

Traffic Report

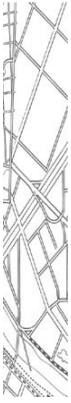
**Proposed Industrial Development
Lot 11, DP 229784 – Templar Road
Erskine Park**

27 March 2008

Prepared for
Jacfin Pty Ltd

Suite 20/809 Pacific Highway
Chatswood NSW 2067
(t) 02 9410 4100 (f) 02 9410 4199
(e) info@mwtttraffic.com.au
(w) www.mwtttraffic.com.au

MASSON | WILSON | TWINEY
TRAFFIC AND TRANSPORT CONSULTANTS



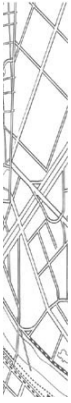
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Author: Jason Rudd
Reviewer: Bruce Masson
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1. Introduction

This report has been prepared on behalf of Jacfin Pty Ltd to assess the traffic and parking implications associated with a proposed industrial development at Templar Road, Erskine Park.

The site is located within the Erskine Park Employment Area as defined by Penrith Local Environmental Plan (LEP) 1994 (Erskine Park Employment Land) and Penrith DCP 2006.

With regard to traffic and parking the LEP, DCP 2006 and associated Erskine Park Employment Area Development Contributions Plan, seeks to:

- enable a diversity of employment generating development at Erskine Park;
- identify transport infrastructure to accommodate employment generating development; and
- establish funding mechanism for infrastructure provision.

This traffic and parking assessment has been prepared with regard to Director General's requirements (DGRs) for a Part 3A Project Application.

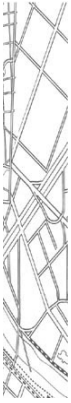
Key transport issues identified in the DGRs to be assessed were:

- proposed site access arrangements including the extension of Templar Road;
- traffic generation potential of proposed development for both construction and operation;
- implications of traffic generation on the efficiency and safety of the surrounding road network; and
- car parking provisions.

The remainder of this report can be summarised as follows:

- Chapter 2: describes the site location and provides a background of proposed road network infrastructure;
- Chapter 3: provides an overview of the proposed development including traffic generation and site access arrangements;

- Chapter 4: considers the proposed development within the strategic context of regional planning and transport infrastructure and assesses the access and parking provisions; and
- Chapter 5: summarises the findings of the report.



2. Site Location and Background

2.1 Site Location

The proposed development site (the site) is a 4.1 hectare wedge shaped parcel of land located within the Erskine Park Employment Area.

The site is bounded by:

- North: CSR industrial site
- South: Water Supply pipeline
- West: Industrial zoned land (including Crown Road Reserve)

The site location within the context of its surrounding land uses is shown in Appendix A.

2.2 Site Access

Access to the site is from the southern end of Templar Road. Templar Road is to be extended to the Jacfin site boundary. CSR has agreed to dedicate a 20 metre wide reserve to accommodate this access as a public road.

The site has been traditionally accessed from Mamre Road via the Crown Road Reserve (western site boundary) and James Erskine Drive. Currently this is the only access available to the site.

However, revised access arrangements to the site are proposed as a result of the inclusion of a biodiversity corridor through the Crown Road Reserve. The proposed access arrangements are discussed further in following sections of this report.

2.3 Surrounding Road Network

The key arterial roads providing access to the site and the Erskine Park Employment Area generally are:

- Mamre Road;
- Erskine Park Road / Roper Road / Carlisle Avenue;
- M4 Motorway; and
- Great Western Highway.

Access to and from the M4 Motorway is provided at:

- Mamre Road – full interchange; and
- Erskine Park Ramp – east facing ramps (access to and from the east).

2.4 Background to Regional Road Network Planning

As part of the strategic planning undertaken for the Erskine Park Employment Area, Penrith City Council and the RTA adopted a peak hour traffic generation rate of 15 trips per hectare for industrial development across the whole employment area.

This traffic generation rate was used to identify regional and local road network improvements required to accommodate the estimated traffic generation of the Erskine Park Employment Area as a whole which includes some 525 hectares of land.

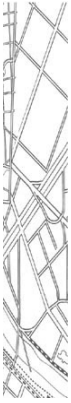
The road and traffic management works required to accommodate the estimated traffic generation potential of the Erskine Park Employment Area are identified in the Erskine Park Employment Area Section 94 Plan.

These works include:

- Major Access Roads
 - Lenore Lane (Northern Access Road) and Arterial Link Road
 - Western Access Road
- Major Intersection Works
 - Mamre Road / Erskine Park Road
 - Mamre Road / James Erskine Drive (western access road)
 - Erskine Park Road / Northern Access Road

The proposed development site (4.1 hectares) is a very small component of the Erskine Park Employment Area (525 hectares) representing less than 1% of the total employment area.

Notwithstanding the above, development of the site will generate traffic as anticipated by the strategic planning for the Erskine Park Employment Area and will be subject to Section 94 contributions for regional and local road network infrastructure works.



3. Overview of Proposed Development

3.1 Description of Proposed Development

It is proposed to develop the site for employment / industrial uses as envisaged for the Erskine Park Employment Area.

The industrial building to be constructed on the site is proposed for warehousing and ancillary office uses with car parking and service vehicle (loading dock) facilities.

The proposed development includes:

- Warehouse floor area: 21,005m² GFA
- Office floor area: 1,285m² GFA
- Car Parking: 218 spaces
- Loading Dock Facility accommodating articulated vehicles.

3.2 Proposed Site Access

It is proposed to access the site via Templar Road. This will require the construction of a road extension from Templar Road to the boundary of the site across the adjacent CSR site.

The extension of Templar Road to the site will be located within a public road reserve to be dedicated to Penrith City Council by CSR.

It is proposed that a vehicle turning area (cul-de-sac treatment) will be constructed within the site's current boundary to allow vehicles to turn around without entering the site's car parking or loading areas.

The cul-de-sac within the Jacfin property will be dedicated as public road reserve on completion of the road works.

Internal access roads to the car parking area and the loading area would connect with the proposed turning area.



4. Assessment of Proposed Development

4.1 Director General's Requirements

With regard to traffic and parking, the key issues to be addressed in the Director General's requirements were:

- Site access arrangements;
- Traffic generation impacts (both operational and construction traffic) on efficiency and safety of road network operation; and
- Car Parking

Each of these issues is addressed below.

4.2 Traffic Generation

As discussed, the strategic planning for the Erskine Park Employment Area has identified road network infrastructure works required to accommodate the proposed warehouse / ancillary office use of the site.

For warehouse land uses the mean floor area per employee was surveyed by the RTA to be 226m² per employee (Roads and Traffic Authority guidelines¹). For the proposed development this equates to approximately 93 employees in the warehouse.

The RTA guidelines specify the following peak hour generation rates for industrial estates:

- AM peak hour: 0.318 trips / employee
- PM peak hour: 0.365 trips / employee

For the proposed warehouse use this equates to a traffic generation of 30 – 34 vehicle trips per peak hour.

¹ Roads and Traffic Authority of New South Wales (2002) *Guide to Traffic Generating Developments*.

Based on Roads and Traffic Authority guidelines² the traffic generation of office component of the proposed development is estimated to be approximately 26 trips per peak hour (2 vehicles / hr / 100m² GFA).

Total traffic generation of the proposed development is estimated to be in the order of 60 vehicle trips per peak hour.

This is compatible with the strategic traffic generation rate for the Erskine Park Employment Area of 15 trips / hectare.

Therefore, the implementation of the planned future road network improvements would accommodate the proposed development of the site.

4.3 Site Access and Internal Road Layout

It is proposed that a road reserve with a width of 20 metres extending from Templar Road to the site boundary will be provided through the CSR site.

The proposed road reserve would accommodate a 7.0 metre wide road pavement which will facilitate satisfactory two way vehicle access (including articulated vehicles) to and from the site.

Therefore access to and from the proposed development site will be via Lenore Lane and Templar Road.

The Lenore Lane / Templar Road intersection has been identified in DCP 2006 as an access point to the land located to the south of Lenore Lane.

The proposed Templar Road extension will connect to Templar Road at what would be a large cul-de-sac, thus creating a roundabout facility. This will maintain a turning area for vehicles without the need to travel along the Templar Road extension to the proposed site. As such the only vehicles requiring access to the Templar Road extension will be vehicles accessing the proposed development site.

The turning area to be provided on the Jacfin property will be sufficient to accommodate u-turn movements by heavy vehicles (including semi trailers and b-doubles).

No on street parking is proposed along the Templar Road extension. This is consistent with the objectives of the DCP 2006.

Separate internal roads within the development site will provide access from the Templar Road extension turning area to the car parking area and to the loading dock

² Roads and Traffic Authority of New South Wales (2002) *Guide to Traffic Generating Developments*.

facility. The provision of access via separate internal road will reduce potential conflicts between cars and heavy vehicle manoeuvring areas. This is consistent with RTA guidelines and AS2890.2.

In summary the proposed site access and internal road layout are considered appropriate for the proposed development.

4.4 Parking Provision

Requirements for the provision of on site parking are specified in the Penrith Development Control Plan 2006 (Part 6 Section 6.14 Erskine Park Employment Area).

The DCP 2006 objectives for the Erskine Park Employment Area are:

- Ensure the provision of adequate on site parking to satisfy the demands generated by the proposed development; and
- Eliminate the need for kerb side parking and congestion on the public road network.

DCP 2006 specifies parking for particular land uses but also states that the parking rates specified by the Roads and Traffic Authority guidelines³ may be used in assessing parking demand.

The DCP 2006 and RTA rates are compared with the proposed parking provision in Table 4.1.

Table 4.1 - On Site Parking Provision

Land Use	Area (GFA m ²)	DCP 2006		RTA Guidelines		Proposed Parking Provision
		Rate	Spaces Required	Rate	Spaces Required	
Warehouse	21005	1/100m ² NLA ¹ .	189	1/300m ²	70	-
Office	1285	1/40m ² NLA ¹ .	29	1/40m ²	32	-
Total			218		102	218 spaces

For the purpose of parking calculations it was assumed NLA = 90% of GFA

The proposed parking provision of 218 on site parking spaces complies with both DCP 2006 requirements and RTA guidelines.

Given the dominance of warehouse uses, it is considered that the proposed parking provision would more than adequately accommodate the parking demands of the proposed development.

The proposed parking layout is generally set out in accordance with the design requirements of AS2890.1-2004.

³ Roads and Traffic Authority of New South Wales (2002) *Guide to Traffic Generating Developments*.

The proposed parking provision of 218 spaces would include both employee and visitor spaces. It is recommended that visitor parking be provided within close proximity to the main building entrance.

Furthermore it is recommended that 1-2% of total parking spaces be designed and designated as disabled parking spaces in accordance with AS2890.1.

4.5 Service Vehicle (Loading) Facilities

As noted above, the proposed loading area will be separated from car parking area. Therefore no heavy vehicle movements through the car park will be necessary to access the loading dock.

The loading dock provision and layout is considered to be appropriate for the proposed warehouse uses. The layout provides significant vehicle manoeuvring area and would facilitate efficient access to and from individual loading docks. The loading and manoeuvring area would adequately accommodate access requirements of articulated vehicles, including B-Double vehicles.

4.6 Construction Traffic

Details regarding the construction methodology, duration of works and traffic generation are not known at this stage. Such details would be developed following project approval. It is envisaged that construction traffic implications will need to be assessed as part of a construction traffic management plan (CTMP) developed prior to the issue of a Construction Certificate as per a normal project approval condition.

However, it is anticipated that all construction traffic access to and from the site would be via the Templar Road extension. Therefore the construction of this road would be undertaken during the initial construction stage.

While the exact volumes of construction traffic to be generated by the site is yet to be determined, it is anticipated that typical daily flows during construction would be similar to if not less than operational traffic generation of the proposed development.

Peak construction traffic generation will occur during concrete pours and bulk earthworks should material be required to be removed or imported to the site. At these periods it is anticipated that some 20 trips per hour (10 in / 10 out) would occur. These details would be confirmed and assessed as part of a CTMP.



5. Conclusions

This report presents the findings of a traffic and parking assessment of the proposed warehouse and ancillary office development on Lot 11 Templar Road, Erskine Park.

The proposed development site is located within the Erskine Park Employment Area. This area has been identified as a major employment area in Western Sydney.

Strategic planning for the Erskine Park Employment Area has identified the development potential of the area and the road network infrastructure improvements required to accommodate development.

Funding arrangements via the Erskine Park Employment Area Development Contributions Plan are in place to facilitate infrastructure provision.

With regard to traffic generation and parking the proposed warehouse / office development on Lot 11 is consistent with the development potential envisaged for the site as part of the Erskine Park Employment Area.

Therefore the identified road network improvements are considered to be appropriate to accommodate the proposed development. Development of the site will be subject to funding contributions for road network improvements in accordance with the Erskine Park Employment Area Development Contributions Plan.

Vehicle access to the site has been facilitated via an agreement with the land owners of the adjacent CSR site with an extension of Templar Road to be constructed across the CSR site between Templar Road and the site. Templar Road is identified in DCP 2006 as an access road to Lenore Lane.

The proposed on site parking provisions are in accordance with the requirements of DCP 2006 and RTA guidelines.

In summary it is concluded that the proposed development is acceptable with regard to traffic and parking.

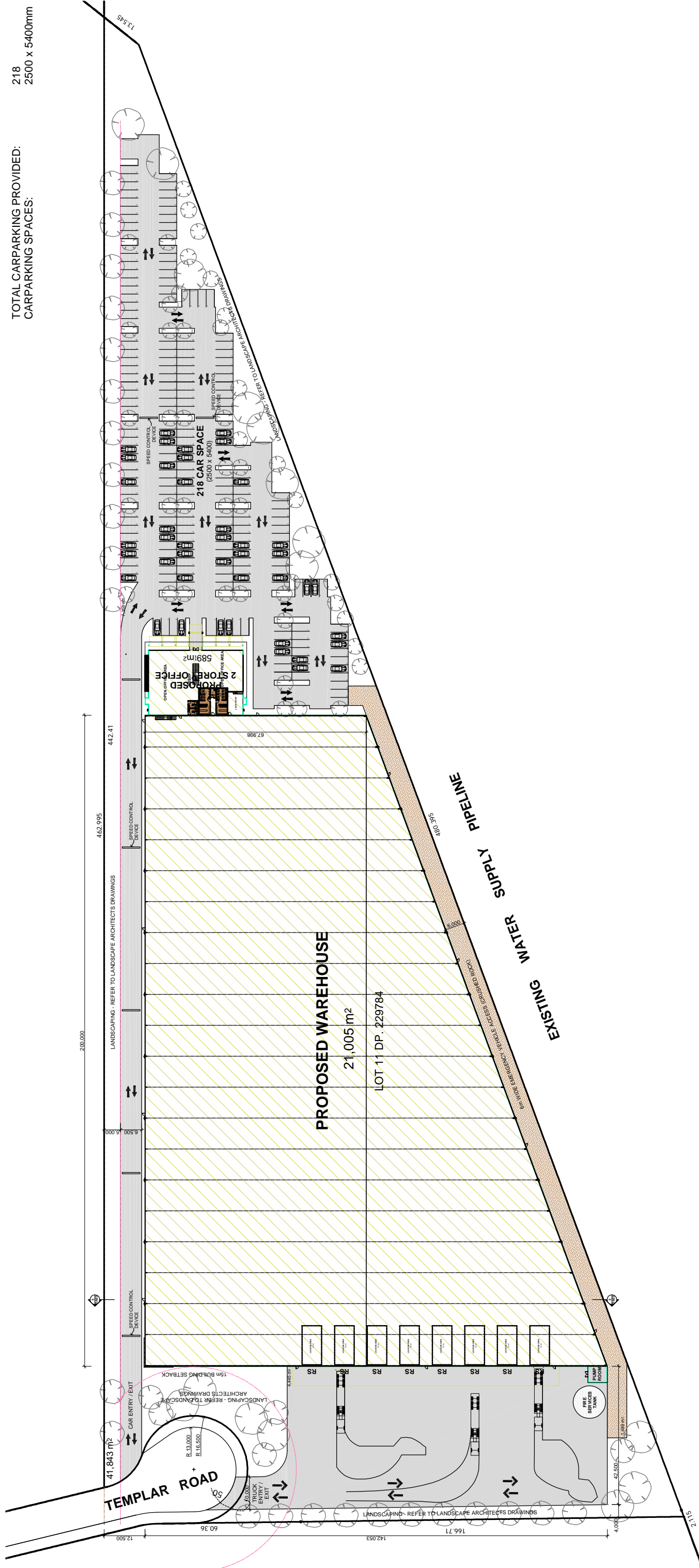


Appendix A - Site Location and Surrounding Land Uses



DEVELOPMENT DATA

SITE AREA: 41,843m²
 WAREHOUSE FLOOR AREA: 21,005m²
 OFFICE FLOOR AREA: 1,285m²
TOTAL BUILDING AREA: 22,290m²
 TRUCK HARDSTAND: 4445m²
 DRIVEWAY & CARPARK HARDSTAND: 7356m²
 EMERGENCY VEHICLE ROAD: 1489m²
 LANDSCAPE AREA: 6959m²
 TOTAL CARPARKING PROVIDED: 218
 CARPARKING SPACES: 2500 x 5400mm



SITE PLAN
1:600



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EST. 1995

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(03) 9347 2611 (02) 9502 4544

PROPOSED WAREHOUSE & OFFICE FOR WATERHOUSE
 LOT 11 DP.229784 TEMPLAR ROAD
 ERSKINE PARK NSW 2208

Project: Address:



Project North:

Date: 24.07.07
 Dwn: B.A.
 Ck'd: 25.07.07

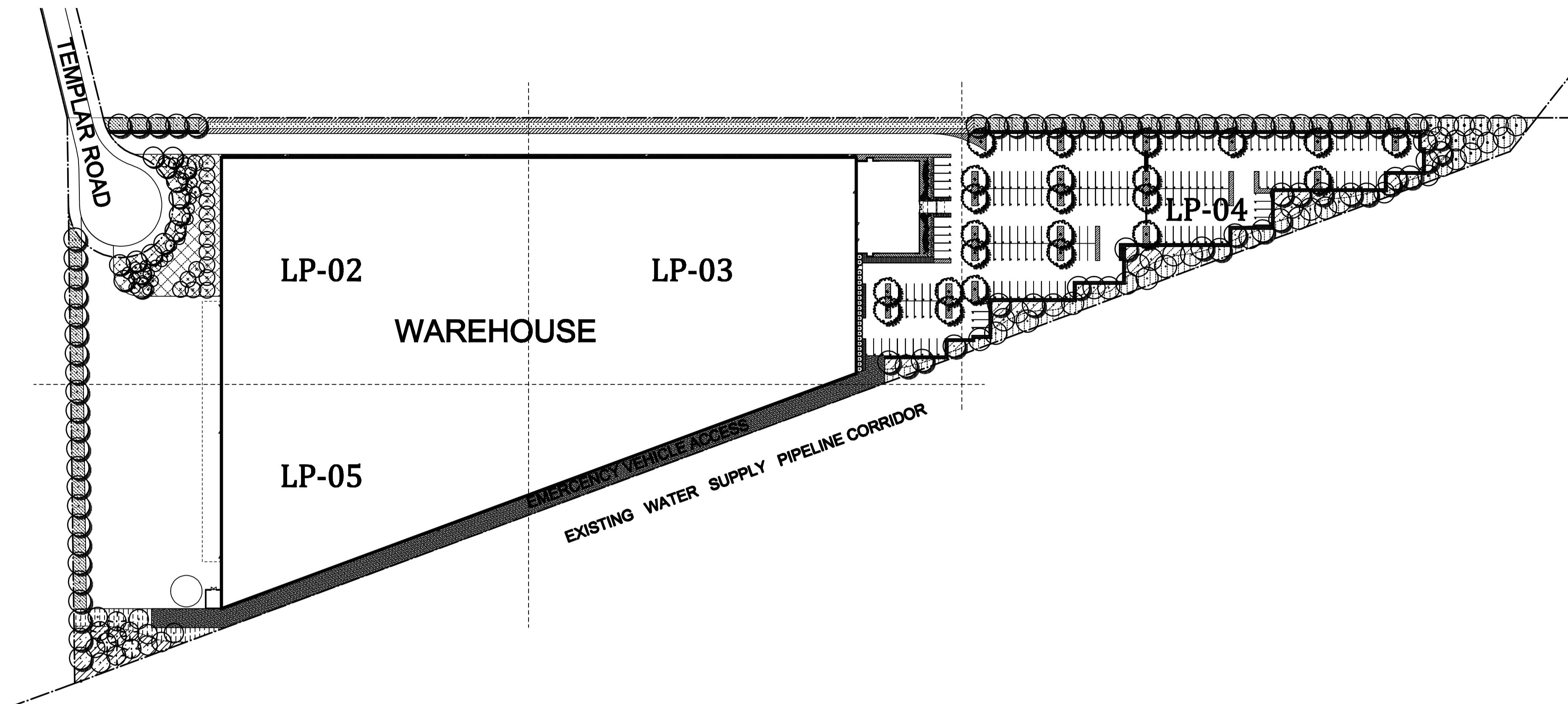
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Job No.	27065
Scale	Half Scale @ A3
Date	25/7/2007
Drawn	B.A.



LANDSCAPE SITE PLAN

SCALE 1:1000

PLANT SCHEDULE

	Symbol	Botanical Name	Common Name	Size
Car park and Office areas	Lc	Lophostemon coriferta	Brush Box	75 litre
	Sl	Syzygium leuhmanni	Lilly Pilly	300mm
	Cm	Clivea miniata	Clivea	150mm
	Cr	Cycas revoluta	Cycad	300mm
	Dlj	Dianella Little Jess	Dianella	Vt
	Lm	Liriope muscari	Liriope	150mm
	Lt	Lomandra tanika	Fine leaf dwarf Lomandra	Vt
	Pm	Phormium Maori maiden	Purple Flax	300mm
	Px	Phlodonon Xanadu		200mm
	Vh	Viola hederacea	Native violet	100mm
Bio retention Swale	DI	Dianella longifolia	Dianella	Vt
	LJ	Lomandra longifolia	Lomandra	Vt
	Ms	Microlaena stipoides var caespitosus	Weeping Rice Grass	Vt
	Ta	Themeda australis	Kangaroo grass	Vt
Rain Detention Garden	Ef	Eucalyptus fibrosa	Broad leaf Iron Bark tree	300mm
	Lp	Leptospermum polygalifolium	Lemon scented Tea tree	150mm
	Md	Melaleuca decora		200mm
	MI	Melaleuca linearifolia	Snow in Summer Prickly-leaved Tea Tree	150mm
	Ms	Melaleuca Stypheloides		200mm
	LI	Lomandra longifolia	Lomandra	Vt
Bio Diversity Planting	Ec	Eucalyptus crebra	Narrow leaved Iron bark	300mm
	Em	Eucalyptus moluccana	Grey Box	300mm
	Et	Eucalyptus tereticomis	Forest red gum	300mm
	Cs	Callistemon salignus	Willow Bottle brush	150mm
Bs	Bursaria spinosa	Blackthorn	tube	
GI	Grevillea linearifolia	White spider flower	tube	
Lp	Leptospermum polygalifolium	Lemon scented Tea tree	150mm	
Ad	Austrodanthonia sp	Wallaby grass	Vt	
DI	Dianella longifolia	Dianella	Vt	
LJ	Lomandra longifolia	Lomandra	Vt	
Ms	Microlaena stipoides var caespitosus	Weeping Rice Grass	Vt	
PI	Pimelea linifolia	Slender rice flower	tube	
Ta	Themeda australis	Kangaroo grass	Vt	

NOTE: All plant species for Bio diversity, Bio-retention swale and Rain Detention gardens as per Cumberland Ecology's recommendations. These have been based on Penrith City Council DCP (2006) and NPWS Technical Report of The Native Vegetation of the Cumberland Plain, Western Sydney (2000).

SPECIFICATION

BUILDER:

Clean and grade site to approximate levels required for landscape finishes. Soil depths to be 350mm for car park islands and gardens to office areas 150mm for other planted areas.

LANDSCAPER:

Planted Areas

All gardens areas to have the sub grades cultivated to a depth of 200mm. All weeds are to be eradicated prior to soil works. Install 300mm depth of imported organic soil mix equal to ANL garden mix to Carpark islands and office gardens and 100mm to all other areas.

Planting

Supply and plant healthy nursery stock of the size and species listed in the plant schedule and in locations shown on the plan. Excavate planting holes to twice the diameter of the plant container and 150mm deeper and backfill around root ball with organic soil mix. Plants are to be well watered in immediately after planting. A native fertilizer equal to Patons native plant food and with a water retention aid such as 'saturaid' is to be applied to each plant at the time of planting at manufacturers recommended rates.

Staking

Stake trees with two 38mm x 38mm square hardwood stakes and tie in figure of eight with 50mm jute webbing stapled to stakes. Trim height of stakes to avoid stem damage in high wind.

Mulch

After planting mulch all planted areas with 75mm of forest blend mulch. Mulch areas adjacent to office with Pine bark (15-25mm)

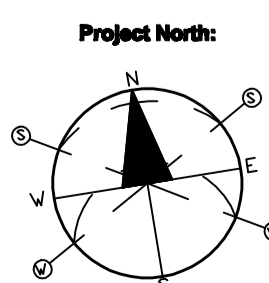
Irrigation

Design and install an automatic drip irrigation system to all planted areas in accordance to the latest Sydney Water Irrigation regulations, and shall consist of the necessary components such as backflow prevention valve and rain sensor.

Maintenance

Maintain all landscape works for 13 weeks after practical completion of the work. All plant material and turf areas are to be kept adequately watered to maintain healthy growth and vigorous growth. Tree planting may require extra watering. Grass areas are to be mown to maintain average height of 35mm with the mowing frequency depending on season. Tree ties and stakes should be kept in proper condition and not removed or modified unless no longer required for support and protection. Mulch areas are to be kept clean and tidy and all weeds removed by hand during regular maintenance. A minimum mulch depth of 50mm should be maintained at all times as required. Replace plants were failed with new plants true to the original material.

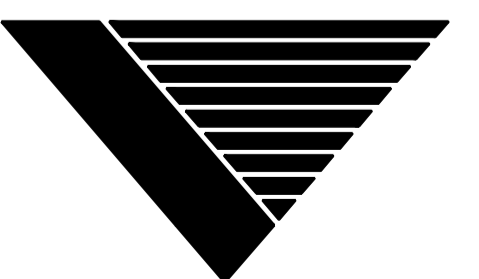
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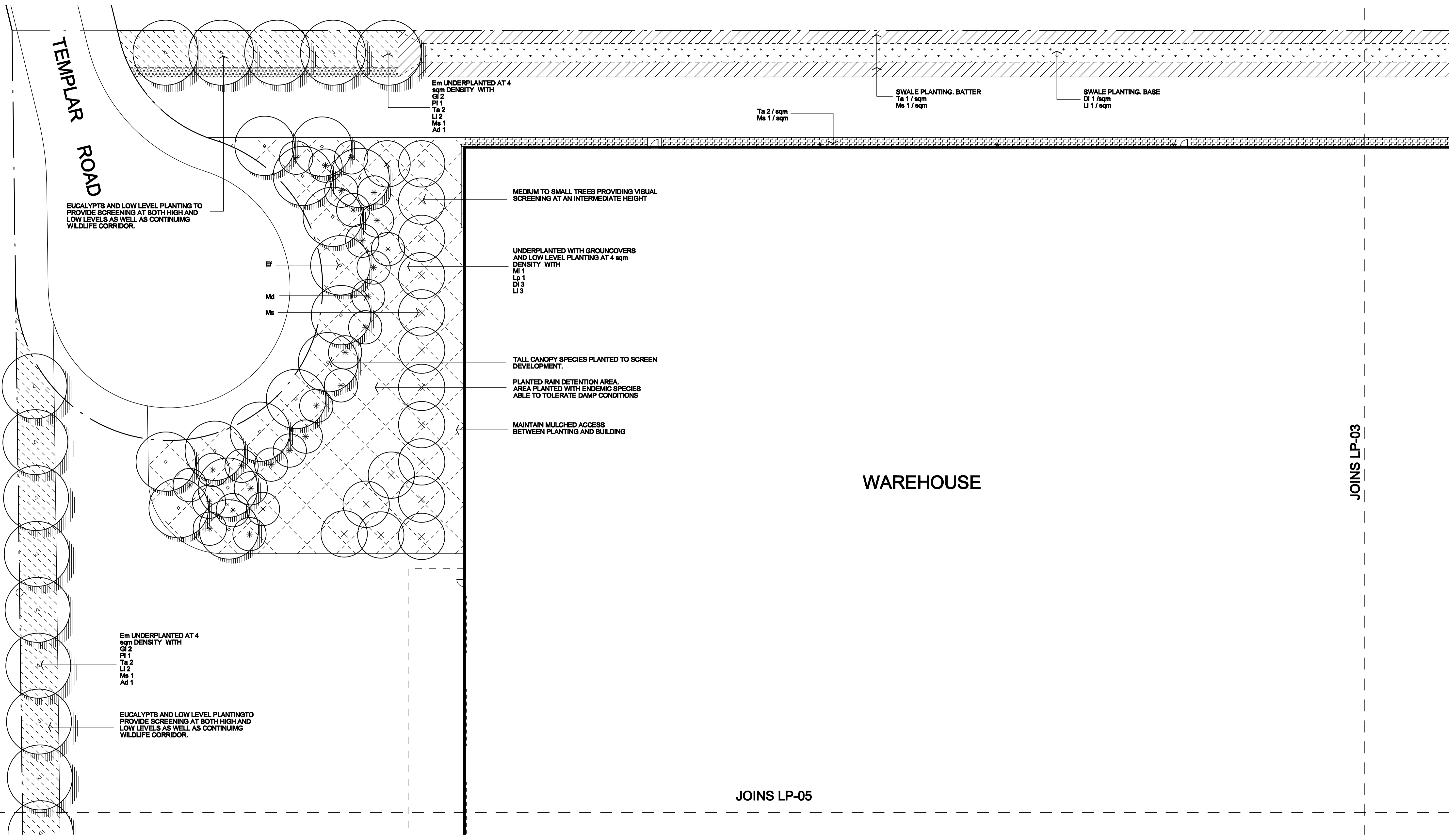
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Amendment	A
Job No.	27065
Scale:	As shown @ A1 Half scale @ A3
Date:	18.02.2008
Drawn:	GES

cabbage tree landscape
 po box 27 Hornsleigh nsw 2120
 ph: 9875 5120 fax: 9875 1037



VAUGHAN CONSTRUCTIONS
 A.C.N. 004 281 440
 EST. 1985
 MELBOURNE SYDNEY
 (03) 9347 2811 (02) 9502 4544



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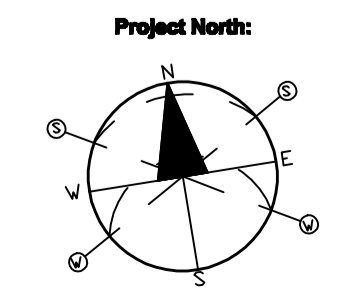
WAREHOUSE

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LANDSCAPE PLAN
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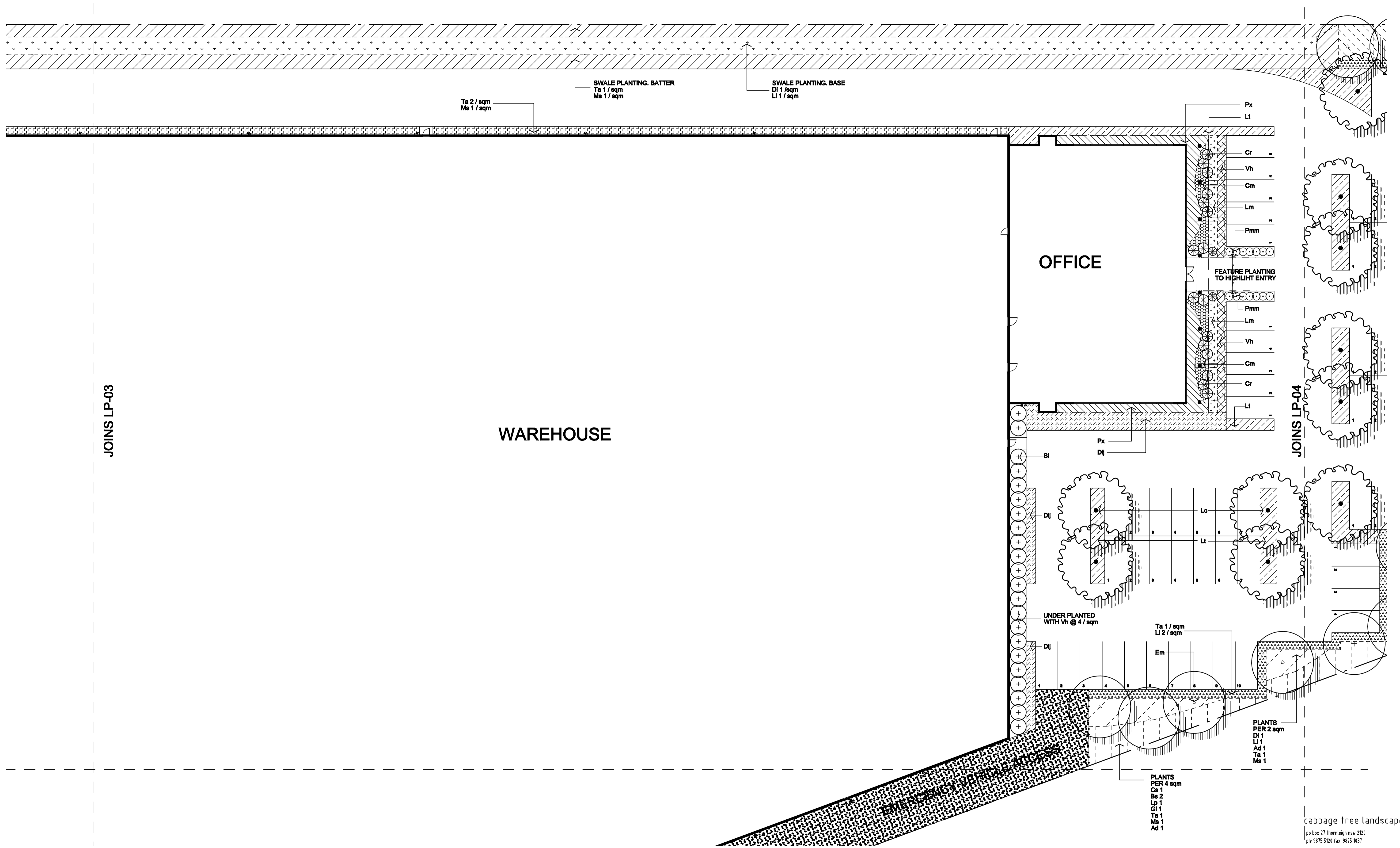
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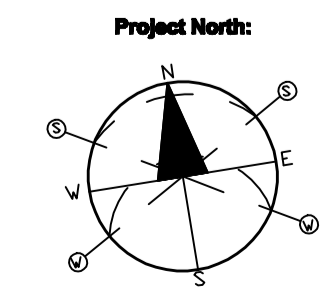
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cabbage tree landscape
 po box 27 thornleigh nsw 2120
 ph: 9875 5120 fax: 9875 1837

LANDSCAPE PLAN
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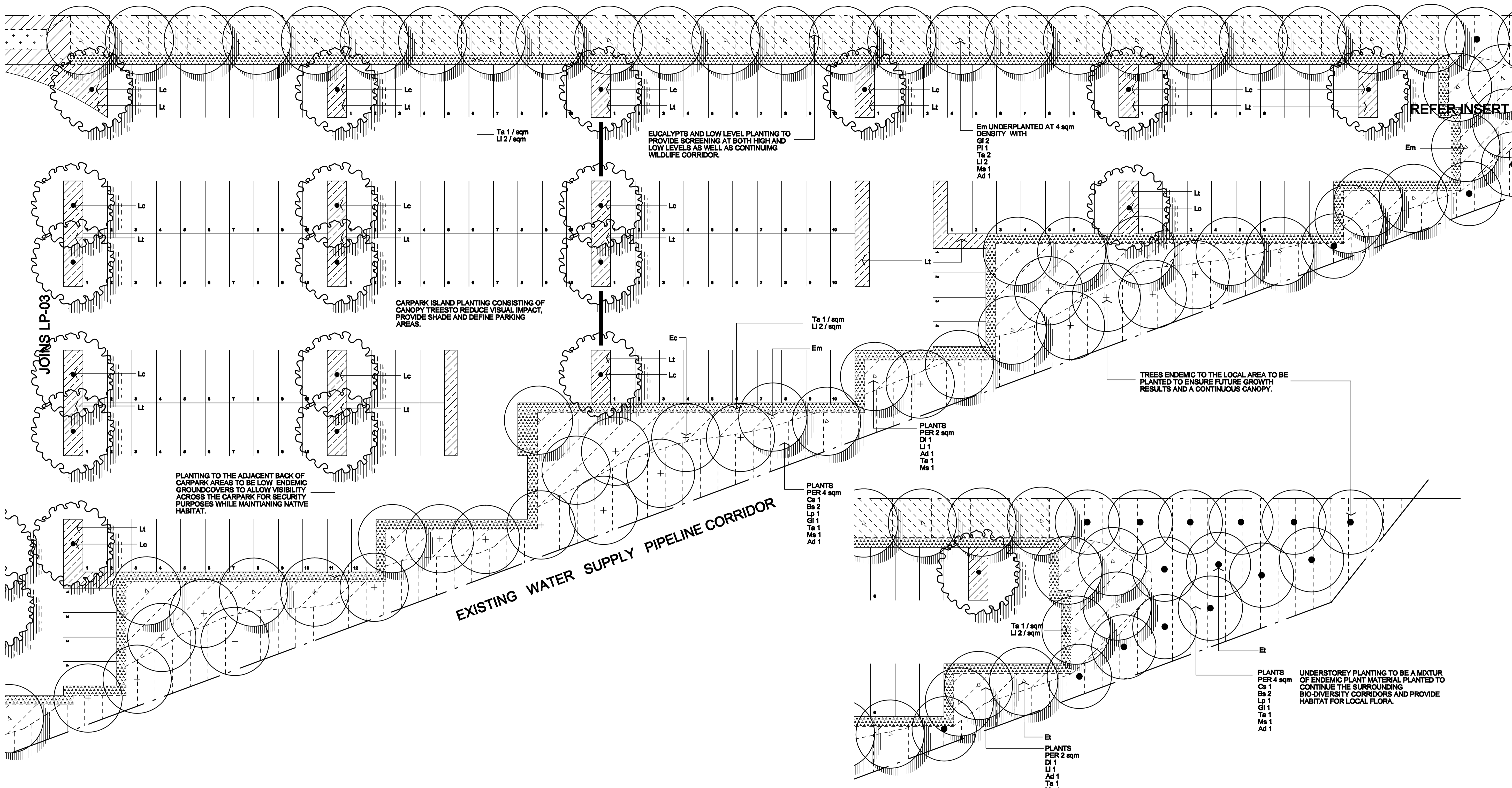
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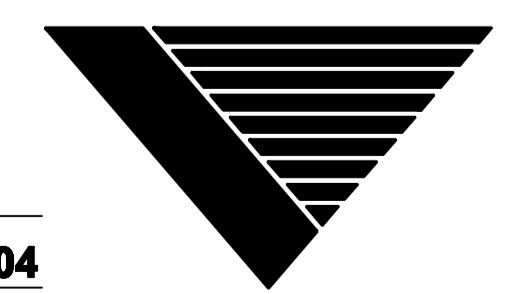


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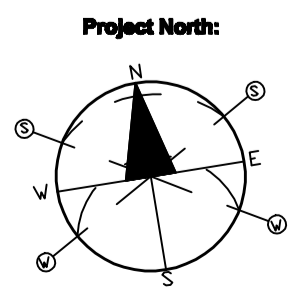
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LANDSCAPE PLAN
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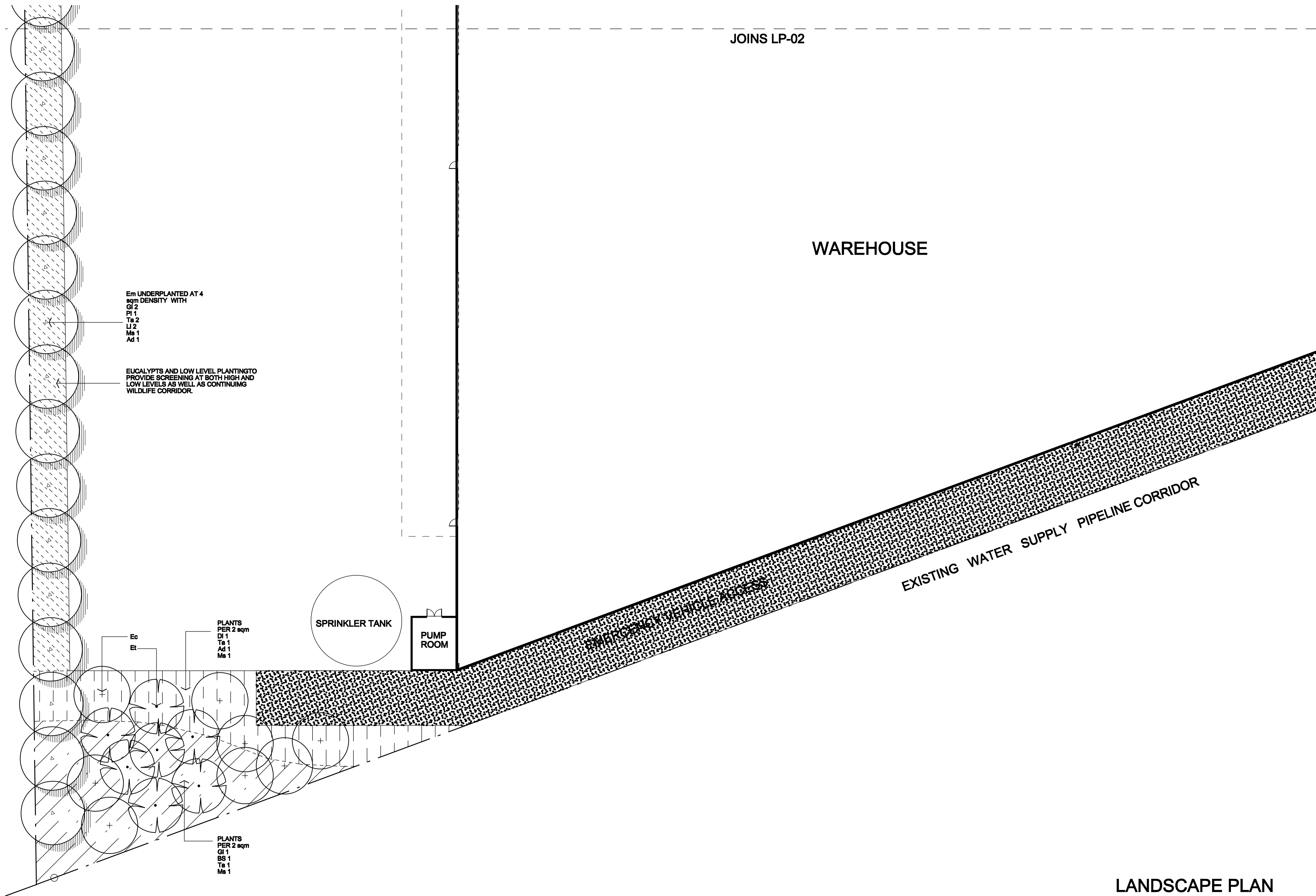
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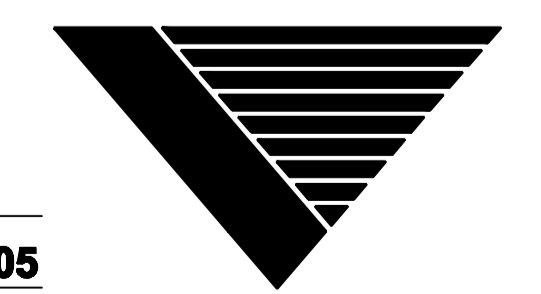
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VAUGHAN CONSTRUCTIONS
 A.C.N. 004 304 643
 EST. 1955



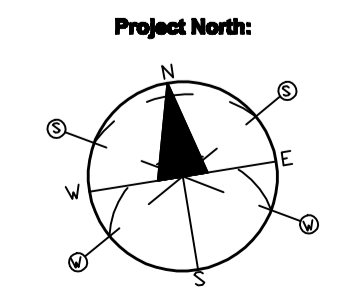
LANDSCAPE PLAN
SCALE 1:200

cabbage tree landscape
po box 27 hornleigh nsw 2120
ph: 9875 5128 fax: 9875 1837



VAUGHAN
CONSTRUCTIONS
A.C.N. 004 334 548
EST. 1955
MELBOURNE SYDNEY
(03) 9347 2611 (02) 9502 4544

Issue	Amendment	Date	Drawn	Chk'd
A	ISSUED FOR DA SUBMISSION	13.03.08	GES	PJS



Project: **PROPOSED WAREHOUSE & OFFICE FOR WATERHOUSE** Title: **LANDSCAPE PLAN**

Address: **LOT 11 DP.229784 TEMPLAR ROAD
ERSKINE PARK NSW 2208**

Dwg No.	DALP-05
Amend't	A
Job No.	27065
Scale:	As shown @ A1 Half scale @ A3
Date:	18.02.2008
Drawn:	GES

**FLOODING AND DRAINAGE CONSIDERATIONS
PART 3A PROJECT APPLICATION**

**TEMPLAR ROAD, ERSKINE PARK
INDUSTRIAL WAREHOUSE DEVELOPMENT**

**SUBMITTED TO
MINISTER OF PLANNING
ON BEHALF OF JACFIN PTY LTD**

JUNE, 2008

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PART 3A PROJECT APPLICATION**

**TEMPLAR ROAD, ERSKINE PARK
INDUSTRIAL WAREHOUSE DEVELOPMENT**

**SUBMITTED TO
MINISTER OF PLANNING
ON BEHALF OF JACFIN PTY LTD**

JUNE, 2008

Stephen N Webb & Associates Pty Ltd
ABN 11 431 355 357

296 Storey Street, MAROUBRA NSW 2035
Tel: (02) 9344 9144 Fax: (02) 9345 2292
507: Flooding-and-Drainage-Considerations

Prepared by: DR S N WEBB

Date: _____

FLOODING AND DRAINAGE CONSIDERATIONS
TEMPLAR ROAD, ERSKINE PARK
PART 3A PROJECT APPLICATION

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1. INTRODUCTION

Jacfin P/L proposes a warehouse development on their land, Lot 11 DP 229784, being approximately 4.1 ha located in the Erskine Business Park. The site is zoned employment under the Penrith LEP 1994.

The Minister for Planning declared on the 6th September 2007 that the development on the subject site was a project to which Part 3A of the EPA Act applies. Jacfin P/L has prepared a Part 3A Project Application for the proposed development. The Director General's requirements (Project Application No. 07_0153) were issued on 26 November 2007.

This report has been prepared to support the Project Application and addresses the Director General's requirements to consider the relationship of the proposed development to the CSR relocated creek. It also addresses the issues of the access road creek crossing and impacts on flooding. I was involved in discussions with DoP on the CSR application for the creek relocation on behalf of Jacfin and as such, have had an extensive involvement in the issues relating to the relocated creek and the proposed access road and waterway crossing to Jacfin's Lot 11 ("**the Jacfin land**").

I have also consulted with Greg Brady of the Department of Water & Energy on a number of occasions. In the most recent meeting it was acknowledged that the design of the waterway crossing was appropriate and it should be relatively straightforward to implement in accordance with the Riparian Guidelines.

I have set out below my comments on the likely effects on flood levels, and local bed and bank scour, of the proposed waterway crossing of the relocated creek on the extension of Templar Road at Erskine Park. I have also commented on the existing drainage lines within the Jacfin land.

2. IMPACTS OF THE WATERWAY CROSSING ON FLOOD LEVELS

2.1 BACKGROUND

The extension of Templar Road to the boundary of the Jacfin land has to cross an artificial creek which has been built by CSR to replace a natural creek being filled in as part of their development.

The artificial creek was inspected on 1st March 2008. Construction of the reach immediately adjoining the Jacfin land had been completed, together with the reach downstream to where the creek exits the CSR land and enters the Crown Road Reserve (CRR). The proposed riparian vegetation had yet to be planted.

The artificial creek has been modified due to representations from Jacfin, and now appears to provide a reasonable design which should be sustainable, and should be able to safely convey flood flows in the normal range of design events. There appear to be some minor differences between the as constructed creek and the Construction Plans previously supplied to Jacfin by CSR.

It is Jacfin's responsibility to design the waterway crossing to safely convey floods without adversely affecting flooding on the CSR site. It is proposed that a 4 span bridge structure (12 metre wide waterway opening) be constructed to convey up to the 100 year ARI flood without any significant afflux (3 spans would be sufficient to bridge the 9 metre wide trapezoidal channel designed to convey most of the flows even in larger events). The proposed waterway crossing is shown in Worley Parsons' Drawing 5269-02-04E.

In this particular instance, it is also important that the crossing not destabilise the bed and banks of the creek in the vicinity of the crossing for low flows. This is to ensure that the riparian vegetation to be established will be sustainable in the longer term, and will not be subject to localised high velocities which could inhibit the establishment and maintenance of the vegetation.

Work-as-executed survey has been obtained of the artificial creek, and the likely impacts of the proposed bridge structure have been assessed using the HEC-RAS model used in the CSR design (this was supplied to me by Browns). The assessment is discussed in Section 2.2 below.

In considering the impacts of the proposed waterway crossing, I have taken into account recommendations in the various Draft Riparian Guidelines provided to me by the Department of Water & Energy (DWE).

2.2 ASSESSMENT

The HEC-RAS model was used to assess the likely changes in flood level for both the 2 year and 100 year ARI floods. The flows used in the Browns' model were adopted for this assessment, these being 9.2 m³/s for the 100y and 2.9 m³/s for the 2y. for the existing artificial channel the channel Manning's "n" value was retained as 0.080, and the Manning's "n" values for the left and right overbank flow areas were retained as 0.100.

The following changes were made to the Browns' HEC-RAS model:

- For the analysis of the proposed waterway crossing, the Manning's "n" value in the channel segment was reduced from 0.080 to 0.050 to reflect a relatively smoother roughness. This is because the structure will consist of smooth concrete sections, and the vegetation intensity will be reduced within 10 metres of the bridge, and through the bridge. Apart from reducing the propensity for debris blockage, this will also be important for ensuring that any fire hazard is minimized in the vicinity of the road.
- The work-as-executed survey was used instead of the design survey in the Browns' model. The work-as-executed survey includes the rock weirs downstream of the crossing which were not part of the original design.
- The Worley Parsons bridge design referred to earlier was used to model the waterway crossing (Drawing 5269-02-04E). It was further assumed that there would be training walls both upstream and downstream of the structure to ensure a smooth transition of flows. Despite this design feature, relatively conservative expansion and contraction coefficients were still used in the modelling.

For the 100 year ARI flood, levels were slightly reduced (of the order of 40 mm) in the vicinity of the bridge as velocities increased slightly. The levels returned to within 10 mm of the pre-existing values within the first 30 metres upstream of the structure.

For the 100 year ARI flood, velocities without the bridge varied from 0.8 m/s to 1.0 m/s in the immediate vicinity of the waterway crossing. With the bridge in place, the velocities increased slightly due to contraction of the cross-section width and the slight reduction in Manning's "n". At the upstream face of the bridge the velocity increased to 1.1 m/s but quickly reduced to less than 1m/s within the first 20 metres upstream of the structure.

For the 2 year ARI flood, levels were slightly reduced (of the order of 50 mm) in the vicinity of the bridge as velocities increased slightly. The levels returned to within 10 mm of the pre-existing values within the first 30 metres upstream of the structure.

For the 2 year ARI flood, velocities without the bridge varied from 0.5 m/s to 0.7 m/s in the immediate vicinity of the waterway crossing. With the bridge in place, the velocities increased slightly due to contraction of the cross-section width and the slight reduction in Manning's "n". At the upstream face of the bridge the velocity increased to 0.8 m/s but quickly reduced to less than 0.7 m/s within the first 20 metres upstream of the structure.

Normally flood levels increase when a waterway crossing is placed across a creek. In this particular case, the relatively wide waterway structure encompasses the entire channel segment and some of the overbank. Further, the channel roughness is slightly reduced as a result of the structure and approaches. This is to reduce the potential for debris blockage and reduce the fire risk near the road. The combination of these factors leads to a small reduction in flood level, rather than the small increase that would normally be expected.

The likely impacts of the velocity changes are discussed in Section 3.2.

3. IMPACTS OF THE WATERWAY CROSSING ON LOCALISED FLOOD BEHAVIOUR

3.1 BACKGROUND

The longitudinal section of the creek through the reach where the waterway crossing is to be established is relatively flat. Further, the new channel design has provided an increased area of flow when compared to the earlier design thus reducing overall velocities. A riffle bed has also been constructed in the invert of the artificial creek at the waterway crossing site as part of the CSR creek works.

All of these features are conducive to providing a low scour environment.

In considering the impacts of the proposed waterway crossing on local velocities and scour I have taken into account recommendations in the various Draft Riparian Guidelines provided to me by DWE.

3.2 ASSESSMENT OF LOCALISED FLOOD BEHAVIOUR

It is intended that in the detailed design of the crossing, the bridge approaches on each side will have transition sections (wing walls) both upstream and downstream to convey the flow through the bridge section so that eddies and localised elevated currents are minimised. Further scour protection will also be included in the transitions, and some minor local extension of the existing riffle bed both upstream and downstream.

The 12 metre wide bridge opening provided means that very little contraction of the flow will occur upstream of the bridge crossing, even in high flows, thus minimising the potential for localised high velocities.

In the 100 year ARI flood approximately 75% of the flow approaching the bridge is contained within the channel segment, which is fully contained within the width of the bridge. 10 to 15% of the flow is contained within each of the overbank segments. In the 2 year ARI flood, in excess of 95% of the flow is contained within the channel segment.

Flood behaviour in the smaller floods is of greater concern in managing scour as such floods occur much more often, and thus tend to have a greater impact on the morphology of a stream.

The design of the artificial creek, the presence of the retaining wall on the northern side, and the 4 span (12 metre) width of the proposed waterway, provide in combination a relatively benign velocity distribution in the vicinity of the crossing. Management and control of localised high velocities is therefore a relatively straightforward exercise.

The rock weirs which have been constructed downstream of the waterway crossing have relatively little impact on velocities and flood levels at the bridge when the riparian vegetation is fully established. However, they will be beneficial in the short run in minimising velocities and reducing scour potential.

3.3 LOCAL DRAINAGE FROM THE JACFIN LAND

After development of the Jacfin land a stormwater drainage outlet will discharge to the artificial creek within the CSR land. Scour protection similar to that provided by CSR for the stormwater outlet immediately upstream of the waterway crossing will be provided. The drainage outlet will have no adverse impact on the stability of the bed and banks of the creek, or the proposed riparian vegetation, at this location.

4. EXISTING DRAINAGE LINES ON JACFIN'S LOT 11

I have carried out a detailed field inspection of Lot 11 to determine the current drainage features and identify any such features which might affect the development potential of the land.

The only drainage features of note were a small farm dam located at the north-western end of the property near the boundary, and a small man-made drainage channel which enters the southern boundary of Lot 11 towards the eastern end of this boundary. This drainage channel originates from a small catchment upstream of the Sydney Water pipelines, and crosses under the pipelines before entering Lot 11.

Shortly after entering the Jacfin land, the drain loses its identity. Surface runoff exiting from the drainage channel finds its way downstream by broad overland flow to the farm dam via a topographic depression which has no defined drainage features, such as a creek bed or banks.

In a storm runoff event, general overland flow would occur within the small catchment upstream of the pipelines. It would then be confined to the short man-made channel extending into the Jacfin land, and would then spread out again as overland flow down to the farm dam near the western boundary.

The farm dam overflows via an ill-defined side spillway and quickly enters the Crown Road Reserve. There is no well-defined channel from the dam to the Crown Road Reserve. Within the Crown Road Reserve, and downstream of its boundary with Jacfin Lot 11, there are a number of ill-defined and irregular natural channels. Again it would appear that flows tend to find their own way through this area, before exiting at various points directly to the CSR land. Now, with the construction of the artificial creek along the boundary of the CSR land, flows originally sourced from the Jacfin land and the small upstream catchment, will exit to the artificial channel. This then exits to the Crown Road Reserve, where the stream channel is better defined and continuous from that point downstream.

In summary, there are no significant drainage features on the Jacfin land. There are no "rivers" as defined in the Water Management Act, and hence no need for any riparian corridors on the Jacfin land.

None of the site features relating to surface runoff would in any way limit the development potential of the land.

5. CONCLUSIONS

A bridge has been designed for the waterway crossing over an artificial creek which crosses the extension of Templar Road. Hydraulic assessments have shown that this bridge will produce no significant adverse impacts on flood levels within the CSR land.

The design of the artificial creek and the waterway crossing provide, in combination, a relatively benign velocity environment for the full range of floods up to the 100 year ARI event. In the detailed design of the bridge structure, wing wall transition structures will be provided to minimise localised velocities near the bridge. Scour protection will also be provided. The principles embodied in the Department of Water & Energy Riparian Guidelines have been taken into account in the preliminary design and will be applied in the detailed design phase.

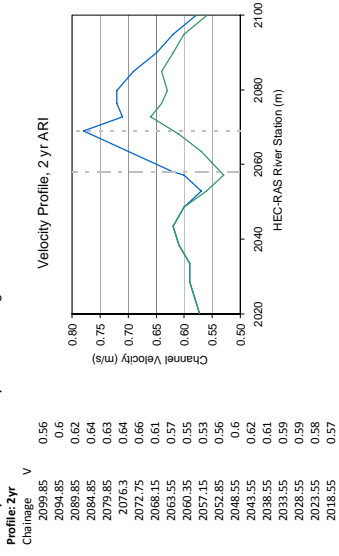
There are no significant drainage features on the Jacfin land. There are no “rivers” as defined in the Water Management Act and there is hence no need for any riparian corridors on the Jacfin land. None of the site features relating to surface runoff limit the development potential of the land.

VELOCITY PROFILES THROUGH TEMPLAR ROAD CROSSING OF ARTIFICIAL CREEK

Velocity Profile along Existing Artificial Creek with Templar Road Crossing

Corrected R Reach	River Sta	Profile	E.G. Elev (m)	W.S. Elev (m)	Crit.W.S. (m)	From Loss (m)	C & E Loss (m)	Top Width (m)	Q Left (m ³ /s)	Q Right (m ³ /s)	Va Chnl (m/s)
2099.85											0.58
2094.85											0.62
2089.85											0.65
2084.85											0.69
2079.85											0.72
2076.3	1877	2076.3* 2Yr	48.18	48.15	47.91	0.01	0	12.64	0.02	2.9	0.01
2072.75	1877	2072.75 2Yr	48.16	48.14	47.88	0.02	0	13.72	0.09	2.82	0.02
2068.95	1877	2068.95 8F 2Yr	48.14	48.11	47.88	0.05	0	10.84	0.08	2.85	0
2057.95	1877	2068.95 8F 2Yr	48.09	48.07	47.76	0	0	11.7	0.06	2.87	0.62
2057.15	1877	2057.15 2Yr	48.09	48.07	47.75	0.01	0	16.39	0.06	2.87	0.6
2052.85	1877	2052.85* 2Yr	48.07	48.06	47.76	0.02	0	16.03	0.05	2.83	0.05
2048.55											0.6
2043.55											0.62
2038.55											0.61
2033.55											0.59
2028.55											0.59
2023.55											0.58
2018.55											0.57

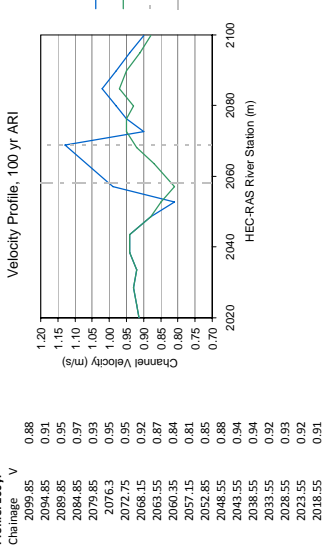
Velocity Profile without Templar Road Crossing



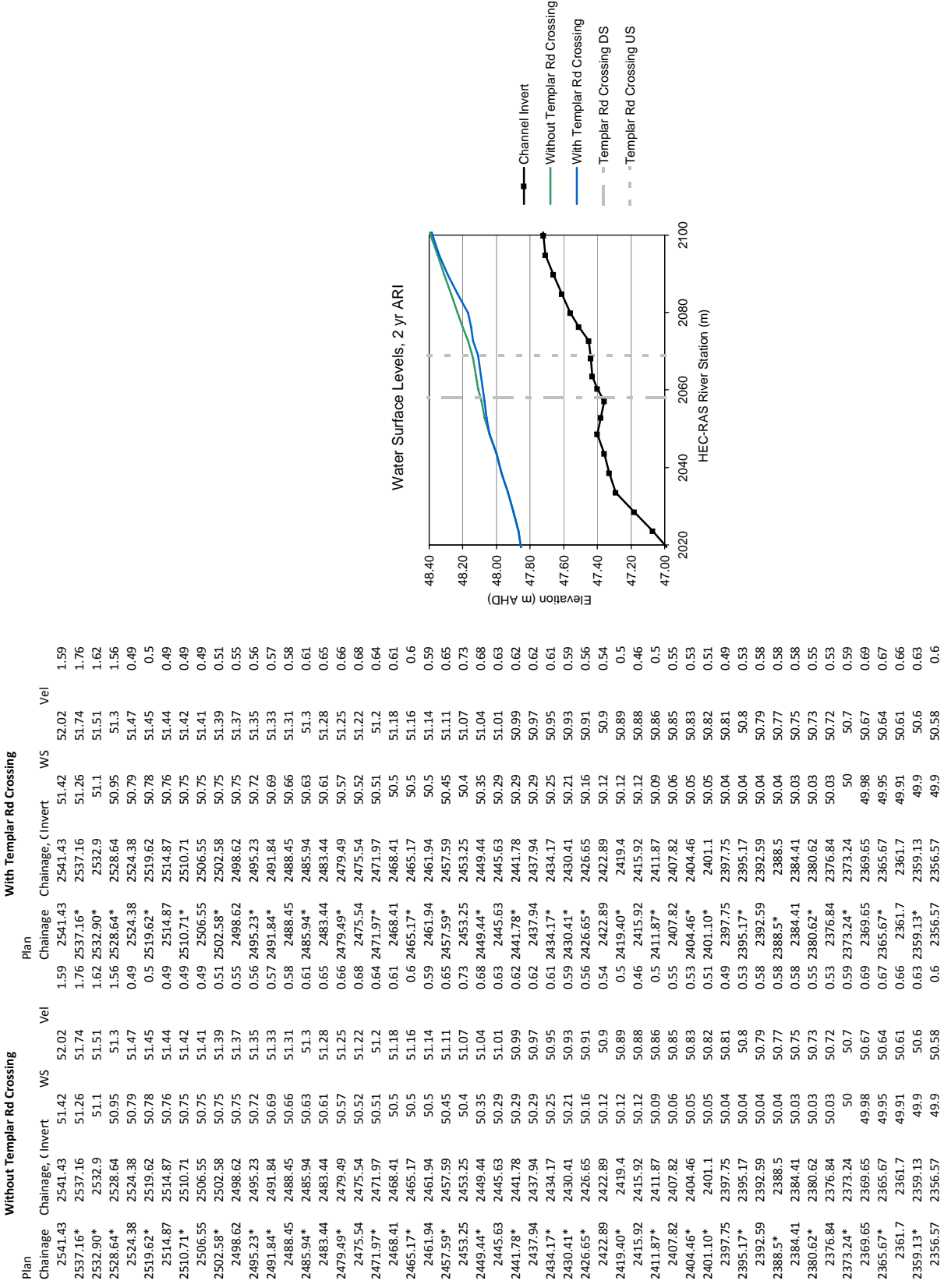
Velocity Profile, 100 yr ARI

Corrected R Reach	River Sta	Profile	E.G. Elev (m)	W.S. Elev (m)	Crit.W.S. (m)	From Loss (m)	C & E Loss (m)	Top Width (m)	Q Left (m ³ /s)	Q Right (m ³ /s)	Va Chnl (m/s)
2099.85											0.9
2094.85											0.94
2089.85											0.96
2084.85											1.02
2079.85											0.98
2076.3	1877	2076.3* 100Yr	48.61	48.57	48.21	0.01	0	21.73	0.92	7.63	0.69
2072.75	1877	2072.75 100Yr	48.6	48.56	48.19	0.01	0.01	23.27	1.48	6.83	0.93
2068.95	1877	2068.95 8F 100Yr	48.57	48.51	48.19	0.06	0	12	1.39	7.85	0
2057.95	1877	2068.95 8F 100Yr	48.5	48.46	48.04	0	0	12	1.08	8.16	1
2057.15	1877	2057.15 100Yr	48.5	48.45	48.03	0.01	0.01	23.11	1	8.24	0.99
2052.85	1877	2052.85* 100Yr	48.48	48.45	48.04	0.01	0	23.44	1.15	7.47	0.63
2048.55											0.88
2043.55											0.88
2038.55											0.94
2033.55											0.94
2028.55											0.92
2023.55											0.95
2018.55											0.92

Profile:100Yr



2yr ARI WATER SURFACE PROFILES THROUGH TEMPLAR ROAD CROSSING OF ARTIFICIAL CREEK



2353.21*	2353.21	49.87	50.56	0.62	2353.21*	2353.21	49.87	50.56	0.62
2349.86	2349.86	49.84	50.54	0.66	2349.86	2349.86	49.84	50.54	0.66
2345.74*	2345.74	49.84	50.5	0.7	2345.74*	2345.74	49.84	50.5	0.7
2341.63	2341.63	49.84	50.46	0.77	2341.63	2341.63	49.84	50.46	0.77
2337.27*	2337.27	49.81	50.42	0.69	2337.27*	2337.27	49.81	50.42	0.69
2332.92*	2332.92	49.77	50.39	0.62	2332.92*	2332.92	49.77	50.39	0.62
2328.56*	2328.56	49.74	50.36	0.55	2328.56*	2328.56	49.74	50.36	0.55
2324.21*	2324.21	49.7	50.35	0.49	2324.21*	2324.21	49.7	50.35	0.49
2319.85*	2319.85	49.67	50.34	0.43	2319.85*	2319.85	49.67	50.34	0.43
2315.50*	2315.50	49.63	50.33	0.38	2315.50*	2315.50	49.63	50.33	0.38
2311.15	2311.15	49.6	50.32	0.34	2311.15	2311.15	49.6	50.32	0.34
2306.98*	2306.98	49.59	50.31	0.37	2306.98*	2306.98	49.59	50.31	0.37
2302.81*	2302.81	49.58	50.31	0.41	2302.81*	2302.81	49.58	50.31	0.41
2298.64*	2298.64	49.56	50.29	0.45	2298.64*	2298.64	49.56	50.29	0.45
2294.47*	2294.47	49.55	50.28	0.52	2294.47*	2294.47	49.55	50.28	0.52
2290.31	2290.31	49.54	50.25	0.62	2290.31	2290.31	49.54	50.25	0.62
2286.33	2286.33	49.52	50.22	0.67	2286.33	2286.33	49.52	50.22	0.67
2282.81*	2282.81	49.51	50.19	0.69	2282.81*	2282.81	49.51	50.19	0.69
2279.29*	2279.29	49.49	50.16	0.72	2279.29*	2279.29	49.49	50.16	0.72
2275.78	2275.78	49.48	50.13	0.76	2275.78	2275.78	49.48	50.13	0.76
2273.18*	2273.18*	49.48	50.1	0.73	2273.18*	2273.18	49.48	50.1	0.73
2270.58	2270.58	49.48	50.08	0.72	2270.58	2270.58	49.48	50.08	0.72
2268.06*	2268.06*	49.48	50.05	0.74	2268.06*	2268.06	49.48	50.05	0.74
2265.54	2265.54	49.48	50.01	0.78	2265.54	2265.54	49.48	50.01	0.78
2262.15*	2262.15*	49.42	49.96	0.79	2262.15*	2262.15	49.42	49.96	0.79
2258.77*	2258.77*	49.37	49.91	0.8	2258.77*	2258.77	49.37	49.91	0.8
2255.39	2255.39	49.31	49.86	0.82	2255.39	2255.39	49.31	49.86	0.82
2251.30*	2251.30*	49.23	49.8	0.81	2251.30*	2251.30	49.23	49.8	0.81
2247.21*	2247.21*	49.16	49.74	0.8	2247.21*	2247.21	49.16	49.74	0.8
2243.12*	2243.12*	49.08	49.69	0.77	2243.12*	2243.12	49.08	49.69	0.77
2239.04	2239.04	49	49.65	0.73	2239.04	2239.04	49	49.65	0.73
2235.18*	2235.18	48.99	49.62	0.73	2235.18*	2235.18	48.99	49.62	0.73
2231.33*	2231.33*	48.97	49.58	0.72	2231.33*	2231.33	48.97	49.58	0.72
2227.48*	2227.48	48.96	49.54	0.72	2227.48*	2227.48	48.96	49.54	0.72
2223.63	2223.63	48.95	49.49	0.74	2223.63	2223.63	48.95	49.49	0.74
2219.61*	2219.61*	48.88	49.45	0.74	2219.61*	2219.61	48.88	49.45	0.74
2215.59*	2215.59	48.8	49.4	0.73	2215.59*	2215.59	48.8	49.4	0.73
2211.57*	2211.57*	48.73	49.36	0.72	2211.57*	2211.57	48.73	49.36	0.72
2207.56	2207.56	48.66	49.33	0.7	2207.56	2207.56	48.66	49.33	0.7
2201.88*	2201.88*	48.64	49.29	0.75	2201.88*	2201.88	48.64	49.29	0.75
2196.20*	2196.20*	48.61	49.24	0.8	2196.20*	2196.20	48.61	49.24	0.8
2190.52*	2190.52*	48.59	49.18	0.87	2190.52*	2190.52	48.59	49.18	0.87
2184.85	2184.85	48.56	49.11	0.97	2184.85	2184.85	48.56	49.11	0.97
2179.85*	2179.85*	48.45	49.02	0.91	2179.85*	2179.85	48.45	49.02	0.91
2174.85*	2174.85*	48.34	48.96	0.81	2174.85*	2174.85	48.34	48.96	0.81
2169.85	2169.85	48.23	48.92	0.68	2169.85	2169.85	48.23	48.92	0.68
2164.85*	2164.85*	48.21	48.88	0.67	2164.85*	2164.85	48.21	48.88	0.67
2159.85*	2159.85*	48.18	48.83	0.66	2159.85*	2159.85	48.18	48.83	0.66
2154.85	2154.85	48.16	48.78	0.67	2154.85	2154.85	48.16	48.78	0.67
2149.85*	2149.85*	48.11	48.73	0.67	2149.85*	2149.85	48.11	48.73	0.67
2144.85*	2144.85*	48.06	48.68	0.67	2144.85*	2144.85	48.06	48.67	0.67
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2134.85*	2134.85*	47.94	48.58	0.64	2134.85*	2134.85	47.94	48.58	0.65
2129.85*	2129.85*	47.87	48.55	0.61	2129.85*	2129.85	47.87	48.54	0.61
2124.85	2124.85	47.81	48.52	0.57	2124.85	2124.85	47.81	48.51	0.57
2119.85*	2119.85*	47.79	48.49	0.53	2119.85*	2119.85	47.79	48.49	0.54

2114.85*	2114.85	47.76	48.47	0.5	2114.85*	2114.85	47.76	48.46	0.51
2109.85	2109.85	47.74	48.45	0.48	2109.85	2109.85	47.74	48.44	0.48
2104.85*	2104.85	47.73	48.42	0.52	2104.85*	2104.85	47.73	48.41	0.53
2099.85*	2099.85	47.72	48.39	0.56	2099.85*	2099.85	47.72	48.38	0.58
2094.85	2094.85	47.71	48.35	0.6	2094.85	2094.85	47.71	48.34	0.62
2089.85*	2089.85	47.66	48.31	0.62	2089.85*	2089.85	47.66	48.29	0.65
2084.85*	2084.85	47.61	48.27	0.64	2084.85*	2084.85	47.61	48.23	0.69
2079.85	2079.85	47.56	48.23	0.63	2079.85	2079.85	47.56	48.17	0.72
2076.3*	2076.3	47.51	48.2	0.64	2076.3*	2076.3	47.51	48.15	0.72
2072.75	2072.75	47.45	48.17	0.66	2072.75	2072.75	47.45	48.14	0.71
2068.15*	2068.15	47.44	48.14	0.61	2068.15*	2068.15	47.44	48.11	0.78
2063.55	2063.55	47.43	48.12	0.57	2063.55	2063.55	47.43	48.07	0.6
2060.35*	2060.35	47.4	48.11	0.55	2060.35*	2060.35	47.4	48.06	0.57
2057.15	2057.15	47.36	48.09	0.53	2057.15	2057.15	47.36	48.04	0.6
2052.85*	2052.85	47.38	48.07	0.56	2052.85*	2052.85	47.38	48.0	0.62
2048.55	2048.55	47.4	48.04	0.6	2048.55	2048.55	47.4	47.97	0.61
2043.55*	2043.55	47.36	48	0.62	2043.55*	2043.55	47.36	47.93	0.59
2038.55*	2038.55	47.33	47.97	0.61	2038.55*	2038.55	47.33	47.9	0.59
2033.55	2033.55	47.29	47.93	0.59	2033.55	2033.55	47.29	47.87	0.58
2028.55*	2028.55	47.18	47.9	0.59	2028.55*	2028.55	47.18	47.9	0.59
2023.55*	2023.55	47.07	47.87	0.58	2023.55*	2023.55	47.07	47.85	0.57
2018.55	2018.55	46.97	47.85	0.57	2018.55	2018.55	46.97	47.82	0.56
2013.55*	2013.55	46.97	47.82	0.56	2013.55*	2013.55	46.97	47.8	0.54
2008.55*	2008.55	46.97	47.8	0.54	2008.55*	2008.55	46.97	47.78	0.53
2003.55*	2003.55	46.97	47.78	0.53	2003.55*	2003.55	46.97	47.78	0.53
1999.35	1999.35	46.97	47.78	0.53	1999.35	1999.35	46.97	47.67	0.64
1998.55	1998.55	46.97	47.67	0.64	1998.55	1998.55	46.97	47.62	0.69
1993.55*	1993.55	46.9	47.62	0.69	1993.55*	1993.55	46.9	47.56	0.77
1988.55*	1988.55	46.83	47.56	0.77	1988.55*	1988.55	46.83	47.47	0.95
1983.55	1983.55	46.77	47.47	0.95	1983.55	1983.55	46.77	47.39	0.91
1978.55*	1978.55	46.69	47.39	0.91	1978.55*	1978.55	46.69	47.3	0.87
1973.55*	1973.55	46.61	47.3	0.87	1973.55*	1973.55	46.61	47.3	0.87
1968.55*	1968.55	46.53	47.21	0.84	1968.55*	1968.55	46.53	47.21	0.84
1963.55*	1963.55	46.45	47.13	0.83	1963.55*	1963.55	46.45	47.13	0.83
1958.55*	1958.55	46.37	47.04	0.82	1958.55*	1958.55	46.37	47.04	0.82
1953.55	1953.55	46.29	46.93	0.86	1953.55	1953.55	46.29	46.93	0.86
1948.55*	1948.55	46.16	46.84	0.82	1948.55*	1948.55	46.16	46.84	0.82
1943.55*	1943.55	46.04	46.77	0.73	1943.55*	1943.55	46.04	46.77	0.73
1938.55*	1938.55	45.91	46.73	0.73	1938.55*	1938.55	45.91	46.73	0.63
1936.7	1936.7	45.91	46.73	0.63	1936.7	1936.7	45.91	46.73	0.63
1933.55*	1933.55	45.79	46.46	0.93	1933.55*	1933.55	45.79	46.46	0.93
1928.55*	1928.55	45.66	46.36	0.92	1928.55*	1928.55	45.66	46.36	0.92
1923.55	1923.55	45.53	46.27	0.93	1923.55	1923.55	45.53	46.27	0.87
1918.55*	1918.55	45.48	46.2	0.92	1918.55*	1918.55	45.48	46.2	0.83
1913.55*	1913.55	45.43	46.14	0.87	1913.55*	1913.55	45.43	46.14	0.76
1908.55*	1908.55	45.38	46.1	0.83	1908.55*	1908.55	45.38	46.1	0.66
1903.55*	1903.55	45.34	46.07	0.76	1903.55*	1903.55	45.34	46.07	0.54
1898.55*	1898.55	45.29	46.06	0.66	1898.55*	1898.55	45.29	46.06	0.43
1893.55	1893.55	45.24	46.05	0.54	1893.55	1893.55	45.24	46.05	0.35
1893.55	1893.55	45.24	46.05	0.43	1893.55	1893.55	45.24	46.05	0.35

from six XS bridge plot

2376.84	2376.84	50.03	51.1	0.83	2376.84	2376.84	50.03	51.1	0.83
2373.24*	2373.24	50	51.08	0.9	2373.24*	2373.24	50	51.08	0.9
2369.65	2369.65	49.98	51.05	0.98	2369.65	2369.65	49.98	51.05	0.98
2365.67*	2365.67	49.95	51.02	0.95	2365.67*	2365.67	49.95	51.02	0.95
2361.7	2361.7	49.91	51	0.92	2361.7	2361.7	49.91	51	0.92
2359.13*	2359.13	49.9	50.99	0.89	2359.13*	2359.13	49.9	50.99	0.89
2356.57	2356.57	49.9	50.97	0.85	2356.57	2356.57	49.9	50.97	0.85
2353.21*	2353.21	49.87	50.95	0.88	2353.21*	2353.21	49.87	50.95	0.88
2349.86	2349.86	49.84	50.93	0.9	2349.86	2349.86	49.84	50.93	0.9
2345.74*	2345.74	49.84	50.9	0.94	2345.74*	2345.74	49.84	50.9	0.94
2341.63	2341.63	49.84	50.87	1	2341.63	2341.63	49.84	50.87	1
2337.27*	2337.27	49.81	50.83	0.99	2337.27*	2337.27	49.81	50.83	0.99
2332.92*	2332.92	49.77	50.8	0.91	2332.92*	2332.92	49.77	50.8	0.91
2328.56*	2328.56	49.74	50.78	0.83	2328.56*	2328.56	49.74	50.78	0.83
2324.21*	2324.21	49.7	50.77	0.76	2324.21*	2324.21	49.7	50.77	0.76
2319.85*	2319.85	49.67	50.75	0.7	2319.85*	2319.85	49.67	50.75	0.7
2315.50*	2315.50	49.63	50.74	0.64	2315.50*	2315.50	49.63	50.74	0.64
2311.15	2311.15	49.6	50.73	0.59	2311.15	2311.15	49.6	50.73	0.59
2306.98*	2306.98	49.59	50.72	0.64	2306.98*	2306.98	49.59	50.72	0.64
2302.81*	2302.81	49.58	50.71	0.69	2302.81*	2302.81	49.58	50.71	0.69
2298.64*	2298.64	49.56	50.69	0.77	2298.64*	2298.64	49.56	50.69	0.77
2294.47*	2294.47	49.55	50.66	0.87	2294.47*	2294.47	49.55	50.66	0.87
2290.31	2290.31	49.54	50.62	1.01	2290.31	2290.31	49.54	50.62	1.01
2286.33	2286.33	49.52	50.58	1.09	2286.33	2286.33	49.52	50.58	1.09
2282.81*	2282.81	49.51	50.55	1.11	2282.81*	2282.81	49.51	50.55	1.11
2279.29*	2279.29	49.49	50.51	1.13	2279.29*	2279.29	49.49	50.51	1.13
2275.78	2275.78	49.48	50.48	1.09	2275.78	2275.78	49.48	50.48	1.09
2273.18*	2273.18	49.48	50.45	1.08	2273.18*	2273.18	49.48	50.45	1.08
2270.58	2270.58	49.48	50.42	1.07	2270.58	2270.58	49.48	50.42	1.07
2268.06*	2268.06	49.48	50.39	1.11	2268.06*	2268.06	49.48	50.39	1.11
2265.54	2265.54	49.48	50.35	1.16	2265.54	2265.54	49.48	50.35	1.16
2262.15*	2262.15	49.42	50.3	1.16	2262.15*	2262.15	49.42	50.3	1.16
2258.77*	2258.77	49.37	50.26	1.16	2258.77*	2258.77	49.37	50.26	1.16
2255.39	2255.39	49.31	50.22	1.15	2255.39	2255.39	49.31	50.22	1.15
2251.30*	2251.3	49.23	50.17	1.15	2251.30*	2251.3	49.23	50.17	1.15
2247.21*	2247.21	49.16	50.12	1.13	2247.21*	2247.21	49.16	50.12	1.13
2243.12*	2243.12	49.08	50.08	1.11	2243.12*	2243.12	49.08	50.08	1.11
2239.04	2239.04	49	50.04	1.08	2239.04	2239.04	49	50.04	1.08
2235.18*	2235.18	48.99	50	1.1	2235.18*	2235.18	48.99	50	1.1
2231.33*	2231.33	48.97	49.96	1.11	2231.33*	2231.33	48.97	49.96	1.11
2227.48*	2227.48	48.96	49.91	1.11	2227.48*	2227.48	48.96	49.91	1.11
2223.63	2223.63	48.95	49.87	1.11	2223.63	2223.63	48.95	49.87	1.11
2219.61*	2219.61	48.88	49.83	1.11	2219.61*	2219.61	48.88	49.83	1.11
2215.59*	2215.59	48.8	49.79	1.1	2215.59*	2215.59	48.8	49.79	1.1
2211.57*	2211.57	48.73	49.75	1.07	2211.57*	2211.57	48.73	49.75	1.07
2207.56	2207.56	48.66	49.73	0.94	2207.56	2207.56	48.66	49.73	0.94
2201.88*	2201.88	48.64	49.68	1.07	2201.88*	2201.88	48.64	49.68	1.07
2196.20*	2196.20	48.61	49.63	1.17	2196.20*	2196.20	48.61	49.63	1.17
2190.52*	2190.52	48.59	49.56	1.29	2190.52*	2190.52	48.59	49.56	1.29

2184.85	2184.85	48.56	49.48	1.46	2184.85	2184.85	48.56	49.47	1.46
2179.85*	2179.85	48.45	49.4	1.36	2179.85*	2179.85	48.45	49.4	1.36
2174.85*	2174.85	48.34	49.34	1.23	2174.85*	2174.85	48.34	49.34	1.24
2169.85	2169.85	48.23	49.29	1.09	2169.85	2169.85	48.23	49.29	1.09
2164.85*	2164.85	48.21	49.25	1.05	2164.85*	2164.85	48.21	49.25	1.05
2159.85*	2159.85	48.18	49.2	1.01	2159.85*	2159.85	48.18	49.2	1.01
2154.85	2154.85	48.16	49.16	0.98	2154.85	2154.85	48.16	49.16	0.98
2149.85*	2149.85	48.11	49.11	0.99	2149.85*	2149.85	48.11	49.11	0.99
2144.85*	2144.85	48.06	49.06	1	2144.85*	2144.85	48.06	49.06	1
2139.85	2139.85	48	49.01	1.02	2139.85	2139.85	48	49.01	1.02
2134.85*	2134.85	47.94	48.97	0.98	2134.85*	2134.85	47.94	48.97	0.98
2129.85*	2129.85	47.87	48.94	0.94	2129.85*	2129.85	47.87	48.94	0.94
2124.85	2124.85	47.81	48.91	0.89	2124.85	2124.85	47.81	48.91	0.89
2119.85*	2119.85	47.79	48.88	0.83	2119.85*	2119.85	47.79	48.88	0.83
2114.85*	2114.85	47.76	48.86	0.79	2114.85*	2114.85	47.76	48.86	0.79
2109.85	2109.85	47.74	48.83	0.75	2109.85	2109.85	47.74	48.83	0.75
2104.85*	2104.85	47.73	48.8	0.85	2104.85*	2104.85	47.73	48.8	0.85
2099.85*	2099.85	47.72	48.76	0.9	2099.85*	2099.85	47.72	48.76	0.9
2094.85	2094.85	47.71	48.72	0.94	2094.85	2094.85	47.71	48.72	0.94
2089.85*	2089.85	47.66	48.67	0.98	2089.85*	2089.85	47.66	48.67	0.98
2084.85*	2084.85	47.61	48.62	1.02	2084.85*	2084.85	47.61	48.62	1.02
2079.85	2079.85	47.56	48.58	0.98	2079.85	2079.85	47.56	48.58	0.98
2076.3*	2076.3	47.51	48.57	0.95	2076.3*	2076.3	47.51	48.57	0.95
2072.75	2072.75	47.45	48.56	0.9	2072.75	2072.75	47.45	48.56	0.9
2068.15*	2068.15	47.44	48.51	1.13	2068.15*	2068.15	47.44	48.51	1.13
2063.55	2063.55	47.43	48.45	0.99	2063.55	2063.55	47.43	48.45	0.99
2060.35*	2060.35	47.4	48.45	0.81	2060.35*	2060.35	47.4	48.45	0.81
2057.15	2057.15	47.36	48.45	0.88	2057.15	2057.15	47.36	48.45	0.88
2052.85*	2052.85	47.38	48.43	0.94	2052.85*	2052.85	47.38	48.43	0.94
2048.55	2048.55	47.4	48.39	0.94	2048.55	2048.55	47.4	48.39	0.94
2043.55*	2043.55	47.36	48.35	0.94	2043.55*	2043.55	47.36	48.35	0.94
2038.55*	2038.55	47.33	48.32	0.92	2038.55*	2038.55	47.33	48.32	0.92
2033.55	2033.55	47.29	48.28	0.93	2033.55	2033.55	47.29	48.28	0.93
2028.55*	2028.55	47.18	48.22	0.91	2028.55*	2028.55	47.18	48.22	0.91
2023.55*	2023.55	47.07	48.25	0.92	2023.55*	2023.55	47.07	48.25	0.92
2018.55	2018.55	46.97	48.22	0.91	2018.55	2018.55	46.97	48.22	0.91
2013.55*	2013.55	46.97	48.18	0.93	2013.55*	2013.55	46.97	48.18	0.93
2008.55*	2008.55	46.97	48.15	0.95	2008.55*	2008.55	46.97	48.15	0.95
2003.55*	2003.55	46.97	48.11	0.98	2003.55*	2003.55	46.97	48.11	0.98
1999.35	1999.35	46.97	48.06	0.98	1999.35	1999.35	46.97	48.06	0.98
1993.55*	1993.55*	46.9	48.01	1.09	1993.55*	1993.55	46.9	48.01	1.09
1988.55	1988.55	46.97	47.93	1.23	1988.55	1988.55	46.97	47.93	1.23
1983.55*	1983.55	46.9	47.84	1.39	1983.55*	1983.55	46.9	47.84	1.39
1988.55*	1988.55	46.83	47.74	1.44	1988.55*	1988.55	46.83	47.74	1.44
1983.55	1983.55	46.77	47.69	1.41	1983.55	1983.55	46.77	47.69	1.41
1978.55*	1978.55	46.69	47.64	1.36	1978.55*	1978.55	46.69	47.64	1.36
1973.55*	1973.55	46.61	47.55	1.31	1973.55*	1973.55	46.61	47.55	1.31
1968.55*	1968.55	46.53	47.45	1.27	1968.55*	1968.55	46.53	47.45	1.27
1963.55*	1963.55	46.45	47.36	1.25	1963.55*	1963.55	46.45	47.36	1.25
1958.55*	1958.55	46.37	47.27	1.22	1958.55*	1958.55	46.37	47.27	1.22
1953.55	1953.55	46.37	47.18	1.22	1953.55	1953.55	46.37	47.18	1.22
1948.55*	1948.55*	46.29	47.18	1.22	1948.55*	1948.55	46.29	47.18	1.22
1943.55	1943.55	46.29	47.18	1.22	1943.55	1943.55	46.29	47.18	1.22
1938.55*	1938.55*	46.29	47.18	1.22	1938.55*	1938.55	46.29	47.18	1.22
1933.55	1933.55	46.29	47.18	1.22	1933.55	1933.55	46.29	47.18	1.22
1928.55*	1928.55*	46.29	47.18	1.22	1928.55*	1928.55	46.29	47.18	1.22
1923.55	1923.55	46.29	47.18	1.22	1923.55	1923.55	46.29	47.18	1.22
1918.55*	1918.55*	46.29	47.18	1.22	1918.55*	1918.55	46.29	47.18	1.22
1913.55	1913.55	46.29	47.18	1.22	1913.55	1913.55	46.29	47.18	1.22
1908.55*	1908.55*	46.29	47.18	1.22	1908.55*	1908.55	46.29	47.18	1.22
1903.55	1903.55	46.29	47.18	1.22	1903.55	1903.55	46.29	47.18	1.22
1898.55*	1898.55*	46.29	47.18	1.22	1898.55*	1898.55	46.29	47.18	1.22
1893.55	1893.55	46.29	47.18	1.22	1893.55	1893.55	46.29	47.18	1.22
1888.55*	1888.55*	46.29	47.18	1.22	1888.55*	1888.55	46.29	47.18	1.22
1883.55	1883.55	46.29	47.18	1.22	1883.55	1883.55	46.29	47.18	1.22
1878.55*	1878.55*	46.29	47.18	1.22	1878.55*	1878.55	46.29	47.18	1.22
1873.55	1873.55	46.29	47.18	1.22	1873.55	1873.55	46.29	47.18	1.22
1868.55*	1868.55*	46.29	47.18	1.22	1868.55*	1868.55	46.29	47.18	1.22
1863.55	1863.55	46.29	47.18	1.22	1863.55	1863.55	46.29	47.18	1.22
1858.55*	1858.55*	46.29	47.18	1.22	1858.55*	1858.55	46.29	47.18	1.22
1853.55	1853.55	46.29	47.18	1.22	1853.55	1853.55	46.29	47.18	1.22
1848.55*	1848.55*	46.29	47.18	1.22	1848.55*	1848.55	46.29	47.18	1.22
1843.55	1843.55	46.29	47.18	1.22	1843.55	1843.55	46.29	47.18	1.22
1838.55*	1838.55*	46.29	47.18	1.22	1838.55*	1838.55	46.29	47.18	1.22
1833.55	1833.55	46.29	47.18	1.22	1833.55	1833.55	46.29	47.18	1.22
1828.55*	1828.55*	46.29	47.18	1.22	1828.55*	1828.55	46.29	47.18	1.22
1823.55	1823.55	46.29	47.18	1.22	1823.55	1823.55	46.29	47.18	1.22
1818.55*	1818.55*	46.29	47.18	1.22	1818.55*	1818.55	46.29	47.18	1.22
1813.55	1813.55	46.29	47.18	1.22	1813.55	1813.55	46.29	47.18	1.22
1808.55*	1808.55*	46.29	47.18	1.22	1808.55*	1808.55	46.29	47.18	1.22
1803.55	1803.55	46.29	47.18	1.22	1803.55	1803.55	46.29	47.18	1.22
1798.55*	1798.55*	46.29	47.18	1.22	1798.55*	1798.55	46.29	47.18	1.22
1793.55	1793.55	46.29	47.18	1.22	1793.55	1793.55	46.29	47.18	1.22
1788.55*	1788.55*	46.29	47.18	1.22	1788.55*	1788.55	46.29	47.18	1.22
1783.55	1783.55	46.29	47.18	1.22	1783.55	1783.55	46.29	47.18	1.22
1778.55*	1778.55*	46.29	47.18	1.22	1778.55*	1778.55	46.29	47.18	1.22
1773.55	1773.55	46.29	47.18	1.22	1773.55	1773.55	46.29	47.18	1.22
1768.55*	1768.55*	46.29	47.18	1.22	1768.55*	1768.55	46.29	47.18	1.22
1763.55	1763.55	46.29	47.18	1.22	1763.55	1763.55	46.29	47.18	1.22
1758.55*	1758.55*	46.29	47.18	1.22	1758.55*	1758.55	46.29	47.18	1.22
1753.55	1753.55	46.29	47.18	1.22	1753.55	1753.55	46.29	47.18	1.22
1748.55*	1748.55*	46.29	47.18	1.22	1748.55*	1748.55	46.29	47.18	1.22
1743.55	1743.55	46.29	47.18	1.22	1743.55	1743.55	46.29	47.18	1.22
1738.55*	1738.55*	46.29	47.18	1.22	1738.55*	1738.55	46.29	47.18	1.22
1733.55	1733.55	46.29	47.18	1.22	1733.55	1733.55	46.29	47.18	1.22
1728.55*	1728.55*	46.29	47.18	1.22	1728.55*	1728.55	46.29	47.18	1.22
1723.55	1723.55	46.29	47.18	1.22	1723.55	1723.55	46.29	47.18	1.22
1718.55*	1718.55*	46.29	47.18	1.22	1718.55*	1718.55	46.29	47.18	1.22
1713.55	1713.55	46.29	47.18	1.22	1713.55	1713.55	46.29	47.18	1.22
1708.55*	1708.55*	46.29	47.18	1.22	1708.55*	1708.55	46.29	47.18	1.22
1703.55	1703.55	46.29	47.18	1.22	1703.55	1703.55	46.29	47.18	1.22
1698.55*	1698.55*	46.29	47.18	1.22	1698.55*	1698.55	46.29	47.18	1.22
1693.55	1693.55	46.29	47.18	1.22	1693.55	1693.55	46.29	47.18	1.22
1688.55*	1688.55*	46.29	47.18	1.22	1688.55*	1688.55	46.29	47.18	1.22
1683.55	1683.55	46.29	47.18	1.22	1683.55	1683.55	46.29	47.18	1.22
1678.55*	1678.55*	46.29	47.18	1.22	1678.55*	1678.55	46.29	47.18	1.22
1673.55	1673.55	46.29	47.18	1.22	1673.55	1673.55	46.29	47.18	1.22
1668.55*	1668.55*	46.29	47.18	1.22	1668.55*	1668.55	46.29	47.18	1.22
1663.55	1663.55	46.29	47.18	1.22	1663.55	1663.55	46.29	47.18	1.22
1658.55*	1658.55*	46.29	47.18	1.22	1658.55*	1658.55	46.29	47.18	1.22
1653.55	1653.55	46.29	47.18	1.22	1653.55	1653.55	46.29	47.18	1.22
1648.55*	1648.55*	46.29	47.18	1.22					

1953.55	1953.55	46.29	47.27	1.25	1943.55*	1943.55	46.04	47.11	1.17
1948.55*	1948.55	46.16	47.18	1.22	1938.55*	1938.55	45.91	47.05	1.11
1943.55*	1943.55	46.04	47.11	1.17	1936.7	1936.7			
1938.55*	1938.55	45.91	47.05	1.11	1933.55*	1933.55	45.79	46.83	1.35
	1936.7				1928.55*	1928.55	45.66	46.74	1.34
1933.55*	1933.55	45.79	46.83	1.35	1923.55	1923.55	45.53	46.67	1.29
1928.55*	1928.55	45.66	46.74	1.34	1918.55*	1918.55	45.48	46.61	1.2
1923.55	1923.55	45.53	46.67	1.29	1913.55*	1913.55	45.43	46.57	1.06
1918.55*	1918.55	45.48	46.61	1.2	1908.55*	1908.55	45.38	46.54	0.92
1913.55*	1913.55	45.43	46.57	1.06	1903.55*	1903.55	45.34	46.52	0.79
1908.55*	1908.55	45.38	46.54	0.92	1898.55*	1898.55	45.29	46.51	0.68
1903.55*	1903.55	45.34	46.52	0.79	1893.55	1893.55	45.24	46.5	0.58



HEGGIES

REPORT 10-6624-R1

Revision 1

**Jacfin Warehousing Facility
Lot 11 Templar Road, Erskine Park
Noise Impact Assessment**

PREPARED FOR

**Worley Parsons
Level 7
116 Miller Street
NORTH SYDNEY NSW 2060**

24 JULY 2008

HEGGIES PTY LTD

ABN 29 001 584 612

Incorporating

New Environment

Graeme E. Harding & Associates

Eric Taylor Acoustics



Jacfin Warehousing Facility

Lot 11 Templar Road, Erskine Park

Noise Impact Assessment

PREPARED BY:

Heggies Pty Ltd
 2 Lincoln Street Lane Cove NSW 2066 Australia
 (PO Box 176 Lane Cove NSW 1595 Australia)
 Telephone 61 2 9427 8100 Facsimile 61 2 9427 8200
 Email sydney@heggies.com Web www.heggies.com

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DOCUMENT CONTROL

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1 INTRODUCTION

Heggies Pty Ltd (Heggies) has been engaged by Worley Parsons to prepare a noise impact assessment for the construction and operations of the proposed Jacfin Warehousing Facility (the Facility) located at Templar Road, Erskine Park, NSW.

This report presents the noise criteria determined through both unattended and operator-attended background noise measurements conducted at the nearest potentially noise sensitive receiver to the proposed Facility, namely, the Emmaus Village. Subsequently, the report presents the predicted noise emissions at this receiver from construction activities and the operational activities associated with the Facility. Road traffic noise emissions are assessed at the nearest noise sensitive receivers on Mamre Road.

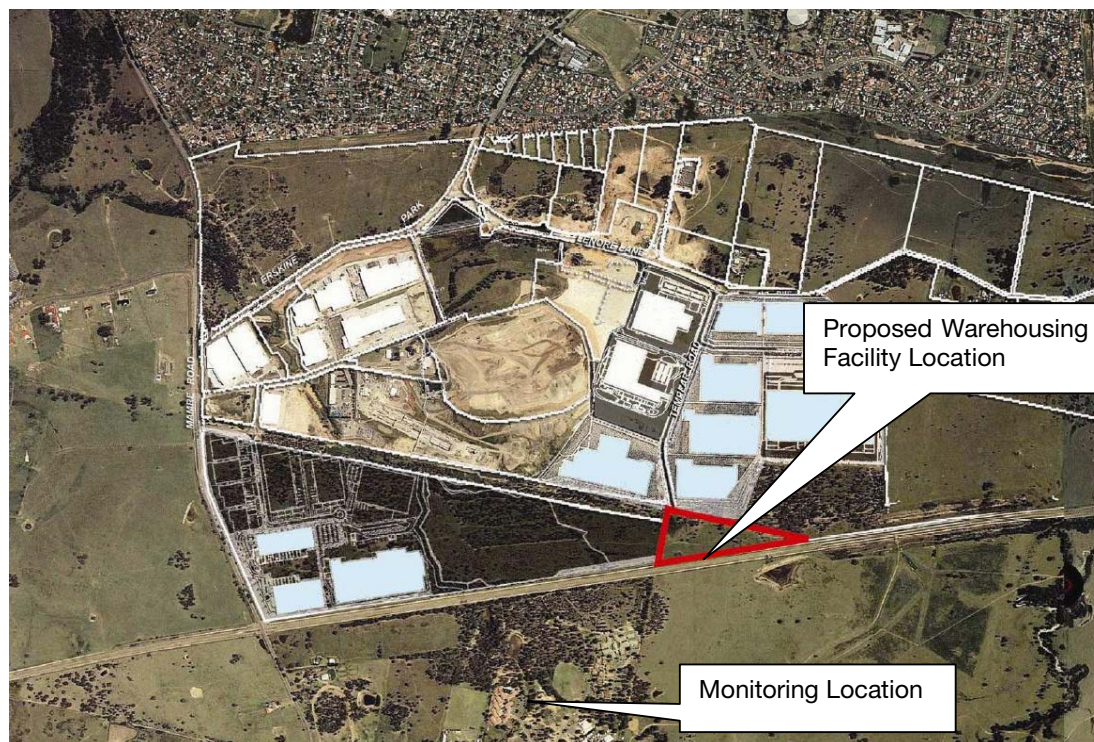
Specific acoustic terminology is used in this report. An explanation of common acoustic terms is provided in **Appendix A**.

2 PROJECT SETTING AND OVERVIEW

2.1 Site Location

The Facility is located at Lot 11 Templar Road, Erskine Park (shown in **Figure 1**). The Facility adjoins the Erskine Park Employment Area (the former CSR site) industrial development to the north (and east) and adjoins the Interlink Industrial Estate (the former Austral Bricks site) warehousing facilities to the west. Located to the south of the Facility is Crown/agricultural land.

Figure 1 Site Location and Background Noise Monitoring Location





2.2 Noise Sensitive Receivers and Background Noise Monitoring Location

The nearest noise sensitive receivers to the proposed Facility are the residents of Emmaus Village (off Bakers Lane, Kemps Creek) to the southwest. The next nearest noise sensitive receivers are situated greater than 1 km to the north of the site and would be shielded from the Facility by the Erskine Park Employment Area and the Interlink Industrial Estate developments.

Background noise measurements were conducted at the Emmaus Catholic College located approximately 740 m to the southwest of the proposed Facility. The monitoring location is shown in **Figure 1**.

2.3 Construction

Construction of the Facility would be undertaken using standard construction methods during normal hours. For assessment purposes, the plant and equipment presented in **Table 1**, together with the number of items and the maximum sound power levels (SWLs) of each item, have been selected as representing the typical worst case noise emissions from the anticipated construction activities.

Table 1 Construction Noise Sources

Equipment	Number of Items	Maximum SWL per Item
Dump Truck	2	114 dBA
Concrete Agitator Truck	2	116 dBA
Concrete Pump	1	109 dBA

2.4 Operations

The Facility is proposed to be in operation 24 hours per day, 7 days per week.

The major source of noise emissions is expected to be that associated with the movement of trucks and loading/unloading operations at the loading bays facing Templar Road, on the western side of the site. The Fire Services Tank and Pump Room extending west from the southwest corner of the warehouse would offer partial shielding from the trucks to the Emmaus Village receivers.

Trucks would reverse under the awning into the loading dock and be unloaded by forklifts. Up to a maximum of eight trucks could be operating on the site at any one time. Accordingly, for assessment purposes, the trucks and mechanical plant presented in **Table 2**, together with the number of items and the maximum sound power levels (SWLs) of each item, have been selected as representing the typical worst case noise emissions from the anticipated operation.

Table 2 Operational Noise Sources

Equipment	Number of Items		Maximum SWL per Item
	Day/Evening	Night-time	
Trucks (manoeuvring)	2	1	114 dBA
Trucks (unloading)	6	2	100 dBA
Mechanical Plant	1	1	95 dBA



2.5 Offsite Road Transportation

The nearest and potentially most affected residential receivers adjoining the primary access route to the facility are those located on Mamre Road at an offset distance of 25 m. **Table 10** presents the maximum anticipated project related vehicle movements during the daytime and night-time periods.

Table 3 Maximum Anticipated Project Related Vehicle Movements

Assessment Period	Project Related Truck Movements per Period ¹	Project Related Light Vehicle Movements per Period ¹
Day	250	250
Night	20	20

Note 1: Vehicle movements estimated based on the size of Facility (based on similar operations).

3 BACKGROUND NOISE MONITORING RESULTS

Unattended background noise monitoring was conducted over the period 26 February to 28 February 2008. The background noise monitoring results are presented in **Table 4**. Daily plots of the statistical ambient noise levels are presented in **Appendix B**.

Table 4 Unattended Background Noise Monitoring Results^{1,2}

Rating Background Level ¹			LAeq (Period) All Noise Sources		
Day	Evening	Night	Day	Evening	Night
41 dBA	41 dBA	40 dBA	54 dBA	52 dBA	45 dBA

Note 1: Daytime 7:00 am to 6:00 pm, Evening 6:00 pm to 10:00 pm, Night-time 10:00 pm to 7:00 am.

Note 2: Background noise monitoring was conducted between 19 February and 4 March 2008, however due to vandalism of the noise monitoring equipment data was only available for the period 26 February to 28 February 2008.

Note 3: Rating Background Level (RBL) determined in accordance with the procedures specified in the Department of Climate Change's (DECC's) Industrial Noise Policy, 2000 (INP).

Operator-attended noise surveys were conducted on 26 February and 4 March 2008 in order to provide an indication of the typical noise sources at the monitoring location (**Figure 1**). The results of the operator-attended noise surveys are presented in **Table 5**.

**Table 5 Operator-Attended Noise Monitoring Results**

Date	Start Time	Measured Ambient Noise Levels			Estimated Industrial LAeq contribution	Description of Maximum Noise Emissions
		LA90	LAeq	LA10		
26/02/08	12:26 pm	44 dBA	53 dBA	56 dBA	30 dBA	Industrial Hum: 28-35 dBA School Children: 40-43 dBA School Bell: 53 dBA School Announcement: 59-65 dBA Aeroplane: 37 dBA Birds: 50-58 dBA Insects: 42-50 dBA
04/03/08	7:49 am	45 dBA	50 dBA	52 dBA	45 dBA	Industrial Hum: 42-46 dBA Reverse Alarm (industrial): 38 dBA School Children: 45-48 dBA School Bus: 52-54 dBA Traffic: 49-52 dBA Aeroplane: 48-62 dBA Birds: 50-67 dBA

4 NOISE ASSESSMENT CRITERIA

4.1 Construction

An LA_{10(15minute)} intrusive noise limit (daytime) at the Emmaus Village has been set at 51 dBA based on the RBL (daytime) + 10 dBA in accordance with the DECC's Environmental Noise Control Manual (for a construction duration of up to 26 weeks).

4.2 Operation

The INP based intrusive noise assessment criteria at the Emmaus Village are presented in **Table 6**. These Criteria are nominated for the purpose of assessing the potential noise emissions from the operation of the project.

Sleep Disturbance

The most recent criteria for sleep disturbance are those contained in the DECC's "Application Notes - NSW Industrial Noise Policy" issued in July 2006. The policy considers sleep disturbance as the emergence of the LA_{1(1minute)} level above the LA_{90(15minute)} level at the time. Appropriate screening criteria for sleep disturbance are determined to be an LA_{1(1minute)} level 15dB(A) above the RBL for the night-time period (10:00am to 7:00am).

Table 6 INP Project Specific Noise Assessment Criteria ^{1,2}

Intrusive LAeq (15 minute) Criteria			Sleep Disturbance LA _{1(1minute)} Criterion
Day	Evening	Night	Night
46 dBA	46 dBA	45 dBA	55 dBA

Note 1: Determined from the RBL's presented in **Table 4**.

Note 2: Daytime 7:00 am to 6:00 pm, Evening 6:00 pm to 10:00 pm, Night-time 10:00 pm to 7:00 am.



4.3 Road Traffic

The DECC's Environmental Criteria for Road Traffic Noise (ECRTN) provides road traffic noise criteria for proposed roads or residential land use developments impacting upon existing roads as well as criteria for other sensitive land uses.

Table 7 presents the relevant noise criteria for this project, for vehicles travelling on Mamre Road.

Table 7 Road Traffic Noise Criteria

Type of Development	Criteria		Where Criteria are Already Exceeded
	Day 7:00 am - 10:00 pm (dBA)	Night 10:00 pm - 7:00 am (dBA)	
7. Land use developments with potential to create additional traffic on existing freeways/arterials	LAeq(15hour) 60	LAeq(9hour) 55	Where feasible and reasonable noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads, regulating times of use, using "clustering", using quiet vehicles and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB

5 NOISE ASSESSMENT

5.1 Construction

The predicted maximum LA10(15minute) noise level at the Emmaus Village receivers, assuming the concurrent operation of the construction plant and equipment presented in **Table 1**, is 48 dBA, which complies with the 51 dBA construction noise criterion.

5.2 Operation

A computer noise model was developed in order to predict the likely noise emission levels from the operation of the proposed Facility. The noise model included the following parameters: number of plant items; plant SWLs; plant operating loads and cycles; distance between the works and the receiver; local topography; and the shielding and attenuation provided by structures.

The predicted maximum LAeq(15minute) noise levels at the Emmaus Village receivers, assuming the concurrent operation of the items presented in **Table 2**, are presented in **Table 8**.

**Table 8 Operational LAeq(15minute) Noise Level Predictions - Emmaus Village**

Period	Weather Condition ¹	Predicted Noise Level	Criteria
Day	Calm	40 dBA	54 dBA
Day	Adverse wind	45 dBA	54 dBA
Evening	Calm	40 dBA	52 dBA
Evening	Adverse wind	45 dBA	52 dBA
Night	Calm	37 dBA	45 dBA
Night	Adverse wind	42 dBA	45 dBA
Night	Adverse stability	39 dBA	45 dBA

Note 1: INP default weather conditions where calm represents neutral non-noise enhancing weather conditions; adverse wind represents a 3 m/s source to receiver wind; and, adverse stability represents a 3°C/100m temperature inversion during the Winter night-time period.

The predicted maximum LA1(1minute) noise levels at the Emmaus Village receivers, assuming the concurrent operation of the items presented in **Table 2**, are presented in **Table 9**.

Table 9 Operation LA1(1minute) Noise Level Prediction - Emmaus Village

Period	Weather Condition ¹	Predicted Noise Level	Criteria
Night	Calm	46 dBA	55 dBA
Night	Adverse wind	51 dBA	55 dBA
Night	Adverse stability	47 dBA	55 dBA

Note 1: INP default weather conditions where calm represents neutral non-noise enhancing weather conditions; adverse wind represents a 3 m/s source to receiver wind; and, adverse stability represents a 3°C/100m temperature inversion during the Winter night-time period.

A review of the operational noise predictions presented in **Table 8** and **Table 9** indicates that the operation of the Facility would comply with both the LAeq(15minute) and LA1(1minute) criteria during all periods (ie daytime, evening and night-time) at the Emmaus Village.

5.3 Road Traffic

The nearest and potentially most affected residential receivers adjoining the primary access route to the Facility are those located on Mamre Road. **Table 10** presents the indicative truck noise levels at the nearest residences to the road, at a distance of 25 metres from the road kerb.

Table 10 Indicative Noise Emission Levels for Truck Traffic on Mamre Road

Assessment Period	Project Related Truck Movements per period ¹	Estimated LAeq(period)	Mamre Road Criterion
Day (7.00 am - 10.00 pm)	250	56 dBA	60 dBA
Night (10.00 pm - 7.00 am)	20	51 dBA	55 dBA

Note 1: Truck movements estimated based on the size of Facility (based on similar operations).

Table 10 indicates that compliance the traffic noise criteria would be met during both the daytime and night-time periods.



6 RECOMMENDED NOISE CONTROL MEASURES

6.1 Construction

In order to ensure that excessive noise is not generated during the construction of the Facility, the recommended noise mitigation measures to be implemented by the construction contractor are listed in **Table 11**.

Table 11 Recommended Noise Mitigation Measures

Item	Description
Construction Hours	Works to be carried out within the standard construction hours.
Deliveries	Deliveries to be carried out within the standard construction hours.
Site Layout	Where possible, plant and equipment to be located and orientated to direct noise away from sensitive receivers.
Quietest Suitable Equipment	Plant and equipment to be selected to minimise noise emission, where possible, whilst maintaining efficiency of function. Residential grade silencers to be fitted and all noise control equipment will be maintained in good order.
Reversing Alarms	Mobile plant and trucks operating on site for a significant portion of the project to have reversing alarm noise emissions minimised, where possible, recognising the need to maintain occupational safety standards.
PA System	No public address system to be used at this site.
Truck Noise (off site)	All trucks regularly used for the project are to have their mufflers, and any other noise control equipment, maintained in good working order. Trucking routes to be on main roads, where feasible.
Training	Site induction training to include a noise awareness component.

6.2 Operation

No noise exceedances are predicted during the operation of the Facility. Nonetheless, prior to the issue of the Occupation Certificate, a noise assessment of the proposed operations will be undertaken by a suitably qualified acoustic consultant in order to demonstrate that the nominated noise criteria would be met. If the predicted noise levels from the facility are predicted to be higher than the criteria nominated in **Section 4** then further assessment/mitigation measures would be undertaken.

7 CONCLUSION

Heggies Pty Ltd (Heggies) was engaged by Worley Parsons to prepare a noise impact assessment for the construction and operations of the proposed Jacfin Warehousing Facility located at Templar Road, Erskine Park, NSW.

This noise assessment concludes that the construction, traffic and operational noise goals are readily achievable through the implementation of standard construction and operational practices (based on an understanding of similar operations).

ACOUSTIC TERMINOLOGY

1 Sound Level or Noise Level

The terms “sound” and “noise” are almost interchangeable, except that in common usage “noise” is often used to refer to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The human ear responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2E-5 Pa.

2 “A” Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an “A-weighting” filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People’s hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the loudness of that sound. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dBA or 2 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120 110	Heavy rock concert Grinding on steel	Extremely noisy
100 90	Loud car horn at 3 m Construction site with pneumatic hammering	Very noisy
80 70	Kerbside of busy street Loud radio or television	Loud
60 50	Department store General Office	Moderate to quiet
40 30	Inside private office Inside bedroom	Quiet to very quiet
20	Unoccupied recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as “linear”, and the units are expressed as dB(lin) or dB.

3 Sound Power Level

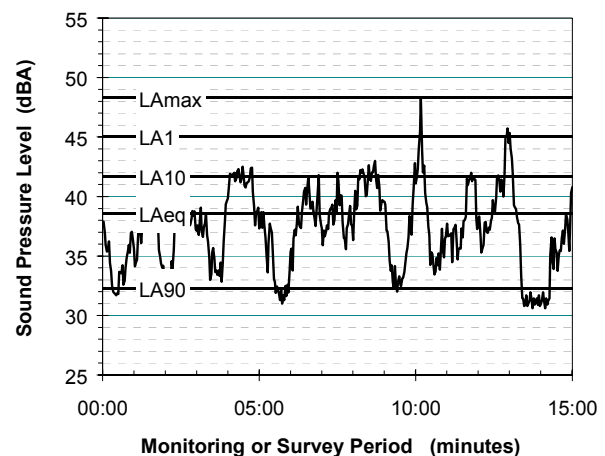
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 1E-12 W.

The relationship between Sound Power and Sound Pressure may be likened to an electric radiator, which is characterised by a power rating, but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4 Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

- LA1 The noise level exceeded for 1% of the 15 minute interval.
- LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.
- LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.
- LAeq The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

When dealing with numerous days of statistical noise data, it is sometimes necessary to define the typical noise levels at a given monitoring location for a particular time of day. A standardised method is available for determining these representative levels.

This method produces a level representing the “repeatable minimum” LA90 noise level over the daytime and night-time measurement periods, as required by the EPA. In addition the method produces mean or “average” levels representative of the other descriptors (LAeq, LA10, etc).

ACOUSTIC TERMINOLOGY

5 Tonality

Tonal noise contains one or more prominent tones (ie distinct frequency components), and is normally regarded as more offensive than “broad band” noise.

6 Impulsiveness

An impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.

7 Frequency Analysis

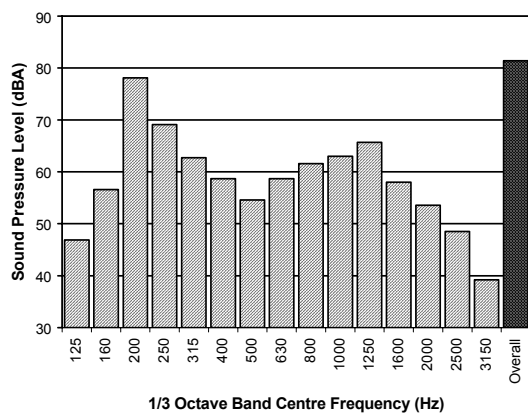
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters, but is now normally carried out using Fast Fourier Transform (FFT) analysers.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (3 bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



8 Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of “peak” velocity or “rms” velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as “peak particle velocity”, or PPV. The latter incorporates “root mean squared” averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements. Where triaxial measurements are used, the axes are commonly designated vertical, longitudinal (aligned toward the source) and transverse.

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V , expressed in mm/s can be converted to decibels by the formula $20 \log (V/V_0)$, where V_0 is the reference level (1E-6 mm/s). Care is required in this regard, as other reference levels are used by some organizations.

9 Human Perception of Vibration

People are able to “feel” vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as “normal” in a car, bus or train is considerably higher than what is perceived as “normal” in a shop, office or dwelling.

10 Overpressure

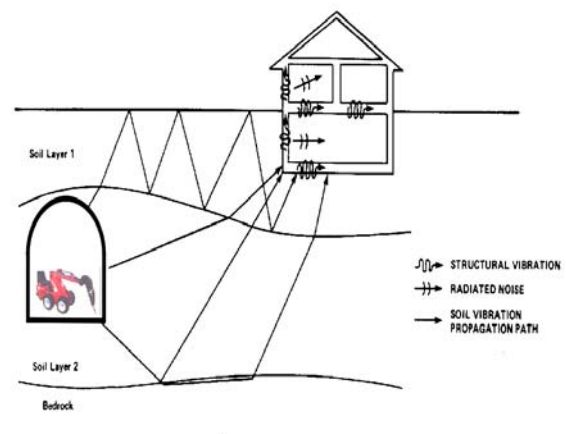
The term “overpressure” is used to describe the air pressure pulse emitted during blasting or similar events. The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.

11 Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed “regenerated noise”, “structure-borne noise”, or sometimes “ground-borne noise”. Regenerated noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of regenerated noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

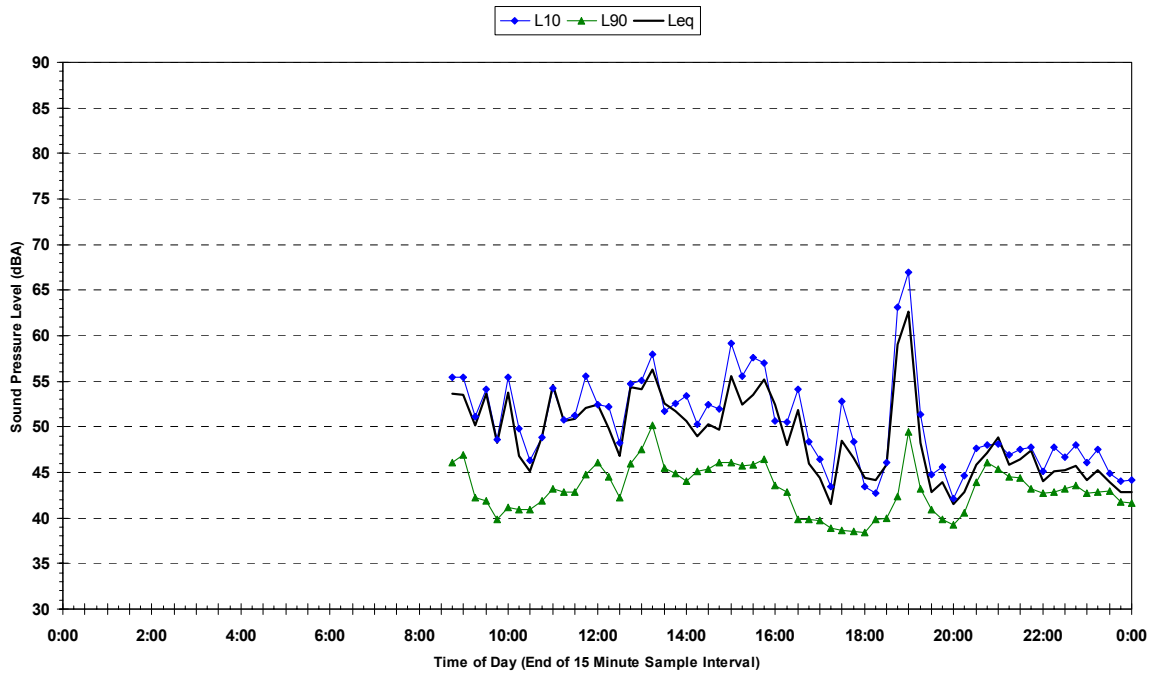
The following figure presents the various paths by which vibration and regenerated noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



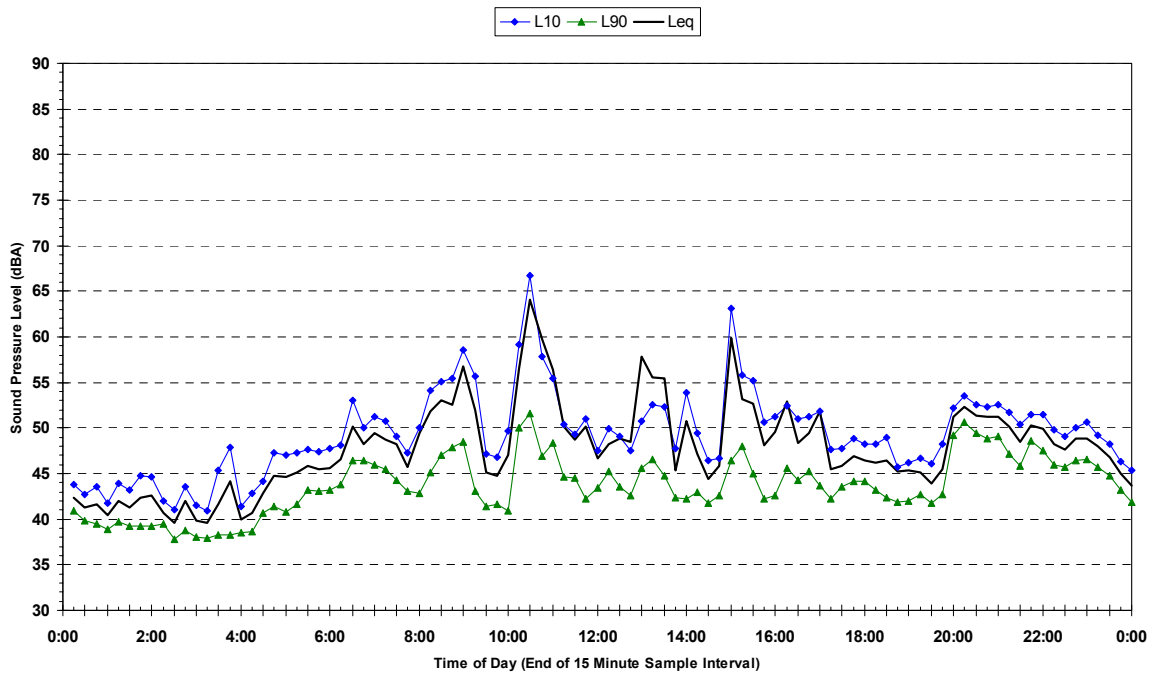
The term “regenerated noise” is also used to describe other types of noise that are emitted from the primary source as a different form of energy. One example would be a fan with a silencer, where the fan is the energy source and primary noise source. The silencer may effectively reduce the fan noise, but some additional noise may be created by the aerodynamic effect of the silencer in the airstream. This “secondary” noise may be referred to as regenerated noise.

STATISTICAL AMBIENT NOISE LEVELS

Statistical Ambient Noise Levels
Emmaus Catholic College - Wednesday 27 February 2008

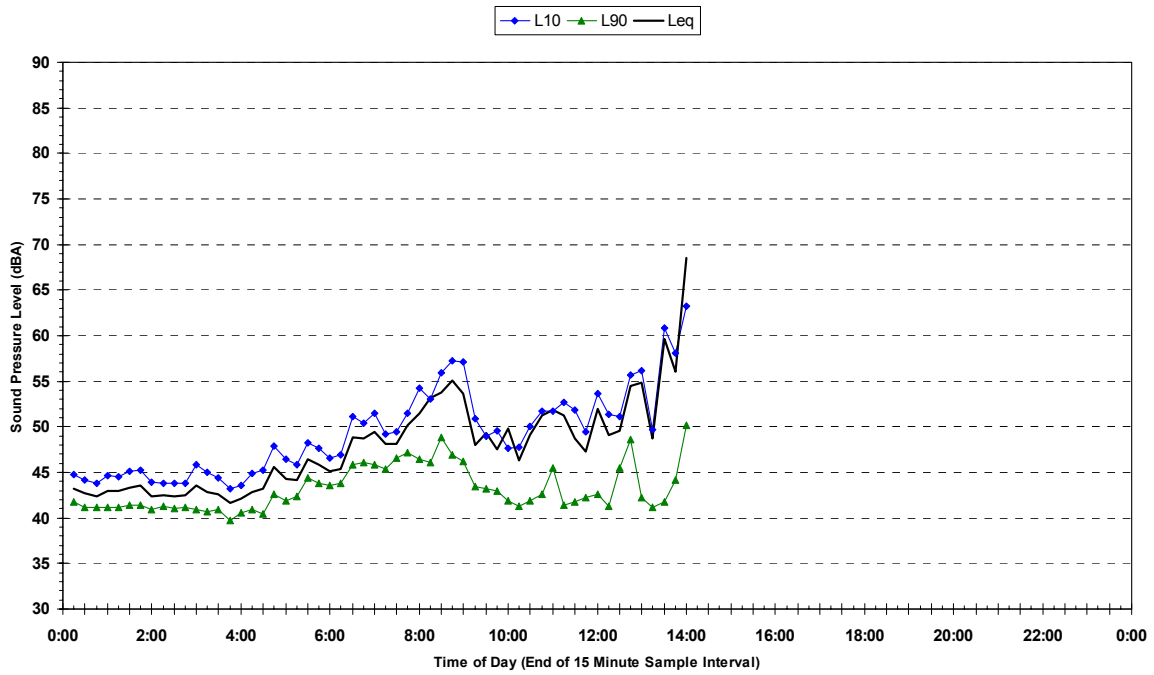


Statistical Ambient Noise Levels
Emmaus Catholic College - Thursday 28 February 2008



STATISTICAL AMBIENT NOISE LEVELS

Statistical Ambient Noise Levels
Emmaus Catholic College - Friday 29 February 2008



Our Reference B08809 - 1

JBA Urban Planning Consultants
Level 7,
77 Berry Street,
North Sydney
NSW 2060



Re: Jacfin Warehousing Facility, Templar Road Erskine Park
– Part 3A Project Application No. 07_0153

Dear Clare,

In reference to your request to provide a response to the Department of Planning letter dated 2.5.2008 and in particular those matters relating to fire management procedures to minimise risk to the Biodiversity Corridor and the fire mitigation measures required to address the risk of bushfires on the proposed facility I provide the following response.

(1) *Fire Management Procedures to minimise risk to the Biodiversity Corridor.*

The proposed development is for the construction of a large Warehouse building, Offices and carpark on a triangular shaped allotment at the terminus of the extended Templar Road. The Warehouse building contains a floor area of 21,005 m² with truck loading docks along the western aspect of the Warehouse. The Office building is attached to the eastern end of the Warehouse building with the Carparking area occupying the eastern triangle of the site.

The Warehouse building will be constructed having a precast concrete dado line of external wall cladding with pre-coloured metal wall cladding on a steel framed wall structure. The Office building will be constructed from similar materials.

In terms of building fire protection, the building will be fully compliant with the Building Code of Australia requirements, including internal wet down sprinklers fitted throughout the Warehouse and Office building and the provision of a fire service water storage tank.

In examining the potential risks to the Biodiversity Corridor from a fire occurrence on the site, the scenarios identified as possible causes of impact are:

- Building fire resulting in radiant heat impact on the vegetation within the Biodiversity Corridor;
- Vehicle fire, including truck fire at the loading dock end of the Warehouse; and
- Contaminated run-off from these fire scenarios.

Should a fire occur in the Warehouse section or Office of the proposed building, the wet-down sprinkler system will activate to extinguish the fire, therefore limiting the likelihood for the building to be fully involved in fire and removing the potential for radiant heat to impact on the adjoining vegetation. Contaminated run off will also be minimised due to the early activation of the wet-down sprinkler system.

Should a fire occur within a car parked in the Carparking area of the site, the radiant heat output from such event would not be sufficient to impact upon the adjoining vegetation within the Biodiversity Corridor.

Should a fire occur in a truck parked in the Loading Dock area of the Warehouse, depending on its closeness to the adjoining vegetation to the west, the radiant heat impact will vary from negligible to moderate localised scorching of the vegetation. It is therefore recommended that fire hose reels be mounted in Hose Boxes along the western edge of the Loading Dock parking area to provide a capacity to extinguish the fire prior to fire service attendance. The fire hoses could also be used to wet down the adjoining bushland.

Contaminated run-off from fire suppression activities will impact upon the stormwater catchment system, therefore management of this contamination will be required. Bunding and absorption materials will be required to be stored on site to be used to minimise the spread of run-off and the stormwater management system should be designed to hold the contaminated water on site and to allow removal by tanker for proper disposal.

(2) *Bushfire Risk to the proposed building.*

The retained vegetation within the Biodiversity Corridors to the north of the eastern portion of the site and to the west of the site will pose a risk to the future Warehouse and Office building.

The NSW Rural Fire Service, in assessing the bushfire risk to industrial developments, recognise that the general fire safety construction provisions required by the Building Code of Australia are acceptable solutions to the provision of bushfire safety to Class 5 – 8 and 10 of the Building Code of Australia. However, the aim and objectives of *Planning for Bushfire Protection 2006* apply to the provision of suitable access for fire fighting operations, water and services, emergency planning and landscaping / vegetation management.

An examination of the proposed development plans has identified that the separation between the western elevation of the Warehouse and the Biodiversity Corridor to the west of the site is 42.0 metres. This width reduces the level of radiant heat exposure on the building from a bushfire occurrence in the vegetation to the west to < 12.5 kWm² which is unlikely to threaten building elements however specific construction requirements will be necessary to prevent ember attack on the building [particularly openings in the external fabric of the building].

This setback provides a “defendable space” width which is four times the minimum width required by the NSW Rural Fire Service.

The separation along the northern boundary is approximately 12.0 metres which provides the requisite “defendable space” along the northern aspect of the building. However, the land to the north of the Warehouse building forms the land within the adjoining CSR site and does not currently contain bushfire prone vegetation. The location of the Office building may be subject to the impacts of bushfires burning in the Biodiversity Corridor to the north of the eastern portion of the site.

To provide protection against this potential impact, the northern and eastern elevations of the Office building shall be constructed to comply with Level 3 specifications as defined by Australian Standard A.S. 3959 – 1999 – “*Construction of Buildings in Bushfire Prone Areas*” and the glazed windows and external glazed doors shall be designed to withstand 40 kWm² radiant heat levels.

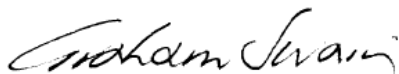
Fire fighting access has been provided to the facility in the form of the Loading Dock parking area to the west, the access road along the northern boundary and the Carpark within the eastern portion of the site. The 6m wide “Emergency Vehicle Access” along the southern boundary completes the loop fire fighting access road and complies with the access provisions of *Planning for Bushfire Protection 2006*.

Fire fighting water supplies have been addressed in the provision of a static water supply tank and hydrants/fire hose reels shall be installed in accordance with the Building Code of Australia and A.S. 2419.1 – 2005.

The proposed landscaping as shown on the Site Plan prepared by Vaughan Constructions, addresses the performance criteria for the provision of landscaping within an Asset Protection Zone/defendable space as defined by Appendix 5 of *Planning for Bushfire Protection 2006* and the NSW Rural Fire Service “*Specifications for Asset Protection Zones*”.

To address emergency planning, an Evacuation Plan shall be prepared for the proposed development.

If you require any further information please contact the undersigned.
Yours faithfully,



Graham Swain.
Managing Director
Australian Bushfire Protection Planners Pty Limited.