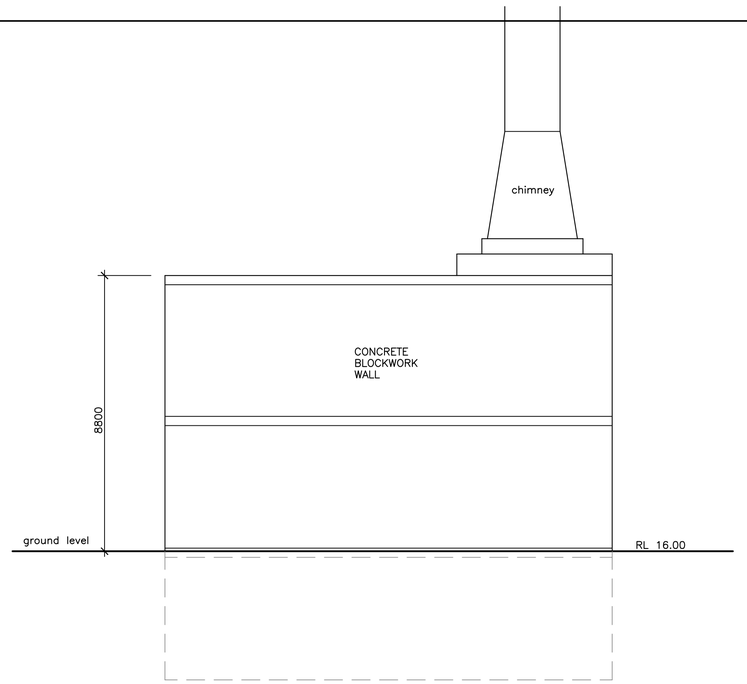
ELF FARM SUPPLIES PTY LTD
P.O.BOX 615 WINDSOR NSW 2756
108 MULGRAVE ROAD MULGRAVE NSW 2756
TEL.ISD (61)02 45775000 FAX.ISD (61)0245878002

DRAWING NO.	ISSUE
200644	A



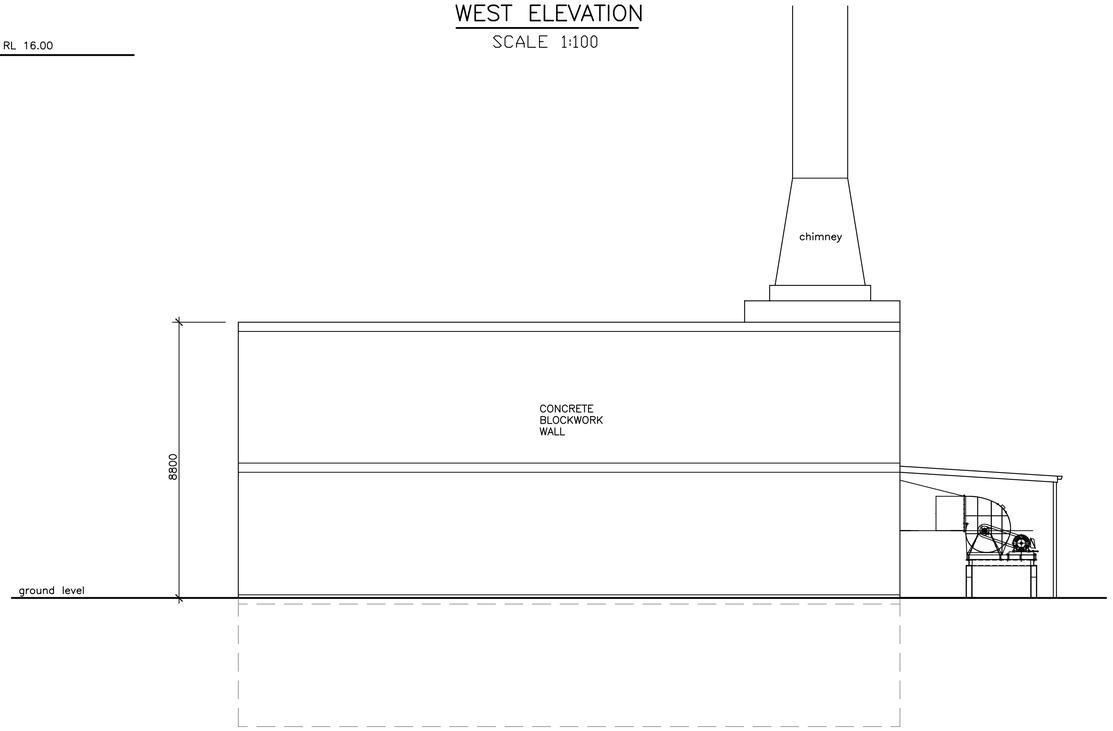
SECTION A–A

SCALE 1:50



WEST ELEVATION

SCALE 1:100



SOUTH ELEVATION

SCALE 1:100

0 1:100 SCALE 10m

0 1:50 SCALE 5m

(D. A. DRAWING ONLY – NOT FOR CONSTRUCTION)

ISSUE	DATE	AMENDMENTS
A	10.11.2010	SCALE BAR ADDED

ABODE DESIGN
PO BOX 767 RICHMOND NSW 2753
PH. 4776 1125 0419 405006

DRAWN	DATE DRAWN	SCALE
I.S.	20.9.2009	1:100 & 1:50 at A1

PROPOSED BIO-SCRUBBER AND WATER STORAGE TANK DEVELOPMENT APPLICATION

ELF FARM SUPPLIES PTY LTD
P.O.BOX 615 WINDSOR NSW 2756
108 MULGRAVE ROAD MULGRAVE NSW 2756
TEL.ISD (61)02 45775000 FAX.ISD (61)0245878002

DRAWING NO.	ISSUE
200645	A