PLASSER AUSTRALIA

DEVELOPMENT APPLICATION –

25 KURRAJONG ROAD, ST MARYS

STATEMENT OF ENVIRONMENTAL EFFECTS

Submitted to Penrith City Council

August 2014

M|G Planning
URBAN PLANNERS

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1. INTRODUCTION

This report constitutes a Statement of Environmental Effects (SEE) and accompanies a Development Application (DA) seeking consent for the development of a workshop addition and ancillary site works at an existing factory owned by Plasser Australia in North St. Marys.

More specifically, development consent is sought for the following:

- New enclosed factory/workshop;
- New covered unenclosed work area;
- Replacement of existing testing tracks;
- Business identification signage;
- Removal of trees;
- Demolition; and
- New truck entry off Kurrajong Road.

The proposed addition will primarily be used for the existing business and no intensification of the use or increase in staff numbers is proposed.

A detailed description of the proposal can be found at Section 3 of this report.

The purpose of this report is to:

- describe the components of the proposal;
- discuss the potential environmental effects of the proposed development;
- draw conclusions as to the significance of any impacts; and
- make a recommendation to Penrith City Council as to whether the DA should be approved.

The development proposal has been assessed based on the characteristics of the site and locality, the Penrith Local Environmental Plan 2010, the Penrith City Development Control Plan 2010, and other relevant local planning controls as well as the requirements of section 79C of the *Environmental Planning and Assessment Act 1979*.

This Statement of Environmental Effects has been prepared by MG Planning Pty Limited for Group GSA on behalf of Plasser Australia. It should be read in conjunction with the following relevant accompanying material:

Appendix 1	Owner's Consent
Appendix 2	Architectural Plans, including Colours and Material Schedule
Appendix 3	Landscape Plans
Appendix 4	Civil Plans
Appendix 5	Services Information
Appendix 6	BCA Report
Appendix 7	Sustainability Report and Green Star Report Card
Appendix 8	Environmental Site Assessment (Contamination Report)
Appendix 9	Arborists Report
Appendix 10	Geotechnical Investigation

2. SITE DESCRIPTION

2.1 Site Location and Ownership

The site is located in the North St Marys Industrial Precinct on the corner of Plasser Crescent and Kurrajong Road and to the north of the Western Railway Corridor. The location of the site is shown in Figures 1 and 2 below.

The site is owned by Plasser Australia, who is a member of Plasser & Theurer Group, one of the world's leading suppliers of railway track maintenance and construction equipment. The factory is fully self-contained with work undertaken on site including:

- Heavy structural steel fabrication;
- Sheet metal fabrication;
- Machining;
- Electrical manufacture and installation;
- Hydraulic installation;
- Hydraulic cylinder manufacture; and
- Fitting and assembly.

The company moved to the current location in the 1980s. Owner's consent to the lodgement of this development application is provided at Appendix 1.

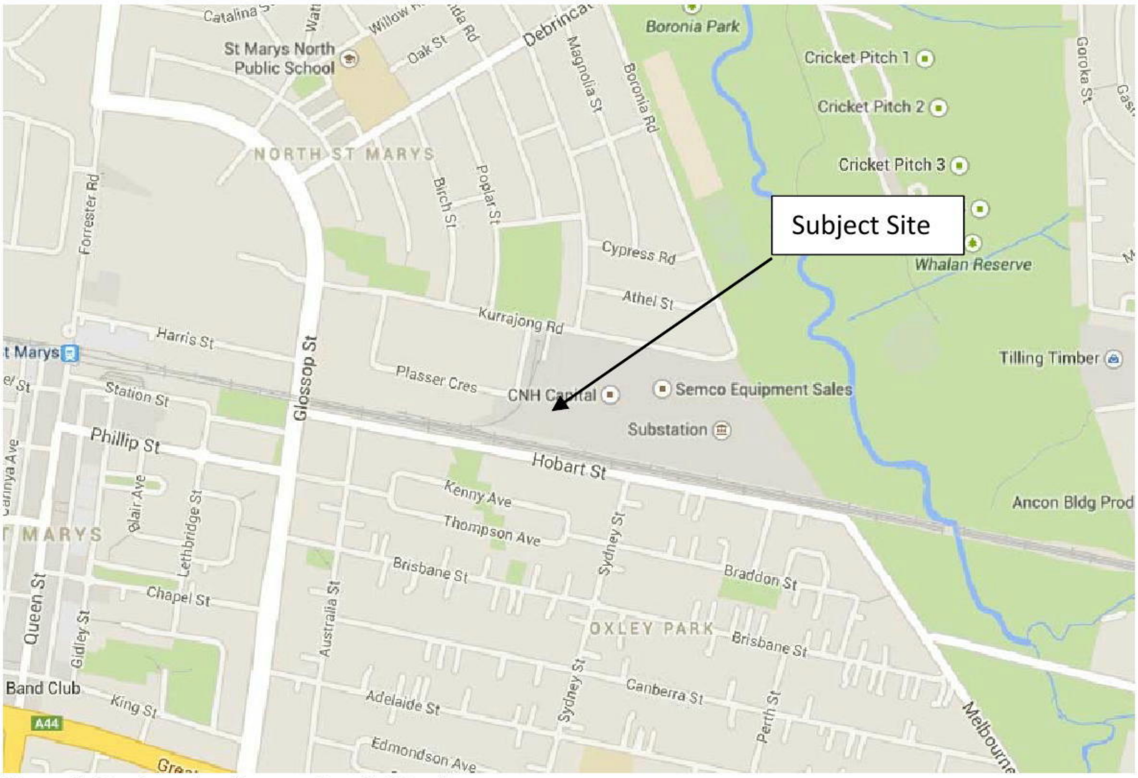

Figure 1: Site Location (Source: Google Maps)

Figure 2: Aerial of site (Source: Nearmap)

2.3 Site Description

The site is known as 25 Kurrajong Road, St Marys being part of Lot 1 DP 600899. The site has an area of 2.32ha, is irregular in shape and accommodates two existing industrial buildings. The larger building is located in the south-east corner of the site, which narrows as it extends north-south along just over half of the eastern boundary. This building consists of a factory/workshop (approx. 6,600m^2) and adjoining office (approx. 725m^2). The smaller building is located in the south-west corner of the site and is a second factory/workshop area (approx. 1037m^2). The total existing building area is 8,362 m^2.

The site has road frontage to Kurrajong Road to the north (refer Photo 1 below) and Plasser Crescent to the west (refer Photo 2). The main car park is located in the northern portion of the site and is accessed from Kurrajong Road. 70 car spaces are currently provided. A small proportion of the on-site parking provision is reserved and the remaining parking provision is accessible to the general staff. The facility currently employs a total of 129 staff members. The main heavy vehicle access is also currently from Kurrajong Road. A secondary access to the site is located on Plasser Crescent between the two main workshops.

The Western Rail corridor bounds the site to the south, and a track forks off into the site to allow train access. A series of train sidings exist within the site to allow multiple trains on-site and train access to the main workshop.

The north and western boundaries are bordered by landscaped areas consisting of grass and a scattering of large eucalypts and palms. The landscaping continues to the office building on the eastern boundary. A landscaping buffer also exists between the site and the train corridor to the south. The entire site is currently bounded by a wire mesh security fence.

Industrial uses are located immediately to the east and west of the site. The Western Rail corridor and Hobart Street act as a buffer between the site and residential uses to the south. Residential dwellings and the large public open space area of Poplar Park is located to the north of the site (refer Photos 4 & 5 below) however the existing (and proposed structures on site) are setback greater than 30m from this frontage.

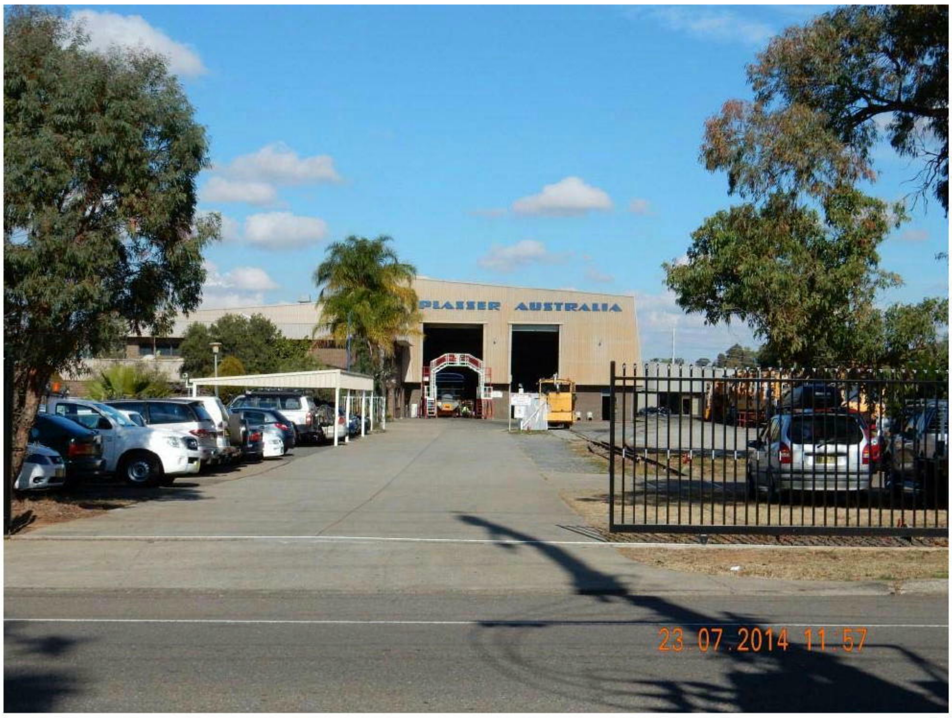

Photo 1: Main entry to site off Kurrajong Road

Photo 2: Secondary entry to site off Plasser Crescent

Photo 3: Location of proposed addition looking south across site.

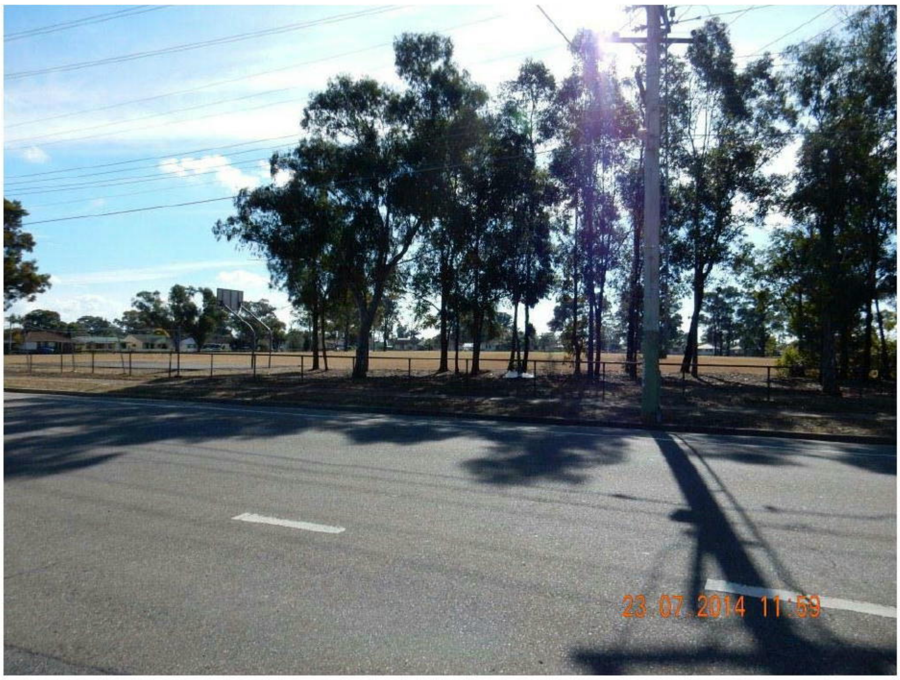

Photo 4: Poplar Park to north of site across Kurrajong Road

Photo 5: Established residential area to north-east of site across Kurrajong Road

3. PROJECT DESCRIPTION

3.1 Description of the Proposal

The proposed works includes the construction of:

- New enclosed services workshop building along the western edge of the site, parallel to Plasser Crescent;
- New covered unenclosed work area, to the south of the new workshop and adjacent to the existing main workshop building;
- Replacement of existing testing tracks;
- Business identification signage;
- Tree removal;
- Demolition of existing retaining wall, paving, car park bitumen etc.;
- Relocation of existing electrical substation and provision of one additional substation;
- New truck entry off Kurrajong Road (to be utilised 3-4 times per year); and
- Widening of existing Plasser Crescent entry.

The proposed additions to the existing industrial development will not result in any increase in production capacity or an increase in staff numbers. The new workshop is primarily proposed for servicing of existing machines rather than as an increase in manufacturing operations. It is possible that there may be a small, but insignificant, increase in goods and services being provided on site as a result of the machine servicing.

The proposed operating hours for the new services workshop is 7am to 5.30pm Monday to Friday.

Details of the proposed additions are illustrated on the architectural drawings (including site plan, floor plans, elevations and sections etc.) prepared by Group GSA at Appendix 2. Further detailed landscape plans showing the location of trees to be removed and the locations and types of plants to be provided are provided at Appendix 3 and civil plans illustrating the proposed works are provided at Appendix 4.

The proposed addition includes of an unenclosed area which will adjoin the western wall of the existing workshop, and will be predominantly used for cleaning of machinery before progressing to the new services workshop. A rail line enters the unenclosed area to the south and divides into two lines, one of which continues to the new services workshop and the other continues through to the outdoor area adjacent to the existing office and parking areas. A 1.5m deep wash down pit is provided just before the entrance to the new services workshop.

The enclosed services workshop will be located directly to the north of the unenclosed area and will be used for machine servicing. The new building will house a 50 tonne crane and a maintenance pit (approx. 1.5m deep) which will extend the length of the building. The new services workshop will have a roller door on the northern elevation in addition to two roller doors on the southern elevation. Additional toilets will be provided in the services workshop.

The proposed enclosed area will be 1,027m^2. The maximum building height is 11.7m and the minimum setback to Plasser Crescent is 5.05m and 30.05m to Kurrajong Road.

To accommodate the additional buildings, some existing infrastructure along the western side of the site will be removed and relocated as per the Demolition Plan included at Appendix 2. This includes relocation of the electricity substation to the Plasser Crescent boundary of the site.

The proposed addition has been designed to match the existing materials, including metal wall cladding along the upper part of the building and masonry wall along the lower part broken up with translucent wall cladding through the centre. The transition from the enclosed area to the unenclosed area will provide some visual interest along the Plasser Crescent boundary.

3.2 Access and Parking

The existing main vehicular access arrangement to the site via the driveway located on the Kurrajong Road frontage will be retained. In addition the existing Plasser Crescent entrance will be widened and a new secondary driveway constructed along the Kurrajong Road frontage, located to the west of the existing driveway. This driveway will provide access to the proposed servicing unit and will be utilised only 3-4 times a year. During operation, the existing parking spaces located on approach to the proposed driveway will not be available for use.

As access from the secondary proposed driveway to be located on the Kurrajong Road frontage is required occasionally (approximately 3-4 time a year) only, the existing parking spaces in this location will generally be available for use. Accordingly the proposal will retain the existing on-site parking provision of 70 parking spaces.

3.3 Landscaping

Landscape Plans prepared by Group GSA Architects are provided at Appendix 3. The proposal will result in the removal of 15 existing trees including 14 trees along Plasser Crescent. These will be replaced with 13 Willow Myrtles and new understorey planting along the western setback. A new steel palisade fence will also be provided along the western boundary.

The existing table and open sided shelters will be relocated amongst the new Plasser Crescent landscaped area. Further additional planting along the eastern façade of the proposed building will include 6 x Alexandra Palms and 2 x Blueberry Ashes. 2 Wilgas will be planted to the west of the parking area to provide additional shading.

3.4 Services and BCA Compliance

Details in relation to proposed services are provided at Appendix 5. As shown in the Hydraulic Services Plan prepared by Northrop, the proposed addition will be serviced by the existing reticulated water and sewer systems provided by Sydney Water. A new potable water and fire hydrant connection, including cold water metre and fire hydrant booster assembly is proposed, which will connect with the existing water pipe at the Kurrajong Road entrance.

The majority of the existing drainage infrastructure located at the site will be retained to manage stormwater runoff generated off the site. New stormwater pits and pipes will be provided to manage stormwater runoff generated off new hardstand areas proposed as part of the development. The new sections of stormwater drainage infrastructure will connect to the existing stormwater drainage network.

A rainwater tank will be introduced to capture and re-use rainwater to minimise the total volume of stormwater discharge from the site. The rainwater tank will have a detention volume of 55 kL consistent with 90% of the site irrigation requirement.

Electrical services and lighting will comply with relevant standards as detailed in the electrical statement of compliance prepared by Northrop Engineers (refer Appendix 5).

The proposed additions are able to comply with the provisions of the Building Code of Australia 2014 as detailed in the BCA Report prepared by McKenzie Group Consulting (refer Appendix 6) subject to confirmation prior to the issue of the Construction Certificate.

3.5 Signage

Business identification signage is proposed as illustrated on the architectural plans at Appendix 2, in the form of two signs: one on the northern elevation of the new services workshop (Plasser Australia lettering) and a secondary sign at the northern most extent of the western elevation (Australia map with Plasser Australia lettering).

3.6 Sustainability

The proposed additions will incorporate sustainable design initiatives in line with what is required for a 4 star Green Star Industrial Design rating as outlined in the Sustainability Report prepared by Northrop Engineers (refer Appendix 7).

The inclusion of sustainable design initiatives demonstrates Australian Best practice in reducing the environmental impact of the development during design and construction. The target requires the implementation of a broad range of sustainable design initiatives addressing all aspects of the environmental impact of the development, including management, indoor environment quality, energy, water, transport, materials, emissions, ecology, and innovation. Points are awarded for each category in accordance with the Green Star Industrial Technical Manual. 45 points are required to achieve a 4 star Green Star rating.

The Sustainability Report identifies the proposed sustainable design objectives and is supported by the Green Star Scorecard. The Green Star Scorecard summarises the proposed method of addressing the Green Star Industrial requirements and includes sustainable design objectives relating to 45 points. It is noted that this document is a moving document that the proposed method of achieving the 45 point may change through the design development of the Plasser Australia Warehouse Extension.

4. ENVIRONMENTAL ASSESSMENT

This section provides an assessment of the planning issues associated with the proposed development in accordance with the relevant matters for consideration under section 79C(1) of the EP&A Act.

4.1 Section 79C(1)(a) Planning Instruments

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy No 55 – Remediation of Land
The general aim of this policy is to provide state-wide planning controls for the remediation of contaminated land. The policy states that land must not be developed if it unsuitable for a proposed use because it is contaminated. If the land is unsuitable, remediation must take place before the land is developed. The policy makes remediation permissible across the State, defines when consent is required, requires all remediation to comply with standards, ensures land is investigated if contamination is suspected, and requires councils to be notified of all remediation proposals.

Given the industrial zoning and current on-site activities it is possible that the site has been contaminated. As such, a preliminary Stage 1 Environmental Site Assessment (ESA) was prepared by Environmental Inspection Services (refer Appendix 8) to:

- Assess the potential risk for widespread soil contamination at the site;
- Assess the potential risk to human health and the environment posed by the contaminants; and
- Comment on the suitability of the site for the proposed development/landuse.

The ESA concluded that:

> *The limited inspection and investigation of the site within the Plasser property did not indicate the presence of any widespread significant contamination of the site that is likely to affect the proposed development. The minor B(a)P elevation above the ecological guideline is not considered significant as the site will be paved.*
>
> *Based on the scope of works undertaken, **EIS are of the opinion that the site is suitable for the proposed industrial development**. However if any significant redevelopment to the site or Plasser property is undertaken in the future we would recommend further investigation.*
>
> *In the event that any unexpected material is encountered during excavation during earthworks (e.g. stained/odorous soil and/or fibre cement fragments). EIS should be contacted immediately to review the findings of this report and waste classification.*

It is therefore considered that the proposed development satisfies the Policy and no remediation works are required before the land is developed. Should contamination be encountered during the excavation process appropriate action consistent with relevant legislative requirements will be taken.

4.1.2 Penrith Local Environmental Plan 2010

The site is zoned IN1 General Industrial under Penrith Local Environmental Plan 2010 (PLEP 2010) with the proposed development falling into the definition of general industries being "a building or place (other than a heavy industry or light industry) that is used to carry out an industrial activity". General Industries are permitted with consent within the IN1 Zone.

Figure 3: Zoning under Penrith LEP 2010

Clause 2.3(2) requires the consent authority to have regard to the objectives for development in a zone when determining a development application in respect of land within the zone.

The objectives of the IN1 General Industrial Zone are:

- *To provide a wide range of industrial and warehouse land uses.*
- *To encourage employment opportunities.*
- *To minimise any adverse effect of industry on other land uses.*
- *To support and protect industrial land for industrial uses.*
- *To promote development that makes efficient use of industrial land.*
- *To permit facilities that serve the daily recreation and convenience needs of persons working in industrial areas.*

The proposal is consistent with objectives of the zone in that the proposed addition is for an industrial and warehouse land use. The proposed addition has been carefully designed to minimise any adverse effect on other land uses and also furthers the efficient use of the site. The proposal will not generate more employment opportunities however will contribute to the ongoing viability of the existing operations on site and job security.

Clause 4.3 of the LEP sets the maximum building height for the site at 12m through the "Height of Buildings Map". The proposed addition will have a maximum height of 11.7m and complies with this requirement.

Clause 5.9 applies to the preservation of trees or vegetation and requires that a person must not ringbark, cut down, top, lop, remove, injure or wilfully destroy a prescribed tree or vegetation except with development consent. Tree removal is proposed as part of the proposed works and an Arboricultural Impact Assessment has therefore been prepared (refer Appendix 9). This matter is addressed in further detail in section 4.2.4 below.

Clause 6.1 requires development consent for earthworks and outlines relevant matters that must be considered by the consent authority prior to granting consent. The proposed development is consistent with the relevant matters. In this regard it is noted that a sediment and erosion control plan has been prepared (refer Appendix 4) and will be implement during the construction phase. In addition a Geotechnical Report has been prepared (refer Appendix 10) and the proposed works will be undertaken in accordance with the recommendations contained therein. The proposed earthworks are minor only and will not impact on the future use of the land.

Clause 6.5 relates to the Protection of scenic character and landscape values. The clause applies to land identified as "Land with scenic and landscape values" on the Scenic and Landscape Values Map. The southern part of the site is identified on the map, however no development is proposed in the identified area and it is therefore considered that this clause does not to apply to the proposed development.

Clause 6.6 requires consideration of servicing of the land, including connection to reticulated water and adequate facilities for the removal and disposal of sewage. The proposed addition will be serviced by the existing reticulated water and sewer systems provided by Sydney Water. A new potable water and fire hydrant connection, including cold water metre and fire hydrant booster assembly is proposed, which will connect with the existing water pipe at the Kurrajong Road entrance.

There are no other provisions contained in PLEP 2010 relevant to the proposed development.

4.1.3 Penrith Development Control Plan 2010

The proposed addition to the existing industrial warehouse is consistent with the provisions of the Penrith DCP 2010 and more specifically Chapter D4 Industrial Development, which applies to all industrial land, including IN1 (General Industrial), in the Penrith City Council LGA.

The subject site is located within Precinct 3 – St Marys (east of Forrester Road) as per Section 4.1 – Key Precincts as shown in Figure 4 and 5 below.

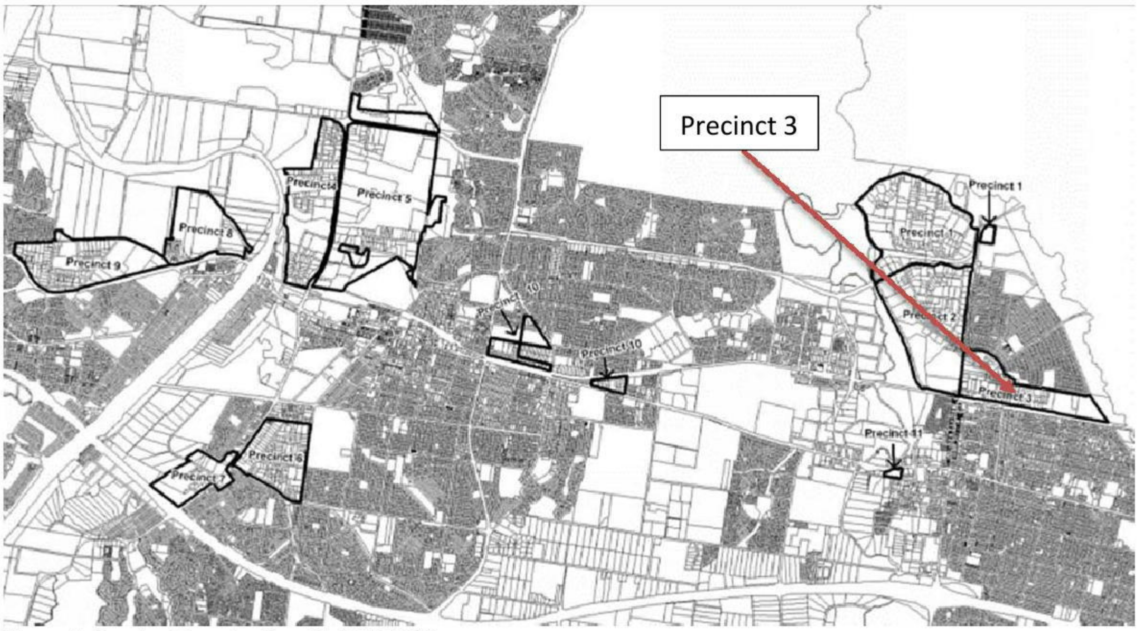

Figure 4: Precinct 3 under Penrith DCP 2010

Figure 5 – Subject site within Precinct 3

An assessment of the proposal against relevant requirements of the DCP is provided in the compliance table at Appendix 11.

The proposed development complies with all relevant requirements contained in Penrith DCP 2010 or where minor non compliances existing (as identified) these are consider acceptable in the circumstances.

4.2 Section 79C(1)(b) Environmental Assessment

4.2.1 Traffic and parking

To address the traffic and parking implications of the proposed development a Traffic Impact Assessment has been prepared by Parking and Traffic Consultants (refer Appendix 12). The Assessment concludes that:

In summary, the proposal involves construction of a warehouse style building accommodating a floor area of 2,700m2GFA which will be occupied by the existing *servicing unit. The proposal involves introduction of a new secondary driveway along the Kurrajong Road frontage located to the west of the existing driveway.*

The assessment has concluded that the proposed warehouse will not result in any increase in traffic activity compared with the existing traffic activity of the facility. In this regard, the proposal will have no notable detrimental impact upon the operation of surrounding road network.

The proposal involves retaining the existing on-site parking provision of 70 car spaces, given that the proposed development will not result in any increase in any staff numbers, the existing on-site parking provision was considered fully compliant and adequate to cater the facility.

The vehicular access arrangements have been designed in accordance with the relevant standard, being AS2890 Parts 2.

Accordingly it is considered that the proposed development is acceptable in traffic and parking terms and will not result in any adverse impact.

4.2.2 Stormwater Management

To address the stormwater implications of the proposed development a Stormwater Management Report and Plans have been prepared by Northrop Consulting Engineers and are provided at Appendix 13.

The Report concludes that:

The proposed stormwater management strategy has been developed in accordance with Councils Council's Development Controls Plans 2010 (DCP), Councils WSUD Technical Guidelines and best management practices for managing urban stormwater.

The proposed stormwater management strategy will involve utilizing a majority of the existing stormwater infrastructure to manage stormwater flows generated across the site. New stormwater drainage pits and pipes will be incorporated to capture runoff from new hardstand areas proposed across the site. The proposed drainage infrastructure will safely convey stormwater from the site, without significantly impacting existing infrastructure, downstream or adjoining properties and environments.

As part of the stormwater management strategy, a stormwater treatment train has been developed to manage the volume of pollutants generated and discharged from the site. The treatment train involves the implementation of Enviropods and a Rainwater tanks. Detailed investigations have been undertaken which have demonstrated that the proposed stormwater management strategy and treatment train adequately address Council stormwater management requirements as specified in Councils Council's Development Controls Plans 2010 (DCP), Councils WSUD Technical Guidelines.

Northrop has consulted with Council engineers who confirmed that no on-site detention is necessary for the proposed development.

In order to achieve Council's WSUD requirements, a 55kL rainwater tank will be designed to collect runoff from the total area of the new factory facility and will be sized to provide 90% of the site irrigation demand.

Having regard to the above it is considered that the proposed development is appropriate and will not result in any adverse impacts in terms of stormwater management.

4.2.3 Noise

As the proposed development incorporates a new potentially noise generating industrial use (services workshop) an acoustic assessment has been prepared by Acoustic Logic (refer Appendix 14). The Assessment concludes that noise emissions associated with the proposed addition will comply with all relevant acoustic criteria, ensuring no unacceptable noise impact on the surrounding residential properties subject to the implementation of the following recommendations:

- *The new Services Workshop and Outdoor Covered Work Area is not to operate before 5:30am or after 10pm. Normal hours of use are 7am to 5:30pm.*
- *The northern doors of the new Services Workshop must be closed until 7am but can be open otherwise.*
- *Detailed review of mechanical plant items is to be undertaken at CC stage (once plant is selected/located) and acoustic design should be undertaken to ensure plant noise will be compliant with the EPA Industrial Noise Policy.*

It notes that subject to the above, no further building/management controls are required to ensure compliance with the Penrith DCP and EPA noise emission guidelines.

It is therefore concluded that subject to the implementation of the above recommendations the proposed development will not result in any adverse acoustic impacts to neighbouring properties.

4.2.4 Tree Removal and Landscaping

The proposed development includes tree removal and according an Arboriculture Impact Assessment has been prepared by Bluegum Tree Care and Consultancy (refer Appendix 9) to assess the likely impacts of the proposed works on the existing site trees and make recommendations regarding construction methods and tree protection measures to limit adverse impacts on trees recommended for retention.

The Assessment considered 15 native trees (fourteen along Plasser Crescent and one near the north-eastern corner of the proposed new Services Workshop) on site proposed for removal and concluded that the trees were not considered to be of sufficient value to warrant retention having a retention value of medium to low only. The Assessment notes that the proposed removal is appropriate given that the trees were not considered to be of sufficient value to warrant a major re-design to facilitate their retention.

Although tree removal is proposed as part of the subject works, new landscaping is proposed to replace trees to be removed and to beautify the site. The Landscape Plans at Appendix 3 illustrate the landscape consent which will include new tree and understorey planting on the site perimeter and adjacent to the new buildings consistent with the existing planting on site.

The proposed landscaping will result in an increase in landscaping on site, will ensure an attractive site presentation and will provided shaded areas for climate control (carpark and seating areas).

It is therefore considered that the proposed tree removal is appropriate having regard to replacement planting and will not result in any adverse environmental impact.

4.2.5 Contamination

As noted in section 4.1.1 above, given the existing industrial use of the site the potential exists for site contamination. Accordingly a Stage 1 Preliminary Environmental Site Investigation has been prepared (Appendix 8). The report concludes that the investigations did not indicate the presence of any widespread significant contamination on the site that is likely to affect the proposed development and that based on the investigations undertaken the consultants are of the opinion that the site is suitable for the proposed industrial development. It is therefore considered that the subject land is suitable for the proposed use and will not give rise to any contamination impacts.

4.2.6 Safety and Security

The proposed addition to the existing industrial development has been designed and located with the considerations of safety, security and crime prevention in mind. The subject site is surrounded by transparent security fencing and intercom controlled sliding gates and has clearly defined entrances which is consistent with Principles 1, 2 and 3 of CPTED relating to natural surveillance, access control and territorial control. Further measures incorporated into the design in accordance with CPTED principles include:

- *Limiting external threats and increase safety within the building and the surrounding area though fencing and lighting*
- *Provision of building and site transparency to enables surveillance of surrounds areas and car parking areas*
- *Low level (understorey) and tree planting surrounding the building to allow the buildings to be view throughout the day and night and to prevent predator traps*
- *Lighting to the building, car parking areas and surrounds area providing passive surveillance and to act as a deterrent, and*
- *The provision of controlled access to the site.*

Having regard to these measures it is considered that the proposal will not give rise to any issues of safety or security.

4.3 Section 79C(1)(c) Site Suitability

The proposed development is for an addition to an existing industrial use relating to the manufacturing and servicing of trains and equipment. The proposed use is heavily dependent on the unique feature of rail line access to the site, which currently exists. The site is within an established industrial area and has industrial uses adjoining all boundaries and is buffered from nearby sensitive uses. The site is situated in an area which is highly accessible by both vehicles and pedestrians/cyclists being located adjacent to one of the major north south collector roads. The site conveniently has dual access to roads, which allows for separation of car parking areas and truck movements.

The subject site is therefore ideally suited to the proposed development.

4.4 Section 79C(1)(e) Public Interest

The proposed services workshop will provide for the ongoing viability of an existing industry within an established industrial area and will not result in any adverse economic or environmental impacts. It is therefore considered to be in the public interest.

5. CONCLUSION

This report constitutes a Statement of Environmental Effects (SEE) and accompanies a development application to Penrith City Council seeking consent for development of a workshop addition and ancillary site works at an existing factory owned by Plasser Australia in North St. Marys.

The aim of this report has been:

- to describe the proposed development;
- to illustrate that the proposed development complies with the intent of relevant statutory and policy documents; and
- to provide an assessment of the likely environmental effects of the proposed development.

The proposal is consistent with the zoning of the site and all relevant provisions contained within Penrith LEP 2010 and Penrith DCP 2010. The assessment contained herein concludes that there are no significant environmental constraints on the site that preclude the development of workshop addition and that the proposed development will not result in any significant adverse economic or environmental impacts.

Accordingly it is concluded that the proposed development is appropriate on the site and within the locality, and should therefore be approved by Penrith City Council.

APPENDIX 5
Services information

NORTHROP

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Sydney NSW 2000

PO Box H171 Australia Square NSW 1215

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E sydney@northrop.com.au

July 31, 2014

Job No.: 140074

Rajat Khanna
Group GSA
Level 7, 80 William St
EAST SYDNEY NSW 2011

Dear Rajat.

RE: Plasser Australia St Marys
Electrical Statement of Compliance

Please find enclosed the statement of compliance for the design of the Electrical Services.

We trust the above information is satisfactory to you; however, should you require any further information, please contact the undersigned.

Yours faithfully,

Francis Huang
Electrical Engineer
Northrop Consulting Engineers

Plasser Australia St Marys

Statement of Compliance – Electrical Services

The following essential services will be included in the electrical services design. The design complies with the clauses referenced.

This statement of compliance applies to the following documentation currently being produced by Northrop Consulting Engineers.

Drawing Number	Drawing Title	Revision
E00	LEGEND, DRAWING SCHEDULE AND SITE PLAN	
E01	SITE PLAN	
E02	EXTERNAL WAREHOUSE POWER AND LIGHTING LAYOUT	
E03	INTERNAL UNDERCOVERED AREA POWER AND LIGHTING LAYOUT	
	ELECTRICAL SERVICES SPECIFICATION	

- **Power Distribution**

The power distribution, including incoming supply, protection and cabling will be designed in accordance with the following standards.

Refer to AS/NZS 3000:2007, AS/NZS 3008.1.1:2009 and the NSW Service and Installation Rules

- **Emergency and Exit Lighting**

A system of self contained, single point emergency and exit lighting will be designed in accordance with the following standards.

Refer to BCA Section E, Clauses E4.2, E4.4, E4.5, E4.6, and E4.8. and AS2293.1

- **Energy Efficiency**

Energy efficiency measures will be included in the design in accordance with the following standards.

Refer BCA Section J, Clauses J6.2 and J6.3

- **Energy Monitoring**

Facilities for energy monitoring will be included in the design in accordance with the following standards.

Refer BCA Section J, Clause J8.3

- **Internal Lighting**

Internal lighting will be designed in accordance with the following standards.

Refer BCA Section F, Clause F4.4, and AS1680.

- **Automatic Fire Detection**

An automatic smoke detection system will be designed in accordance with the following standards.

Refer NCC (BCA) Section E, Table 2.2a, NSW Table E2.2b and BCA Specification E2.2a. and AS1670

- **Occupant Warning System**

An occupant warning system will be designed in accordance with the following standards.

Refer NCC (BCA), Section E and AS1670

- **External Lighting**

External lighting will be designed in accordance with the following standards.

Refer AS1158 and AS4282.

Full Name of Designer:	Yogesh Maharaj
Qualifications:	BE (Electrical) MIE Aust ACMA
Address of Designer:	Level 1, 60 Hickson Road
	Sydney NSW 2000
Business Telephone No:	(02) 9241 4188 Fax No: (02) 9241 4324
Name of Employer:	Northrop Consulting Engineers P/L

Yogesh Maharaj
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Job No:	**Job Name:**	**Date:**	25/07/2014
S140074	Plasser Australia	**Pages:**	

From	Rita Bu

Cc	**Company**	**Attention**	**Fax No.**
	Endeavour Energy	CWadmin	

Subject	Application for Connection

To whom it may concern,

Northrop Engineers have been appointed as the electrical design consultant for the development of an upgrading of an industrial building at 2 Plasser Crescent, Kellyville, NSW. Please find attached Connection Application – Application for connection of load including all Strata Development, and preliminary architectural plans for your information.

We propose to have a new 1000kVA padmount substation and demolish the existing substation 28428.

If you require any further information, please do not hesitate to contact me.

Regards,

Rita Bu
Electrical Engineer
Northrop Building Services

APPENDIX 6
BCA Report

mckenzie group

BUILDING CODE OF AUSTRALIA REPORT

Proposed New Factory Building
25 Kurrajong Road, North St. Marys

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Date	Revision Number	No. of pages	Issue or Description of Amendment	Checked By	Approved By	Date Approved
04.08.14	A	11	Preliminary	Joel Lewis	Geoff Pearce	05.08.14

Executive Summary

McKenzie Group Consulting was engaged by GSA Group to conduct a BCA assessment of the proposed new factory building located at 25 Kurrajong Road, North St Marys. This report has been prepared to outline the level of BCA compliance of the proposed building against the prescriptive provision of the Building Code of Australia 2014.

For the purpose of this report, only the proposed new factory building has been assessed. It is noted that other buildings are located on the allotment however the proposed new factory building has been assessed as a standalone fire compartment due to the separation in construction between the new and existing buildings.

The assessment of the design documentation has revealed that the following areas are required to be assessed against the relevant performance requirements of the BCA. The submission for Construction certificate will need to include verification from a suitably accredited fire engineer: -

DTS Clause	Description of Non-Compliance	Performance Requirement
C1.1	Reduction of fire-resisting construction of external walls	CP1 & CP2
D1.4	Due to the installation of the covered working area, the distance from the existing buildings to a road or open place has increased.	DP4 & EP2.2

The fire engineered solution relating to DP4 & EP2.2 will need to be approved after consultation with the NSW Fire Brigade as part of the Construction Certificate process.

The documentation will need further detailing such as exit door locations, door hardware, specifications and stairway construction.

The application for Construction Certificate shall be assessed under the relevant provisions of the Environmental Planning & Assessment Act 1979 (As Amended) and the Environmental Planning & Assessment Regulation 2000.

Prepared by,

Joel Lewis
Building Surveyor
McKenzie Group Consulting

1.0 Introduction

This report has been prepared as a review of the proposed works against the current version of the Building Code of Australia, being BCA 2014. This report has been prepared to highlight areas that will be required to be addressed to bring about compliance with BCA 2014.

The following BCA report has been prepared on the review of the submitted documentation as outlined in Appendix A of this report.

1.1 Current Legislation

The applicable legislation governing the design of buildings is the Environmental Planning and Assessment Act 1979. This Act requires that all new building works must be designed to comply with the BCA.

The version of the BCA applicable to the development, is version that in place at the time of the application to the Certifying authority for the Construction Certificate.

2.0 Building Assessment Data

Summary of Construction Determination: -

	Proposed New Factory Building
Classification	5 / 8
Number of Storeys Contained	2
Rise In Storeys	2
Type of Construction	B
Effective Height (m)	<12m

Summary of the floor areas and relevant populations where applicable: -

Part of Project	BCA Classification	Approx. Floor Area (m^2)	Approx. Floor Volume (m^3)	Assumed Population
Office	5	20m2	Included	2 persons
Factory	8	8m2	16,928m3	29 persons
Total		**1448m2**	**16,928 m²**	**31 persons**

Notes:
1. The above populations have been base on the floor areas and calculations in accordance with Table D1.1.3 of the BCA.
2. The floor areas have been adjusted without ancillary areas such as sanitary facilities, corridors, shelving and or racking layouts in storage areas.

3.0 Structural Provisions

Any new structural works are to comply with the applicable requirements of AS/NZS 1170.1.

Glazing is to comply with AS1288, and AS2047.

Prior to the issue of the Construction Certificate structural certification is required to be provided.

4.0 Fire Resistance

The buildings should be constructed generally in accordance with Table 5 of Specification C1.1 of the Building Code of Australia 2014. The building has been assessed to be required to meet the provisions of a Type B Construction to achieve compliance with the deemed to satisfy provisions of the general floor area and volume limitations.

The building has been assessed on the basis of being a single fire compartment for the proposed new factory building. As the proposed new factory is separated from the existing buildings on the allotment, the building is determined as being one fire compartment.

The applicable requirements of specifications C1.1 of the BCA require the external walls to be of fire rated construction should the distance to any fire-source feature to which it is exposed be within the following parameters:

For load-bearing parts-	
Less than 1.5m	240/240/240
1.5 to less than 3 m	240/180/120
3 to less than 9 m	240/90/60
9 to less than 18 m	240/60/-
18 m or more	-/-/-
For non- load-bearing parts—	
less than 1.5 m	-/240/240
1.5 to less than 3 m	-/180/120
3 m or more	-/-/-

Upon assessment of the drawings, should the Eastern elevation external wall be load-bearing construction, 240/90/60 minute fire rated construction is required. The fire rated construction is required as the fire source feature of the side boundary is located 3 to less than 9 m from the external wall.

Should the fire rating of the external wall as mentioned above required to be reduced, a Fire engineered Solution will need to be sought to address this issue against Performance Requirement CP1 & CP2 of the BCA.

4.1 Fire Hazard Properties

T he fire hazard properties of fixed surface linings and mechanical ductwork will also need to be addressed within the detailed documentation phase pursuant to specification C1.10 Building Code of Australia.

5.0 Egress

5.1 Exit Travel Distances

The current 'Deemed-To-Satisfy' provisions of the Building Code of Australia stipulate the following in relation to travel distances:

> *'No point on a floor must be more than 20m from an exit, or a point from which travel in different directions to 2 exits is available, in which case the maximum distance to one of those exits must not exceed 40m.'*

Exit locations are not detailed on the reviewed documentation as stated in Appendix A. Further information is required for assessment to determine compliance with the BCA.

It is noted that a service trench is located within the proposed building, running the length of the building. Egress from the service trench must be within the defined parameters.

Due to the installation of the covered working area, the egress distances from the existing building will be increased and may not comply with the prescriptive provisions of the BCA. As egress distances are measured to a road or open space, the egress distance is required to be measured to the edge of the covered working area. Further information is required for assessment.

Should the egress distances not be achieved, the egress distance will need to be addressed as part of an alternative solution prepared by the fire engineer to address DP4 as they do not meet BCA 2014 deemed to satisfy provisions.

5.2 Dimensions of Exits

Minimum dimensions of 1000mm and 2000mm height to be provided within exits, with the paths of travel should provide a minimum width of 1000mm (note that all maintenance access, cat walks, etc may comply with AS1657 in which case a 600mm clear width is required).

Doorways are permitted to contain a clear opening width of 750mm with a height of 1980mm as part of egress requirements. Access for persons with disabilities however requires a clear doorway opening width of 850mm (i.e minimum 870 mm doors).

Exit locations are not detailed on the reviewed documentation as stated in Appendix. Further information is required for assessment to determine compliance with the BCA.

5.3 Door Hardware

The current prescriptive requirements stipulate that all doors in an exit or in the path of travel to an exit must be readily openable without a key from the person seeking egress via a single handed action on a single device.

5.4 Balustrade / Handrails / Stair Construction

It is noted that a stairway is provide for access to the first floor office. As the level of the surface below is greater than 1m, balustrades and handrails are required to be installed.

The height of a balustrade or other barrier must be constructed in accordance with the following:

> *(ii) The height is not less than—*
>
> > *(A) 1 m above the floor of any access path, balcony, landing or the like where the path of travel has a gradient less than 1:20; or*

(B) 865 mm above the floor of a landing to a stair or ramp where the balustrade or other barrier is provided along the inside edge of the landing and does not exceed a length of 500 mm.

(iii) A transition zone may be incorporated where the balustrade or other barrier height changes from 865 mm on the stair flight or ramp to 1 m at the landing.

Handrails must be -

(i) located along at least one side of the ramp or flight;

(ii) in any other case, fixed at a height not less than 865mm measured above the nosing of the stair treads and the floor surface of the ramp, landing or the like; and

(iii) continuous between stair flight landings and have no obstructions on or above them that tend to break a hand hold; and

(iv) in a required exit serving an are required to be accessible, designed and constructed to comply with clause 12 of AS 1428.1.

Due to the small detail provided in relation to the stairway, further information is required for assessment to determine compliance with the BCA.

5.5 Access for Persons with a Disability

Access for people with disabilities shall be provided to and within the building in accordance with the requirements of Clause D3.2, D3.3 and D3.4 of the BCA 2014. Parts of the building required to be accessible shall comply with the requirements of AS1428.1-2009.

As the location of the access doorways are not shown on the drawings, further information is required for assessment to determine compliance with AS1428.1-2009 and the BCA.

Parking shall be provided for people with disabilities in accordance with in accordance with Clause D3.5 of the BCA, 1 space for every 100 carparking spaces. Facilities services and features of the building accessible to people with disabilities shall be identified by signage complying with Clause D3.6 of the BCA.

General

Access to be provided to and within the building pursuant to AS1428.1-2009 as follows:

- Via the principle public entry and at least 50% of all other entrances
- From designated car parking spaces for the use of occupants with a disability.
- From another accessible building connected by a pedestrian link.
- All areas used by the public.

Note that entrances that are not accessible are to be located within 50m of an entrance that is accessible.

6.0 Fire Services & Equipment

The following fire services will need to be provided throughout the building:

- An automatic sprinkler system in accordance with the relevant provision of clause E1.5 of the BCA and AS 2118.1-1999;
- Fire hydrants in accordance with clause E1.3 of the BCA and AS 2419.1-2005,
- Fire hose reels in accordance with clause E1.4 of the BCA and AS 2441-2005,
- Portable Fire Extinguishers in accordance with Clause E1.6 of the BCA and AS 2444-2001,
- Emergency lighting, exit signage and directional exit signage is required throughout the building in accordance with Part E of the BCA and AS/NZS 2293.1-2005

6.1 Fire Hydrants

A system of Fire Hydrants is required to be provided to BCA Clause E1.3 and AS 2419.1-2005. Further certification will be required from a Hydraulic Consultant.

As a hydrant system is currently located on the site, this may be utilised for the proposed new building.

As part of any upgrade strategy, a gap analysis is be undertaken by the fire services consultant to advise of the required upgrades to the system to bring about compliance with current BCA provisions. Should upgrade of the building be required, the means of achieving compliance may be brought about by:-

1. Carrying out upgrade works to bring about system compliance with the Deemed-to-satisfy provision of the BCA; or
2. A performance based solution be developed by the Fire Engineer in consultation with Fire and rescue NSW to verify compliance with performance Requirement EP1.4 of the of the BCA; or

A combination of options (1) and (2) outlined above

6.2 Fire Hose Reels

A Fire Hose Reel System are required to be installed to BCA Clause E1.4 and AS2441-2005.

Fire hose reels are required to be located within 4m of exits and provide coverage within the building based on a 36m hose length.

6.3 Sprinklers

As the building has been classified as a Type B construction and is assessed within the deemed to satisfy provisions of the BCA, fire sprinklers are not required to the building.

7.0 Ventilation and Smoke Hazard Management

As sprinklers are located throughout the proposed building, a smoke hazard management system is not required to the building.

9.0 Sanitary Facilities

Accessible sanitary facilities are required to be provided on every storey containing sanitary compartments. In order to comply with the BCA, an accessible toilet is to be located within the proposed factory building.

Please note the Unisex facilities provided for people with disabilities may be counted once for each sex. These facilities are to be provided in accordance with AS1428.1-2001.

Appendix A - Design Documentation

The following documentation was used in the assessment and preparation of this report: -

Drawing No.	Title	Date	Drawn By	Revision
6308	Detail & Level Survey of Lot 1 in DP600899	05/06/14	SDG	A
6308	Detail & Level Survey of Lot 1 in DP600899	05/06/14	SDG	A
1000	Demolition Plan	25/06/14	Group GSA	-
1100	Site Plan	25/06/14	Group GSA	-
2000	Proposed Plan – Ground floor	26/06/14	Group GSA	-
3000	Proposed – Elevations and Section	17/06/14	Group GSA	-
3100	Proposed – Sections	17/06/14	Group GSA	-
	Truck Movement Diagram	25/06/14	-	-

Appendix B- Fire Resistance Levels

The table below represents the Fire resistance levels required in accordance with BCA 2014:

Table 4 TYPE B CONSTRUCTION: FRL OF BUILDING ELEMENTS

Building element	**Class of building—FRL: (in minutes)**			
	Structural adequacy/Integrity/Insulation			
	2, 3 or 4 part	**5, 7a or 9**	**6**	**7b or 8**
EXTERNAL WALL (including any column and other building element incorporated therein) or other external building element, where the distance from any *fire-source feature* to which it is exposed is—				
For *loadbearing* parts—				
less than 1.5 m	90/ 90/ 90	120/120/120	180/180/180	240/240/240
1.5 to less than 3 m	90/ 60/ 30	120/ 90/ 60	180/120/ 90	240/180/120
3 to less than 9 m	90/ 30/ 30	120/ 30/ 30	180/ 90/ 60	240/ 90/ 60
9 to less than 18 m	90/ 30/–	120/ 30/–	180/ 60/–	240/ 60/–
18 m or more	–/–/–	–/–/–	–/–/–	–/–/–
For non-*loadbearing* parts—				
less than 1.5 m	–/ 90/ 90	–/120/120	–/180/180	–/240/240
1.5 to less than 3 m	–/ 60/ 30	–/ 90/ 60	–/120/ 90	–/180/120
3 m or more	–/–/–	–/–/–	–/–/–	–/–/–
EXTERNAL COLUMN not incorporated in an *external wall*, where the distance from any *fire-source feature* to which it is exposed is—				
less than 3 m	90/–/–	120/–/–	180/–/–	240/–/–
3 m or more	–/–/–	–/–/–	–/–/–	–/–/–
COMMON WALLS and FIRE WALLS—	90/ 90 / 90	120/120/120	180/180/180	240/240/240
INTERNAL WALLS—				
Fire-resisting lift and stair *shafts*—				
Loadbearing	90/ 90/ 90	120/120/120	180/120/120	240/120/120
Fire-resisting stair *shafts*				
Non-*loadbearing*	–/ 90/ 90	–/120/120	–/120/120	–/120/120
Bounding *public corridors*, public lobbies and the like—				
Loadbearing	60/ 60/ 60	120/–/–	180/–/–	240/–/–
Non-*loadbearing*	–/ 60/ 60	–/–/–	–/–/–	–/–/–
Between or bounding *sole-occupancy units*—				
Loadbearing	60/ 60/ 60	120/–/–	180/–/–	240/–/–
Non-*loadbearing*	–/ 60/ 60	–/–/–	–/–/–	–/–/–
OTHER LOADBEARING INTERNAL WALLS				
and COLUMNS—	60/–/–	120/–/–	180/–/–	240/–/–

ROOFS	–/–/–	–/–/–	–/–/–	–/–/–

APPENDIX 7

Sustainability Report and Green Star Score Card

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Plasser Australia Warehouse Extension

Sustainability Report

PREPARED BY:
Northrop Consulting Engineers
Level 1, Grafton Bond Store
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SYDNEY NSW 2000

PREPARED FOR:
Rider Levett Bucknall
Level 5
41 Maclean Street
NORTH SYDNEY NSW 2060

Date: 14th August 2014

REVISIONS SCHEDULE

Date	Rev. No.	Amendments
14/08/14	Draft	

Report Author:

Suzanna Remmerswaal

Sustainability Engineer

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1 INTRODUCTION

This report forms a response to the Penrith City Council Development Control Plan (DCP) Section D4 Industrial Development, Item 4.4 Building Design C Controls, Clause a) and supports the Development Application for the proposed $6.5 million Warehouse Extension at Plasser crescent, St Marys NSW. This report identifies the proposed sustainable design objectives and is supported by the Green Star Scorecard.

Northrop Sustainability has been engaged to provide sustainability services for the Warehouse Extension through the concept and detailed design.

2 PROJECT DESCRIPTION

The Plasser Australia Warehouse Extension is part of the existing Plasser Australia industrial facility. The extension includes a workshop building and adjacent covered roof area. The new workshop is required to continue the servicing of existing machines used by Plasser Australia and is not being used for manufacturing. The workshop includes a small office and toilet facilities and is otherwise general workshop. There are currently 129 staff members at Plasser Australia, and the warehouse extension may result in the engagement of 2-4 new staff. The existing outdoor furniture is being replaced as part of the works and no additional car parking is being provided. New motorcycle parking is being provided as part of the works. Existing amenities in the Plasser Australia facility include showers, lockers and change rooms, and a factory lunchroom.

3 VISION

Plasser Australia is committed to incorporating sustainable design initiatives into the Warehouse Extension in line with what is required for a 4 star Green Star Industrial Design rating.

The inclusion of sustainable design initiatives required to target a 4 star Green Star Industrial Design rating demonstrates Australian Best practice in in reducing the environmental impact of the development during design and construction. The target requires the implementation of a broad range of sustainable design initiatives addressing all aspects of the environmental impact of the development, including management, indoor environment quality, energy, water, transport, materials, emissions, ecology, and innovation. Points are awarded for each category in accordance with the Green Star Industrial Technical Manual. 45 points are required to achieve a 4 star Green Star rating.

This report identifies the proposed sustainable design objectives and is supported by the Green Star Scorecard. The Green Star Scorecard summarises the proposed method of addressing the Green Star Industrial requirements and include sustainable design objectives relating to 45 points. This document is a moving document through the design development of the Plasser Australia Warehouse Extension. Targeted points may change throughout the detailed design and construction."

Figure 1. Sustainability Vision for the Warehouse Extension)

4 SUSTAINABILITY OBJECTIVES

The proposed environmental objectives fall under nine (9) categories in accordance with the Green Star Industrial .rating tool. These objectives capture the sustainability principles and the sustainable design initiatives identified in the Green Star Scorecard address these objectives. The objectives and initiatives have been reviewed by the project team, and a cost/benefit analysis has been undertaken.

Management	• Include environmental principles from project inception through the design and construction phases to commissioning, tuning and operation of the building.
Emissions	• Impacts from the buidling's emissions are minimes, including light pollution, legionella, ozone depletion. • All stormwater discharged from site is treated to meet pollution reduction targets.
Ecology	• Biodiversity of the site is maintained following development.
Indoor Environment Quality	• Enhance the comfort and well being of building occupants through the provision of building attributes which contribute to a high quality indoor environment.
Energy and Greenhouse Gas Emissions	• Reduce greenhouse gas emisions through the reduction of operational energy cosnumption.
Transport	• Encourage mass and active transport to reduce the greenhouse gas emsisions associated with transport.
Water	• Reduce the building's predicted potable water consumption through strategies such as rainwater reuse, and water efficient fixtures and fittings.
Materials	• Encourage the use of materials with a reduecd environmental impact and embodied energy, incllduing dematerialisation and sourcing of concrete, steel and PVC.
Innovation	• Increase environmental awareness of building users.

5 PROJECT MILESTONES

The following project milestones and timeline have been identified for implementing the proposed sustainable design objectives.

Review and Workshop

- Review of the Green Star Industrial Rating Tool and potential sustainable design initiatives
- Workshop with proposed approach and cost / benefits with the project team to determine how objectives can be met.

Concept Design

- Issue Sustainability Report and Green Star Scorecard for review and inclusion into the Concept Design.
- Review Concept Design to ensure that the project team's response to the objectives have been included.

Development Application

- Inclsuion of Sustainability Report and Green Star Scorecard into Development Application.

Detailed Design

- Review detailed design documentation and advise on on incorporation of sustainable design initiatives in line with the Green Star Scorecard..

Detailed Design Review

- Review detailed design and report on inclusion of sustainable design initiatives in line with the Green Star Scorecard.

6 SUSTAINABILITY BENCHMARKING TOOLS

6.1 Green Star – Buildings and Communities

Green Star is a comprehensive, national, voluntary environmental rating system that evaluates the environmental design and construction of buildings. A Green Star certification has largely become a representation of market leadership in both the areas of environmental design and premier building and urban environment design. The Green Star framework currently rates buildings at the design, construction and performance stages and is administered by the Green Building Council of Australia (GBCA). Communities can also be rated at a development wide level under the Green Star – Communities Rating Tool. Buildings and communities can achieve 4 star 'Australian Best Practice', 5 star 'Australian Excellence' or 6 star 'World Leadership' certifications. Green Star is effective in clearly branding a development as a market leader.

greenstar

Figure 2. Melton Library and Learning Hub, Green Star Public Building Pilot 5 Star Design

6.2 Green Star – Industrial

The Warehouse Extension is eligible for rating under the Green Star Industrial – Building Extension Rating Tool, and will be eligible under the Green Star Design and As Built 2014 Rating Tool (to be released October 2014). A certified rating is not targeted; however the Green Star Industrial and Green Star Design and As Built 2014 Rating Tools are able to guide our inclusion of sustainable design initiatives.

APPENDIX A: GREEN STAR SCORECARD

Plasser Australia Warehouse Extension - Green Star Industrial Design Scorecard

Version: 003 | Date: 19/08/2014 | Green Star Industrial | Prepared by: SR
Definitions: The Gross Floor Area (GFA) is approximately 1,500sqm with an adjacent covered outdoor area.
The Occupied Space includes a small office in the warehouse extension and will be 15-20sqm (less than 500sqm and less than 2.5% of the GFA).

Credit	Available Points	Targeted Points	Credit Criteria	Project Approach	Costs	Suggested Evidence	Provisional Costs for Evidence
Management							
Man-1 Green Star Accredited Professional (August 2011)	2	2	A Green Star Accredited Professional (GSAP) has been contractually engaged to advise on all features and stages of the Green Star Certification process; and, provide environmental design advice based on Green Star from the schematic design phase through to construction completion.	A GSAP has been engaged from concept design through to detailed design to provide environmental design advice.	$6,000	-Evidence of engagement.	-
Man-2 Commissioning - Clauses	2	2	Comprehensive pre-commissioning, commissioning, and quality monitoring are contractually required to be performed for all building services (electrical and hydraulic); and The works outlined above are done in accordance with the CIBSE Commissioning Codes. Additionally, a design intent report is developed; training of building management staff is provided; and, the design team and contractor transfer the project knowledge to the project owner/manager.	Note that this applies to the electrical and hydraulic building services only as there is no BMCS, heating, or air conditioning being provided. The project needs to address this by including commissioning in accordance with the CIBSE commissioning codes in the ventilation, electrical and hydraulic building services tender documentation. "Comprehensive pre-commissioning, commissioning, and quality monitoring" is considered to include at a minimum: pre-commissioning including review of design in accordance with the CIBSE codes; functional/commissioning testing at installation; seasonal testing; recording of test results; and recording of changes made to the building services as a result of the testing and design review. Given the level of services provided, it is not anticipated that undertaking this will be intensive. The design intent report is to be a compilation of the final design briefs, and a training plan for buildings staff should be prepared by Plasser Australia. Tender documentation should include requirements for the contractor and project team to provide Plasser with as built drawings and commissioning results.	None anticipated.	- Evidence of inclusion of commissioning requirements in tender documentation. - Evidence of requirement for the project team to provide as built drawings and commissioning results. - Training Plan.	-
Man-3 Building Tuning	1	1	One point is awarded where: - All building systems are tuned during a 12 month period after handover; - A building tuning report on the outcomes of the tuning is provided to the building owners.	Building tuning applies to building services such as: electrical, lighting and hot water. The tuning of the building systems must include: - Monthly monitoring with quarterly reports to Plasser Australia; - Verification that systems are performing as designed in all variations of climate and occupancy; - optimisation of time schedules to match occupant needs and system performance; - aligning of the operation of systems to the built space they serve. At the end of 12 months, the building tuning results should be reviewed and all systems should incorporate modifications to improve performance.	None anticipated.	- Evidence of inclusion of commissioning requirements in tender documentation.	-
Man-4 Independent Commissioning Agent	1	0	One point is awarded where an Independent Commissioning Agent (ICA) advises, monitors and verifies the commissioning of the nominated building systems throughout the tender, construction and commissioning phases.	This requires the engagement of an additional party. As an owner operator, Plasser's involvement in commissioning and tuning results in a high standard of commissioning and tuning. Not currently targeted.	Not currently targeted.	-	-
Man-5 Building Users' Guide	1	1	One point is awarded where a simple and easy to use Building Users' Guide (BUG), which includes information relevant to the building users, occupants and tenants representatives, is developed and made available to the building owner.	Plasser to provide a building users guide based on the information provided in the project design briefs. BUG to include sections on: energy and environmental strategy; monitoring and targeting; buildings services; transport facilities; materials and waste; and expansion / re-fit considerations. Plasser are the sole tenant and owner operator.	None anticipated.	- Draft building users guide.	-

Plasser Australia Warehouse Extension - Green Star Industrial Design Scorecard

Version: 003 | Date: 19/08/2014 | Green Star Industrial | Prepared by: SR
Definitions: The Gross Floor Area (GFA) is approximately 1,500sqm with an adjacent covered outdoor area.
The Occupied Space includes a small office in the warehouse extension and will be 15-20sqm (less than 500sqm and less than 2.5% of the GFA).

Credit	Available Points	Targeted Points	Credit Criteria	Project Approach	Costs	Suggested Evidence	Provisional Costs for Evidence
Man-6 Environmental Management	3	3	The contractor implements a comprehensive, project-specific Environmental Management Plan (EMP) for the works in accordance with Section 3 of the NSW Environmental Management System Guidelines 2009. The EMP includes provisions for construction Indoor Air Quality (IAQ) for the works that meets or exceeds the recommended control measures of Chapters 3 and 4 of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2008. The contractor has a valid ISO 14001 Environmental Management System (EMS) accreditation prior to and throughout construction.	Most contractors hold ISO14001 certification. The provision of an EMP is a requirement of compliance with ISO14001 and should be generated by the contractor as a matter of course. Provisions in accordance with the SMACNA IAQ Guidelines are an additional requirement and address noise, pollution and indoor air quality during construction. Appointment of contractors may be slightly limited by the selection of those who are able to comply with these requirements.	None anticipated.	- Evidence of inclusion of requirements for an EMP including provisions relating to the SMACNA Guidelines, and ISO14001 certification in tender documentation.	-
Man-7 Waste Management	2	2	Up to two points are awarded where: - One point where 60% of demolition and construction waste to be reused or recycled. - Two points where 90% of demolition and construction waste to be reused or recycled.	Requirements for 90% of demolition and construction waste to be reused or recycled to be included in contractual documentation. This is a fairly typical industry requirement, and no cost would be anticipated from the contractor. It is acceptable to have a waste collection system where mixed waste is separated for reuse and recycling at the waste facility rather than separation onsite.	None anticipated.	- Evidence of inclusion of waste reuse and recycling requirements in tender documentation.	-
Man-16 Metering	3	3	Water meters: One point is awarded where water meters with the capacity to collect, record and monitor water consumption data are installed for all major water uses of the building. Electricity meters: Up to two points are awarded as follows: - One point is awarded where electricity meters with the capacity to collect, record and monitor electricity consumption data provided for all electricity uses greater than 100kVA. - An additional point is awarded where electricity meters with the capacity to collect, record and monitor electricity consumption data provided separately for lighting and separately for power for each primary function space.	This will require 1-2 additional water meters for bathrooms, irrigation/rainwater supply and up to 5 additional electrical meters for uses greater than 100kVA, such as metering of the cranes. Machinery such as welding machines which for functional reasons are only used when on and do not have energy use associated with a standby mode or similar are not appropriate to meter. Plasser Australia to advise what other machines have electricity uses greater than 100kVA. Separate metering of lighting and power has already been allowed for in the design.	$5-6,000 for additional meters. It is anticipated that there will be a significant amount of pay back associated with these meters as it will enable facilities management to address water leaks, or inefficient operation or performance of electrical items.	- Evidence of meters provided in tender documentation.	-
Sub-total	**15**	**14**					
Indoor							
IEQ-1 Ventilation Rates	NA	NA	Naturally Ventilated Spaces: 95% of the nominated area is naturally ventilated in accordance with AS1668.2-2002. Minimising Outdoor Air Pollutants: The entry of outdoor pollutants through the ventilation system must be minimised by: - Locating the outdoor air intakes (including doors and windows used for natural ventilation) such that the shortest distance from the intake to any specific potential outdoor contaminant source is in accordance with ASHRAE Standard 62.1-2007, Section 5, Table 5-1; and - Designing the outdoor air intakes in accordance with ASHRAE Standard 62.1-2007, Section 5.6 (including all sub-clauses). Where the Occupied Space is less than 2.5% of the GLA, or less than 500m2 (whichever is smaller), this point is 'Not Applicable'.	The building is being naturally ventilated in accordance with Australian Standard 1668.2-2002. We anticipate that complying with the outdoor air pollutants requirement pertaining to ASHRAE 62.1 can be achieved with no significant cost implications. Due to the small size of the occupied space, this credit is technically Not Applicable. At this stage however, the project is targeting compliance with IEQ-1 for 100% of the GFA, as rewarded under IEQ-23.	NA	- Tender documentation demonstrating design compliance, such as tender drawings and a statement from the designer.	-

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Credit	Available Points	Targeted Points	Credit Criteria	Project Approach	Costs	Suggested Evidence	Provisional Costs for Evidence
IEQ-2 Air Change Effectiveness	NA	NA	Naturally Ventilated Spaces: - The project is located in BCA climate zones 1,2,3,4,5 or 6; - The total size of the effective ventilation openings is at least 10% of the internal floor area of the space, with a total minimum size of 1m2 - Doors are not considered ventilation openings; - All spaces are fitted with low and a high ventilation openings totalling at least 2% of the internal floor area each; - The high ventilation opening is located 1.8m above FFL. - There must be a difference of at least 1.5m between the high and low ventilation openings. There is no minimum height requirement for the low opening; - The maximum distance from a wall perpendicular to a ventilation opening is less than 2m; - The maximum distance between multiple openings along one façade is less than 2m; - The ventilation openings are weather protected from rain both horizontally and vertically; - All walls will include ventilation openings. - The inlets and outlets must be located in the same space. Where the Occupied Space is less than 2.5% of the GLA, or less than 500m2 (whichever is smaller), this point is 'Not Applicable'.	The building is being naturally ventilated in accordance with Australian standard 1668.2-2002. Due to the small size of the occupied space, this credit is technically Not Applicable. At this stage however, the project is targeting compliance with these elements, apart from the following: - The maximum distance between multiple openings along one façade is less than 2m - this is being considered, however is unlikely to be pursued due to potential structural and aesthetic impact.	NA	- Tender documentation demonstrating design compliance, such as tender drawings and a statement from the designer.	No costs anticipated at this stage.
IEQ-3 Indoor Pollutant Monitoring & Control	NA	NA	The Occupied Space is 'Naturally Ventilated' as per IEQ-1 'Ventilation Rates', and ventilation rates are directly controlled by occupants. Where the Occupied Space is less than 2.5% of the GLA, or less than 500m2 (whichever is smaller), this point is 'Not Applicable'.	This credit is not applicable and is currently not targeted. Plasser to confirm if they wish to target occupant control.	NA	-	-
IEQ-4 Daylight	3	2	Up to three points are awarded where the percentage of the GLA as stated below has: - A daylight factor (DF) of at least 2.0% at finished floor level (FFL) under a uniform design sky; - A daylight illuminance factor of at least 160Lux based on an annual dynamic simulation model, for 80% of the standard occupied hours (Daylight Autonomy). In both cases the points are awarded as follows: - One point for 30% of the GLA; - Two points for >60% of the GLA; - Three points for more than 90% of the GLA. (excepting rooms that, for functional reasons, require the exclusion of daylight).	Hand calculations to be undertaken to determine the Daylight Factor of the space. Significant daylight provided through translucent elements in the walls and floor. Plasser to confirm if there are any spaces which require the exclusion of daylight for functional reasons.	-	- Tender documentation demonstrating design compliance, such as tender drawings and window schedule and a statement from the GSAP.	Allowed for in GSAP scope.

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Credit	Available Points	Targeted Points	Credit Criteria	Project Approach	Costs	Suggested Evidence	Provisional Costs for Evidence
IEQ-5 Thermal Comfort	1	0	One point is awarded where for 95% of the industrial space, the internal temperatures for 98% of the year are within 80% of Acceptability Limit 1 of ASHRAE 55-200. Thermal Comfort - Occupied Space - Not applicable. Thermal Comfort - Occupant Individual Comfort Control - Not applicable.	Demonstrating compliance with this credit requires additional thermal comfort building energy simulation. Not currently targeted. Plasser to confirm if they wish to pursue this credit.	Not currently targeted.		-
IEQ-6 Hazardous Materials	NA	NA	For new developments or developments in which none of the above hazardous materials were found, this credit is 'Not Applicable' and is excluded from the points available used to calculate the Indoor Environment Quality Category score.	This credit is not applicable and is currently not targeted.	NA	-	-
IEQ-7 Internal Noise Levels	2	2	Two points are available as follows: - One point is awarded where 95% of the GLA is designed to comply with Table 1 of AS/NZS 2107:2000, as follows: The design sound level is no more than the 'Satisfactory' –+ 3dB recommended design sound level; and The reverberation time shall be less than the higher 'Recommended Reverberation –Time'. -An additional point is awarded where the sound insulation between acoustically sensitive rooms and the 'Industrial Space' complies with Dw + LAeq,T > 75. Acoustically sensitive rooms are defined as meeting rooms, private offices, boardrooms, laboratories, video conferencing rooms, and any other enclosed room where acoustic privacy is required. Where a general office space is next to an industrial process, the project must demonstrate that no additional acoustic separation is required beyond that provided to maintain background noise levels at the appropriate levels.	The background noise level should be less than 70dB(A) to allow for conversation. Any ventilation plant serving the workshop should comply without treatment, but that should be confirmed at CC once plant is selected. The volume of the workshop is such that the reverberation time would be suitable without additional treatment. The office and toilet partition performance would need to be Dw > 25 – which is achievable with plasterboard/fibre cement wall partitions (i.e. stud with lining both sides), but the bathroom would need a solid core timber door and to be installed with gaps minimised.	No significant costs anticipated.	- Short report from the acoustics consultant confirming the tender design achieves the requirements.	TBC by Acoustic Logic.
IEQ-8 Volatile Organic Compounds	2	2	At least 95% of all internally applied paint products meet the Total Volatile Organic Compound (TVOC) Content Limits outlined in Table IEQ-8.1 or where no paint is used in the project. At least 95% of all internally applied adhesive and sealant products meet the Total Volatile Organic Compound (TVOC) Content Limits outlined in Table IEQ-8.2 or where no adhesives or sealants are used. At least 95% of all floor coverings meet the Total Volatile Organic Compound (TVOC) Content limits outlined in Table IEQ-8.3. Where no floor coverings have been installed, this point is not applicable.	All paints, adhesives and sealants to comply. No floor coverings applied in the project.	No additional cost anticipated.	- Requirements for compliant products included in tender specifications.	-
IEQ-9 Formaldehyde Minimisation	1	1	One point is awarded where 95% of all engineered wood products (including exposed and concealed applications) either have low formaldehyde emissions, see Table IEQ-9.1, or contain no formaldehyde.	All engineered wood products to comply (e.g. toilet partitions). Architect to advise on what engineered wood products likely to be included in the project.	No additional cost anticipated.	- Requirements for compliant products included in tender specifications.	-

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Credit	Available Points	Targeted Points	Credit Criteria	Project Approach	Costs	Suggested Evidence	Provisional Costs for Evidence
IEQ-11 Daylight Glare Control	1	0	One point is awarded where glare from sunlight form all viewing facades across the GLA is reduced through a combination of blinds, screens, fixed devices, or other means (excepting rooms that, for functional reasons, require the exclusion of daylight).	Glare from sunlight form all viewing facades across the GLA is reduced through a combination of blinds, screens, fixed devices, or other means. Additional cost for automated blinds. Payback period cannot be determined due to intangible benefits to occupants but may include improved indoor environment quality, and occupant productivity. Not currently targeted.	Not currently targeted.	-	-
IEQ-13 Electric Lighting Levels	1	1	One point is awarded where for 95% of the GLA, the lighting system is flicker free and has a maintained illuminance of no more than 25% above those recommended in: - For industrial tasks and processes: Table E1 of AS1680.2.4 - For circulation and for other general areas Table D1 AS1680.2.1 - For workspaces and other activities not covered by the above, Table 3.1 of AS1680.1. (excluding rooms that, for functional reasons, have specific lighting requirements).	Design allows for compliance with these parameters.	No additional cost anticipated.	- Tender documentation demonstrating design compliance, such as tender drawings and a statement from the designer.	-
IEQ-14 External Views	NA	NA	Up to two points are awarded where 60% (one point) or 80% (two points) of the occupied space has a direct line of sight to the outdoors. Where the Occupied Space is less than 2.5% of the GLA, or less than 500m2 (whichever is smaller), this credit is 'Not Applicable' and is excluded from the points available used to calculate the Indoor Environment Quality Category score.	Recommend that Occupied Space is located such that external views are achieved. Due to the small size of the occupied space, this credit is technically Not Applicable. At this stage however, the project is targeting compliance with IEQ-14 for the Occupied Space, as rewarded under IEQ-23.	NA	- Tender documentation demonstrating design compliance, such as tender drawings and a statement from the designer.	-
IEQ-17 Air Distribution System	NA	NA	All new and existing ductwork has access provided to both sides of all moisture and debris generating components including cooling coils, heating coils, humidifiers and filters for maintenance (see Diagram IEQ-17.1); and All new and existing ductwork is clean, or has been cleaned in accordance with the National Air Duct Cleaners Association ACR 2006 Standard; Where the space is 'Naturally Ventilated' as per IEQ-1 'Ventilation Rates', this credit is 'Not Applicable' and is excluded from the points available used to calculate the Indoor Environment Quality Category score.	Recommend that all ductwork is provided new. Due to the small size of the occupied space, this credit is technically Not Applicable. At this stage however, the project is targeting compliance with IEQ-17 for the Occupied Space, as rewarded under IEQ-23.	NA	- Tender documentation demonstrating design compliance, such as tender drawings and a statement from the designer.	-

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Credit	Available Points	Targeted Points	Credit Criteria	Project Approach	Costs	Suggested Evidence	Provisional Costs for Evidence
IEQ-19 Breakout Space	2	2	Two points are awarded where it is demonstrated that at least one breakout space (space) is provided in accordance with all of the following: The combined area is equivalent to at least 1% of the GLA, or where the occupancy rate is known, 2m2 per person, with a minimum of 40m2 per space; - Each space is designed to be universally accessible, well lit, well ventilated, non smoking and is located to avoid noise, odour and air pollution; Where the space is outdoors, it must provide: - Shading to at least 50% of the portion that is outdoor; –Screening from prevailing winds that have a frequency equal to or greater than 10% –annually; and A minimum area of 30% of the space is soft landscaping. Where the space is indoors it must also be shown that: - At least 30% of the space has a Daylight Factor (DF) of at least 2.0% or Daylight –Illuminance (DI) of 200 lux; and - At least one large plant (300mm pot) or two small plants (150mm) per every 15m–2 are provided throughout the space.	Plasser to confirm the attributes of the breakout spaces provided within the facility including the lunchroom and outdoor areas. Additional urban design elements are required to gain compliance for outdoor areas.	Additional costs to provide shading and screening for the outdoor breakout area.	- Statement from Plasser Australia.	-
IEQ-23 Small Occupied Spaces	2	1.1	Up to two points are awarded as follows: One point is awarded for every three initiatives achieved from the following list of credits: - IEQ-1 'Ventilation Rates' (Natural Ventilation); – IEQ-2 'Air Change Effectiveness'; –IEQ-3 'Indoor Pollutant Monitoring and Control'; –IEQ-5 'Thermal Comfort' (Occupied Space Criteria); –IEQ-5 'Thermal Comfort' (Individual Comfort Control Criteria); –IEQ-7 'Internal Noise Levels'; or –IEQ-14 'External Views' (60% nominated area). The nominated area for this credit is 'Occupied Space'.	As described, design allows for compliance with IEQ-1, IEQ-2, IEQ-7 and IEQ-14.	No additional cost anticipated.	- As described for IEQ-1, IEQ-2, IEQ-7 and IEQ-14.	-
Sub-total	**15**	**11.1**					

NORTHROP

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Credit	Available Points	Targeted Points	Credit Criteria	Project Approach	Costs	Suggested Evidence	Provisional Costs for Evidence
Energy							
Ene Conditional Requirement	Cond	Yes	To meet the conditional requirement; the project's predicted greenhouse gas emissions must be equal to, or show an improvement over, the predicted greenhouse gas emissions of the 'Benchmark Building' as determined by the Greenhouse Gas Emissions Calculator. The Benchmark Building is a 10% improvement on the Reference building.	Ventilation systems must make a 10% improvement to the BCA benchmark. Lighting systems must make a 10% improvement to the BCA benchmark in accordance with Appendix A, recommend the inclusion of motion sensors and lighting zoning <100sqm. In addition to the natural ventilation strategy, we are proposing a number of passive systems including: - External shading especially to the West to limit solar gain in the summer. - Natural ventilation with low level intakes and high-level ventilation, incorporating the use of thermal sinks (black/dark materials at roof level outtakes). - Operable glazed louvers with a high Solar Heat Gain Coefficient (SHGC) and a low U Value on the North and West. - Insulation of surfaces with low thermal mass, i.e. metal surfaces on the facade Prevents heat gain from the sun during summer and heat loss in winter. - High thermal mass building materials for sun facing facades, such as polished concrete floors on then or the and West. These can act as a heat sink in the summer, absorbing incident heat and rejecting it at night in cooler conditions. - Operable shading: Limit solar heat gain through facades during summer, but operable to maximise solar gains in winter. No points under ENE-1 are currently targeted.	None anticipated.	- Tender documentation demonstrating design compliance, such as tender drawings and a statement from the designer.	-
Ene-1 Greenhouse Gas Emissions	20	0	Up to 20 points are awarded where it is demonstrated that the building's predicted greenhouse gas have been reduced below that of the Benchmark Building (e.g. 5% improvement = 1 point, which equates to a 10% improvement on the BCA Section J Energy Efficiency minimum requirements).				
Ene-3 Peak Energy Demand Reduction (December 2013)	2	0	Up to two points are awarded where it is demonstrated that the building has reduced its peak energy demand load on the electrical infrastructure as follows: One point where: - Peak energy demand is actively reduced by 15%; – Or A flatter demand curve is achieved, i.e. the difference between the peak and average demand does not exceed 40%. Two points where: - Peak energy demand is actively reduced by 30%; – Or A flatter demand curve is achieved, i.e. the difference between the peak and average demand does not exceed 20%.	Where the Peak energy demand is likely to occur during 8am and 4pm, photovoltaic panels can contribute to reducing the peak load. Not currently targeted.	Photovoltaic System - Grid connected 99kW 450sqm PV panels (including rebates) $130-160,000 Payback period approx. 4-6 years - Grid connected 14kW 60sqm PV panels (including rebates) $50-70,000	-	-
Sub-total	**22**	**0**					
Transport							
Tra-1 Provision of Car Parking	1	1	For one point: The number of car parking spaces does not exceed the minimum local parking allowance by more than 10%. For two points: The number of car parking spaces does not exceed the minimum local parking allowance.	No additional car parking spaces are included in the warehouse extension.	None.	- Tender documentation demonstrating design compliance, such as tender drawings.	
Tra-2 Fuel-Efficient Transport	1	1	One point is awarded where 25% of the total parking paces are designed and labelled as parking for small cars or as parking for motorcycles, at least 10% of the total parking spaces are designed and labelled as parking for small cars, and at least 80% of the parking spaces for small cars and motorcycles are preferred parking spaces.	Additional motor cycle spaces are being included as part of the warehouse extension works. No additional car parking spaces are included in the warehouse extension.	Cost of motor cycle spaces / line marking.	- Tender documentation demonstrating design compliance, such as tender drawings.	

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Credit	Available Points	Targeted Points	Credit Criteria	Project Approach	Costs	Suggested Evidence	Provisional Costs for Evidence
Tra-3 Cyclist Facilities	2	1	For one point, cyclist facilities for 5% of the building occupants is provided. For two points, cyclist facilities for 10% of the building occupants is provided. Additionally, at least one continuous bicycle path from the building entrance to the area(s) bicycle parking spaces are located is provided, and at least five visitor bicycle parking spaces are provided.	The provision of 7 cycle spaces is required to achieve one point. Shower facilities and lockers are already provided.	Provision of a facility for secure bicycle storage within the facility.	- Tender documentation demonstrating design compliance, such as tender drawings.	
Tra-4 Commuting Mass Transport	5	3	Up to five points are awarded based on the number and quality of commuting mass transport options available to building users, as determined by the Green Star Commuting Mass Transport Calculator.	Rail line: 1.0km to St Marys Station (T1 Western Line) Bus lines: 782, S11, 745, 759, 758, 835, 774 within 600m.	None.	- Tender documentation demonstrating design compliance, such as tender drawings.	
Tra-6 Trip Reduction - Mixed Use	2	2	One point is awarded where at least two amenities are within 1000m walking distance of the main building. Two points are awarded where at least five amenities are within 1000m walking distance of the main building.	200m: Mulfric Foods, Penrith City Rewinds 400m: Poplar Park 600m: Oxley Park Take Away, BJ's Sydney St Takeaway Café 800m: Mary's Tiny Tots Preschool.	None.	- Tender documentation demonstrating design compliance, such as tender drawings.	
Sub-total	**11**	**8**					
Water							
Wat-1 Occupant Amenity Water	5	5	The building's predicted potable water consumption has been reduced below that of the 'Benchmark Building'.	This is achieved through the inclusion of highest WELS rated fixtures and fittings and the rainwater tank as required by council.	None anticipated.	- Tender documentation demonstrating design compliance, such as tender drawings and a fixtures and fittings schedule.	
Wat-3 Landscape Irrigation	1	1	Potable water consumption for landscape irrigation has been reduced by 90%.	This is achieved through the inclusion of the rainwater tank as required by council. The council's requirement is to satisfy a minimum of 80% of the landscaping irrigation demand. Rainwater tank is sized at 55kL to meet 90% of demand in accordance with Green Star requirements.	None.	- Tender documentation demonstrating design compliance, such as tender drawings and a water balance model.	
Wat-4 Heat Rejection Water	NA	NA	One point is awarded where potable water consumption of water based heat rejection systems is reduced by 50%. Two points are awarded where potable water consumption of water based heat rejection systems is reduced by 90%, or there are no water based heat rejection systems.	There are no water based heat rejection systems proposed for the project.	NA	-	

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Credit	Available Points	Targeted Points	Credit Criteria	Project Approach	Costs	Suggested Evidence	Provisional Costs for Evidence
Wat-5 Fire System Water Consumption	NA	NA	There is sufficient temporary storage for a minimum of 80% of the water used for routine testing of the fire protection system for re-use on-site; and each floor is fitted with a sprinkler system that has isolation valves or shut-off points for localised drain-down; OR The fire protection system does not expel water for testing. Where no sprinkler system is present, this credit is not applicable.	There are no sprinkler systems present in the project.	NA	-	
Sub-total	**6**	**6**					
Materials							
Mat-1 Recycling Waste Storage	2	2	Two points are awarded where dedicated storage area(s) for the separation and collection of recyclable waste is provided and it is adequately sized to handle the recyclable waste arising from the occupied space and process waste, and is sufficiently sized to accommodate the storage equipment for the following recyclables as a minimum: cardboard; glass; plastics - mixed containers; plastics - soft plastics; plastics - polystyrene; metals; and, where kitchens are present, used cooking oil and organic compost material.	Plasser to confirm if the space can be provided in the warehouse or is already provided in the existing facility.	No additional cost anticipated.	- Tender documentation demonstrating design compliance, such as tender drawings.	
Mat-2 Building Reuse	6	0	Up to 90% of the total existing facade or 60% of the major structure of the building by vertical area or gross building volume respectively is reused.	No reuse proposed.	Not targeted.		
Mat-3 Recycled Content & Re-used Products and Materials	2	0	Materials selected for base building construction or integrated fitout works which have a post-consumer recycled content of at least 50% (by mass) or are recycled and/or reused products and materials, represent at least 0.5% of the project's total contract value.	We understand that there are some recycled materials proposed, however less than 0.5% of the project's contract value.	Not targeted.		
Mat-4 Concrete (July 2012)	1	1	Reduction of Portland cement by 30% measured by mass across all concrete used in the project compared to the Green Star reference case.	This is common practice in the industry. Targeting this credit reduces the embodied energy in the building.	Sourcing compliant concrete can have some additional costs.	- Tender documentation demonstrating design compliance, such as tender specifications for green concrete.	
Mat-5 Steel	2	1	All structural and reinforcing steel to be manufactured by a responsible steel maker, and where reinforcing steel comprises 60% or more of the total steel used in the structure of the building: at least 95% or reinforcing bar and mesh must meet or exceed a 500 MPa strength grade; at least 60% must be produced using energy reducing processes in its manufacture; and, at least 15% by mass of all reinforcing steel is assembled using off site optimal fabrication techniques.	This is common practice in the industry.	No additional cost anticipated.	- Tender documentation demonstrating design compliance, such as tender specifications for compliant steel.	
Mat-6 PVC	2	2	At least 60% of the common uses of PVC products in buildings by cost must meet Best Practice Guidelines for PVC in the Built Environment.	This is common practice in the industry.	No additional cost anticipated.	- Tender documentation demonstrating design compliance, such as tender specifications for compliant PVC.	

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Credit	Available Points	Targeted Points	Credit Criteria	Project Approach	Costs	Suggested Evidence	Provisional Costs for Evidence
Mat-7 Timber	1	1	95% (by cost) of all timber used in the building and construction works is certified under FSC International and/or PEFC accredited certifications schemes or is from a reused source; or is sourced from a combination of both.	High costs associated with targeting this credit.	Not targeted.		
Mat-9 Dematerialisation	1	1	Cladding: At least 25% of the roof or facade cladding area has a dual function (e.g. roof garden substrate, photovoltaic shingles or facade panels). Finishes: At least 95% of all occupied space floor material is exposed structure with no covering (e.g. exposed sealed concrete floor); or, At least 95% of all occupied space ceiling is exposed structure and services (e.g. exposed concrete ceiling). Ductwork: The occupied space of the building is fully naturally ventilated. Structure: At least 50% of the GFA is framed in structural steel and it is demonstrated that the building's structural requirements and integrity have been achieved using at least 10% less steel by mass than in a structure with conventional framing, without changing the load path to other structural components. Piping: No water supply piping is used for flushing in the urinals or toilets (i.e. all urinals or toilets are water free), or mass of underground piping is reduced by at least 25% for the same functional requirement and material.	This can be achieved through finishes and ductwork. Dual function photovoltaic roof cladding has also been considered, but is not being included at this stage.	No additional cost anticipated for exposed floors, ceiling and natural ventilation of occupied space.	- Tender documentation demonstrating design compliance, such as tender drawings, or finishes schedule.	
Sub-total	**17**	**8**					
Land Use and							
Eco Conditional Requirement (March 2009)	-	-	Site is not located on prime agricultural land, land containing old growth forest, or within 100m of a wetland listed as being of 'high ecological value'.	Site is not located on prime agricultural land, land containing old growth forest, or within 100m of a wetland listed as being of 'high ecological value'.	None.	-Confirmation from the planner or council.	
Eco-1 Topsoil	1	0	One point is awarded where: - No topsoil is removed from the site; - All topsoil affected by the construction works is separated and protected from degradation, erosion or mixing with fill or waste; and, - 95% of all topsoil retains its productivity. This credit is 'Not Applicable' and is excluded from the points available used to calculate the Land Use and Ecology Category Score where: - No topsoil on site was affected by the construction/refurbishment works; or - The topsoil on site is inherently non-productive.	Cost for separation and protection of the topsoil, limitation of storage space onsite.	Not currently targeted.		
Eco-2 Re-use of Land	1	1	One point is awarded where: - The extension boundaries are wholly within an area of the site that was Previously Developed Land; OR - 75% of the site was Previously Developed Land at the time of site purchase.	The site for the warehouse extension is considered to be previously developed land.	None.	- Documentation showing site prior to development.	

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Eco-3 Reclaimed Contaminated Land	NA	NA	The site contained Significant Contamination; and the developer/owner has undertaken remedial steps to decontaminate the site prior to construction. This credit is 'Not Applicable' for projects that are building extensions, and is excluded from the points available used to calculate the Land Use and Ecology Category score.	The warehouse is a building extension.	NA		
Eco-4 Change of Ecological Value	4	1	Any threatened or vulnerable species located onsite are protected, no net reduction of native vegetation, and land use ecology is either improved or not diminished. This is determined by the Green Star - Change of Ecological Value Calculator based on a comparison of the state of the site before and after design/construction.	There are no threatened or vulnerable species located onsite, no net reduction of native vegetation, and land use ecology is not diminished. Strategies to improve the ecological value of the land require significant costs and creation of ecologically valuable landscape.	None.	- Tender documentation demonstrating design compliance, such as tender landscape drawings.	
Sub-total	6	2					
Emissions							
Emi-1 Refrigerant ODP	1	1	All refrigerants used in the project have an Ozone Depleting Potential (ODP) of zero; or, No refrigerants are used in the project.	No refrigerants are used in the project.	None.	Statement confirming that no refrigerants are used in the project.	Allowed for in GSAP scope.
Emi-2 Refrigerant GWP	2	2	One point where 50% of all refrigerants used in the project have a 100-year Global Warming Potential (GWP100) of 10 or less; Two points where: All refrigerants used in the project have a GWP100 of 10 or less; or, No refrigerants are used in the project.	No refrigerants are used in the project.	None.	Statement confirming that no refrigerants are used in the project.	Allowed for in GSAP scope.
Emi-3 Refrigerant Leaks	1	1	The project does not contain any refrigeration machinery.	The project does not contain any refrigeration machinery.	None.	Statement confirming that no refrigeration machinery are used in the project.	Allowed for in GSAP scope.
Emi-4 Insulant ODP	1	1	All thermal insulants have zero ODP in their manufacture and composition.	This is a standard attribute of thermal insulation in the industry.	None.	- Tender documentation demonstrating design compliance, such as tender specification.	
Emi-5 Stormwater (January 2011)	3	2	The post-development peak 2 year Average Recurrence Interval (ARI) event discharge from the site does not exceed the pre-development peak 2 year ARI event discharge; and All stormwater discharged from site meets the Pollution Reduction Targets in Column B of Green Star Table Emi-5.1.	Treatment in accordance with Column B is required by Council. Stormwater pollution reduction targets as follows: o 80% reduction of Total Suspended Solids (TSS); o 90% reduction of gross pollutants; o 45% reduction of total nitrogen (TN); and, o 60% reduction of Total Phosphorous	None.	- Tender documentation demonstrating design compliance, such as tender drawings, stormwater management plan, and specifications of the SQID.	
Emi-6 Discharge to Sewer	5	0	The building outflows to the sewerage system due to building occupants' usage have been reduced through rainwater, greywater or Blackwater reuse to toilets or showers against an average-practice benchmark.	No points are awarded for rainwater reuse to landscape irrigation.	Not currently targeted.		

Plasser Australia Warehouse Extension - Green Star Industrial Design Scorecard

Version: 003 | Date: 19/08/2014 | Green Star Industrial | Prepared by: SR
Definitions: The Gross Floor Area (GFA) is approximately 1,500sqm with an adjacent covered outdoor area.
The Occupied Space includes a small office in the warehouse extension and will be 15-20sqm (less than 500sqm and less than 2.5% of the GFA).

Credit	Available Points	Targeted Points	Credit Criteria	Project Approach	Costs	Suggested Evidence	Provisional Costs for Evidence
Emi-7 Light Pollution	1	1	Two (2) points are awarded where: - The lighting design complies with AS 4282 'Control of the Obtrusive Effects of Outdoor Lighting'; and, either: - Relative to its particular mounting orientation, no external luminaire has an Upward Light Output Ratio that exceeds 5%; or, - Direct illuminance from external luminaries produces a maximum initial point illuminance value no greater than 0.5 Lux to the site boundary and no greater than 0.1 Lux to 4.5 metres beyond the site into the night sky, when modelled using a calculation plane set at the highest point of the building.	Design will comply with AS 4282 and upward light output light ratios.	None.	- Tender documentation demonstrating design compliance, such as tender drawings, specification, statement of compliance from designer.	
Emi-8 Legionella	1	1	There is no water-based heat rejection system(s) serving the building.	There is no water-based heat rejection system(s) serving the building.	None.		
Emi-10 Noise Pollution	1	0	One point is awarded where, when measured outdoors at the property boundary of noise sensitive areas, the contribution from all significant noise sources, including adjustments, is less than the ambient background noise level minus 10dB; or 35 dBLAeq during the day and less than 30dBLAeq at other times.	We have a house opposite the site on Kurrajong Road. Background minus 10dB means that noise from our site cannot be heard at the receiver. Noise from the existing use of the site can be heard at the residential receiver and I predict that noise from the new workshop would also be heard at this receiver. It would be a significant cost to the project to design the new workshop so that its use was not able to be heard at the house opposite.	None.		
Sub-total	**16**	**9**					
Innovation							
Inn-1 Innovative Strategies & Technologies (September 2013)	2	0	Up to two points can be awarded for an innovation initiative which is considered to be: - A technology or process that is considered a 'first' in Australia or the world; or, - The project substantially contributes to the broader market transformation towards sustainable development in Australia or the world.	Plasser to confirm if there are any innovations proposed for the operation of the warehouse.	Not currently targeted.		
Inn-2 Exceeding Green Star Benchmarks (September 2013)	2	0	Up to two points can be awarded for an innovation initiative where there has been a substantial improvement on an existing Green Star credit as follows: - One point for a solution that results in the elimination of the specific negative environmental impact of the project targeted by an existing credit; and, - Two points for a solution that results in substantial (e.g. 5% or greater above neutral) restorative environmental impact targeted by an existing credit.	Plasser to confirm where they wish to pursue exceeding green star benchmarks.	Not currently targeted.		
Inn-3 Environmental Design Initiatives (September 2013)	1	1	One point can be awarded where an initiative in the project viable addresses a valid environmental concern outside of the current scope of this Green Star tool.	A suggested method of innovation could be: Three of the tenancy or building's environmental attributes are displayed in a manner that can be readily understood by users, and reflect an environmental initiative rewarded within a Green Star Credit; One attribute must relate to energy use; One attribute must relate to water use; and, Each attribute must be clearly displayed and the measurable environmental and economic benefits communicated to the casual observer. The environmental data of the energy and water initiatives is clearly and permanently presented and displayed (e.g. through signs).	Cost for provision of display screens and interface between meters and display.	- Tender documentation demonstrating design compliance, such as tender drawings, signs schedule.	
Sub-total	**5**	**1**					

Plasser Australia Warehouse Extension - Green Star Industrial Design Scorecard

Version: 003 | Date: 19/08/2014 | Green Star Industrial | Prepared by: SR

Definitions: The Gross Floor Area (GFA) is approximately 1,500sqm with an adjacent covered outdoor area.

The Occupied Space includes a small office in the warehouse extension and will be 15-20sqm (less than 500sqm and less than 2.5% of the GFA).

Credit	Available Points	Targeted Points	Credit Criteria	Project Approach	Costs	Suggested Evidence	Provisional Costs for Evidence
Total Points (Weighted)	Total Available	**Total Targeted**	4 star Green Star: Requires 45 points with a recommended 10% buffer = 50 points.				
	100.0	54.4					

APPENDIX 8
Environmental site assessment

ENVIRONMENTAL INVESTIGATION SERVICES

REPORT

TO

PLASSER AUSTRALIA PTY LTD

ON

PRELIMINARY STAGE 1 ENVIRONMENTAL SITE ASSESSMENT

FOR

PROPOSED PLASSER RAIL YARD EXTENSION

AT

25 KURRAJONG ROAD, NORTH ST MARYS

1 AUGUST 2014 **REF: E27578KHrpt**

AS/NZS ISO 9001 Certified
Davis Langdon Certification Services

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1 INTRODUCTION

Plasser Australia Pty Ltd ('the client') commissioned Environmental Investigation Services (EIS)[1] to undertake a preliminary Stage 1 Environmental Site Assessment (ESA) for the proposed Plasser rail yard extensions at 25 Kurrajong Road, North St Marys, NSW).

The site location is shown on Figure 1 and the ESA was confined to the site boundaries as shown on Figure 2. The proposed area of the rail yard extensions is referred to as 'the site' in this report. When reference is made to the entire Plasser property it is referred to as the 'Plasser Property' i.e. Lot 1 DP 600899.

The ESA was undertaken generally in accordance with an EIS proposal (Ref: EP8065KH) of 4 June 2014 and written acceptance from the client of 7 July 2014.

A geotechnical investigation was undertaken in conjunction with the ESA by JK Geotechnics[2]. The results of the investigation are presented in a separate report (Ref. 27578ZRrpt, 2014[3]).

1.1 Proposed Development Details

The proposed development includes paving the majority of the site, and erection of a steel framed warehouse for a covered working area and the construction of a new factory building.

1.2 Objectives

The objectives of the ESA are to:

- Assess the potential risk for widespread soil contamination at the site;
- Assess the potential risk to human health and the environment posed by the contaminants; and
- Comment on the suitability of the site for the proposed development/landuse.

1.3 Scope of Work

The scope of work included:

- A review of background information made available to EIS;
- A review of site information and limited site history documents;
- A site inspection to identify areas of environmental concern (AEC);

[1] Environmental consulting division of Jeffery & Katauskas Pty Ltd (J&K)
[2] Geotechnical consulting division of J&K
[3] Referred to as JK 2014 Report

- Preparation of a Preliminary Conceptual Site Model (CSM) to outline the AEC, Potential Contaminants of Concern (PCC) and potential receptors;
- Interpretation of the analytical results against the adopted Site Assessment Criteria (SAC); and
- Preparation of a report presenting the results of the assessment.

The report was prepared with reference to regulations/guidelines outlined in the table below. Individual guidelines are also referenced within the text of the report.

Table 1-1: Guidelines

Guidelines/Regulations/Documents
Contaminated Land Management Amendment Act (2008[4])
State Environmental Planning Policy No.55 – Remediation of Land (1998[5])
Guidelines for Consultants Reporting on Contaminated Sites (2011[6])
Guidelines on the Duty to Report Contamination[7]
Guidelines for the NSW Site Auditor Scheme, 2nd Edition (2006[8])
National Environmental Protection (Assessment of Site Contamination) Amendment Measure (2013[9])
NSW EPA Contaminated Sites Sampling Design Guidelines (1995[10])
NSW DECCW Waste Classification Guidelines - Part 1: Classifying Waste (2009[11])

[4] NSW Government Legislation, (2008), *Contaminated Land Management Amendment Act.* (referred to as CLM Amendment Act 2008)

[5] NSW Government, (1998), *State Environmental Planning Policy No. 55 – Remediation of Land.* (referred to as SEPP55)

[6] NSW Office of Environment and Heritage (OEH), (2011), *Guidelines for Consultants Reporting on Contaminated Sites.* (referred to as Reporting Guidelines 2011)

[7] NSW EPA, (Draft 2011), *Guidelines on the Duty to Report Contamination.* (referred to as Duty to Report Contamination 2011)

[8] NSW DEC, (2006), *Guidelines for the NSW Site Auditor Scheme, 2nd ed.* (referred to as Site Auditor Guidelines 2006)

[9] National Environment Protection Council (NEPC), (2013), *National Environmental Protection (Assessment of Site Contamination) Amendment Measure 2013 (No.1).* (referred to as NEPM 2013)

[10] NSW EPA, (1995), *Contaminated Sites Sampling Design Guidelines.* (referred to as EPA Sampling Design Guidelines 1995)

[11] NSW DECCW, (2009), *Waste Classification Guidelines, Part 1: Classifying Waste.* (referred to as Waste Classification Guidelines 2009)

2 DATA QUALITY ASSESSMENT

2.1 Data Quality Objectives (DQOs)

The DQOs provide a systematic approach for undertaking the assessment and outlines the criteria against which the data can be assessed.

A methodology for establishing the DQOs is presented in the document *Data Quality Objectives Process for Hazardous Waste Site Investigations* (2000[12]). This methodology has been adopted in the NEPM 2013, AS4482.1-2005[13] and the Site Auditor Guidelines 2006. The main steps involved in preparing the DQOs are summarised in the table below:

Table 2-1: DQOs

Step	Input
State the Problem	The presence of contamination may pose a risk to human health and the environment. An ESA is required to assess the potential risk and to comment on the suitability of the site for the proposed development/landuse.
Identify the Decisions	The assessment aims to address the objectives outlined in **Section 1.2.**
Identify Inputs into the Decision	The following inputs will be used to address the decisions: • Review of site information including regional geology, topography, setting, hydrogeology and surface water flow (see **Section** 3); • Review of site history information (see **Section** 4**);** • Undertake a site inspection to identify the AEC (see **Section** 5); • Prepare a preliminary CSM (see **Section** 5**);** • Assessment of analytical data. The DQIs that will be used to assess the analytical data are outlined in **Section** 2.2; and • Compare the analytical results against the SAC outlined in **Section** 6.
Study Boundary	The investigation was confined to the site boundaries as shown in Figure 1.
Develop a Decision Rule	The analytical results will be assessed against the SAC (see **Section** 6**).** The NEPM 2013 recommends using statistical analysis to assess the laboratory data for soil samples against the health based SAC. The data set should be assessed against the following criteria: • The 95% Upper Confidence Limit (UCL) value of the arithmetic mean concentration of each contaminant should be less than the SAC; • The standard deviation (SD) of the results must be less than 50% of the

[12] US EPA, (2000), *Data Quality Objectives Process for Hazardous Waste Site Investigations.* (referred to as US EPA 2000)

[13] Standards Australia, (2005), *Guide to the Investigation and Sampling of sites with Potentially Contaminated Soil.* (referred to as AS 2005)

Step	Input
	SAC; and • No single value exceeds 250% of the relevant SAC.
Specific Limits on Decision Errors	Decision errors are false positive (i.e. stating the site is free of contamination when it is not) or false negative (i.e. stating that the site is contaminated when it is not). The more significant error is the false positive which may result in potential risks to human health and the environment. To account for this, the assessment has assumed that elevated concentrations of contaminants are present in the samples unless demonstrated otherwise.
Optimise the Design for Obtaining Data	The Site Auditor Guidelines 2006 recommend evaluating the data set as a whole to determine any limitations within the data set. The overall data set will be optimised by reviewing the data as the project proceeds. When necessary, adjustments will be made to the sampling or analytical program.

2.2 Data Quality Indicators (DQIs)

The DQIs required to address inputs into the decision include: precision, accuracy, representativeness, completeness and comparability. Reference should be made to the appendices for further information of the DQIs. The DQIs will be addressed as follows:

Table 2.2: DQIs

Indicator	Methods
Completeness	Data and documentation completeness will be achieved by: • Preparation of sampling and analysis plan; • Preparation of chain of custody (COC) records; • Review of the laboratory sample receipt information; • Use of National Association of Testing Authorities (NATA) registered laboratories for all analysis; • Visual, olfactory and PID screening of samples during the investigation; and • Laboratory analysis to target PCC. Any changes to the analytical schedule to be documented.
Comparability	Data comparability will be achieved by: • Maintaining consistency in sampling techniques; • Use of appropriate preservation, storage and transport methods; and • Use of consistent analysis techniques and reporting standards by the laboratories.
Representativeness	Data representativeness will be achieved by: • Sampling from accessible areas of the site; and • Representative coverage of analysis for PCC. Any changes to the analytical schedule to be documented.
Precision	Precision will be achieved by: • Calculating the relative percentage difference (RPD) of duplicate samples; • The following acceptance criteria will be used to assess the RPD

Indicator	Methods
	results: ➢ results > 10 times the practical quantitation limit (PQL), RPDs < 50% are acceptable; ➢ results between 5 and 10 times PQL, RPDs < 75% are acceptable; ➢ results < 5 times PQL, RPDs < 100% are acceptable; and • An explanation is provided if RPD results are outside the acceptance criteria.
Accuracy	Accuracy will be achieved by: • Use of trained and qualified field staff; • Appropriate industry standard sampling equipment and decontamination procedures; • Sampling and screening equipment will be factory calibrated on a regular basis. Calibration will be checked internally prior to use; • Sampling and equipment decontamination; • Collection and analysis of field Quality Assurance (QA) and Quality Control (QC) samples for PCC; • The field QA/QC analysis will include: ➢ 1 of sample as intra-laboratory duplicate; • Appropriate sample preservation, handling, holding time and COC procedure; • Review of the primary laboratory QA/QC data including: RPDs, surrogate recovery, repeat analysis, blanks, laboratory control samples (LCS) and matrix spikes; • The following acceptance criteria will be used to assess the primary laboratory QA/QC results. Non-compliance to be documented: ➢ RPDs: ○ results that are < 5 times the PQL, any RPD is acceptable; and ○ results > 5 times the PQL, RPDs between 0-50% are acceptable; ➢ LCS recovery and matrix spikes: ○ 70-130% recovery acceptable for metals and inorganics; ○ 60-140% recovery acceptable for organics; and ○ 10-140% recovery acceptable for VOCs; ➢ Surrogate spike recovery: ○ 60-140% recovery acceptable for general organics; and ○ 10-140% recovery acceptable for VOCs; ➢ Blanks: All less than PQL; and • Reporting to industry standards.

3 SITE INFORMATION AND PHYSICAL SETTING

3.1 Site Identification

Table 3-1: Site Identification Information

Site Owner:	Plasser Australia PTY Ltd
Site Address:	25 Kurrajong Road, North St Marys
Lot & Deposited Plan:	Part of Lot 1 DP 600899
Local Government Authority:	Penrith City Council
Site Area (m^2):	5000
RL (AHD in m) (approx.):	41
Geographical Location (MGA) (approx.):	N: 6261950 E: 295064
Site Location Plan:	Figure 1
Borehole Location Plan:	Figure 2

3.2 Site Location and Setting

The Plasser property is located to the south of Kurrajong Road and to the east of Plasser Crescent. The site is located in the central section of the Plasser property. The site is located in a predominantly commercial/industrial area of St Marys. The site is located approximately 700m to the west of Ropes Creek.

3.3 Topography

The surrounding regional topography is relatively flat with some minor undulations. The site is characterised by a localised slope that generally falls to the south at approximately 1°.

3.4 Site Inspection

A walkover inspection of the Plasser property and immediate surrounds was undertaken on 14 July 2014. The inspection was limited to accessible areas of the Plasser property and did not include an internal inspection of buildings.

At the time of the inspection, the Plasser property was occupied by Plasser Australia. In the southern and eastern section of the Plasser property was occupied by two large buildings. The buildings were constructed of predominately brick, plastic cladding and sheet metal. The larger building located in the south eastern section of the Plasser property appeared to be used for the manufacturing of trains. The smaller building located in the south western section of the Plasser property appeared to be used for storage a various train associated parts.

Entry to the Plasser property was gained via a concrete driveway off Kurrajong Road in the northern section. The concrete driveway extended south into the larger building. Adjacent to the driveway was asphaltic concrete (AC) car parks east and west. Localised landscaped areas with plants and small to medium sized trees were located around the office in the northern section of the larger building.

Located in the south western section of the Plasser property was what appeared to be a small detached fuel shed. Various drums of fuels/oils were stored outside the shed with associated spills observed on the ground. An unidentified circular metal object was observed in the ground in the immediate vicinity north of the fuel shed. A photograph of the object is included in the appendices. The size of the object suggests that it could have been the location of a backfilled fill point for an underground storage tank (UST).

Located approximately 20m east of the shed was ponded waste water around a drum. EIS were informed by a staff member that the water had been generated by the sand blasting process. The ponded water extended into the rail corridor/ bushland off-site to the south. We understand that these areas are not part of the proposed development area and were not addressed in this investigation.

Several train tracks were observed predominately running north to south with the main train track extending off the Plasser property in a south westerly direction connecting to the rail corridor. Several fuel/oil spills were observed on the surface of the ballast on the onsite train tracks.

The site itself was relatively flat. A rail track ran across the site from north to south. Numerous short spurs off the main track were also observed. Apart from the rail track the site was generally vacant.

3.5 Surrounding Land Use

The landuses of the areas immediately surrounding the Plasser property included:

- North – Kurrajong Road, beyond which was grassed playing fields and residential properties.
- South – Rail corridor, beyond which were residential properties
- East – CNH Australia Pty Ltd, beyond which were commercial/industrial businesses.
- West – Plasser Crescent, beyond which were commercial/industrial businesses.

3.6 Regional Geology

A review of the regional geological map of Penrith (1991[14]) indicates that the site is underlain by Bringelly Shale of the Wianamatta Group, which typically consists of shale, carbonaceous claystone, claystone, laminite, fine to medium grained lithic sandstone, rare coal and tuff.

3.7 Salinity Risk Map

A review of the risk map of the Salinity Potential in Western Sydney prepared by Department of infrastructure, Planning and Natural Resources (2002[15]) indicates that the site is located in an area classed as 'moderate' salinity potential.

3.8 Hydrogeology

A review of groundwater bores registered with the NSW Office of Water[16] (NOW) was undertaken by EIS. The search was limited to registered bores located within approximately 500m of the site. The search did not reveal any registered bores within this radius.

3.9 Surface Water Flows

Based on the site and surrounding topography, surface water flows would be expected to enter the stormwater system flowing towards the east adjacent to the rail corridor.

[14] Department of Mineral Resources, (1991), *1:100,000 Geological Map of Penrith (Series 9030).*

[15] Department of Infrastructure, Planning and Natural resources (2002), Salinity Potential in western Sydney

[16] http://www.waterinfo.nsw.gov.au/gw/, visited on (9/07/2014)

4 SITE HISTORY ASSESSMENT

4.1 Aerial Photographs

Historical aerial photographs of the site and immediate surrounds were reviewed for the assessment. The majority of the photographs were obtained from the NSW Department of Lands. A summary of the relevant information is presented in the following table:

Table 4-1: Summary of Historical Aerial Photos

Year	Details
1943[17]	The Plasser property and immediate surrounds appeared to be bushland in the 1943 Photograph. The rail track appeared to border the southern section of the Plasser property. A Creek (Ropes Creek) was located approximately 700m east of the Plasser property. Note the image was of poor quality on the date viewed.
1947	The appearance of Plasser property and the immediate surroundings appeared to be generally similar to the 1943 aerial photograph.
1956	The appearance of Plasser property and the immediate surroundings appeared to be generally similar to the 1947 aerial photograph. However, it appeared that the development of residential housing had increased to the south.
1965	The appearance of Plasser property and the immediate surroundings appeared to be generally similar to the 1956 aerial photograph. However, to the north, south and west of the Plasser property appeared to have undergone development. Several blocks which appeared to be residential housing were built north and west of the Plasser property. A small unnamed creek appears to have been diverted to the east to accommodate this development.
1978	The appearance of Plasser property and the immediate surroundings appeared to be generally similar to the 1965 aerial photograph. However, the bushland located on the Plasser property appeared to have been partially cleared and several tracks extended across the Plasser property. What appeared to be a culvert under construction was located to the west of the Plasser property. A large industrial warehouse appeared to have been constructed immediately to the east of the Plasser property with various materials stored outside. Development to the north and south appeared to have continued.
1986	Several large industrial sheds appeared to have been constructed to the west in the immediate vicinity of the Plasser property. The north section of the Plasser property appeared to have been paved. In the south eastern section of the Plasser property two large rectangular sheds appeared to have been constructed with adjacent smaller sheds north and south. Several train tracks appeared to have been constructed in the western section of the Plasser property. The south western section of the Plasser property appeared to be used for the storage of various materials.
1994	The appearance of Plasser property and the immediate surroundings appeared to be generally similar to the 1986 aerial photograph. However, an L-shaped shed

[17] https://six.maps.nsw.gov.au/wps/portal/SIXViewer, visited on 15/7/2014

Year	Details
	appeared to have been constructed adjacent to the large rectangular shed. Development to the east and west appeared to have increased with the construction of various industrial associated shed/warehouses.
2005	The appearance of Plasser property and the immediate surroundings appeared to be generally similar to the 1994 aerial photograph. However, on the Plasser property a roof appeared to have been constructed that extending north and south connecting adjacent sheds. In the south western section of the Plasser property two rectangular connecting sheds appeared to have been constructed.
2011 (SIX Maps)	The appearance of Plasser property and the immediate surroundings appeared to be generally similar to the 2005 aerial photograph. However, a small rectangular car park awning appeared to have been constructed in the north eastern section of the Plasser property. Various materials appeared to be stored on the western side of the main onsite train track.

4.2 WorkCover Records

WorkCover records were reviewed for the assessment. Copies of relevant documents are attached in the appendices. The search did not indicate any licences to store dangerous goods including underground fuel storage tanks (USTs) or above ground storage tanks (ASTs) at the Plasser property.

4.3 NSW EPA Records

The NSW EPA records available online were reviewed for the assessment. Copies of relevant documents are attached in the appendices. A summary of the relevant information is provided in the following table:

Table 4-2: Summary of NSW EPA Online Records

Source	Details
CLM Act 1997[18]	There were no notices for the Plasser property under Section 58 of the Act.
NSW EPA List of Contaminated Sites[19]	The Plasser property is not listed on the NSW EPA register. EIS note that 69 Kurrajong Road (Electrical Substation) is listed as a contaminated Plasser property. The Substation is considered to be down gradient of the subject Plasser property.
POEO Register[20]	There were no notices for the Plasser property on the POEO register.

[18] http://www.epa.nsw.gov.au/prclmapp/searchregister.aspx, visited on 10/7/2014
[19] http://www.epa.nsw.gov.au/clm/publiclist.htm, visited on 10/7/2014
[20] http://www.epa.nsw.gov.au/prpoeoapp/, visited on 10/7/2014

5 PRELIMINARY CONCEPTUAL SITE MODEL (CSM)

5.1 Areas of Environmental Concern (AEC) & Potential Contaminants of Concern (PCC)

The AEC identified in the table below are based on a review of the background information, site history information and site inspection. The AEC are sections of the site that have potentially been impacted by activities, site conditions and/or specific features that could present an environmental concern with regards to potential contamination.

Table 5-1: AEC and PCC

AEC	PCC
Fill Material: Fill material on site may have been historically imported from various sources and can contain elevated concentrations of contaminants.	HM, TPH, BTEX, PAHs, OCPs, OPPs, PCBs and asbestos
Commercial/Industrial Activity: The site was used for industrial purposes including the manufacturing of trains. Contamination could have occurred during this period associated with the manufacturing processes, storage and spillage of chemicals. The site is located in a predominantly industrial area of North St Marys. The NSW EPA records have indicated that No. 69 located to the immediate east of the site has a remediation/clean-up notice. However, this is not considered to represent a risk as it is down-gradient of the site.	HM, TPH, BTEX, PAHs, PCBs and asbestos
Use of Pesticides for Landscaping: Large sections of the site are covered by landscaping. The use of pesticides could have resulted in potential contamination.	HM, OCPs and OPPs
Hazardous Building Materials: The use of hazardous building material (e.g. asbestos) in the former buildings could have resulted in potential contamination.	Asbestos, lead and PCBs

Note:
HM – Heavy metals including arsenic, cadmium, chromium, copper, lead, mercury, nickel & zinc
TPH – Total petroleum hydrocarbons including light, mid and heavy fractions
BTEX – Monocyclic aromatic hydrocarbons
VOCs - Volatile organic compounds includes BTEX compounds
PAHs - Polycyclic aromatic hydrocarbons
OCPs - Organochlorine pesticides
OPPs - Organophosphorus pesticides
PCBs - Polychlorinated Biphenyls

5.2 Contamination Fate and Transport

The fate and transport of PCC identified at the site is summarised in the following table:

Table 5-2: Fate and Transport of PCC

PCC	Fate and Transport
Non-volatile contaminants including: metals, heavy fraction PAHs, OCPs, OPPs, PCBs and asbestos	With the exception of asbestos, non-volatile contaminants are predominantly confined to the soil and groundwater medium. The mobility of these contaminants varies depending on: the nature and type of contaminant present (e.g. leachability, viscosity etc.); soil type/porosity; surface water infiltration; groundwater levels; and the rate of groundwater movement. ***Presence of Ash and Slag:*** Non-volatile contaminants associated with ash and slag waste (some heavy metals, heavy fraction PAHs, and sometimes heavy fraction TPHs) are bound within a relatively insoluble matrix. Slag and ash is usually formed as a by-product of combustion at high temperatures which 'locks in' the contaminants within the matrix. ***Presence of Asbestos:*** The potential transport of asbestos fibres is associated with the disturbance of asbestos contaminated soils and release of fibres into the atmosphere. This is likely to occur during excavation works. A number of studies have found that soils effectively filter out asbestos fibres and retain them within the soil matrix. The studies concluded that there is no significant migration of asbestos fibres, either through soil or groundwater. ***Site Conditions:*** Surface water has the potential to infiltrate into the subsurface at the subject site via garden beds, grassed areas, unlined water retention facilities etc. Surface water infiltration could increase the migration potential of certain contaminants. Excess surface water has the potential to run-off into Ropes Creek located to the 700 west of the site.
Volatile contaminants including: TPH, BTEX, VOCs and light fraction PAHs	Volatile contaminants are usually more mobile when compared to the non-volatile compounds. The potential for migration of volatile contaminants such as light fraction PAHs and TPH is relatively high in sandy soil with a high water table. These contaminants break down rapidly as a result of microbial activity and availability of nutrients including nitrogen, oxygen etc. The mobile contaminants would be expected to move down to the

PCC	Fate and Transport
	rock surface or groundwater table and migrate down gradient from the source. The mobility would depend on a range of factors such as: soil type/porosity; surface water infiltration; groundwater levels; confining layers within the aquifer; solubility in groundwater etc.

5.3 Sensitive Receptors and Exposure Pathways

The potential receptors and exposure pathways identified at the site are presented in the following table:

Table 5-3: Potential Receptors and Exposure Pathways

Receptor	Pathway
Human Receptors: • Site occupants; • Site visitors; • Contractors and workers; • Future site occupants; and • Off-site occupants.	• Dermal contact, ingestion and inhalation; • Inhalation of airborne asbestos fibres; and • On-site migration of contaminated ground water.
Environmental Receptors: • Ropes Creek is located approximately 700m to the west of the site; • Landscaped areas located approximately north eastern section of the site.	• Exposure by direct contact with plants and animals; and • Surface water run off containing contamination flowing into Ropes creek.

6 SITE ASSESSMENT CRITERIA (SAC)

The SAC adopted for this ESA is outlined in the table below. The SAC has been derived from NEPM 2013 and other guidelines as outlined in **Section 1.3**. Explanatory notes are included in the attached appendices.

The guideline values for individual contaminants outlined in Schedule B1 of the NEPM 2013 are reproduced in the appendices. The criterion for the individual contaminants analysed for this assessment are presented in the attached report tables.

Table 6-1: SAC Adopted for this Investigation

Guideline	Applicability
Health Investigation Levels (HILs)	The proposed land use is commercial/industrial. The HIL-D criteria have been adopted for this ESA.
Health Screening Levels (HSLs)	The HSL-D criteria for soil have been adopted for this ESA. An assessment of soil vapour is outside the scope of this ESA. Further consideration of vapour risks would be required in the event that particular contaminants are identified during the ESA.
Ecological Assessment Criteria	EAC are presented in conjunction with the relevant report tables. A preliminary assessment of ecological risk, based on the limited information available at this stage, has been included in the report. The Ecological Investigation Levels (EILs) and Ecological Screening Levels (ESLs) for 'Commercial Industrial' have been adopted for the preliminary assessment. The EILs for selected metals have been derived as follows: • The ABC values for high traffic (25^{th} percentiles) areas for new suburbs of NSW published in Olszowy et. al. (1995[21]) has been adopted for this assessment.
Asbestos in Soil	The 'presence/absence' of asbestos in soil has been adopted as the assessment criterion for the Preliminary Site Investigation (PSI).
Waste Classification (WC) Criteria	A WC will be required for the off-site disposal of material excavated for the development. The criteria outlined in the Waste Classification Guidelines 2009 have been adopted for this investigation.

[21] Olszowy, H., Torr, P., and Imray, P., (1995), *Trace Element Concentrations in Soils from Rural and Urban Areas of Australia. Contaminated Sites Monograph Series No. 4*. Department of Human Services and Health, Environment Protection Agency, and South Australian Health Commission.

7 INVESTIGATION PROCEDURE

7.1 Soil Sampling Plan

The NSW EPA Sampling Design Guidelines 1995 recommend a sampling density for a contamination assessment based on a systematic sampling pattern. Based on the size of the investigation area, the guidelines provide a minimum number of sampling points required for the investigation.

The guidelines recommend sampling from a minimum of 11 evenly spaced sampling points for a site of this size (approximately 3, 400m^2) for a Stage 2 ESA.

Samples for this investigation were obtained from 4 evenly spaced sampling points as shown on the attached Figure 2. This density is approximately 36% of the minimum sampling density recommended for a Stage 2 ESA.

Sampling was not undertaken in inaccessible areas of the site such as beneath existing buildings.

7.2 Soil Sampling Methodology

Fieldwork for this investigation was undertaken on 14 July 2014. Locations were marked using spray paint. The sampling locations were cleared for underground services prior to drilling.

The sample locations were drilled using a truck mounted hydraulically operated drill rig equipped with spiral flight augers. Soil samples were obtained from a Standard Penetration Test (SPT) sampler or directly from the auger when conditions did not allow use of the SPT sampler.

Soil samples were collected from the fill and natural profiles encountered during the investigation. Samples were also obtained when there was a distinct change in lithology or based on the observations made during the investigation. All samples were recorded on the borehole attached in the appendices.

During sampling, soil at selected depths was split into primary and duplicate samples for field QA/QC analysis.

Samples were placed in glass jars with plastic caps and teflon seals with minimal headspace. Samples for asbestos analysis were placed in zip-lock plastic bags. Sampling personnel used disposable nitrile gloves during sampling activities. The samples were labelled with the job number, sampling location, sampling depth and date.

7.3 VOC Screening

A portable Photoionisation Detector (PID) was used to screen the samples for the presence of VOCs and to assist with selection of samples for BTEX analysis.

The sensitivity of the PID is dependent on the organic compound and varies for different mixtures of hydrocarbons. Some compounds give relatively high readings and some can be undetectable even though present in identical concentrations. The portable PID is best used semi-quantitatively to compare samples contaminated by the same hydrocarbon source.

The PID is calibrated before use by measurement of an isobutylene standard gas. All the PID measurements are quoted as parts per million (ppm) isobutylene equivalents.

PID screening for VOCs was undertaken on soil samples using the soil sample headspace method. VOC data was obtained from partly filled zip-lock plastic bags following equilibration of the headspace gases. The PID headspace data is presented on the COC documents attached in the appendices.

7.4 Decontamination and Sample Preservation

Details of the decontamination procedure adopted during sampling are presented in the appendices. Where applicable, the sampling equipment was decontaminated using a scrubbing brush and potable water and Decon 90 solution (phosphate free detergent) followed by rinsing with potable water.

Soil samples were preserved by immediate storage in an insulated sample container with ice in accordance with AS4482.1-2005 and AS4482.2-1999[22] as summarised in the following table:

Table 7-1: Soil Sample Preservation and Storage

Analyte	Preservation	Storage
Heavy metals	Unpreserved glass jar with Teflon lined lid	Store at <4°, analysis within 28 days (mercury and Cr[VI]) and 180 days (other metals).
VOCs (TPH/BTEX)	As above	Store at <4°, analysis within 14 days
PAHs, OCP, OPP & PCBs	As above	Store at <4°, analysis within 14 days
Asbestos	Sealed plastic bag	None

[22] *Guide to the Sampling and Investigation of Potentially Contaminated Soil Part2: Volatile Substances,* Standards Australia, 1999 (referred to as AS 1999)

On completion of the fieldwork, the samples were delivered in the insulated sample container to a NATA registered laboratory for analysis under standard COC procedures. Field sampling protocols adopted for this assessment are summarised in the attached appendices.

7.5 Analytical Schedule

The analytical schedule is outlined in the following table:

Table 7-2: Analytical Schedule

PCC	No. of Fill Soil Samples	No. of Natural Soil Samples
Heavy Metals	4	2
TPH/BTEX	4	2
PAHs	4	2
OCPs/OPPs	4	0
PCBs	4	0
Asbestos	4	0

7.6 Laboratory Analysis

The samples were analysed by the following laboratories:

Table 7-3: Laboratory Details

Samples	Laboratory	Report Reference
All primary samples, intra-laboratory duplicates	Envirolab Services Pty Ltd, NATA Accreditation Number – 2901 (ISO/IEC 17025 compliance)	113121

Samples were analysed by the laboratories using the analytical methods detailed in Schedule B(3) of NEPM 2013. Reference should be made to the laboratory reports attached in the appendices for further details.

8 INVESTIGATION RESULTS

8.1 Subsurface Conditions

A summary of the subsurface conditions encountered during the investigation is presented in the table below. Reference should be made to the borehole logs attached in the appendices for further details.

Table 8-1: Summary of Subsurface Conditions

Profile	Description[1]
Pavement	Asphaltic Concrete (AC) pavement was encountered in BH4
Fill	Fill material was encountered at the surface or beneath the pavement in all boreholes. The maximum depth of fill of 0.8m was recorded in BH1. The fill typically comprised clayey gravel, gravelly clay, clayey sand, silty clay and sandy gravel. The fill contained inclusions of igneous and shale gravel, root fibres and slag.
Natural Soil	Silty clay, medium to high plasticity, orange brown, light grey, traces of fine to coarse ironstone gravel.
Bedrock	Shale, grey, brown, extremely weathered.

Note:
1 – Depths described in metres below ground level

8.2 VOC Screening

PID soil sample headspace readings are presented in attached report tables and the COC documents attached in the appendices. All results were 0 ppm equivalent isobutylene which indicates a lack of PID detectable VOCs.

8.3 Soil Laboratory Results

The soil laboratory results are compared to the relevant SAC in the attached report tables. A summary of the results assessed against the SAC is presented below.

Table 8-2: Summary of Soil Laboratory Results

Analyte	Results Compared to SAC
Heavy Metals	**HILs:** All heavy metal results were below the HIL-D criteria. **EILs:** All heavy metal results were below the commercial/industrial criteria. **WC:** All heavy metal results were less than the CT1 criteria.

Analyte	Results Compared to SAC
TPH	**HSLs:** All TPH results were below the HSL-D criteria. **ESLs:** All TPH results were below the commercial/industrial criteria. **WC:** All TPH results were less than the relevant CT1 criteria.
BTEX	**HSLs:** All BTEX results were below the HSL-D criteria. **ESLs:** All BTEX results were below the commercial/industrial criteria. **WC:** All BTEX results were less than the relevant CT1 criteria.
PAHs	**HILs:** All PAH results were below the HIL-D criteria. **HSLs:** All naphthalene results were below the HSL-D criteria. **ESLs + ESLs:** The Benzo(a)pyrene result for soil sample BH2 (0.1-0.2) was above the commercial/industrial criteria. The remaining results were all less than the commercial/industrial guidelines. The naphthalene results were all less than the commercial/industrial guidelines. **WC:** Benzo(a)pyrene result for soil sample BH2 (0.1-0.2) was above the Waste Classification CT1 criteria. TCLP leachates were prepared from the BH2 (0.1-0.2) sample and analysed for PAHs. The results were less than the TCLP1 criteria.
OCPs & OPPs	**HILs:** All OCP and OPP results were below the HIL-D criteria. **EILs:** All results were below the commercial/industrial criteria. **WC:** All OCP and OPP results were less than the relevant CT1criteria.

Analyte	Results Compared to SAC
PCBs	**HILs:** All PCB results were below the HIL-D criteria. **WC:** All PCB results were less than the CT1 criteria.
Asbestos	**PSI:** Asbestos was not detected in the samples analysed for the investigation.

8.4 Laboratory Results

9 QA/QC ASSESSMENT

The QA/QC assessment includes a review of the DQIs established for the investigation (see **Section 2.2**). A summary of the field QA/QC samples are outlined below:

Table 9-1: Field QA/QC Samples

Field QA/QC	Frequency	Sample Details
Intra-laboratory duplicates	10% of Primary Samples	Soil Samples: Dup AC1 is a soil duplicate of sample BH3 (0.1-0.2)

An assessment of the DQIs is summarised in the following table.

Table 9-2: Assessment of DQIs

Completeness

Data and documentation completeness was achieved through the following measures:

- COC records were prepared for each batch of samples sent to the labs (refer to appendices);
- Laboratory sample receipt information was reviewed for each batch (refer to appendices);
- NATA registered laboratories were used for all analysis;
- Visual observations and PID screening of samples was undertaken during the investigation as noted on the boreholes and COC documents (refer to appendices); and
- All soil samples were analysed for the PCC identified in **Section 5.1**, except for VOCs which were screened using a PID.

Comparability

Data comparability was achieved through the following measures:

- Similar sampling techniques were used during the investigation;
- Appropriate preservation, storage and transport methods were adopted for all samples; and
- Consistent analysis techniques and reporting standards were adopted by the laboratories.

Representativeness

Data representativeness was achieved through the following measures:

- The sampling plan was optimised to obtain adequate coverage of sample locations and

Precision

Intra-laboratory RPD Results:

The intra-laboratory soil RPD results are presented in the attached report tables. The results indicated that field precision was acceptable.

Accuracy

Accuracy was achieved through the following measures:

- Trained and qualified field staff were used for the investigation;
- Appropriate industry standard sampling equipment and decontamination procedures were adopted for the investigation as outlined in the attached appendices;
- Sampling and screening equipment are routinely factory calibrated. An in-house calibration check was undertaken prior to using onsite;
- Appropriate sample preservation, handling, holding time and COC procedures were adopted for the investigation;
- The report was prepared generally in accordance with Reporting Guidelines 2011;
- Accuracy of field sampling was assessed as follows:
- Review of laboratory QA/QC data is summarised below:

  Laboratory Duplicate RPD Results: Laboratory duplicate RPD results for the soil analysis were generally within the acceptance criteria adopted by the laboratory;

  Matrix Spike Recovery: Matrix spike recovery concentrations were within the acceptable limits;

  Surrogate Spike Recovery: Surrogate spike recovery concentrations were within the acceptable limits. It is noted that surrogate concentrations were not reported in some soil samples, with the lack of results explained as matrix interference; and

  LCS recovery: LCS recovery concentrations were within the acceptable limits.

10 DISCUSSION

The limited site history indicates the Plasser property was developed in the 1980s and prior to that was bushland.

The limited inspection and investigation of the site within the Plasser property did not indicate the presence of any widespread significant contamination of the site that is likely to affect the proposed development. The minor B(a)P elevation above the ecological guideline is not considered significant as the site will be paved.

11 CONCLUSIONS

The Preliminary ESA included a desktop with a limited site history assessment, site walkover inspection and limited soil sampling from four boreholes.

EIS consider that the report objectives (see **Sections 1.2**) have been addressed. Based on the scope of works undertaken, EIS are of the opinion that the site is suitable for the proposed industrial development. However if any significant redevelopment to the site or Plasser property is undertaken in the future we would recommend further investigation.

In the event that any unexpected material is encountered during excavation during earthworks (e.g. stained/odorous soil and/or fibre cement fragments). EIS should be contacted immediately to review the findings of this report and waste classification.

11.1 Regulatory Requirement

The regulatory requirements applicable for the site are outlined in the following table:

Table 11-1: Regulatory Requirement

Guideline	Applicability
Duty to Report Contamination 2008[23]	At this stage, EIS consider that there is no requirement to notify the NSW EPA of the site contamination.
POEO Act 1997	Section 143 of the POEO Act 1997 states that if waste is transported to a place that cannot lawfully be used as a waste facility for that waste, then the transporter and owner of the waste are each guilty of an offence. The transporter and owner of the waste have a duty to ensure that the waste is disposed of in an appropriate manner.
Work Health and Safety Code of Practice 2011[24]	Sites contaminated with asbestos become a 'workplace' when work is carried out there and require a register and asbestos management plan.

[23] NSW Government Legislation, (2008), *Guidelines on the Duty to Report Contamination.* (referred to as Duty to Report Contamination 2008)

[24] WorkCover NSW, (2011), *WHS Regulation: Code of Practice – How to Manage and Control Asbestos in the Workplace.*

12 LIMITATIONS

The report limitations are outlined below:

- EIS accepts no responsibility for any unidentified contamination issues at the site. Any unexpected problems/subsurface features that may be encountered during development works should be inspected by an environmental consultant as soon as possible;
- Previous use of this site may have involved excavation for the foundations of buildings, services, and similar facilities. In addition, unrecorded excavation and burial of material may have occurred on the site. Backfilling of excavations could have been undertaken with potentially contaminated material that may be discovered in discrete, isolated locations across the site during construction work;
- This report has been prepared based on site conditions which existed at the time of the investigation; scope of work and limitation outlined in the EIS proposal; and terms of contract between EIS and the client (as applicable);
- The conclusions presented in this report are based on investigation of conditions at specific locations, chosen to be as representative as possible under the given circumstances, visual observations of the site and immediate surrounds and documents reviewed as described in the report;
- Subsurface soil and rock conditions encountered between investigation locations may be found to be different from those expected. Groundwater conditions may also vary, especially after climatic changes;
- The investigation and preparation of this report have been undertaken in accordance with accepted practice for environmental consultants, with reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria outlined in the report;
- Where information has been provided by third parties, EIS has not undertaken any verification process, except where specifically stated in the report;
- EIS has not undertaken any assessment of off-site areas that may be potential contamination sources or may have been impacted by site contamination, except where specifically stated in the report;
- EIS accept no responsibility for potentially asbestos containing materials that may exist at the site. These materials may be associated with demolition of pre-1990 constructed buildings or fill material at the site;
- EIS have not and will not make any determination regarding finances associated with the site;
- Additional investigation work may be required in the event of changes to the proposed development or landuse. EIS should be contacted immediately in such circumstances;
- Material considered to be suitable from a geotechnical point of view may be unsatisfactory from a soil contamination viewpoint, and vice versa; and

- This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose.

LIST OF IN-TEXT TABLES

IMPORTANT INFORMATION ABOUT THIS REPORT

These notes have been prepared by EIS to assist with the assessment and interpretation of this report.

The Report is Based on a Unique Set of Project Specific Factors:
This report has been prepared in response to specific project requirements as stated in the EIS proposal document which may have been limited by instructions from the client. This report should be reviewed, and if necessary, revised if any of the following occur:

- the proposed land use is altered;
- the defined subject site is increased or sub-divided;
- the proposed development details including size, configuration, location, orientation of the structures or landscaped areas are modified;
- the proposed development levels are altered, eg addition of basement levels; or
- ownership of the site changes.

EIS/J&K will not accept any responsibility whatsoever for situations where one or more of the above factors have changed since completion of the assessment. If the subject site is sold, ownership of the assessment report should be transferred by EIS to the new site owners who will be informed of the conditions and limitations under which the assessment was undertaken. No person should apply an assessment for any purpose other than that originally intended without first conferring with the consultant.

Changes in Subsurface Conditions
Subsurface conditions are influenced by natural geological and hydrogeological process and human activities. Groundwater conditions are likely to vary over time with changes in climatic conditions and human activities within the catchment (e.g. water extraction for irrigation or industrial uses, subsurface waste water disposal, construction related dewatering). Soil and groundwater contaminant concentrations may also vary over time through contaminant migration, natural attenuation of organic contaminants, ongoing contaminating activities and placement or removal of fill material. The conclusions of an assessment report may have been affected by the above factors if a significant period of time has elapsed prior to commencement of the proposed development.

This Report is Based on Professional Interpretations of Factual Data
Site assessments identify actual subsurface conditions at the actual sampling locations at the time of the investigation. Data obtained from the sampling and subsequent laboratory analyses, available site history information and published regional information is interpreted by geologists, engineers or environmental scientists and opinions are drawn about the overall subsurface conditions, the nature and extent of contamination, the likely impact on the proposed development and appropriate remediation measures.

Actual conditions may differ from those inferred, because no professional, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, but steps can be taken to help minimise the impact. For this reason, site owners should retain the services of their consultants throughout the development stage of the project, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

Assessment Limitations

Although information provided by a site assessment can reduce exposure to the risk of the presence of contamination, no environmental site assessment can eliminate the risk. Even a rigorous professional assessment may not detect all contamination on a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which showed no signs of contamination when sampled. Contaminant analysis cannot possibly cover every type of contaminant which may occur; only the most likely contaminants are screened.

Misinterpretation of Site Assessments by Design Professionals

Costly problems can occur when other design professionals develop plans based on misinterpretation of an assessment report. To minimise problems associated with misinterpretations, the environmental consultant should be retained to work with appropriate professionals to explain relevant findings and to review the adequacy of plans and specifications relevant to contamination issues.

Logs Should not be Separated from the Assessment Report

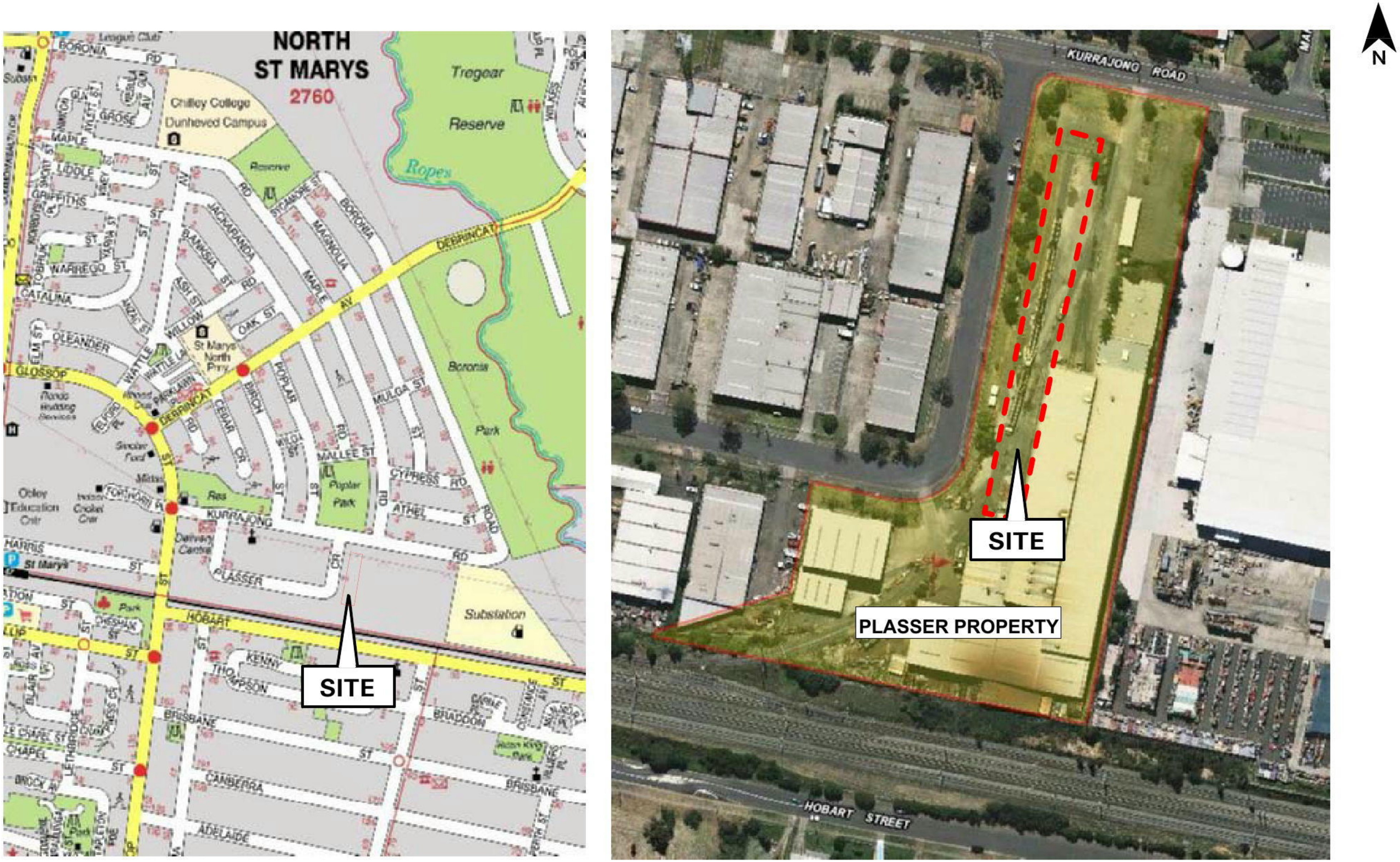
Borehole and test pit logs are prepared by environmental scientists, engineers or geologists based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these should not be re-drawn for inclusion in site remediation or other design drawings, as subtle but significant drafting errors or omissions may occur in the transfer process. Photographic reproduction can eliminate this problem, however contractors can still misinterpret the logs during bid preparation if separated from the text of the assessment. If this occurs, delays, disputes and unanticipated costs may result. In all cases it is necessary to refer to the rest of the report to obtain a proper understanding of the assessment. Please note that logs with the 'Environmental Log' header are not suitable for geotechnical purposes as they have not been peer reviewed by a Senior Geotechnical Engineer.

To reduce the likelihood of borehole and test pit log misinterpretation, the complete assessment should be available to persons or organisations involved in the project, such as contractors, for their use. Denial of such access and disclaiming responsibility for the accuracy of subsurface information does not insulate an owner from the attendant liability. It is critical that the site owner provides all available site information to persons and organisations such as contractors.

Read Responsibility Clauses Closely

Because an environmental site assessment is based extensively on judgement and opinion, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, model clauses have been developed for use in written transmittals. These are definitive clauses designed to indicate consultant responsibility. Their use helps all parties involved recognise individual responsibilities and formulate appropriate action. Some of these definitive clauses are likely to appear in the environmental site assessment, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to any questions.

REPORT FIGURES

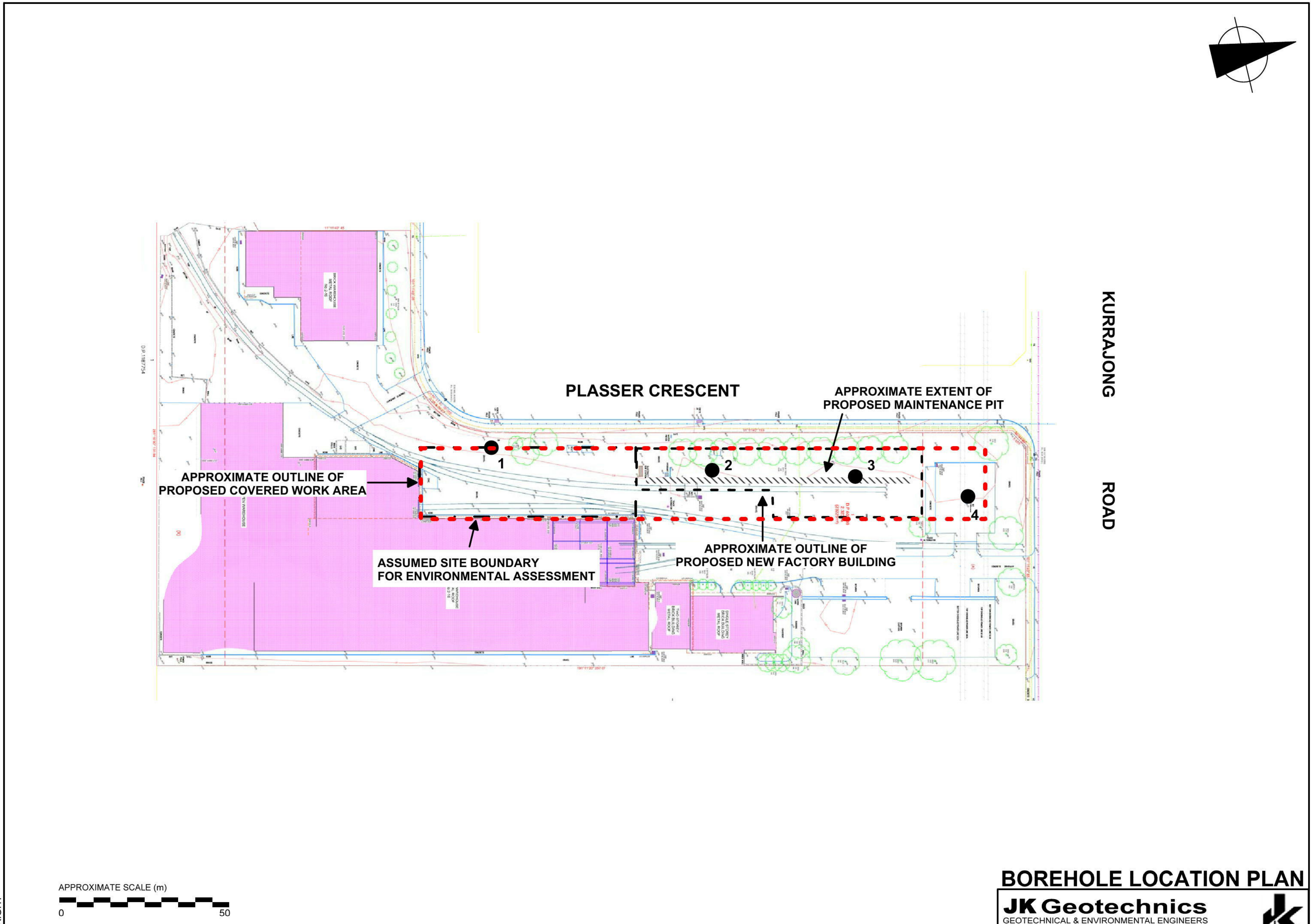


NOTES:
Figure 1 has been recreated from UBD on disc (version 5.0) and GooglesixMaps
Figure is not to scale.

UBD Map ref: 165 M13 & M14

Reference should be made to the report text for a full understanding of this plan.

EIS ENVIRONMENTAL INVESTIGATION SERVICES	Project Number: **E27578KH**	Title: **SITE LOCATION PLAN**
	Figure: **1**	Address: **25 Kurrajong Road, North St Marys, NSW**



BOREHOLE LOCATION PLAN

JK Geotechnics
GEOTECHNICAL & ENVIRONMENTAL ENGINEERS

Report No. 27578ZR Figure No. 2

REPORT TABLES

TABLE A
SOIL LABORATORY RESULTS COMPARED TO HILs
All data in mg/kg unless stated otherwise

			HEAVY METALS								PAHs		ORGANOCHLORINE PESTICIDES (OCPs)							OP PESTICIDES (OPPs)		
			Arsenic	Cadmium	Chromium VI [2]	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	B(a)P TEQ [3]	HCB	Endosulfan	Methoxychlor	Aldrin & Dieldrin	Chlordane	DDT, DDD & DDE	Heptachlor	Chlorpyrifos	TOTAL PCBs	ASBESTOS FIBRES
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0,1	0.1	100
Site Assessment Criteria (SAC) [1]			3000	900	3600	240000	1500	730	6000	400000	4000	40	80	2000	2500	45	530	3600	50	2000	7	Detected/Not Detected
Sample Reference	**Sample Depth**	**Sample Description**																				
BH1	0.5-0.6	Fill: Gravely Clay	7	LPQL	20	15	14	LPQL	5	21	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	Not Detected
BH1	0.9-1.0	Silty Clay	7	LPQL	18	12	14	LPQL	3	13	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH2	0.1-0.2	Fill: Clayey Sand	5	LPQL	24	28	18	LPQL	13	32	16	3	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	Not Detected
BH3	0.1-0.2	Fill: Silty Clay	7	LPQL	26	12	28	LPQL	6	31	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	Not Detected
BH3	0.9-1.0	Silty Clay	4	LPQL	16	8	11	LPQL	2	7	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH4	0.2-0.3	Fill Sandy Gravel	LPQL	LPQL	20	7	8	LPQL	4	6	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	Not Detected
Total Number of Samples			6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	4	4	4
Maximum Value			7	0	26	28	28	0	13	32	16	3	0	0	0	0	0	0	0	0	0	NC

Explanation:
1 - Site Assessment Criteria (SAC): NEPM 2013, HIL-D: 'Commercial/Industrial'
2 - The results are for Total Chromium which includes Chromium III and VI. For initial screening purposes, we have assumed that the samples contain only Chromium VI unless demonstrated otherwise by additional analysis.
3 - B(a)P TEQ - Benzo(a)pyrene Toxicity Equivalence Quotient has been calculated based on 8 carcinogenic PAHs and their Toxic Equivalence Factors (TEFs) outlined in NEPM 2013

Concentration above the SAC **VALUE**

Abbreviations:

PAHs: Polycyclic Aromatic Hydrocarbons	UCL: Upper Level Confidence Limit on Mean Value
B(a)P: Benzo(a)pyrene	HILs: Health Investigation Levels
PQL: Practical Quantitation Limit	NA: Not Analysed
LPQL: Less than PQL	NC: Not Calculated
OPP: Organophosphorus Pesticides	NSL: No Set Limit
OCP: Organochlorine Pesticides	SAC: Site Assessment Criteria
PCBs: Polychlorinated Biphenyls	NEPM: National Environmental Protection Measure

TABLE B
SOIL LABORATORY RESULTS COMPARED TO HSLs
All data in mg/kg unless stated otherwise

				C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	PID [2]
PQL - Envirolab Services				25	50	0.2	0.5	1	3	1	
HSL Land Use Category [1]				**COMMERCIAL/INDUSTRIAL**							
Sample Reference	**Sample Depth**	**Depth Category**	**Soil Category**								
BH1	0.5-0.6	0m to < 1m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH1	0.9-1.0	0m to < 1m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH2	0.1-0.2	0m to < 1m	Sand	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH3	0.1-0.2	0m to < 1m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH3	0.9-1.0	0m to < 1m	Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
BH4	0.2-0.3	0m to < 1m	Sand	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0
Total Number of Samples				6	6	6	6	6	6	6	6
Maximum Value				LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	0

Explanation:
1 - Site Assessment Criteria (SAC): NEPM 2013
2 - Field PID values obtained during the investigation

Concentration above the SAC VALUE
The guideline corresponding to the elevated value is highlighted in grey in the Site Assessment Criteria Table below

Abbreviations:
UCL: Upper Level Confidence Limit on Mean Value
HSLs: Health Screening Levels
NA: Not Analysed
PQL: Practical Quantitation Limit
LPQL: Less than PQL
SAC: Site Assessment Criteria
NC: Not Calculated
NL: Not Limiting
NEPM: National Environmental Protection Measure

SITE ASSESSMENT CRITERIA

				C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene
PQL - Envirolab Services				25	50	0.2	0.5	1	3	1
HSL Land Use Category [1]				**COMMERCIAL/INDUSTRIAL**						
Sample Reference	**Sample Depth**	**Depth Category**	**Soil Category**							
BH1	0.5-0.6	0m to < 1m	Clay	310	NL	4	NL	NL	NL	NL
BH1	0.9-1.0	0m to < 1m	Clay	310	NL	4	NL	NL	NL	NL
BH2	0.1-0.2	0m to < 1m	Sand	260	NL	3	NL	NL	230	NL
BH3	0.1-0.2	0m to < 1m	Clay	310	NL	4	NL	NL	NL	NL
BH3	0.9-1.0	0m to < 1m	Clay	310	NL	4	NL	NL	NL	NL
BH4	0.2-0.3	0m to < 1m	Sand	260	NL	3	NL	NL	230	NL

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TABLE C
SOIL LABORATORY RESULTS COMPARED TO WASTE CLASSIFICATION GUIDELINES (2009)
All data in mg/kg unless stated otherwise

			HEAVY METALS								PAHs	
			Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	B(a)P
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.05
General Solid Waste CT1 [1]			100	20	100	NSL	100	4	40	NSL	NSL	0.8
General Solid Waste SCC1 [1]			500	100	1900	NSL	1500	50	1050	NSL	200	10
Restricted Solid Waste CT2 [1]			400	80	400	NSL	400	16	160	NSL	NSL	3.2
Restricted Solid Waste SCC2 [1]			2000	400	7600	NSL	6000	200	4200	NSL	800	23
Sample Reference	**Sample Depth**	**Sample Description**										
BH1	0.5-0.6	Fill: Gravely Clay	7	LPQL	20	15	14	LPQL	5	21	LPQL	LPQL
BH1	0.9-1.0	Silty Clay	7	LPQL	18	12	14	LPQL	3	13	LPQL	LPQL
BH2	0.1-0.2	Fill: Clayey Sand	5	LPQL	24	28	18	LPQL	13	32	16	**3**
BH3	0.1-0.2	Fill: Silty Clay	7	LPQL	26	12	28	LPQL	6	31	LPQL	LPQL
BH3	0.9-1.0	Silty Clay	4	LPQL	16	8	11	LPQL	2	7	LPQL	LPQL
BH4	0.2-0.3	Fill Sandy Gravel	LPQL	LPQL	20	7	8	LPQL	4	6	LPQL	LPQL
Total Number of samples			6	6	6	6	6	6	6	6	6	6
Maximum Value			7	LPQL	26	28	28	LPQL	13	32	16	3

			OCPs				TOTAL OPPs	Total PCBs	TRH					BTEX COMPOUNDS				ASBESTOS FIBRES
			Aldrin & Dieldrin	Chlordane	DDT, DDD & DDE	Heptachlor			C_6-C_9	C_{10}-C_{14}	C_{15}-C_{28}	C_{29}-C_{36}	Total C_{10}-C_{36}	Benzene	Toluene	Ethyl benzene	Total Xylenes	
PQL - Envirolab Services			0.1	0.1	0.1	0.1	0.1	0.1	25	50	100	100	250	0.2	0.5	1	3	100
General Solid Waste CT1 [1]			NSL	NSL	NSL	NSL	detect[2]	NSL	NSL	NSL			NSL	10	288	600	1000	-
General Solid Waste SCC1 [1]			Scheduled Chemicals <50					50	650	NSL			10000	18	518	1080	1800	-
Restricted Solid Waste CT2 [1]			NSL	NSL	NSL	NSL	detect[2]	NSL	NSL	NSL			NSL	40	1152	2400	4000	-
Restricted Solid Waste SCC2 [1]			Scheduled Chemicals <50					50	2600	NSL			40000	72	2073	4320	7200	-
Sample Reference	**Sample Depth**	**Sample Description**																
BH1	0.5-0.6	Fill: Gravely Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	Not Detected
BH1	0.9-1.0	Silty Clay	NA	NA	NA	NA	NA	NA	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	NA
BH2	0.1-0.2	Fill: Clayey Sand	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	270	900	1170	LPQL	LPQL	LPQL	LPQL	Not Detected
BH3	0.1-0.2	Fill: Silty Clay	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	Not Detected
BH3	0.9-1.0	Silty Clay	NA	NA	NA	NA	NA	NA	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	NA
BH4	0.2-0.3	Fill Sandy Gravel	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	Not Detected
Total Number of samples			4	4	4	4	4	4	6	6	6	6	6	6	6	6	6	LPQL
Maximum Value			LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	270	900	1170	LPQL	LPQL	LPQL	LPQL	NC

Explanation:

1 - NSW DECCW Waste Classification Guidelines (2009)

2 - Some Individual OPPs have CT1 & CT2 values. Reference should be made to the Waste Classification Guidelines in the event of any detections

Concentration above the CT1	VALUE
Concentration above SCC1	VALUE
Concentration above the SCC2	VALUE

Abbreviations:

PAHs: Polycyclic Aromatic Hydrocarbons	UCL: Upper Level Confidence Limit on Mean Value	BTEX: Monocyclic Aromatic Hydrocarbons
B(a)P: Benzo(a)pyrene	ALPQL: All values less than PQL	OCP: Organochlorine Pesticides
PQL: Practical Quantitation Limit	NA: Not Analysed	CT: Contaminant Threshold
LPQL: Less than PQL	NC: Not Calculated	SCC: Specific Contaminant Concentration
OPP: Organophosphorus Pesticides	NSL: No Set Limit	HILs: Health Investigation Levels
PID: Photoionisation Detector	SAC: Site Assessment Criteria	NEPM: National Environmental Protection Measure
PCBs: Polychlorinated Biphenyls	TRH: Total Recoverable Hydrocarbons	

EIS

TABLE D
SOIL LABORATORY RESULTS COMPARED TO EILs AND ESLs
All data in mg/kg unless stated otherwise

Land Use Category [1]			**COMMERCIAL/INDUSTRIAL**																			
						AGED HEAVY METALS-EILs						EILs		ESLs								
			pH	CEC (cmol$_c$/kg)	Clay Content (% clay)	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	B(a)P
PQL - Envirolab Services			-	1	-	4	1	1	1	1	1	0.1	0.1	25	50	100	100	0.2	0.5	1	3	0.05
Ambient Background Concentration (ABC) [2]			-	-	-	NSL	10	8	NSL	5	45	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL
Sample Reference	**Sample Depth**	**Soil Texture**																				
BH1	0.5-0.6	Coarse	NA	NA	NA	7	20	15	14	5	21	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
BH1	0.9-1.0	Fine	NA	NA	NA	7	18	12	14	3	13	LPQL	NA	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
BH2	0.1-0.2	Coarse	NA	NA	NA	5	24	28	18	13	32	LPQL	LPQL	LPQL	LPQL	850	1100	LPQL	LPQL	LPQL	LPQL	3
BH3	0.1-0.2	Fine	NA	NA	NA	7	26	12	28	6	31	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
BH3	0.9-1.0	Fine	NA	NA	NA	4	16	8	11	2	7	LPQL	NA	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
BH4	0.2-0.3	Coarse	NA	NA	NA	LPQL	20	7	8	4	6	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL
Total Number of Samples			LPQL	LPQL	LPQL	6	6	6	6	6	6	6	4	6	6	6	6	6	6	6	6	6
Maximum Value			LPQL	LPQL	LPQL	7	26	28	28	13	32	LPQL	LPQL	LPQL	LPQL	850	1100	LPQL	LPQL	LPQL	LPQL	3

Explanation:
1 - Site Assessment Criteria (SAC): NEPM 2013
2 - ABC Values for selected metals has been adopted from the published background concentrations presented in Olszowy et. al., (1995), Trace Element Concentrations in Soils from Rural and Urban New South Wales (the 25th percentile values for new suburbs with high traffic have been quoted)

Concentration above the SAC VALUE
The guideline corresponding to the elevated value is highlighted in grey in the EIL and ESL Assessment Criteria Table below

Abbreviations:
EILs: Ecological Investigation Levels
B(a)P: Benzo(a)pyrene
PQL: Practical Quantitation Limit
UCL: Upper Level Confidence Limit on Mean Value
ESLs: Ecological Screening Levels
NA: Not Analysed
LPQL: Less than PQL
SAC: Site Assessment Criteria
NEPM: National Environmental Protection Measure
NC: Not Calculated
NSL: No Set Limit
ABC: Ambient Background Concentration

EIL AND ESL ASSESSMENT CRITERIA

Land Use Category [1]			**COMMERCIAL/INDUSTRIAL**																			
						AGED HEAVY METALS-EILs						EILs		ESLs								
			pH	CEC (cmol$_c$/kg)	Clay Content (% clay)	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	B(a)P
PQL - Envirolab Services			-	1	-	4	1	1	1	1	1	0.1	0.1	25	50	100	100	0.2	0.5	1	3	0.05
Ambient Background Concentration (ABC) [2]			-	-	-	NSL	10	8	NSL	5	45	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL
Sample Reference	**Sample Depth**	**Soil Texture**																				
BH1	0.5-0.6	Coarse	NA	NA	NA	160	320	93	1800	60	155	370	640	215	170	1700	3300	75	135	165	180	1.4
BH1	0.9-1.0	Fine	NA	NA	NA	160	320	93	1800	60	155	370	--	215	170	2500	6600	95	135	185	95	1.4
BH2	0.1-0.2	Coarse	NA	NA	NA	160	320	93	1800	60	155	370	640	215	170	1700	3300	75	135	165	180	1.4
BH3	0.1-0.2	Fine	NA	NA	NA	160	320	93	1800	60	155	370	640	215	170	2500	6600	95	135	185	95	1.4
BH3	0.9-1.0	Fine	NA	NA	NA	160	320	93	1800	60	155	370	--	215	170	2500	6600	95	135	185	95	1.4
BH4	0.2-0.3	Coarse	NA	NA	NA	160	320	93	1800	60	155	370	640	215	170	1700	3300	75	135	165	180	1.4

TABLE E
SOIL INTRA-LABORATORY DUPLICATE RESULTS & RPD CALCULATIONS
All results in mg/kg unless stated otherwise

SAMPLE	ANALYSIS	Envirolab PQL	INITIAL	REPEAT	MEAN	RPD %
Sample Ref = BH3 0.1-0.2	Arsenic	4	7	5	6.0	33
Dup Ref = DUP AC1	Cadmium	0.4	LPQL	LPQL	NC	NC
	Chromium	1	26	21	23.5	21
Envirolab Report: 113121	Copper	1	12	13	12.5	8
	Lead	1	28	22	25.0	24
	Mercury	0.1	LPQL	LPQL	NC	NC
	Nickel	1	6	8	7.0	29
	Zinc	1	31	34	32.5	9

Explanation:
The RPD value is calculated as the absolute value of the difference between the initial and repeat results divided by the average value expressed as a percentage. The following acceptance criteria will be used to assess the RPD results:

Results > 10 times PQL = RPD value < = 50% are acceptable
Results between 5 & 10 times PQL = RPD value < = 75% are acceptable
Results < 5 times PQL = RPD value < = 100% are acceptable

If result is LPQL then 50% of the PQL is used for the calculation

RPD Results Above the Acceptance Criteria — VALUE

Abbreviations:

PQL: Practical Quantitation Limit
LPQL: Less than PQL
NA: Not Analysed
NC: Not Calculated

OCP: Organochlorine Pesticides
OPP: Organophosphorus Pesticides
PCBs: Polychlorinated Biphenyls

TABLE F
SOIL LABORATORY TCLP RESULTS
All data in mg/L unless stated otherwise

			Arsenic	Cadmium	Chromium	Lead	Mercury	Nickel	B(a)P
PQL - Envirolab Services			0.05	0.01	0.01	'	0.0005	0.02	0.001
TCLP1 - General Solid Waste [1]			5	1	5	5	0.2	2	0.04
TCLP2 - Restricted Solid Waste [1]			20	4	20	20	0.8	8	0.16
TCLP3 - Hazardous Waste [1]			>20	>4	>20	>20	>0.8	>8	>0.16
Sample Reference	**Sample Depth**	**Sample Description**							
BH2	0.1-0.2	Fill: Clayey Sand	NA	NA	NA	NA	NA	NA	LPQL

Explanation:

1 - NSW DECCW Waste Classification Guidelines (2009)

General Solid Waste	**VALUE**
Restricted Solid Waste	**VALUE**
Hazardous Waste	**VALUE**

Abbreviations:

PQL: Practical Quantitation Limit
LPQL: Less than PQL
B(a)P: Benzo(a)pyrene
NC: Not Calculated
NA: Not Analysed
TCLP: Toxicity Characteristics Leaching Procedure

Appendix A: Borehole Logs and Explanatory Notes

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BOREHOLE LOG

Borehole No.
1

Client: PLASSER AUSTRALIA PTY LTD
Project: PROPOSED RAIL YARD EXTENSION
Location: 2 PLASSER CRESCENT, ST MARYS, NSW

Job No. 27578ZR
Date: 14-7-14
Method: SPIRAL AUGER JK350
R.L. Surface: ≈ 39.4m
Datum: AHD
Logged/Checked by: A.P.C./P.R.

Groundwater Record	Field Tests	Depth (m)	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION & AFTER 3 HRS		0		FILL: Clayey gravel, fine to coarse grained igneous, grey and brown, with roots and root fibres.	D			GRASS COVER
	SPT 11/50mm REFUSAL			FILL: Gravelly clay, medium plasticity, orange brown and grey, fine to coarse grained sandstone and igneous gravel, trace of slag.	MC<PL			
		1	CL	SILTY CLAY: medium plasticity, light grey mottled orange brown, with fine to medium grained ironstone gravel, trace of root fibres.	MC>PL	H		
	N = 30 7,12,18	2					>600 >600 >600	
	N = 41 14,19,22	3					300 300 300	
		4		as above, but with occasional XW shale bands.				
	N > 38 14,26, 12/50mm REFUSAL	5					>600 580 550	
	N > 49 10,21, 28/100mm REFUSAL	6	CH	SILTY CLAY: high plasticity, grey and brown, with fine to medium grained ironstone gravel, and occasional L strength shale bands.			>600 >600 >600	
		7	-	SHALE: grey and brown, with clay bands.	XW-DW	EL-VL		VERY LOW 'TC' BIT RESISTANCE

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BOREHOLE LOG

Borehole No.
1
2/2

Client: PLASSER AUSTRALIA PTY LTD
Project: PROPOSED RAIL YARD EXTENSION
Location: 2 PLASSER CRESCENT, ST MARYS, NSW

Job No. 27578ZR
Date: 14-7-14
Method: SPIRAL AUGER JK350
R.L. Surface: ≈ 39.4m
Datum: AHD
Logged/Checked by: A.P.C./P.R.

Groundwater Record	SAMPLES (ES, U50, DB, DS)	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
						SHALE: grey and brown, with clay bands.	XW-DW	EL-VL		VERY LOW RESISTANCE
		N > 35 12,35/ 150mm REFUSAL							>600 >600 >600	
			8							
		N > 30 11,30/ 150mm REFUSAL	9						>600 >600 >600	
						SHALE: dark grey and brown, with XW bands.	DW	VL-L		LOW RESISTANCE
			10							
								L		LOW TO MODERATE RESISTANCE
			11							
								M		MODERATE TO HIGH RESISTANCE
			12			END OF BOREHOLE AT 12.0m				
			13							
			14							

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BOREHOLE LOG

Borehole No.
2

Client: PLASSER AUSTRALIA PTY LTD
Project: PROPOSED RAIL YARD EXTENSION
Location: 2 PLASSER CRESCENT, ST MARYS, NSW

Job No. 27578ZR
Date: 14-7-14
Method: SPIRAL AUGER JK350
R.L. Surface: ≈ 39.5m
Datum: AHD
Logged/Checked by: A.P.C./P.R.

Groundwater Record	SAMPLES (ES, U50, DB, DS)	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION OF AUGERING			0			FILL: Clayey gravel, fine to coarse grained igneous, dark grey and dark brown.	D			GRASS COVER
						FILL: Gravelly clay, low to medium plasticity, dark brown, with fine to coarse grained igneous and shale gravel, trace of roots and root fibres.	MC<PL			
		N = 16 4,5,11			CL	SILTY CLAY: medium plasticity, light grey mottled orange and red brown, with fine to coarse grained ironstone gravel, trace of roots and root fibres.	MC>PL	VSt	380 350 350	
			1							
		N = 23 7,10,13						H	580 560 550	
			2							
		N = 30 6,10,20	3					VSt	280 250 280	
			4			as above, but occasional iron indurated bands and XW shale bands.		H		
		N > 49 18,19, 30/100mm REFUSAL							>600 580 580	
ON COMPLETION OF CORING			5							
					CH	SILTY CLAY: high plasticity, light grey and brown, occasional XW shale bands.				
		N = 50 11,20,30	6						>600 >600 >600	
			7							

BOREHOLE LOG

Borehole No.
2

Client: PLASSER AUSTRALIA PTY LTD
Project: PROPOSED RAIL YARD EXTENSION
Location: 2 PLASSER CRESCENT, ST MARYS, NSW

Job No. 27578ZR **Method:** SPIRAL AUGER JK350 **R.L. Surface:** ≈ 39.5m
Date: 14-7-14 **Datum:** AHD
Logged/Checked by: A.P.C./P.R.

Groundwater Record	SAMPLES (ES, U50, DB, DS)	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
		N > 30 15,30/ 150mm REFUSAL				SHALE: orange brown mottled grey, with clay bands.	XW-DW	EL-VL		VERY LOW 'TC' BIT RESISTANCE
			8				DW	VL		VERY LOW TO LOW RESISTANCE
			9			SHALE: light grey.		L		LOW RESISTACE
			10							
			11			REFER TO CORED BOREHOLE LOG				
			12							
			13							
			14							

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CORED BOREHOLE LOG

Client: PLASSER AUSTRALIA PTY LTD
Project: PROPOSED RAIL YARD EXTENSION
Location: 2 PLASSER CRESCENT, ST MARYS, NSW

Job No. 27578ZR **Core Size:** NMLC **R.L. Surface:** ≈ 39.5m
Date: 14-7-14 **Inclination:** VERTICAL **Datum:** AHD
Drill Type: JK350 **Bearing:** - **Logged/Checked by:** A.P.C./P.R

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ EL VL L M H VH EH	DEFECT SPACING (mm) 500 300 100 50 30 10	DEFECT DETAILS DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific	General
		10		START CORING AT 10.37m						
FULL RET-URN		11		SHALE: dark grey.	DW	L M			- XWS, 5°, 50mm.t - CS, 5°, 30mm.t - CS, 5°, 2mm.t - XWS, 5°, 30mm.t - CS, 3°, 140mm.t - CS, 2°, 10mm.t - XWS, 10°, 20mm.t - J, 60°, P, S	
		12		SHALE: dark grey and light grey, interbedded with fine grained sandstone.		H			- XWS, 2°, 20mm.t - CS, 5°, 2mm.t - CS, 2°, 10mm.t - CS, 5°, 2mm.t - J, 65°, P, S - XWS, 10°, 5mm.t - 2xJ, SUBVERTICAL, P, S - CS, 10°, 15mm.t - J, SUBVERTICAL, Un, R - CS, 5°, 80mm.t - J, SUBVERTICAL, P, S - J, SUBVERTICAL, P, S - CS, 45°, 50mm.t	
		13		END OF BOREHOLE AT 12.97m						
		14								
		15								
		16								

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BOREHOLE LOG

Borehole No.
3
1/2

Client: PLASSER AUSTRALIA PTY LTD
Project: PROPOSED RAIL YARD EXTENSION
Location: 2 PLASSER CRESCENT, ST MARYS, NSW

Job No. 27578ZR **Method:** SPIRAL AUGER JK350 **R.L. Surface:** ≈ 39.5m
Date: 14-7-14 **Datum:** AHD
Logged/Checked by: A.P.C./P.R.

Groundwater Record	SAMPLES (ES, U50, DB, DS)	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION & AFTER 1 HR			0			FILL: Silty clay topsoil, high plasticity, dark brown, with roots and root fibres.				GRASS COVER
		N = 8 1,3,5			CH	SILTY CLAY: high plasticity, red brown, with roots and root fibres, fine to medium grained ironstone gravel.	MC>PL	St	120 150 110	
			1							
		N = 30 7,10,20				SILTY CLAY: high plasticity, light grey mottled orange brown, with fine to medium grained ironstone gravel.		VSt-H	>600 >600 >600	
			2							
		N > 37 15,23 14/100mm REFUSAL	3						230 250 220	
			4							
		N = 32 9,12,20						H	>600 580 >600	
			5							
		N > 25 15,25/ 100mm REFUSAL	6			SILTY CLAY: high plasticity, light grey and orange brown, with occasional XW shale bands.			>600 >600 >600	
			7							

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BOREHOLE LOG

Borehole No.
3
2/2

Client: PLASSER AUSTRALIA PTY LTD
Project: PROPOSED RAIL YARD EXTENSION
Location: 2 PLASSER CRESCENT, ST MARYS, NSW

Job No. 27578ZR
Date: 14-7-14
Method: SPIRAL AUGER JK350
R.L. Surface: ≈ 39.5m
Datum: AHD
Logged/Checked by: A.P.C./P.R.

Groundwater Record	SAMPLES (ES, U50, DB, DS)	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
						SHALE: orange brown.	XW-DW	EL-VL		VERY LOW 'TC' BIT RESISTANCE
			8			SHALE: grey and orange brown.	DW	VL		VERY LOW TO LOW RESISTANCE
			9			SHALE: grey.		L		LOW RESISTANCE
			10					H		HIGH RESISTANCE
						END OF BOREHOLE AT 10.5m				
			11							
			12							
			13							
			14							

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BOREHOLE LOG

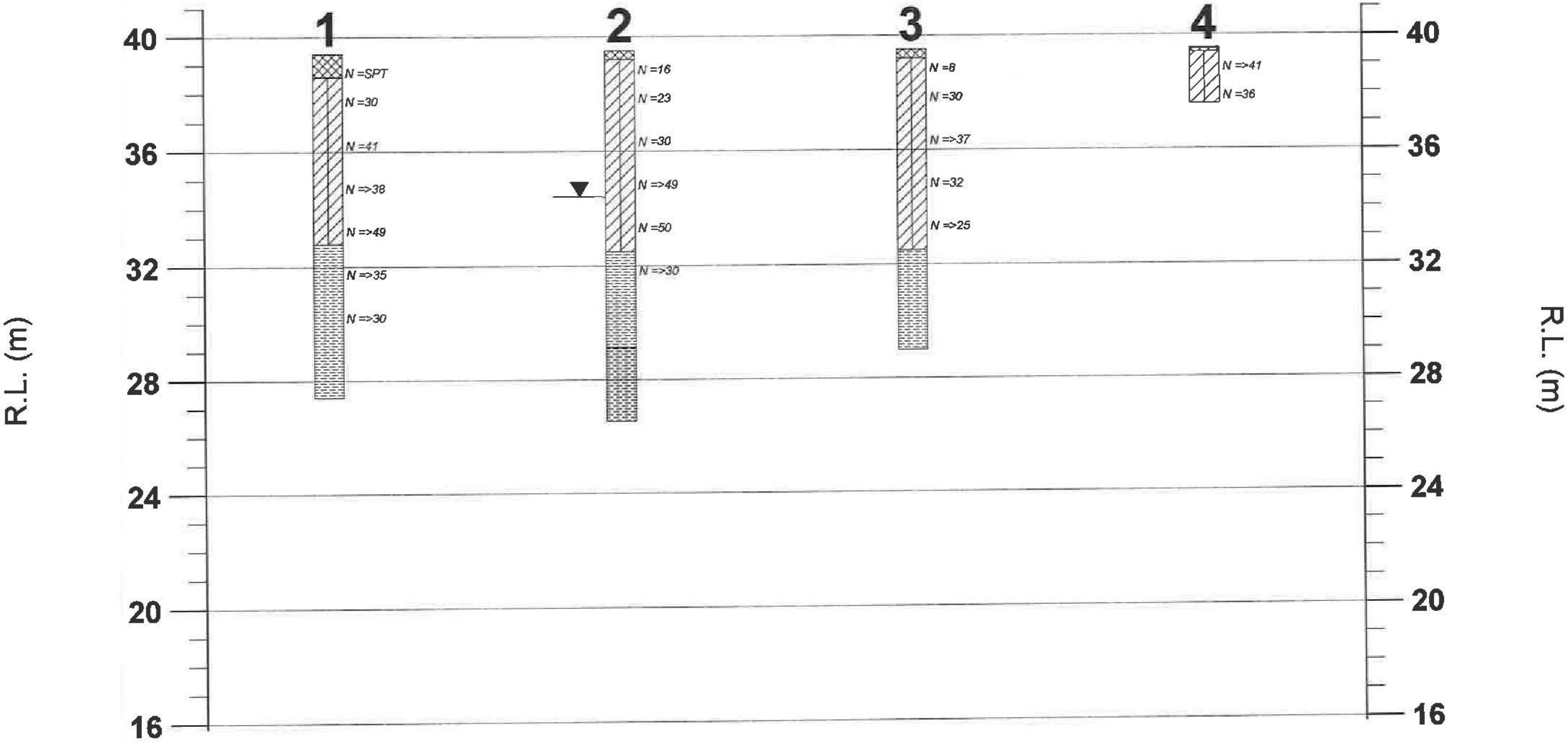
Borehole No. **4**
1/1

Client: PLASSER AUSTRALIA PTY LTD
Project: PROPOSED RAIL YARD EXTENSION
Location: 2 PLASSER CRESCENT, ST MARYS, NSW

Job No. 27578ZR
Date: 14-7-14
Method: SPIRAL AUGER JK350
R.L. Surface: ≈ 39.5m
Datum: AHD
Logged/Checked by: A.P.C./P.R.

Groundwater Record	Samples (ES / U50 / DB / DS)	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION			0		-	ASPHALTIC CONCRETE: 30mm.t	D			ROADBASE
	DB				CH	FILL: Sandy gravel, fine to coarse grained igneous, grey, fine to coarse grained sand.	MC>PL			
	DS	N > 41 12,23, 18/50mm REFUSAL			CL-CH	SILTY CLAY: high plasticity, red brown and light grey.			>600 >600 >600	
			1			SILTY CLAY: medium to high plasticity, light grey, with fine to coarse grained ironstone gravel.				
	DS	N = 36 15,16,20							>600 >600 >600	
			2			END OF BOREHOLE AT 1.95m				
			3							
			4							
			5							
			6							
			7							

GRAPHICAL BOREHOLE SUMMARY



Fill

Silty Clay

Shale

Asphaltic/ Bituminous Paving or Coal

Observed water level

N SPT "N" VALUE

Nc SOLID CONE BLOW COUNTS PER 150mm

NOTE: REFER TO BOREHOLE LOGS

Scale: 1 : 200 (vert) ; NTS (horiz)

JK Geotechnics

Job No.: 27578ZR

Figure No.: 2

EXPLANATORY NOTES – ENVIRONMENTAL LOGS

INTRODUCTION

These notes have been provided to supplement the environmental report with regards to drilling and field logging. Not all notes are necessarily relevant to all reports. Where geotechnical borehole logs are utilised for environmental purpose, reference should also be made to the explanatory notes included in the geotechnical report. Environmental logs are not suitable for geotechnical purposes.

The ground is a product of continuing natural and manmade processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Environmental studies involve gathering and assimilating limited facts about these characteristics and properties in order to understand the ground on a particular site under certain conditions. These conditions are directly relevant only to the ground at the place where, and time when, the investigation was carried out.

DESCRIPTION AND CLASSIFICATION METHODS

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, the SAA Site Investigation Code. In general, descriptions cover the following properties – soil or rock type, colour, structure, strength or density, and inclusions. Identification and classification of soil and rock involves judgement and the Company infers accuracy only to the extent that is common in current geotechnical practice.

Soil types are described according to the predominating particle size and behaviour as set out in the attached Unified Soil Classification Table qualified by the grading of other particles present (e.g. sandy clay) as set out below (note that unless stated in the report, the soil classification is based on a qualitative field assessment, not laboratory testing):

Soil Classification	Particle Size
Clay	less than 0.002mm
Silt	0.002 to 0.075mm
Sand	0.075 to 2mm
Gravel	2 to 60mm

Non-cohesive soils are classified on the basis of relative density, generally from the results of Standard Penetration Test (SPT) as below:

Relative Density	SPT 'N' Value (blows/300mm)
Very loose	less than 4
Loose	4 – 10
Medium dense	10 – 30
Dense	30 – 50
Very Dense	greater than 50

Cohesive soils are classified on the basis of strength (consistency) either by use of hand penetrometer, laboratory testing or engineering examination. The strength terms are defined as shown in the following table:

Classification	Unconfined Compressive Strength kPa
Very Soft	less than 25
Soft	25 – 50
Firm	50 – 100
Stiff	100 – 200
Very Stiff	200 – 400
Hard	Greater than 400
Friable	Strength not attainable – soil crumbles

Rock types are classified by their geological names, together with descriptive terms regarding weathering, strength, defects, etc. Where relevant, further information regarding rock classification is given in the text of the report. In the Sydney Basin, 'Shale' is used to describe thinly bedded to laminated siltstone.

DRILLING OR EXCAVATION METHODS

The following is a brief summary of drilling and excavation methods currently adopted by the Company, and some comments on their use and application. All except test pits and hand auger drilling require the use of a mechanical drilling rig.

Test Pits: These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils if it is safe to descend into the pit. The depth of penetration is limited to approximately 3m for a backhoe and up to 6m for an excavator. Limitations of test pits include problems associated with disturbance and difficulty of reinstatement; and the consequent effects on nearby structures. Care must be taken if construction is to be carried out near test pit locations to either properly re-compact the backfill during construction, or to design and construct the structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

Hand Auger Drilling: A borehole of 50mm to 100mm diameter is advanced by manually operated equipment. Premature refusal of the hand augers can occur on a variety of materials such as fill, hard clay, gravel or ironstone, and does not necessarily indicate rock level.

Continuous Spiral Flight Augers: The borehole is advanced using 75mm to 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling and in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected after withdrawal of the auger flights, but they can be very disturbed and layers may become mixed. Information from the auger sampling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability due to mixing or softening of samples by groundwater, or uncertainties as to the original depth of the samples. Augering below the groundwater table is of even lesser reliability than augering above the water table.

Rock Augering: Use can be made of a Tungsten Carbide (TC) bit for auger drilling into rock to indicate rock quality and continuity by variation in drilling resistance and from examination of recovered rock fragments. This method of investigation is quick and relatively inexpensive but provides only an indication of the likely rock strength and predicted values may be in error by a strength order. Where rock strengths may have a significant impact on construction feasibility or costs, then further investigation by means of cored boreholes may be warranted.

Wash Boring: The borehole is usually advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from "feel" and rate of penetration.

Mud Stabilised Drilling: Either Wash Boring or Continuous Core Drilling can use drilling mud as a circulating fluid to stabilise the borehole. The term 'mud' encompasses a range of products ranging from bentonite to polymers such as Revert or Biogel. The mud tends to mask the cuttings and reliable identification is only possible from intermittent intact sampling (e.g. from SPT and U50 samples) or from rock coring, etc.

Continuous Core Drilling: A continuous core sample is obtained using a diamond tipped core barrel. Provided full core recovery is achieved (which is not always possible in very low strength rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation. In rocks, an NMLC triple tube core barrel, which gives a core of about 50mm diameter, is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as CORE LOSS. The locations of losses are determined on site by the supervising engineer; where the location is uncertain, the loss is placed at the top end of the drill run.

Standard Penetration Tests: Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils as a means of indicating density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" – Test F3.1.

The test is carried out in a borehole by driving a 50mm diameter split sample tube with a tapered shoe, under the impact of a 63kg hammer with a free fall of 760mm. It is normal for the tube to be driven in three successive 150mm increments and the 'N' value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

- In the case where full penetration is obtained with successive blow counts for each 150mm of, say, 4, 6 and 7 blows, as: N = 13 (4, 6, 7)
- In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm, as: N>30 (15, 30/40mm)

The results of the test can be related empirically to the engineering properties of the soil. Occasionally, the drop hammer is used to drive 50mm diameter thin walled sample tubes (U50) in clays. In such circumstances, the test results are shown on the borehole logs in brackets.

A modification to the SPT test is where the same driving system is used with a solid 60 tipped steel cone of the same diameter as the SPT hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the SPT. The results of this Solid Cone Penetration Test (SCPT) are shown as "Nc" on the borehole logs, together with the number of blows per 150mm penetration.

LOGS

The borehole or test pit logs presented herein are an interpretation of the subsurface conditions, and their reliability will depend to some extent on the frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will enable the most reliable assessment, but is not always practicable or possible to justify on economic grounds. In any case, the boreholes or test pits represent only a very small sample of the total subsurface conditions.

The attached explanatory notes define the terms and symbols used in preparation of the logs.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than "straight line" variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

GROUNDWATER

Where groundwater levels are measured in boreholes, there are several potential problems:

- Although groundwater may be present, in low permeability soils it may enter the hole slowly or perhaps not at all during the time it is left open;
- A localised perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes and may not be the same at the time of construction; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole or 'reverted' chemically if water observations are to be made.

More reliable measurements can be made by installing standpipes which are read after stabilising at intervals ranging from several days to perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from perched water tables or surface water.

FILL

The presence of fill materials can often be determined only by the inclusion of foreign objects (e.g. bricks, concrete, plastic, slag/ash, steel etc) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult with limited testing and sampling to reliably determine the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density, strength and material type is much greater than with natural soil deposits. If the volume and quality of fill is of importance to a project, then frequent test pit excavations are preferable to boreholes

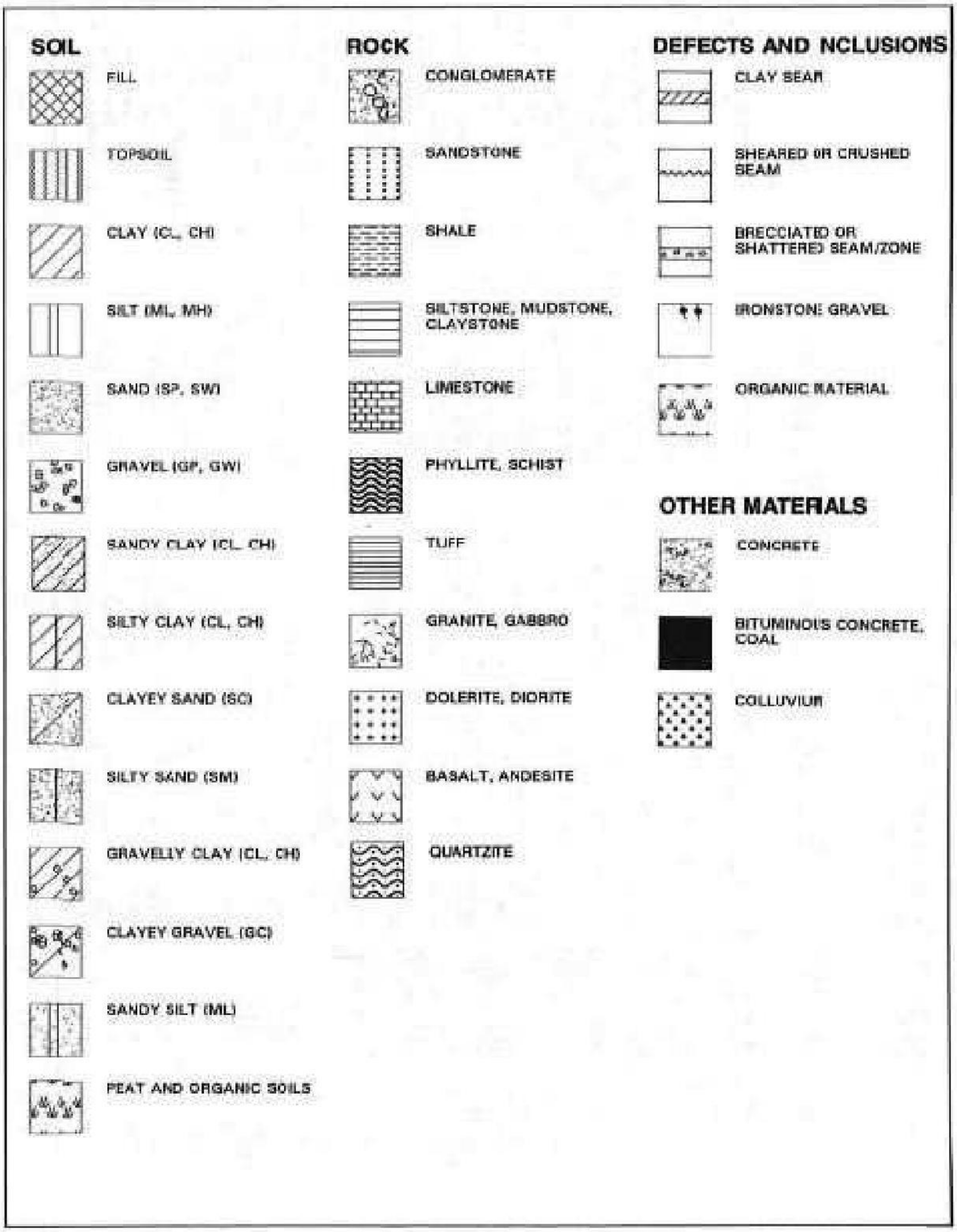
LABORATORY TESTING

Laboratory testing has not been undertaken to confirm the soil classifications and rocks strengths indicated on the environmental logs unless noted in the report.

SITE ANOMALIES

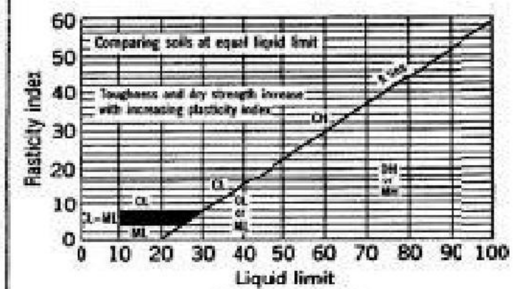
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, EIS should be notified immediately.

GRAPHIC LOG SYMBOLS FOR SOIL AND ROCKS



Field Identification Procedures (Excluding particles larger than 75 µm and basing fractions on estimated weights)				Group Symbols a	Typical Names	Information Required for Describing Soils	Laboratory Classification Criteria		
Coarse-grained soils More than half of material is *larger* than 75 µm sieve size (The 75 µm sieve size is about the smallest particle visible to naked eye)	Gravels More than half of coarse fraction is larger than 4 mm sieve size	Clean gravels (little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes	*GW*	Well graded gravels, gravel-sand mixtures, little or no fines	Give typical name; indicate approximate percentages of sand and gravel; maximum size; angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information; and symbols in parentheses For undisturbed soils add information on stratification, degree of compactness, cementation, moisture condition and drainage characteristics Example: *Silty sand*, gravelly; about 20% hard, angular gravel particles 12 mm maximum size; rounded and subangular sand grains coarse to fine, about 15% non-plastic fines with low dry strength; well compacted and moist in place; alluvial sand; (*SM*)	Use grain size curve in identifying the fractions as given under field identification Determine percentages of gravel and sand from grain size curve. Depending on percentage of fines (fraction smaller than 75 µm sieve size) coarse grained soils are classified as follows: Less than 5% *GW, GP, SW, SP* More than 12% *GM, GC, SM, SC* 5% to 12% *Borderline* cases requiring use of dual symbols	$C_U = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			Predominantly one size or a range of sizes with some intermediate sizes missing	*GP*	Poorly graded gravels, gravel-sand mixtures, little or no fines			Not meeting all gradation requirements for *GW*	
		Gravels with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures see *ML* below)	*GM*	Silty gravels, poorly graded gravel-sand-silt mixtures			Atterberg limits below "A" line, or *PI* less than 4	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
			Plastic fines (for identification procedures, see *CL* below)	*GC*	Clayey gravels, poorly graded gravel-sand-clay mixtures			Atterberg limits above "A" line, with *PI* greater than 7	
	Sands More than half of coarse fraction is smaller than 4 mm sieve size	Clean sands (little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes	*SW*	Well graded sands, gravelly sands, little or no fines			$C_U = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			Predominantly one size or a range of sizes with some intermediate sizes missing	*SP*	Poorly graded sands, gravelly sands, little or no fines			Not meeting all gradation requirements for *SW*	
		Sands with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures, see *ML* below)	*SM*	Silty sands, poorly graded sand-silt mixtures			Atterberg limits below "A" line or *PI* less than 5	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
			Plastic fines (for identification procedures, see *CL* below)	*SC*	Clayey sands, poorly graded sand-clay mixtures			Atterberg limits below "A" line with *PI* greater than 7	

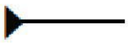
Identification Procedures on Fraction Smaller than 380 µm Sieve Size		Dry Strength (crushing characteristics)	Dilatancy (reaction to shaking)	Toughness (consistency near plastic limit)	Group Symbols	Typical Names	Information Required for Describing Soils
Fine-grained soils More than half of material is *smaller* than 75 µm sieve size	Silts and clays liquid limit less than 50	None to slight	Quick to slow	None	*ML*	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	Give typical name; indicate degree and character of plasticity, amount and maximum size of coarse grains; colour in wet condition, odour if any local or geologic name, and other pertinent descriptive information, and symbol in parentheses For undisturbed soils add information on structure, stratification, consistency in undisturbed and remoulded states, moisture and drainage condition Example: *Clayey silt*, brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; (*ML*)
		Medium to high	None to very slow	Medium	*CL*	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
		Slight to medium	Slow	Slight	*OL*	Organic silts and organic silt-clays of low plasticity	
	Silts and clays liquid limit greater than 50	Slight to medium	Slow to none	Slight to medium	*MH*	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
		High to very high	None	High	*CH*	Inorganic clays of high plasticity, fat clays	
		Medium to high	None to very slow	Slight to medium	*OH*	Organic clays of medium to high plasticity	
Highly Organic Soils		Readily identified by colour, odour, spongy feel and frequently by fibrous texture			*Pt*	Peat and other highly organic soils	



Plasticity chart
for laboratory classification of fine grained soils

Note: 1 Soils possessing characteristics of two groups are designated by combinations of group symbols (eg. GW-GC, well graded gravel-sand mixture with clay fines).
2 Soils with liquid limits of the order of 35 to 50 may be visually classified as being of medium plasticity.

LOG SYMBOLS

LOG COLUMN	SYMBOL	DEFINITION
Groundwater Record		Standing water level. Time delay following completion of drilling may be shown.
		Extent of borehole collapse shortly after drilling.
		Groundwater seepage into borehole or excavation noted during drilling or excavation.
Samples	ES	Soil sample taken over depth indicated, for environmental analysis.
	U50	Undisturbed 50mm diameter tube sample taken over depth indicated.
	DB	Bulk disturbed sample taken over depth indicated.
	DS	Small disturbed bag sample taken over depth indicated.
	ASB	Soil sample taken over depth indicated, for asbestos screening.
	ASS	Soil sample taken over depth indicated, for acid sulfate soil analysis.
	SAL	Soil sample taken over depth indicated, for salinity analysis.
Field Tests	N = 17 4, 7, 10	Standard Penetration Test (SPT) performed between depths indicated by lines. Individual show blows per 150mm penetration. 'R' as noted below.
	N_c = 5 7 3 R	Solid Cone Penetration Test (SCPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration for 60 degree solid cone driven by SPT hammer. 'R' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	VNS = 25	Vane shear reading in kPa of Undrained Shear Strength.
	PID = 100	Photoionisation detector reading in ppm (Soil sample heads pace test).
Moisture (Cohesive Soils)	MC>PL	Moisture content estimated to be greater than plastic limit.
	MC≈PL	Moisture content estimated to be approximately equal to plastic limit.
	MC<PL	Moisture content estimated to be less than plastic limit.
(Cohesionless)	D	DRY – Runs freely through fingers.
	M	MOIST – Does not run freely but no free water visible on soil surface.
	W	WET – Free water visible on soil surface.
Strength (Consistency) Cohesive Soils	VS	VERY SOFT – Unconfined compressive strength less than 25kPa
	S	SOFT – Unconfined compressive strength 25-5 0kPa
	F	FIRM – Unconfined compressive strength 50-1 00kPa
	St	STIFF – Unconfined compressive strength 100- 200kPa
	VSt	VERY STIFF – Unconfined compressive strength 200- 400kPa
	H	HARD – Unconfined compressive strength greater than 400kPa
	( )	Bracketed symbol indicates estimated consistency based o n tactile examination or other tests.
Density Index/ Relative Density (Cohesionless Soils)		**Density Index (ID) Range (%)** — **SPT ' N' Value Range (Blows/300mm)**
	VL	Very Loose <15 — 0-4
	L	Loose 15-35 — 4-10
	MD	Medium Dense 35-65 — 10-30
	D	Dense 65-85 — 30-50
	VD	Very Dense >85 — >50
	( )	Bracketed symbol indicates estimated density based on ease of drilling or other tests.
Hand Penetrometer Readings	300 250	Numbers indicate individual test results in kPa on representative undisturbed material unless noted otherwise
Remarks	'V' bit	Hardened steel 'V' shaped bit.
	'TC' bit	Tungsten carbide wing bit.
	T_{60}	Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.

LOG SYMBOLS CONTINUED

ROCK STRENGTH

Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance in the bedding. The test procedure is described by the International Journal of Rock Mechanics, Mining and Geomechanics Abstract Volume 22, No 2, 1985.

TERM	SYMBOL	Is (50) MPa	FIELD GUIDE
Extremely Low:	EL		Easily remoulded by hand to a material with soil properties.
		0.03	
Very Low:	VL		May be crumbled in the hand. Sandstone is "sugary" and friable.
		0.1	
Low:	L		A piece of core 150 mm long x 50mm dia. may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.
		0.3	
Medium Strength:	M		A piece of core 150 mm long x 50mm dia. can be broken by hand with difficulty. Readily scored with knife.
		1	
High:	H		A piece of core 150 mm long x 50mm dia. core cannot be broken by hand, can be slightly scratched or scored with knife; rock rings under hammer.
		3	
Very High:	VH		A piece of core 150 mm long x 50mm dia. may be broken with hand-held pick after more than one blow. Cannot be scratched with pen knife; rock rings under hammer.
		10	
Extremely High:	EH		A piece of core 150 mm long x 50mm dia. is very difficult to break with h and-held hammer . Rings when struck with a hammer.

ROCK STRENGTH

ABBREVIATION	DESCRIPTION	NOTES
Be	Bedding Plane Parting	Defect orientations measured relative to the normal to (i.e. relative to horizontal for vertical holes)
CS	Clay Seam	
J	Joint	
P	Planar	
Un	Undulating	
S	Smooth	
R	Rough	
IS	Iron stained	
XWS	Extremely Weathered Seam	
Cr	Crushed Seam	
60t	Thickness of defect in millimetres	

Appendix B: Laboratory Reports and Chain of Custody Documents

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS **113121**

Client:
Environmental Investigation Services
PO Box 976
North Ryde BC
NSW 1670

Attention: Jake Cashman

Sample log in details:

Your Reference:	**E27578KH**		
No. of samples:	10 Soils		
Date samples received / completed instructions received	15/07/14	/	15/07/14

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	22/07/14	/	21/07/14
Date of Preliminary Report:	Not Issued		

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Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference:	UNITS	113121-2	113121-3	113121-5	113121-7	113121-8
Your Reference	-------------	BH1	BH1	BH2	BH3	BH3
Depth	------------	0.5-0.6	0.9-1.0	0.1-0.2	0.1-0.2	0.9-1.0
Date Sampled		14/07/2014	14/07/2014	14/07/2014	14/07/2014	14/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014	17/07/2014
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	100	101	85	94	98

vTRH(C6-C10)/BTEXN in Soil		
Our Reference:	UNITS	113121-9
Your Reference	-------------	BH4
Depth	------------	0.2-0.3
Date Sampled		14/07/2014
Type of sample		Soil
Date extracted	-	16/07/2014
Date analysed	-	17/07/2014
TRH C_6 - C_9	mg/kg	<25
TRH C_6 - C_{10}	mg/kg	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25
Benzene	mg/kg	<0.2
Toluene	mg/kg	<0.5
Ethylbenzene	mg/kg	<1
m+p-xylene	mg/kg	<2
o-Xylene	mg/kg	<1
naphthalene	mg/kg	<1
Surrogate aaa-Trifluorotoluene	%	98

svTRH (C10-C40) in Soil						
Our Reference:	UNITS	113121-2	113121-3	113121-5	113121-7	113121-8
Your Reference	-------------	BH1	BH1	BH2	BH3	BH3
Depth	------------	0.5-0.6	0.9-1.0	0.1-0.2	0.1-0.2	0.9-1.0
Date Sampled		14/07/2014	14/07/2014	14/07/2014	14/07/2014	14/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014	17/07/2014
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	270	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	900	<100	<100
TRH >C_{10}-C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16}-C_{34}	mg/kg	<100	<100	850	<100	<100
TRH >C_{34}-C_{40}	mg/kg	<100	<100	1,100	<100	<100
Surrogate o-Terphenyl	%	89	86	94	94	91

svTRH (C10-C40) in Soil		
Our Reference:	UNITS	113121-9
Your Reference	-------------	BH4
Depth	------------	0.2-0.3
Date Sampled		14/07/2014
Type of sample		Soil
Date extracted	-	16/07/2014
Date analysed	-	17/07/2014
TRH C_{10} - C_{14}	mg/kg	<50
TRH C_{15} - C_{28}	mg/kg	<100
TRH C_{29} - C_{36}	mg/kg	<100
TRH >C_{10}-C_{16}	mg/kg	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50
TRH >C_{16}-C_{34}	mg/kg	<100
TRH >C_{34}-C_{40}	mg/kg	<100
Surrogate o-Terphenyl	%	90

PAHs in Soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ------------- ------------	113121-2 BH1 0.5-0.6 14/07/2014 Soil	113121-3 BH1 0.9-1.0 14/07/2014 Soil	113121-5 BH2 0.1-0.2 14/07/2014 Soil	113121-7 BH3 0.1-0.2 14/07/2014 Soil	113121-8 BH3 0.9-1.0 14/07/2014 Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014	17/07/2014
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	1.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	0.3	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	2.2	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	2.3	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	0.9	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	1.0	<0.1	<0.1
Benzo(b+k)fluoranthene	mg/kg	<0.2	<0.2	3.3	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	2.3	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	1.5	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	1.4	<0.1	<0.1
Benzo(a)pyrene TEQ NEPM B1	mg/kg	<0.5	<0.5	3.0	<0.5	<0.5
Total +ve PAH's	mg/kg	NIL (+)VE	NIL (+)VE	16	NIL (+)VE	NIL (+)VE
Surrogate p-Terphenyl-d14	%	107	96	104	101	98

PAHs in Soil		
Our Reference:	UNITS	113121-9
Your Reference	-------------	BH4
Depth	------------	0.2-0.3
Date Sampled		14/07/2014
Type of sample		Soil
Date extracted	-	16/07/2014
Date analysed	-	17/07/2014
Naphthalene	mg/kg	<0.1
Acenaphthylene	mg/kg	<0.1
Acenaphthene	mg/kg	<0.1
Fluorene	mg/kg	<0.1
Phenanthrene	mg/kg	<0.1
Anthracene	mg/kg	<0.1
Fluoranthene	mg/kg	<0.1
Pyrene	mg/kg	<0.1
Benzo(a)anthracene	mg/kg	<0.1
Chrysene	mg/kg	<0.1
Benzo(b+k)fluoranthene	mg/kg	<0.2
Benzo(a)pyrene	mg/kg	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1
Benzo(a)pyrene TEQ NEPM B1	mg/kg	<0.5
Total +ve PAH's	mg/kg	NIL (+)VE
Surrogate p-Terphenyl-d14	%	98

Organochlorine Pesticides in soil					
Our Reference:	UNITS	113121-2	113121-5	113121-7	113121-9
Your Reference	-------------	BH1	BH2	BH3	BH4
Depth	------------	0.5-0.6	0.1-0.2	0.1-0.2	0.2-0.3
Date Sampled		14/07/2014	14/07/2014	14/07/2014	14/07/2014
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	92	94	90	89

Organophosphorus Pesticides					
Our Reference:	UNITS	113121-2	113121-5	113121-7	113121-9
Your Reference	-------------	BH1	BH2	BH3	BH4
Depth	------------	0.5-0.6	0.1-0.2	0.1-0.2	0.2-0.3
Date Sampled		14/07/2014	14/07/2014	14/07/2014	14/07/2014
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	92	94	90	89

PCBs in Soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ------------ ------------	113121-2 BH1 0.5-0.6 14/07/2014 Soil	113121-5 BH2 0.1-0.2 14/07/2014 Soil	113121-7 BH3 0.1-0.2 14/07/2014 Soil	113121-9 BH4 0.2-0.3 14/07/2014 Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014
Arochlor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	92	94	90	89

Acid Extractable metals in soil						
Our Reference:	UNITS	113121-2	113121-3	113121-5	113121-7	113121-8
Your Reference	-------------	BH1	BH1	BH2	BH3	BH3
Depth	------------	0.5-0.6	0.9-1.0	0.1-0.2	0.1-0.2	0.9-1.0
Date Sampled		14/07/2014	14/07/2014	14/07/2014	14/07/2014	14/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date digested	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014	17/07/2014
Date analysed	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014	17/07/2014
Arsenic	mg/kg	7	7	5	7	4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	20	18	24	26	16
Copper	mg/kg	15	12	28	12	8
Lead	mg/kg	14	14	18	28	11
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	5	3	13	6	2
Zinc	mg/kg	21	13	32	31	7

Acid Extractable metals in soil			
Our Reference:	UNITS	113121-9	113121-10
Your Reference	-------------	BH4	DUPAC1
Depth	------------	0.2-0.3	-
Date Sampled		14/07/2014	14/07/2014
Type of sample		Soil	Soil
Date digested	-	17/07/2014	17/07/2014
Date analysed	-	17/07/2014	17/07/2014
Arsenic	mg/kg	<4	5
Cadmium	mg/kg	<0.4	<0.4
Chromium	mg/kg	20	21
Copper	mg/kg	7	13
Lead	mg/kg	8	22
Mercury	mg/kg	<0.1	<0.1
Nickel	mg/kg	4	8
Zinc	mg/kg	6	34

Moisture						
Our Reference:	UNITS	113121-2	113121-3	113121-5	113121-7	113121-8
Your Reference	-------------	BH1	BH1	BH2	BH3	BH3
Depth	------------	0.5-0.6	0.9-1.0	0.1-0.2	0.1-0.2	0.9-1.0
Date Sampled		14/07/2014	14/07/2014	14/07/2014	14/07/2014	14/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014	17/07/2014
Moisture	%	9.4	9.4	13	17	18

Moisture			
Our Reference:	UNITS	113121-9	113121-10
Your Reference	-------------	BH4	DUPAC1
Depth	------------	0.2-0.3	-
Date Sampled		14/07/2014	14/07/2014
Type of sample		Soil	Soil
Date prepared	-	16/07/2014	16/07/2014
Date analysed	-	17/07/2014	17/07/2014
Moisture	%	17	9.6

Asbestos ID - soils Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ------------- ------------	113121-2 BH1 0.5-0.6 14/07/2014 Soil	113121-5 BH2 0.1-0.2 14/07/2014 Soil	113121-7 BH3 0.1-0.2 14/07/2014 Soil	113121-9 BH4 0.2-0.3 14/07/2014 Soil
Date analysed	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014
Sample mass tested	g	Approx 10g	Approx 10g	Approx 15g	Approx 20g
Sample Description	-	Grey coarse-grained clay soil	Dark brown coarse-grained soil	Brown coarse-grained soil & rocks	Brown coarse-grained clay soil
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg
Trace Analysis	-	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-008	Moisture content determined by heating at 105+/-5 deg C for a minimum of 12 hours.
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			16/07/2014	[NT]	[NT]	LCS-10	16/07/2014
Date analysed	-			17/07/2014	[NT]	[NT]	LCS-10	17/07/2014
TRHC6 - C9	mg/kg	25	Org-016	<25	[NT]	[NT]	LCS-10	114%
TRHC6 - C10	mg/kg	25	Org-016	<25	[NT]	[NT]	LCS-10	114%
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	LCS-10	97%
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	LCS-10	113%
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	LCS-10	18%
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	LCS-10	120%
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	LCS-10	124%
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NR]	[NR]
Surrogate aaa-Trifluorotoluene	%		Org-016	106	[NT]	[NT]	LCS-10	104%

QUALITY CONTROL svTRH (C10-C40) in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			16/07/2014	[NT]	[NT]	LCS-4	16/07/2014
Date analysed	-			16/07/2014	[NT]	[NT]	LCS-4	16/07/2014
TRHC10 - C14	mg/kg	50	Org-003	<50	[NT]	[NT]	LCS-4	89%
TRHC15 - C28	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-4	97%
TRHC29 - C36	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-4	105%
TRH>C10-C16	mg/kg	50	Org-003	<50	[NT]	[NT]	LCS-4	89%
TRH>C16-C34	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-4	97%
TRH>C34-C40	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-4	105%
Surrogate o-Terphenyl	%		Org-003	96	[NT]	[NT]	LCS-4	95%

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			16/07/2014	[NT]	[NT]	LCS-5	16/07/2014
Date analysed	-			17/07/2014	[NT]	[NT]	LCS-5	17/07/2014
Naphthalene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-5	102%
Acenaphthylene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-5	97%
Phenanthrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-5	105%
Anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-5	103%

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-5	104%
Benzo(a)anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Chrysene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-5	92%
Benzo(b+k)fluoranthene	mg/kg	0.2	Org-012 subset	<0.2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	mg/kg	0.05	Org-012 subset	<0.05	[NT]	[NT]	LCS-5	106%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	105	[NT]	[NT]	LCS-5	98%

QUALITY CONTROL Organochlorine Pesticides in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			16/07/2014	113121-2	16/07/2014 || 16/07/2014	LCS-4	16/07/2014
Date analysed	-			17/07/2014	113121-2	17/07/2014 || 17/07/2014	LCS-4	17/07/2014
HCB	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	LCS-4	89%
gamma-BHC	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
beta-BHC	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	LCS-4	91%
Heptachlor	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	LCS-4	85%
delta-BHC	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
Aldrin	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	LCS-4	85%
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	LCS-4	88%
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
pp-DDE	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	LCS-4	90%
Dieldrin	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	LCS-4	88%
Endrin	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	LCS-4	92%
pp-DDD	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	LCS-4	99%
Endosulfan II	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
pp-DDT	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	LCS-4	90%
Methoxychlor	mg/kg	0.1	Org-005	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
Surrogate TCMX	%		Org-005	92	113121-2	92 || 89 || RPD: 3	LCS-4	83%

QUALITY CONTROL Organophosphorus Pesticides	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			16/07/2014	113121-2	16/07/2014 || 16/07/2014	LCS-4	16/07/2014
Date analysed	-			17/07/2014	113121-2	17/07/2014 || 17/07/2014	LCS-4	17/07/2014
Diazinon	mg/kg	0.1	Org-008	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
Dimethoate	mg/kg	0.1	Org-008	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
Ronnel	mg/kg	0.1	Org-008	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
Chlorpyriphos	mg/kg	0.1	Org-008	<0.1	113121-2	<0.1 || <0.1	LCS-4	102%
Fenitrothion	mg/kg	0.1	Org-008	<0.1	113121-2	<0.1 || <0.1	LCS-4	88%
Bromophos-ethyl	mg/kg	0.1	Org-008	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
Ethion	mg/kg	0.1	Org-008	<0.1	113121-2	<0.1 || <0.1	LCS-4	100%
Surrogate TCMX	%		Org-008	92	113121-2	92 || 89 || RPD: 3	LCS-4	91%

QUALITY CONTROL PCBs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			16/07/2014	113121-2	16/07/2014 || 16/07/2014	LCS-4	16/07/2014
Date analysed	-			17/07/2014	113121-2	17/07/2014 || 17/07/2014	LCS-4	17/07/2014
Arochlor 1016	mg/kg	0.1	Org-006	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
Arochlor 1221	mg/kg	0.1	Org-006	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
Arochlor 1232	mg/kg	0.1	Org-006	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
Arochlor 1242	mg/kg	0.1	Org-006	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
Arochlor 1248	mg/kg	0.1	Org-006	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
Arochlor 1254	mg/kg	0.1	Org-006	<0.1	113121-2	<0.1 || <0.1	LCS-4	102%
Arochlor 1260	mg/kg	0.1	Org-006	<0.1	113121-2	<0.1 || <0.1	[NR]	[NR]
Surrogate TCLMX	%		Org-006	92	113121-2	92 || 89 || RPD: 3	LCS-4	92%

QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date digested	-			17/07/2014	[NT]	[NT]	LCS-2	17/07/2014
Date analysed	-			17/07/2014	[NT]	[NT]	LCS-2	17/07/2014
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	[NT]	[NT]	LCS-2	104%
Cadmium	mg/kg	0.4	Metals-020 ICP-AES	<0.4	[NT]	[NT]	LCS-2	112%
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-2	108%
Copper	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-2	104%
Lead	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-2	106%
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	[NT]	[NT]	LCS-2	97%

QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-2	107%
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-2	108%

QUALITY CONTROL Moisture	UNITS	PQL	METHOD	Blank
Date prepared	-			[NT]
Date analysed	-			[NT]
Moisture	%	0.1	Inorg-008	[NT]

Report Comments:

Asbestos-ID in soil: All samples analysed as received. However, samples are below the recommended volume of 40-50g (50mL) as per AS4964-2004. This insufficient sample size may lead to inaccurate interpretation of the result as it may not be representative of the sampled area.

Asbestos ID was analysed by Approved Identifier:	Paul Ching
Asbestos ID was authorised by Approved Signatory:	Paul Ching

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS **113121-A**

Client:
Environmental Investigation Services
PO Box 976
North Ryde BC
NSW 1670

Attention: Jake Cashman

Sample log in details:

Your Reference:	**E27578KH**
No. of samples:	Additional testing on 1 soil
Date samples received / completed instructions received	15/07/14 / 23/07/14

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	30/07/14 / 25/07/14
Date of Preliminary Report:	Not Issued

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

PAHs in TCLP (USEPA 1311)		
Our Reference:	UNITS	113121-A-5
Your Reference	-------------	BH2
Depth	------------	0.1-0.2
Date Sampled		14/07/2014
Type of sample		Soil
pH of soil for fluid# determ.	pH units	8.3
pH of soil for fluid # determ. (acid)	pH units	1.3
Extraction fluid used	-	1
pH of final Leachate	pH units	5.1
Date extracted	-	24/07/2014
Date analysed	-	24/07/2014
Naphthalene in TCLP	mg/L	<0.001
Acenaphthylene in TCLP	mg/L	<0.001
Acenaphthene in TCLP	mg/L	<0.001
Fluorene in TCLP	mg/L	<0.001
Phenanthrene in TCLP	mg/L	<0.001
Anthracene in TCLP	mg/L	<0.001
Fluoranthene in TCLP	mg/L	<0.001
Pyrene in TCLP	mg/L	<0.001
Benzo(a)anthracene in TCLP	mg/L	<0.001
Chrysene in TCLP	mg/L	<0.001
Benzo(b+k)fluoranthene in TCLP	mg/L	<0.002
Benzo(a)pyrene in TCLP	mg/L	<0.001
Indeno(1,2,3-c,d)pyrene - TCLP	mg/L	<0.001
Dibenzo(a,h)anthracene in TCLP	mg/L	<0.001
Benzo(g,h,i)perylene in TCLP	mg/L	<0.001
Total +ve PAH's	mg/L	NIL (+)VE
Surrogate p-Terphenyl-d14	%	118

Method ID	Methodology Summary
Inorg-004	Toxicity Characteristic Leaching Procedure (TCLP) using AS 4439 and USEPA 1311 and in house method INORG-004.
EXTRACT.7	Toxicity Characteristic Leaching Procedure (TCLP).
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 22nd ED, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Org-012 subset	Leachates are extracted with Dichloromethane and analysed by GC-MS.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS.

QUALITY CONTROL PAHs in TCLP (USEPA 1311)	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			24/07/2014	[NT]	[NT]	LCS-W1	24/07/2014
Date analysed	-			24/07/2014	[NT]	[NT]	LCS-W1	24/07/2014
Naphthalene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	LCS-W1	104%
Acenaphthylene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	[NR]	[NR]
Acenaphthene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	[NR]	[NR]
Fluorene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	LCS-W1	111%
Phenanthrene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	LCS-W1	108%
Anthracene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	[NR]	[NR]
Fluoranthene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	LCS-W1	108%
Pyrene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	LCS-W1	107%
Benzo(a)anthracene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	[NR]	[NR]
Chrysene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	LCS-W1	97%
Benzo(b+k)fluoranthene in TCLP	mg/L	0.002	Org-012 subset	<0.002	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	LCS-W1	109%
Indeno(1,2,3-c,d)pyrene -TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012	110	[NT]	[NT]	LCS-W1	117%

Document Set ID: 6126735
Version: 1, Version Date: 02/09/2014

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

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Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
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When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

SAMPLE AND CHAIN OF CUSTODY FORM

TO:		FROM:
ENVIROLAB SSERVICES PTY LTD 12 ASHFIELD STREET CHATSWOOD NSW 2067 P: (02) 99106200 F: (02) 99106201 Attention: Aileen	EIS Job Number: E27578KH Date Results Required: STANDARD Page: 1	ENVIRONMENTAL INVESTIGATION SERVICES REAR OF 115 WICKS ROAD MACQUARIE PARK, NSW 2113 P: 02-9888 5000 F: 02-9888 5001 Attention: Jake Cashman

Location: North St Marys

Sampler: AC

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	PID	Sample Description	Combo 6a	Combo 3	PH, CEC and Clay Content	8 Metals	Asbestos
14/07/2014	1	BH1	0.1-0.2	G, A	0	Soil					
	2		0.5-0.6				X				
	3		0.9-1.0					X			
	4		1.5-1.95								
	5	BH2	0.1-0.2				X				
	6		0.9-1.0								
	7	BH3	0.1-0.2				X				
	8		0.9-1.0					X			
	9	BH4	0.2-0.3				X				
	10	DUPAC1	–	G	–					X	

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 113121

Date Received: 15/7/14
Time Received: 17:15
Received by: Kw
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Remarks (comments/detection limits required):

Sample Containers:
G - 250mg Glass Jar
A - Ziplock Asbestos Bag
P - Plastic Bag

Relinquished By:	Date:	Time:	Received By:	Date:
Jake Cashman	15/7/14		Kevin Wang	15/7/14

Aileen Hie

From: Jake Cashman [jcashman@jkgroup.net.au]
Sent: Wednesday, 23 July 2014 2:38 PM
To: Aileen Hie
Subject: 113121 (TCLP Required)

Aileen,

Report Number 113121
EIS Job Number E27578KH (North St Marys)

Could you please arrange TCLP test for PAH's for the following sample.

Envirolab Sample number 5
EIS BH2 (0.1-0.2)

113121 A
std T/A
due 30/7.

Regards,

Jake Cashman
Environmental Scientist

Environmental Investigation Services
CONSULTING ENVIRONMENTAL ENGINEERS AND SCIENTISTS

Tel: 02 9888 5000 PO Box 976 115 Wicks Road
Fax: 02 9888 5001 North Ryde BC NSW 1670 Macquarie Park NSW 2113
jcashman@jkgroup.net.au
www.jkgeotechnics.com.au

Appendix C: Site Information

Selected Plasser property Photos taken on 14 July 2014

Photograph 1: Taken showing the unidentified circular metal object in the southern section of the Plasser property, facing south.

Photograph 2: Taken showing the drums of fuel stored in the section of the Plasser property, facing east. Note the spills observed on the surface of the soil.

Photograph 3: Taken showing the ponded water from the sand blasting process in the southern section of the Plasser property, facing east.

Photograph 4: Taken showing the ponded water from the sand blasting process in the southern section of the Plasser property, facing east.

Appendix C1: WorkCover Records

JC

NSW GOVERNMENT | WorkCover

07 JUL 2014

WorkCover NSW
92-100 Donnison Street, Gosford, NSW 2250
Locked Bag 2906, Lisarow, NSW 2252
T 02 4321 5000 F 02 4325 4145
WorkCover Assistance Service 13 10 50
DX 731 Sydney workcover.nsw.gov.au

Our Ref: D14/089690
Your Ref: Jake Cashman

16 July 2014

Attention: Jake Cashman
Environmental Investigation Services
PO BOX 976
North Ryde BC NSW 1670

Dear Mr Cashman,

RE SITE: 25 Kurrajong Rd North St Marys NSW

I refer to your site search request received by WorkCover NSW on 10 July 2014 requesting information on licences to keep dangerous goods for the above site.

A search of the Stored Chemical Information Database (SCID) and the microfiche records held by WorkCover NSW has not located any records pertaining to the above mentioned premises.

If you have any further queries please contact the Dangerous Goods Licensing Team on (02) 4321 5500.

Yours Sincerely

Brent Jones
Senior Licensing Officer
Dangerous Goods Team

Appendix D: Report Explanatory Notes

Appendix D1: Abbreviations

Abbreviations

ABC	Ambient Background Concentrations
ACL	Added Contaminant Limits
AC	Asbestos Cement
ACM	Asbestos-Containing Material
ADWG	Australian Drinking Water Guidelines
AEC	Area of Environmental Concern
AF	Asbestos Fines
AHD	Australian Height Datum
As	Arsenic
ASL	Asbestos Health Screening Levels
ASS	Acid Sulfate Soil
AST	Above Ground Storage Tank
BA	Building Application
Bgl	Below Ground Level
BH	Borehole
BOM	Bureau of Meteorology
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CLM	Contaminated Land Management
CMP	Construction Management Plan
COC	Chain of Custody Documentation
Cr	Chromium
CSM	Conceptual Site Model
CT	Contamination Threshold
Cu	Copper
DA	Development Application
DBYD	Dial Before You Dig
DQI	Data Quality Indicators
DQOs	Data Quality Objective
DSI	Detailed Site Investigation
EAC	Ecological Assessment Criteria
EC	Electrical Conductivity
EILs	Ecological Investigation Levels
EMP	Environmental Management Plan
ENM	Excavated Natural Material
EPA	Environmental Protection Agency
ESA	Environmental Site Assessment
ESL	Ecological Screening Level
FA	Fibrous Asbestos
FR	Field Rinsate
GAI	General Approvals of Immobilisation
GSW	General Solid Waste
HILs	Health Based Investigation Level
HM	Heavy Metals
HMTV	Hardness Modified Trigger Values
HSLs	Health Screening Level
HW	Hazardous Waste
ISO	International Organisation of Standardisation
JK	Jeffery and Katauskas
LCS	Lab Control Spike
LNAPL	Light Non-Aqueous Phase Liquid
MGA	Map Grid of Australia
MW	Monitoring Well

Abbreviations

NATA	National Association of Testing Authorities
NEPM	National Environmental Protection Measure
NSW	New South Wales
OCP	Organochlorine Pesticides
OPP	Organophosphate Pesticides
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PCB	Polychlorinated Biphenyls
PCC	Potential Contaminants of Concern
PID	Photo-ionisation Detector
PQL	Practical Quantitation Limit
PSI	Preliminary Site Investigation
PVC	Polyvinyl chloride
QA	Quality Assurance
QC	Quality Control
RAP	Remediation Action Plan
RL	Reduced Level
RPD	Relative Percentage Difference
RSW	Restricted Solid Waste
SAC	Site Assessment Criteria
SAQP	Sampling, Analysis and Quality Plan
SAS	Site Audit Statement
SAR	Site Audit Report
SCC	Specific Contamination Concentration
SD	Standard Deviation
SIX	Six Maps
SPT	Hardness Modified Trigger Values
sVOC	Semi-Volatile Organic Compounds
SWL	Standard Water Level
TB	Trip Blank
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbons
TS	Trip Spike
UCL	Upper Confidence Limit
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VENM	Virgin Excavated Natural Material
VOC	Volatile Organic Compounds
VOCC	Volatile Organic Chlorinated Compound
WA	Western Australia
WHS	Workplace, Health and Safety
Zn	Zinc

Appendix D2: SAC Explanatory Notes

SAC EXPLANATORY NOTES

A brief summary of the SAC applicable to this investigation is presented below. Reference should be made to the NEPM 2013 for further information.

1. Health Investigation Levels (HILs) - Soil

The NEPM 2013 includes Health Based Investigation Levels (HILs) for a range of contaminants based on the risk of exposure, duration of exposure, toxicity and land use (availability). The HILs are scientifically based, generic assessment criteria designed to be used in the first stage of an assessment of potential risks to human health from exposure to contaminants (Tier 1 or 'screening stage').

The HILs are generally applicable to the top 3m of the soil profile for low-density residential land use. However, site specific conditions should determine the applicability of the HILs to soils below this depth for other land uses.

The HILs are divided into four categories outlined in the following table:

Table 1.1: HILs Categories – Soil

Category/Column	Land Use
HIL A	Residential with garden/accessible soil (home-grown produce contributing less than 10% of vegetable and fruit intake, no poultry); also includes children's day-care centres, preschools and primary schools.
HIL B	Residential with minimal opportunities for soil access, includes dwellings with fully and permanently paved yard space such as high-rise buildings and flats.
HIL C	Public open spaces like parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths. Does not include undeveloped public open spaces such as urban bushland and reserves.
HIL D	Commercial/Industrial includes premises such as shops, offices, factories and industrial sites.

Where the proposed land use includes more than one land use category (for example a mixed-use development including residential/retail/commercial land uses) the exposure setting of the most 'sensitive' ground floor site use is considered to be the most appropriate.

2. Interim Soil Vapour HILs for Volatile Organic Chlorinated Compounds (VOCCs)

The NEPM 2013 includes interim soil vapour HILs for selected VOCCs [see Table 1A(2) of Schedule B (1), NEPM 2013] to assess the vapour inhalation/intrusion pathway. The interim guidelines provide Tier 1 guidance for health risks for soil contamination sources and groundwater plumes associated with VOCCs. These values may be applied for general site assessments and sub-slab environments for evaluation of potential health risks for the 0-1m sub-slab profile. The VOCCs HILs for residential A and B (see landuse in Table 1.1 above) land uses are combined.

3. <u>Health Screening Levels (HSLs) for Petroleum Compounds</u>

The NEPM 2013 has adopted the HSLs for total petroleum hydrocarbon (TPH) compounds developed by the Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE). The HSLs have been derived based on the recommended total recoverable hydrocarbons (TRH) analytical method which includes BTEX compounds and naphthalene.

HSLs have been derived for soil, groundwater and soil vapour and apply to exposure to petroleum hydrocarbons through the dominant vapour inhalation exposure pathway only. HSLs are applicable to the ground floor land use only.

HSLs are derived by taking into account multiple factors (referred to as the 'multiple lines of evidence approach') which are summarised in the table below.

Table 1.2: Multiple Factors Governing Site Specific HSLs

Factor	Description
Land use	HIL A to HIL D outlined in Table 1.1. The HSLs for Residential A and B land uses are combined. HSLs are applicable to the ground floor land use only.
Soil Type	The below classification is based on the soil texture classification in Table A1 of the standard AS1726: • <u>Sand</u> – Coarse grained soil; • <u>Silt</u> – Fine grained soil – silts and clays (liquid limit <50%); and • <u>Clay</u> – Fine grained soil – silts and clays (liquid limit >50%). Where there is reasonable doubt, a more conservative approach should be adopted or laboratory testing for particle size should be undertaken.
Soil Depth (mBGL)[1]	The soil depth range is outlined below: • 0m to <1m; • 1m to <2m; • 2m to <4m; and • >4m (4m+).
Groundwater (mBGL)[1]	Presence of moisture/groundwater is an important factor. The depth of occurrence, land use (outlined above) and soil type (outlined above) should be taken into account. The depth of occurrence is outlined below: • 2m to <4m;

Factor	Description
	• 4m to <8m; and • >8m (8m+).
Soil Vapour (mBGL)[1]	Presence of soil vapour, depth of occurrence, land use (outlined above) and soil type (outlined above) should be taken into account. The depth of occurrence is outlined below: • 0m to <1m; • 1m to <2m; • 2m to <4m; • 4m to <8m; and • >8m (8m+). Soil vapour measurements can provide a more accurate representation of vapour risk. This is preferred where contaminated groundwater is present at less than 2m below ground or basement levels.
Contaminants	BTEX, Naphthalene and TPH fractions F1-F4: • F1: $C_6 - C_{10}$. The BTEX concentration must be subtracted to obtain F1 value; • F2: $>C_{10} - C_{16}$. The naphthalene concentration must be subtracted to obtain the F2 value; • F3: $>C_{16} - C_{34}$; and • F4: $>C_{34}$. The F3 and F4 fractions are non-volatile and therefore not of concern for vapour intrusion. Exposure to these compounds can occur via direct contact. Reference should be made to the NEPM 2013 in the event direct contact can occur.

Bio-degradation	Account for bio-degradation due to the presence of oxygen:
	• Concentration of oxygen greater than >5% in soil vapour at a depth of 1m below the surface immediately adjacent to the concrete slab;
	• Maximum slab width of less than 15m, with oxygen access on both sides. A distance of 7-8m from the exposed soil at the slab boundary is considered the maximum lateral under-slab penetration of oxygen;
	• Provided the above conditions are met, the following bio-degradation factors can be applied:
	  ➢ Factor of x10 for depths to source of 2 to <4m; and
	  ➢ Factor of x100 for depths to source of 4m+ where the vapour source strength is 100mg/L (100,000mg/m^3) or less.
	• Bio-degradation is not applicable for depths less than 2m; and

Factor	Description
	• Not applicable to ecological receptors; and • Reference should also be made to management limits.
Other Factors	Consideration should also be given to the following: • Check the status and condition of the slab for the presence of cracks and deterioration. This can act as a preferential pathway; • Potential for direct contact to workers; and • The soil saturation concentration of a contaminant occurs when the pore water is at its solubility limit and soil vapour is at the maximum. When the HSLs exceed this limit, the vapour in soil or above the groundwater cannot result in an unacceptable vapour risk and is denoted as NL (not limited) in the HSLs tables.

Note:
mBGL – meters below ground level

a) Limitations of HSLs

A site specific approach of direct intervention should be development in the following cases:

- Identified contamination has an atypical petroleum composition;
- Groundwater contaminated with petroleum hydrocarbons is present at less than 2m below ground or basement surface;
- Contaminated groundwater or LNAPL is entering or in contact with a basement or building foundations;
- The impacted soil source thickness is >2m;
- A preferential migration pathway is present that could connect a vapour source to a building; and
- Hydrocarbon odour is present in buildings or utilities which indicate a preferential migratory pathway and an immediate human health risk.

b) Silica Gel Clean-Up

Soil samples are initially analysed for TRH without a preliminary silica gel clean-up of the sample. Consequently the TRH result may include other compounds such as phthalates, humic acids, fatty acids and sterols (if present).

Silica gel clean-up should remove these other compounds and result in a more accurate result for petroleum hydrocarbons. If undertaken these results have been referred to as TPH_{sgel} within this report.

4. Ecological Assessment Criteria (EAC)

The NEPM 2013 includes a methodology for developing site specific EAC for the protection of terrestrial ecosystems from site contamination. The EAC provide the basis for a Tier 1 site assessment of ecological risk. The factors to take into account for deriving site specific EAC are outlined in the following table:

Table 1.3: Factors for Deriving Site Specific EAC

Factor	Description
Land Use Setting	The EAC are applicable for the following generic land use settings based on protection of ecological significance: • Areas of ecological significance (99% protection); • Urban residential areas and public open space (80% protection); and • Commercial/Industrial land use (60% protection).
Application Depth	The EAC are applicable to the top 2m of soil at the finished surface/ground level which corresponds to the root zone and habitation zone of many species.
Ecological Investigation Levels (EILs)	EILs are derived for the following contaminants: • Aged contaminants (>2 years): Chromium III (CrIII), Copper (Cu), Lead (Pb), Nickel (Ni) and Zinc (Zn). The methodology for deriving site specific EILs for aged contaminants are outlined in below; and • Other contaminants with published EILs: Arsenic (As), DDT (pesticide) and Naphthalene (a PAH compound). EILs for fresh contaminants (i.e. present for less than 2 years) should be specifically derived for the site as outlined in NEPM 2013.
Ecological Screening Levels (ESLs)	ESLs apply to TRH fractions F1-F4 (see Table 1.2); BTEX and Benzo(a)pyrene (a PAH compound).

a) Ecological Investigation Levels (EILs)

The NEPM 2013 provides generic EILs for Arsenic, DDT and Naphthalene that are applicable to all soils as a total soil contaminant concentration. The EILs for the remaining aged contaminants (Cr III, Cu, Ni, Pb and Zn) are derived using the following methodology:

Table 1.4: Steps for Deriving Site Specific EILs

Step	Description
Step 1 – Soil Property	Analyse the soil samples for the following: • CEC ($cmol_c$/kg) to determine EILs for Cu, Ni and Zn; • pH (to determine EILs for Cu); and • Clay content (% clay) (to determine the EIL for CrIII).
Step 2 – Establish Added Contaminant Limits (ACLs)	The ACL is the added concentration of a contaminant above which further appropriate investigation and evaluation of the impact on ecological values is required. The ACL take into account the biological availability of the elements in various soils. For establishing the site specific ACLs, consideration should be given

Step	Description
	to the soil parameters outlined in Step 1. The ACL for Cu may be determined by pH or CEC. The lower of the determined value should be selected for the EIL calculation. The ACL for Pb is taken directly from the published data.
Step 3 – Calculate the Ambient Background Concentration (ABC)	The ABC takes into account the naturally occurring background levels and contaminant levels introduced by anthropogenic activity like emissions from vehicles etc. The NEPM 2013 provides the following methods for calculating the ABC: • Method 1: The preferred method is to measure the ABC at an appropriate reference site where there is a high naturally occurring background; • Method 2: Obtain ABC from the urban metal level studies undertaken by Olszowy et al. (1995) or Hamon et al. (2004). The ABC in this method varies based on the contaminant and the soil iron and/or manganese concentrations; and • Method 3: ABCs for individual suburbs which high and low traffic areas for NSW are available for CrIII, Cu, Pb, Ni and Zn from Olszowy et al. (1995) (see NEPM 2013 Schedule B5b).
Step 4 – Calculate the EIL	EIL is calculated by summing the ACL and ABC: **EIL = ACL + ABC**

b) Ecological Screening Levels (ESLs) for Petroleum Compounds

Similar to the HSLs outlined above, the NEPM 2013 has adopted the ESLs for TPH compounds developed by the Canadian Council of the Ministers of the Environment (CCME) in the publication *Canada-wide Standard for Petroleum Hydrocarbons (PHC) in soil* (CCME 2008[25]). Site specific ESLs are derived based on fresh contamination and should not be applied directly to the assessment of sediments. The following factors apply:

Table 1.5: Multiple Factors for Site Specific ESLs

Factor	Description
Land Use Setting and Application Depth	Refer to Table 1.1.
Soil Type	• Fine Grained – includes clays and silts; and • Coarse Grained – sands and gravels.
Contaminants	BTEX, Benzo(a)pyrene and TPH fractions F1-F4: • F1: C_6 – C_{10}. The BTEX concentration must be subtracted to

[25] CCME, (2008), *Canada-wide Standard for Petroleum Hydrocarbons (PHC) in soil* (referred to as CWS PHC)

Factor	Description
	obtain F1 value; • F2: $>C_{10} - C_{16}$. The naphthalene concentration must be subtracted to obtain the F2 value; • F3: $>C_{16} - C_{34}$; and • F4: $>C_{34}$. The ESLs for F1 and F2 is of moderate reliability.

5. Management Limits for Petroleum Hydrocarbons

The NEPM 2013 has adopted the physical and aesthetic management limits outlined in the CWS PHC publication. These limits are applied after considering the relevant HSLs and ESLs for adverse effects of TPH contamination including: presence of free phase (LNAPL); fire hazards; explosive hazards; effects on buried infrastructure; and aesthetic considerations.

These limits are relevant for operating sites where significant sub-slab leakage of petroleum compounds has occurred and when decommissioning industrial and commercial sites.

6. Asbestos in Soil

The NEPM 2013 includes guidelines for the assessment of asbestos in soil. Asbestos is identified to occur as:

- ACM (asbestos containing material);
- Bonded ACM – e.g. fibro frags >7mm (identified during site inspection/sampling);
- Fibrous Asbestos (FA) – friable materials e.g. insulation products, weathered fibro that can be crushed by hand pressure, crumbled, woven materials etc (identified during site inspection/sampling); and
- Asbestos Fines (AF) –free fibres, fibre bundles, fibro frags <7mm (considered friable), generally only identified by laboratory.

The guidelines recommend undertaking a preliminary site investigation (PSI) if the site history or site inspection indicates the possibility or occurrence of potential asbestos contamination. In the event a detailed site investigation (DSI) is required, the NEPM 2013 recommends using the Western Australian (WA) Asbestos Guidelines 2009[26].

a) Criteria for PSI

EIS has adopted the 'presence/absence' method for the PSI in accordance with AS4964-2004[27]. If asbestos is present, the status of the asbestos material (friable or bonded/non-friable) is further considered due to the implications associated with site remediation and/or management. The presence of asbestos may require a DSI as outlined below.

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[26] WA Department of Health, (2009), *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia.* Published May 2009 (referred to as Western Australian Asbestos Guidelines 2009)

[27] Australian Standard 4964, (2004), *Method for the Qualitative Identification of Asbestos in Bulk Samples.* (referred to as AS4964)

b) Criteria for DSI

The Western Australian Asbestos Guidelines 2009 prescribe a site investigative model for a DSI. The WA guidelines are based on various studies but generally use the Dutch guidelines with a conservation factor of 10. The asbestos health screening levels (HSLs) adopted by NEPM 2013 is outlined in the table below:

Table 1.6: ASLs for DSI

Form of Asbestos	HSLs (w/w)			
	Residential A[1]	**Residential B[2]**	**Recreational C[3]**	**Commercial / Industrial D[4]**
Bonded ACM	0.01%	0.04%	0.02%	0.05%
FA and AF[5] (Friable)	0.001%			
All forms	No Visible Asbestos at the Surface			

Notes:

1 to 4 – Refer to the landuse categories for HILs outlined in Table 1.1

5 – The guideline value only applies for analysis quantified by gravimetric procedures (see Section 4.10 of NEPM 2013). This is not applicable to free fibres.

The following considerations should be made for determining asbestos concentrations in soil:

- The occurrence of asbestos at the surface should be recorded on a grid system of 10m x 10m;
- Non-impacted soils should be excluded from the calculations to avoid dilution effects;
- Separate determination should be made for each stratum/unit of fill or soil;
- Averaging or using statistical procedures is not appropriate;
- Sub-surface samples obtained from boreholes and/or trenches, the calculation should be carried out per sample; and
- A weight-of-evidence approach is recommended for determining whether the exceedances are of concern.

The amount of asbestos in ACM for a measured/estimated amount of soil is expressed as a % weight for weight (%w/w). This can be estimated using the following expression:

$$\% \frac{w}{w}\, asbestos\ in\ soil = \frac{\%\, asbestos\ content\ \times bonded\ ACM\ (kg)}{soil\ volume\ (L) \times soil\ density\ (\frac{kg}{L})}$$

The % asbestos content within bonded ACM is estimated to be 15% by enHealth (2005). Soil density for sandy soils is approximately 1.65kg/L.

c) Limitation of adopting the Western Australian Asbestos Guidelines 2009

The following limitations have been identified for using the WA asbestos guidelines:

- The guidelines assume that the asbestos contamination is confined to the top 10cm of the soil profile;
- The guidelines are applicable to sandy soils which are the predominant soil type encountered in WA;

- The sampling methodology recommended in the guideline (wet soil, raking, tilling) may not be adequate in clayey and silty conditions;
- The presence of asbestos below the HSLs may still pose a risk to site receptors which will require remediation or management; and
- The sampling density recommend in the guideline (2 x NSW EPA density) may not be achievable for sites which are less than $500m^3$ in area.

7. Waste Classification Criteria for Off-Site Disposal of Soil

Any material excavated for the proposed development will require a waste classification for off-site disposal in accordance with the Waste Classification Guidelines 2009.

Soils are classed into the following categories based on the chemical contaminant criteria outlined in the guidelines:

Table 1.7: Waste Categories

Category	Description
General Solid Waste (non-putrescible) (GSW)	• If SCC ≤ CT1 then TCLP not needed to classify the soil as GSW • If TCLP ≤ TCLP1 and SCC ≤ SCC1 then treat as GSW
Restricted Solid Waste (non-putrescible) (RSW)	• If SCC ≤ CT2 then TCLP not needed to classify the soil as RSW • If TCLP ≤ TCLP2 and SCC ≤ SCC2 then treat as RSW
Hazardous Waste (HW)	• If SCC > CT2 then TCLP not needed to classify the soil as HW • If TCLP > TCLP2 and/or SCC > SCC2 then treat as HW
Excavated Natural Material (ENM)	The criteria to classify material as ENM are outlined in The Excavated Natural Material Exemption (2012[28]).
Virgin Excavated Natural Material (VENM)	Natural material (such as clay, gravel, sand, soil or rock fines) that meet the following: • that has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial mining or agricultural activities; • that does not contain sulfidic ores or other waste; and • includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved from time to time by a notice published in the NSW Government Gazette.

Note:

[28] Protection of the Environment Operations (Waste) Regulation 2005 – General Exemption Under Part 6, Clase 51 and 51A, The excavated natural material exemption, 2012 (ENM exemption 2012)

SCC – Specific Contaminant Concentration
CT – Contaminant Threshold
TCLP – Toxicity Characteristics Leaching Procedure

a) General Approvals of Immobilisation (GAI)

Significant amounts of waste ash and gravely slag were available in the late nineteenth and early twentieth century as a result of the use of coal for industrial and domestic heating purposes. Widespread use of ash/slag waste (either as ash or mixed with other soil and waste materials) as fill material was common in the suburbs of Sydney at this time.

To account for the presence of ash and slag, the NSW EPA has published the following:

Table 1.8: GAIs

Approval Number	Waste Stream	Contaminants	Waste Assessment Requirements
1999/05[29]	Ash, ash-contaminated natural excavated materials or coal-contaminated natural excavated material	B(a)P and PAHs	The SCC limits for PAHs and B(a)P outlined in the Waste Classification Guidelines 2009 do not apply for the assessment of this waste stream. The material can be classified according to the leachable concentration (TCLP) value of B(a)P alone. Disposal restrictions apply for material classified under this GAI.
2009/07[30]	Metallurgical furnace slag or metallurgical furnace slag contaminated natural excavated materials	Beryllium, Chromium (VI), lead, nickel, PAHs and B(a)P	The SCC limits for these contaminants outlined in the Waste Classification Guidelines 2009 do not apply for the assessment of this waste stream. The material can be classified according to their leachable concentrations (TCLP) values alone.

Note:

SCC – Specific Contaminant Concentration
TCLP – Toxicity Characteristics Leaching Procedure
B(a)P - Benzo(a)pyrene
PAHs – Polycyclic Aromatic Hydrocarbons

8. Groundwater Investigation Levels (GILs)

The appropriate settings for current and potential uses of groundwater should be identified for establishing the GILs. Contaminated groundwater may pose a risk to receptors at the point of extraction or as a result of discharge into the receiving environment and groundwater resources.

[29] http://www.environment.nsw.gov.au/resources/waste/GenImmobApp_1999-05_Ash_ACNEM_or_CCNEM.pdf (GAI 1999/05)
[30] http://www.environment.nsw.gov.au/resources/waste/2009-07_Metallurgical_furnace_slag.pdf (GAI 2009/07)

The assessment should be designed to consider the risk of groundwater contamination to all potential on site and off site receptors.

In assessing groundwater contamination, NEPM 2013 has adopted the framework outlined in the National Water Quality Management Strategy which includes the following guidelines:

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (AWQG) (2000). This includes a framework for developing guidelines for aquifer assessment. The guidelines provide water quality parameters for aquatic ecosystems (fresh and marine waters), industrial, agricultural, recreational and irrigation uses;
- Australian Drinking Water Guidelines (ADWG) (2011). Includes the Australian Drinking Water Guidelines used to assess drinking water quality; and
- Guidelines for Managing Risk in Recreational Water (GMRRW) (NHMRC 2008).

The NEPM 2013 has adopted HSLs for the assessment of petroleum hydrocarbons in groundwater.

The presence of elevated contaminants above the GILs triggers further investigation to assess the source(s) and the extent of the contamination. Guidance on the remediation and management of contaminated groundwater is outlined in *NSW DECCW Guidelines for the Assessment and Management of Groundwater Contamination (2007[31])*.

a) Hardness Modified Trigger Values (HMTVs)

Water hardness can affect the bioavailability of metals/metalloids in fresh water. Consequently, Section 3.4.3.2 of the ANZECC 2000 guidelines includes algorithms to derive hardness modified trigger values (HMTVs) for metals/metalloid concentrations in fresh water.

[31] NSW DECCW, (2007), *Guidelines for the Assessment and Management of Groundwater Contamination.* (referred to as Groundwater Contamination Guidelines 2007)

APPENDIX 9
Arborists report

Arboricultural Impact Assessment

Proposed new factory at Plasser Australia

25 Kurrajong Road, North St Marys

Date: July 2014

Author: Alexis Anderson

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1 Contents

2 Summary

This Arboricultural Impact Assessment (AIA) is based on fifteen (15) trees located at the Plasser Australia factory site, North St Marys. The tree population of the site is made up of planted Australian natives. The proposed works include construction of a new factory building.

The Retention Values of the subject trees were rated as outlined in the following Table. Refer to Figure A (page 4) for tree locations.

Table A: Retention Values of the Subject Trees.

	High Retention Value (Tree Number)	Medium Retention Value (Tree Number)	Low Retention Value (Tree Number)
To be Retained	-	-	-
To be Removed	-	1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14	2, 12, 15

All of the assessed trees are proposed to be removed to facilitate the proposed works. None of the assessed trees had High Retention Values. The assessed trees were not considered to be of sufficient value to warrant a major re-design to facilitate their retention. There were other larger trees on the site that are clear of the proposed works that are able to be retained.

3 Introduction

3.1 Background

This Arboricultural Impact Assessment (AIA) was prepared for Plasser Australia Pty Ltd in relation to the existing trees and proposed new factory at 25 Kurrajong Road, North St Marys (subject site).

The purpose of this AIA is to assess the likely impacts of the proposed works on the existing site trees and make recommendations regarding construction methods and tree protection measures to limit adverse impacts on any trees able to be retained.

This AIA has been prepared in accordance with the Australian Standard 4970-2009, *Protection of trees on development sites.*

3.2 Subject Site/Subject Trees

The subject site is located within Lot 1 in D.P.600899. The area of assessment is situated towards the western boundary (Plasser Crescent frontage). The majority of the site is occupied by factory buildings, office building, car parking areas and rail lines.

The tree population of the site consists of planted Australian natives. Trees 2-15 form part of an informal group planting located along the Plasser Crescent frontage. There are other shrubs and small trees located amongst this group of trees. The trees shown on the Survey Plan in this area are indicative only and do not represent actual tree positions.

Tree 1 is a stand-alone tree located near the north-eastern corner of the proposed new factory.

Refer to Figure A (below) for approximate tree locations and numbers. A detailed description of the subject trees is included in the Tree Assessment Table (Attachment A).

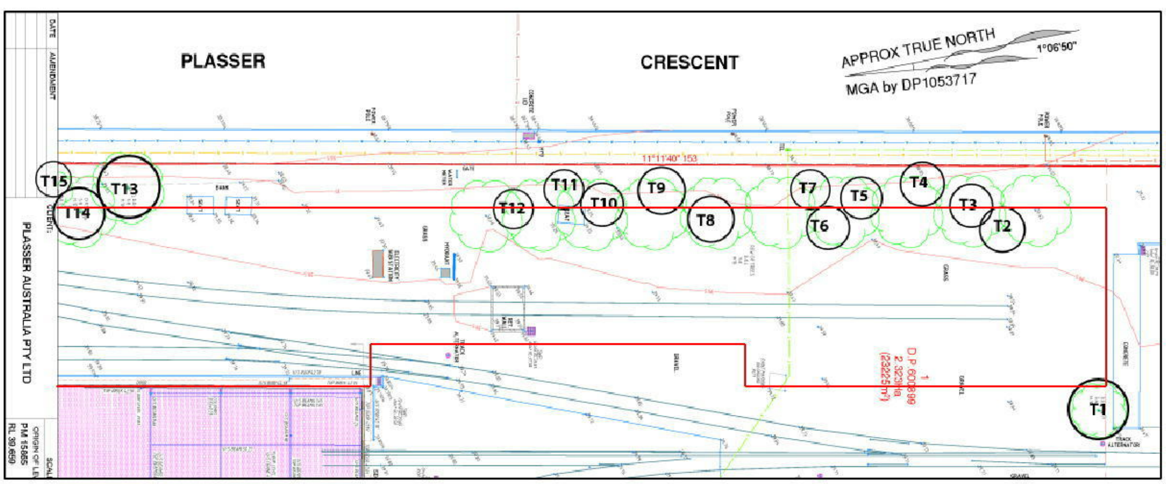

Figure A: Excerpt from the Detail and Level Survey showing approximate tree positions and numbering. The approximate outline of the new factory is shown as red lines.

3.3 Proposed Works

It is proposed to construct a new factory close the Plasser Crescent frontage. Excavation will be required for installation of the ground floor slab.

4 Methodology

4.1 Site Inspection

Site inspection and tree assessment was undertaken on the 15th of July, 2014. The trees were assessed from ground level using a Tree Assessment Table, which is included as Attachment A. The definitions and explanations of terms used are outlined in the Tree Table Definitions page which is included at Attachment B.

The tree assessment was undertaken for the purpose of pre-development planning. Detailed tree risk assessment was not requested or included in the scope of works.

4.2 Plans and Diagrams

The following plans were provided for review as part of this assessment:

- Site Plan, 1100, Group GSA, 17/6/14.
- Demolition Plan, 1000, Group GSA, 17/6/14.
- Proposed Ground Floor Plan, 2000, Group GSA, 17/6/14
- Proposed Elevations and Sections, 3000, Group GSA, 17/6/14
- Proposed Section, 3100, Group GSA, 17/6/14

The Detail and Level Survey prepared by SDG (05.06.2014) was also reviewed.

Trees 2-12 were not accurately plotted on the provided plans. The approximate positions of these trees have been plotted on the plans within this report.

All tree protection diagrams were hand drawn by Bluegum Tree Care and Consultancy.

4.3 Tree Protection Zones

Tree assessments in accordance with the Australian Standard 4970-2009, *Protection of trees on development sites*, require calculation of a Tree Protection Zone (TPZ). Within the TPZ, a smaller root zone called the Structural Root Zone (SRZ) is also calculated. The terms TPZ and SRZ are used throughout this report. The following is a brief explanation of these terms:

Tree Protection Zone -TPZ: This is the area that should be isolated from construction disturbance so that the tree remains viable. Some disturbance within the TPZ may be possible following arboricultural assessment.

Structural Root Zone -SRZ: This is the area required to maintain tree stability. Excavation within the SRZ can lead to whole tree failure.

Refer to the Tree Assessment Table (Attachment A) for the Tree Protection Zones of the assessed trees.

4.4 Retention Values

Retention values are derived from a combination of Estimated Life Expectancy rating and Landscape and Environmental Significance ratings.

- **HIGH Retention Value**: These trees are worthy of retention and design consideration should be made where possible to allow their retention.
- **MEDIUM Retention Value**: These trees are worthy of retention and minor design consideration should be made to retain these trees wherever possible (e.g. placement of ancillary structures, garden retaining walls, driveway levels).
- **LOW Retention Value**: These trees should not be considered to be a constraint to design layout. Some of these trees should be removed irrespective of any proposed development.

The method of determining and defining retention values used in this report has been derived from the ©Retention Index developed by Tree Wise Men® Australia Pty Ltd.

4.5 Consideration for Tree Retention and Removal

Where demolition of existing structures, excavation or fill is proposed within the Tree Protection Zone (TPZ), arboricultural assessment and sensitive construction methods will be required. Where works are proposed outside of the TPZ, no sensitive construction methods are required.

Tree removal recommendations have been based on tree Retention Values and construction offsets. Trees may generally be recommended for removal in the following circumstances:

- Trees located within construction footprints.
- Trees with construction proposed within SRZ where root loss cannot be avoided through sensitive design.
- Trees with a TPZ loss of more than 25%, may be recommended for removal providing tree sensitive design cannot be implemented to avoid significant root and canopy loss.
- Trees with low Retention Values may be recommended for removal irrespective of proposed development.

5 Potential Impacts of Proposed Works

5.1 Trees to be removed

Tree Number	Retention Value	Reason for Removal
1	Medium	Located over the electrical easement.
2, 12	Low	Within proposed building footprint.
6, 8, 10, 14	Medium	
15	Low	Proposed ground floor slab within the Structural Root Zone
3, 4, 5, 7, 9, 11, 13	Medium	

6 Recommendations

6.1 Prior to Construction

Tree Removal: Fifteen (15) trees and the surrounding shrubs are proposed to be removed. Tree removal works should be undertaken in accordance with the WorkCover Code of Practice for Amenity Tree Industry, 1998.

6.2 Post Construction

Tree Replacement: It is recommended that replacement planting include canopy trees with mature height greater than 10 metres. Recommended replacement species include:

- Spotted Gum, *Corymbia maculate*
- Forest Red Gum, *Eucalyptus teriticornis*
- Narrow-leaved Ironbark, *Eucalyptus crebra*
- Swamp Paperbark, *Melaleuca decora*

There may be some opportunities for new planting along the Kurrajong Road frontage and towards the north-western corner of the site.

7 Statement of Impartiality

- This report prepared by Bluegum Tree Care & Consultancy (BTCC) reflects the impartial and expert opinion of Alexis Anderson.
- BTCC is acting independently of and not as the advocate for the owners of the subject trees.
- BTCC does not undertake tree pruning and removal works and will not have any involvement with pruning or removing trees which are the subject of this report.

8 Limitations

- The findings of this report are based upon and limited to visual examination of trees from ground level without any climbing, internal testing or exploratory excavation.
- The tree assessment was undertaken for the purpose of pre-development planning. Detailed tree risk assessment was not requested or included in the scope of works.
- This report reflects the health and structure of trees at the time of inspection. Bluegum cannot guarantee that a tree will be healthy and safe under all circumstances or for a specified period of time. There is no guarantee that problems or defects with assessed trees, will not arise in the future. Liability will not be accepted for damage to person or property as a result of failure of assessed trees.

Tree No.	Common Name/ Genus Species	DBH (mm)	Height (m)	Canopy Spread Radius (m)	Age Class	Health / Vigour	Structural Condition	Tree Protection Zone (m)	Structural Root Zone (m)	Estimated Life Expectancy (ELE)	Landscape and Environmental Significance	Retention Value	Comments	Likely Construction Impacts	Proposed Action.
1	Southern Mahogany, *Eucalyptus botryoides*	230, 220	7	4	M	G	G	3.8	2.1	Long (30+ yrs)	3	Medium	Planted as part of ealier group of trees.	Proposed new factory within the TPZ (clear of the Strutcural Root Zone). Proposed landscaping works within the SRZ. Electical easement within the SRZ.	Remove.
2	Parramatta Green Wattle, *Acacia parramattensis*	150	5	4	LM	P	F	2.0	1.5	Short (0-5 yrs)	4	Low	Planted as part of more recent group of trees.	Within proposed building footprint.	Remove.
3	Broad-Leaved Apple, *Angophora subvelutina*	170	7	2	SM	G	G	2.0	1.6	Long (30+ yrs)	3	Medium	Planted as part of more recent group of trees.	Proposed building footprint within the Structural Root Zone.	Remove.
4	Swamp Mahogany, *Eucalyptus robusta*	320, 230	6	4	M	G	F	4.7	2.2	Long (30+ yrs)	3	Medium	Planted as part of earlier group of trees. Western side of the canopy has been lopped for powerline clearance.	Proposed building footprint within the Structural Root Zone.	Remove.
5	Narrow-leaved Ironbark, *Eucalyptus crebra*	110	6	1	SM	G	G	2.0	1.5	Long (30+ yrs)	3	Medium	Planted as part of more recent group of trees.	Proposed building footprint within the Structural Root Zone.	Remove.
6	Swamp Mahogany, *Eucalyptus robusta*	200	5	3	M	G	G	2.4	1.7	Long (30+ yrs)	3	Medium	Planted as part of ealier group of trees.	Within proposed building footprint.	Remove.
7	Swamp Mahogany, *Eucalyptus robusta*	290	7	4	M	G	G	3.5	2.0	Long (30+ yrs)	3	Medium	Planted as part of ealier group of trees.	Proposed building footprint within the Structural Root Zone.	Remove.
8	Swamp Mahogany, *Eucalyptus robusta*	170	5	3	M	G	G	2.0	1.6	Long (30+ yrs)	3	Medium	Planted as part of ealier group of trees.	Within proposed building footprint.	Remove.
9	Swamp Mahogany, *Eucalyptus robusta*	170	5	3	M	G	G	2.0	1.6	Long (30+ yrs)	3	Medium	Planted as part of ealier group of trees.	Proposed building footprint within the Structural Root Zone.	Remove.
10	Swamp Mahogany, *Eucalyptus robusta*	190	6	3	M	G	G	2.3	1.6	Long (30+ yrs)	3	Medium	Planted as part of ealier group of trees.	Within proposed building footprint.	Remove.
11	Swamp Mahogany, *Eucalyptus robusta*	260	7	4	M	G	G	3.1	1.9	Long (30+ yrs)	3	Medium	Planted as part of ealier group of trees.	Proposed building footprint within the Structural Root Zone.	Remove.
12	Parramatta Green Wattle, *Acacia parramattensis*	160	6	4	M	G	G	2.0	1.5	Short (0-10 yrs)	3	Low	Planted as part of more recent group of trees.	Within proposed building footprint.	Remove.
13	Tallowwood, *Eucalyptus microcorys*	290	9	4	M	G	G	3.5	2.0	Long (30+ yrs)	3	Medium	Planted as part of ealier group of trees.	Proposed building footprint within the Structural Root Zone.	Remove.
14	Tallowwood, *Eucalyptus microcorys*	330, 210	9	4	M	G	G	4.7	2.2	Long (30+ yrs)	3	Medium	Planted as part of more recent group of trees.	Within proposed building footprint.	Remove.
15	Swamp Mahogany, *Eucalyptus robusta*	150	4	2	M	F	F	2.0	1.5	Medium (10-30 yrs)	4	Low	Planted as part of ealier group of trees.	Proposed building footprint within the Structural Root Zone.	Remove.

ATTACHMENT B –TREE ASSESSMENT DEFINITIONS

Height. Tree height is estimated from ground level. This assessment is made independently of data plotted on survey plan. These measurements have not been confirmed with clinometer or other surveying instrument.

Diameter at Breast Height (DBH). Trunk diameter is measured at 1.4 metres above ground level. A diameter tape is used which calculates the diameter from a measurement of the circumfrence. DBH is primarily used for the calculation of the TPZ and SRZ.
If a tree has more than 4 trunks, the diameter of the four largest trunks is recorded. For irregular trunk formations the DBH is calculated as outlined in Appendix A of AS4970-2009 -*Protection of Trees on Development Sites*.

Canopy Spread Radius. Average canopy spread radius is estimated from the centre of trunk to the outer edge of canopy. Refer to Comments column for detail of heavily skewed canopy spread.

Age Class - This is an estimation of the tree's current age class based on size, growth habit, local environmental conditions and comparison with surrounding trees.

- **Immature (IM)**: This is a juvenile specimen that is likely to have germinated within the previous 5 years.
- **Early Mature (EM)**: This is a tree that is established within its growing environment, though has not reached an age of reproductive maturity or the natural growth habit of a mature individual.
- **Mature (M)**: This is a tree has reached both reproductive maturity and a physical form and shape typical for the species. Trees can have a Mature Age Class for the majority of their life span.
- **Late-Mature (LM)**: There trees show early signs of senescence with symptoms such as reduced canopy density and an accumulation of dead branches.
- **Over-mature (OM)**: These trees show symptoms of irreversible decline such as canopy dieback with dead branches concentrated in the upper canopy.

Health - Good (G), Fair (F) or Poor (P). This is primarily based on the extent of vigorous new foliage growth at branch tips and the colour, size and density of foliage generally. The percentage of live branches to dead branches is considered. The location of any dead branches is also considered. The presence of any pest or disease is considered as part of this assessment. Health can vary with climatic conditions.

Structural Condition - **Good (G), Fair (F) or Poor (P).** This is an assessment of tree structure and stability. Root anchorage, trunk lean, structural defects, canopy skew and any hazardous features are considered. Dead branches can be considered as part of Structural Condition if they are of a size and location that could cause injury or property damage.

Tree Protection Zone (TPZ). This is a radial distance of (12X) the DBH measured from centre of trunk. TPZ is rounded to the nearest 0.1 metre. A TPZ should not be less than 2m or greater than 15m. The TPZ for palms and other monocots should not be less than 1m outside of the crown projection. Existing constraints to root spread can vary the TPZ. For a tree to remain viable, construction activity should be excluded or undertaken with care within the TPZ. Disturbance within up to 10% of the TPZ area is considered to be a minor encroachment. Disturbance to more than 10% of the TPZ area is considered a major encroachment. Major encroachment into the TPZ is possible depending on the type of disturbance, and species tolerance to disturbance. Exploratory excavation may be required to quantify the presence of roots at the alignment of proposed ground disturbance.
This is based upon the Australian Standard AS 4970, 2009, *Protection of trees on development sites* and the Matheney & Clarke "*Guidelines for adequate tree preservation zones for healthy, structurally stable trees*".

Structural Root Zone (SRZ). This is a radial distance based on the following formula- **SRZ =** $(D \times 50)^{0.42} \times 0.64$ (for trees less than 150mm Diameter, a minimum SRZ of 1.5 metres). SRZ measurements are rounded to the nearest 0.1m. .
The Structural Root Zone is the area of soil and roots required to maintain tree stability. Excavation within the SRZ can result in whole tree failure. Fully elevated construction is possible within SRZ with specific rootzone assessment. Existing constraints to root spread can vary the SRZ. This method of determining SRZ is outlined at Section **3.3.5** of Australian Standard AS 4970, 2009, *Protection of trees on development sites.*

Estimated Remaining Life Expectancy: This gives a length of time that the Arborist believes a particular tree can be retained from the time of assessment with an acceptable level of risk based on the information available at the time of the inspection. This system of rating does not take into consideration the likely impacts of any proposed development. Ratings are **Long** (retainable for 30 years or more with an acceptable level of risk), **Medium** (retainable for 10-30 years), **Short** (retainable for 0-10 years) and **Removal** (tree requiring immediate removal due to imminent hazard or absolute unsuitability).

Landscape & Environmental Significance*. This is an assessment of the impact of the tree on the surrounding landscape amenity and natural environment. Rarity, habitat value, physical prominence, historical and cultural significance of the tree are considered in this rating system. The Landscape & Environmental Value ratings used in this report are:

1. **Very High Value:** This is an outstanding specimen that holds irreplaceable environmental, landscape or cultural value.
2. **High Value:** An excellent specimen that holds environmental, landscape or cultural value that is present in other site trees or that could be replaced.
3. **Moderate Value:** Can be a good to fair specimen with environmental, landscape or cultural value that is common within other trees in the locality.
4. **Low Value:** Removal would not result in any loss of site amenity or environmental value. Can include undesirable or weed species or trees growing in unsuitable locations.
5. **Very Low Value** : Dead or hazardous with no other environmental or cultural value. Could also include weed species. These trees should be removed or pruned in a way to make safe irrespective of any development.

***Note**: The concept of using a five (5) point scale to assess tree significance was derived from the Tree Wise Men® Australia Pty Ltd ©Significance Rating Scale.

Retention Value*. Retention values are derived from a combination of Estimated Life Expectancy rating and Landscape and Environmental Significance ratings.

<table>
<tr><th rowspan="7">Landscape & Environmental Significance</th><th rowspan="2"></th><th colspan="4">Estimated Life Expectancy</th></tr>
<tr><th>Long</th><th>Medium</th><th>Short</th><th>Removal</th></tr>
<tr><td>Very High (1)</td><td colspan="2" rowspan="2">HIGH</td><td rowspan="2">MEDIUM</td><td rowspan="2"></td></tr>
<tr><td>High (2)</td></tr>
<tr><td>Medium (3)</td><td colspan="2">MEDIUM</td><td colspan="2" rowspan="3">LOW</td></tr>
<tr><td>Low (4)</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Very Low (5)</td></tr>
</table>

HIGH Retention Value: These trees are worthy of retention and major design consideration should be made where possible to allow this.

MEDIUM Retention Value: These trees are worthy of retention and minor design consideration should be made to retain these trees wherever possible (e.g. placement of ancillary structures, garden retaining walls, driveway levels).

LOW Retention Value: These trees should not be considered to be a constraint to design layout. Some of these trees should be removed irrespective of any proposed development.

***Note:** The method of determining and defining retention values used in this report has been derived from the ©Retention Index developed by Tree Wise Men® Australia Pty Ltd.

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APPENDIX 10
Geotechnical assessment

REPORT

TO
PLASSER AUSTRALIA PTY LTD

ON
GEOTECHNICAL INVESTIGATION

FOR
PROPOSED RAIL YARD EXTENSION

AT
2 PLASSER CRESCENT, ST MARYS, NSW

5 August 2014
Ref: 27578ZRrpt

JK Geotechnics
GEOTECHNICAL & ENVIRONMENTAL ENGINEERS

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Date: 5 August 2014
Report No: 27578ZRrpt
Revision No: 0

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For and on behalf of
JK GEOTECHNICS
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1 INTRODUCTION

This report presents the results of a geotechnical investigation for the proposed rail yard extension at 2 Plasser Crescent, St Marys, NSW. The investigation was commissioned by Scott Lawrence of Plasser Australia Pty Ltd, by signed 'Acceptance of Proposal' form dated 7 July 2014. The commission was on the basis of our fee proposal (Ref: P38800ZR) dated 4 June 2014.

We have been supplied with the following information:

- Architectural drawings (Drawing Numbers 1000, 1100, 2000, 3000 and 3100, dated 17 June 2014) prepared by Group GSA Pty Ltd,
- A survey plan prepared by SDG (Ref. 6308 Issue A, dated 5 June 2014), and
- A geotechnical brief (Ref: S140074, dated 30 May 2014) prepared by Northrop Engineers.

Based on the supplied information, we understand that the proposed rail yard extension will include:

- A new steel framed covered work area with a concrete floor slab adjacent to the north-western side of the existing workshop.
- A new steel framed factory building with a concrete floor slab located immediately to the north of the new covered work area. The new building will include a 50 tonne crane and a maintenance pit (approximately 2m deep) which will extend the length of the building.
- The proposed finished floor reduced level (RL) of the new covered work area and factory building will be similar to the existing workshop, i.e. RL39.83m and localised raising of site surface levels by a maximum of about 0.4m will be required.
- New rigid external pavements.

Northrop have indicated serviceability and ultimate column loads of 150kN and 900kN, respectively.

The provided design traffic for the proposed rigid driveway pavements at the Plasser Crescent and Kurrajong Road frontages are $4.5x10^5$ Heavy Vehicle Axle Groups (HVAGs) and $7.3x10^3$ HVAGs, respectively.

The purpose of the investigation was to obtain geotechnical information on subsurface conditions as a basis for comments and recommendations on earthworks, excavation conditions, retention, site classification to AS2870-2011, footings, on-grade floor slabs and external pavements, drainage and preliminary advice on likely pavement design thicknesses.

Environmental Investigation Services (EIS), our specialist environmental division have also completed a Preliminary Stage 1 Environmental Site Assessment report (Ref. E27578KHrpt) dated 30 July 2014, which should be read in conjunction with this report.

2 INVESTIGATION PROCEDURE

The fieldwork for the investigation was carried out on 14 July 2014 using our truck mounted JK350 drilling rig and comprised the auger drilling of four boreholes (BH1 to BH4) to depths between 1.5m to 10.37m. One borehole (BH2) was then extended by rotary coring techniques with water flush to a final depth of 12.97m.

The borehole locations (as nominated by Northrop) are indicated on the attached Figure 1, and were set out by taped measurements from existing surface features and apparent site boundaries. Prior to the fieldwork commencing, the boreholes were electro-magnetically scanned for buried services by a specialist sub-contractor.

The approximate surface RLs at the borehole locations were interpolated between spot heights and contours indicated on the provided survey plan. The survey datum is the Australian Height Datum (AHD).

The state of the compaction of the fill and the strength of the natural clayey soils were assessed from the Standard Penetration Test (SPT) 'N' values, which were augmented by the results of hand penetrometer readings on cohesive soil samples recovered from the SPT split tube. The strength of the augered bedrock profile was assessed from observation of the drilling resistance when using a tungsten carbide ('TC') bit, examination of the recovered rock cuttings and subsequent correlation with laboratory moisture content test results. The strength of the relatively competent cored portion of weathered bedrock in BH2 was assessed by examination of the recovered rock core and correlation with subsequent Point Load Strength Index tests.

Groundwater observations were made in the boreholes during auger drilling and on completion of auger drilling and coring. We note that water is introduced as part of the coring process and often obscures groundwater measurement in the cored portions of the borehole. In addition, groundwater levels may not have stabilised in the short time period after auger drilling and coring. No longer-term ground water monitoring was carried out.

For more details of the investigation procedures, reference should be made to the attached Report Explanation Notes.

The fieldwork was carried out under the full time direction of our geotechnical engineer (Adrian Callus), who set out the borehole locations, directed the electro-magnetic scan for buried services, logged the encountered subsurface profile and nominated in-situ testing and sampling. The borehole logs (which also include field test results, Point Load Strength Index test results and groundwater observations) are attached, together with a glossary of logging terms and symbols used.

Selected soil and rock chip samples were returned to the Soil Test Services Pty Ltd (STS) NATA registered laboratory, for moisture content, Atterberg Limit, linear shrinkage, Standard compaction and four day soaked CBR testing. The results are summarised in the attached Tables A and B. The recovered rock core was also returned to STS where it was photographed and Point Load Strength Index tests completed. A summary of the Point Load Strength Index tests and estimated Unconfined Compressive Strengths are presented in the attached Table C. The photograph of the recovered rock core is presented opposite the log for BH2.

Selected soil samples were also submitted under chain of custody to an alternate NATA registered laboratory (EnviroLab Services Pty Ltd) for soil pH, chloride and sulphate content testing. The test results are presented in the attached Appendix A.

3 RESULTS OF INVESTIGATION

3.1 Site Description

The site is located within gently undulating topography between two creek lines (Ropes Creek and South Wianamatta Creek) trending approximately north-south and located to the east and west of the site, respectively.

The site has northern and western frontages onto Kurrajong Road and Plasser Road, respectively.

The subject site was ‘L’ shaped in plan, with the long axis trending north-south. At the time of the fieldwork the southern and south eastern portion of the site was occupied by a two storey steel framed warehouse with brick infill panels and steel cladding and adjoining one and two storey brick office and amenities buildings. A similar warehouse was located over the south western corner of the site.

An electrical sub-station was located over the grass surfaced north-western corner of the site and the grass surfaced areas lined the street frontages. Several medium sized trees lined the western street frontage and the grassed surfaced area was a maximum of about 0.5m above the adjacent paved footpath surface and sloped down to the footpath at between approximately 30^{o} and 60^{o}. The remainder of the site comprised asphaltic concrete (AC) surfaced car parking areas and a concrete driveway which extended south from the central portion of the northern street frontage to the warehouse.

The Main Western rail line corridor lined the southern site boundary. Two rail tracks curved around from within the rail corridor into the south western corner of the site then extended north through the site to the west of the existing buildings. The western track was supported on rail ballast and sleepers approximately 0.5m higher than the surrounding ground surface.

The eastern site boundary was lined by AC and grass surfaced yard areas. Brick and metal clad warehouse buildings were set-back in excess of 40m from the eastern site boundary.

Unless noted above, site surface levels were generally similar across the site boundaries.

Based on a cursory inspection from within the site the existing buildings and paved areas generally appeared to be in good condition. However, the northern car park area appeared to be in a fair condition with crocodile, longitudinal and transverse cracking evident.

3.2 <u>Subsurface Conditions</u>

The 1:100,000 geological map of Penrith indicates that the site underlain by Bringelly Shale of the Wianamatta Group, comprising shale, carbonaceous claystone, claystone, laminite, fine to medium-grained lithic sandstone, rare coal and tuff. We note that the geological map also indicates that the site is located between two alluvial deposits, to the east and west of the site, associated with Ropes Creek and South Wianamatta Creek, respectively.

Generally, the boreholes revealed a subsurface profile comprising of limited thickness of fill overlying a deep residual clay profile with shale bedrock encountered at depth. Groundwater was not encountered over the depth of the investigation. For detailed subsurface conditions at each borehole location, reference should be made to the attached borehole logs. A graphical borehole summary is presented in Figure 2. A summary of the pertinent subsurface conditions is provided below:

Paved Surfaces

BH4 encountered an AC paved surface (30mm thick) overlying a 120mm thick gravelly base course.

Fill

Silty clay, gravelly clay and clayey gravel fill was encountered from surface level in BH1, BH2 and BH3. The clayey fill was assessed to be of medium or high plasticity. The fill extended to depths of 0.8m (BH1) and 0.3m (BH2 and BH3).

Residual Silty Clay

Residual silty clay assessed to be of medium or high plasticity and very stiff to hard (occasionally stiff) strength was encountered beneath the fill or pavement materials in all the boreholes. BH4 was terminated at a depth f 1.95m within the residual silty clay. In the remaining boreholes, the residual silty clay extended to the top surface of the weathered bedrock.

Weathered Bedrock

Weathered shale bedrock was encountered in all the boreholes except BH4 beneath the residual silty clays at depths of 6.6m (BH1) and 7m (BH2 and BH3). On first contact the shale bedrock was generally of poor quality and typically assessed to be extremely to distinctly weathered and of extremely low to very low strength. The shale improved to distinctly weathered and generally of low (or very low) and medium strength. The shale was of high strength below 12.6m depth in BH2. We note that below 11.9m depth fine grained sandstone was interbedded with the shale.

Numerous defects were encountered in the cored portion of BH2 and generally comprised the following:

- Sub-horizontal (rarely steeply dipping) clay seams (CS) and extremely weathered seams (XWS) ranging between about 2mm and 140mm thickness.

- Moderately to steeply sloping planar (occasionally undulating) defects.

In accordance with Table 1b of the "Engineering Classification of Shales and Sandstones in the Sydney Region", as revised by Pells et al 1998 a preliminary engineering classification of the shale bedrock has been carried out based on the boreholes and the laboratory test results, and is tabulated below.

Borehole	Expected Shale Class	
	Depth Top of Class V	**Depth Top of Class IV**
1	6.6m* (RL32.8m)	9.8m* (RL29.6m)
2	7m* (RL32.5m)	8m (RL31.5m)
3	7m* (RL32.5m)	7.8m* (RL31.7m)

* **classification based on augered (or augered portion) of boreholes**

We note that despite shale of medium and high strength being encountered in the cored portion of BH2, the significant number of seams (potentially compressible CS and XWS) was limited the classification to Class IV. Consequently, higher strength bands in the augered boreholes have been similarly assessed.

Groundwater

Groundwater seepage was not encountered in the boreholes during, or on completion of, auger drilling. On completion of core drilling a water flush level was recorded at a depth of 5.1m. It should be noted that water introduced during core drilling obscures groundwater measurements and groundwater levels may not have stabilised during the relative short period between borehole completion and measurement of water levels.

Full water flush returns were noted during the core drilling of BH2 and a relatively impermeable rock mass is therefore indicated. Longer term groundwater monitoring was not carried out.

3.3 Laboratory Test Results

Based on the Liquid Limit and Linear Shrinkage determinations the residual silty clays were assessed to be of medium and high plasticity with a moderate to high potential for shrink/swell reactivity with changes in moisture content.

The four day soaked CBR values of the residual silty clay samples from BH3 and BH4 have returned values of 1.5% and 1.0%, respectively when compacted to 98% of Standard Maximum Dry Density (SMDD) and surcharged with 9kg. The natural moisture contents of the samples tested from BH3 and BH4 were 5.2% and 3.2% 'wet' of their respective Standard Optimum Moisture Content (SOMC). In addition, during soaking, the samples swelled by 3.0% and 4.5% in BH3 and BH4, respectively.

The moisture content determinations on recovered rock auger cutting samples generally confirmed our field assessment of rock strength.

The point load test results indicated that the rock within the cored portion of BH2 was of low to high strength with estimated Unconfined Compressive Strengths (UCS) ranging between 4MPa and 54MPa. However, the majority of the test results indicated low or medium strength.

A summary of the laboratory chemical test results is provided in the table below.

Borehole Number	**Sample Depth (m)**	**Description**	**pH Units**	**Sulphate (mg/kg)**	**Chloride (mg/kg)**
2	0.5 – 0.95	Silty CLAY	5.0	390	550
2	4.5 – 4.95	Silty CLAY	5.5	210	1,600
3	3.0 – 3.45	Silty CLAY	4.6	540	1,300

4 COMMENTS AND RECOMMENDATIONS

4.1 Site Preparation

The following earthworks recommendations should be complemented by reference to AS3798-2007 "Guidelines on Earthworks for Commercial and Residential Developments" and the Safe Work Australia Code of Practice 'Excavation Work', dated October 2013.

4.1.1 Excavation

Following stripping of the pavements, removal of trees and any topsoil and root affected soils, the 2m deep excavation for the maintenance in the new factory building will encounter a limited thickness of fill and natural silty clay soils and can be readily completed using tracked excavators.

We note that it is imperative to remove trees as soon as practicable in order for the moisture content of the clayey subsoils to recover. Tree root systems dry out the surrounding clayey soils and their removal will result in localised recovery leading to swelling which may have a detrimental impact on the performance of floor slabs.

Any topsoil or root affected soils may be separately stockpiled for re-use in landscape areas.

4.1.2 Subgrade Preparation

Following stripping of all pavements, vegetation, topsoil and root affected soils and prior to placement of any fill to raise site levels, subgrade preparation over the footprint of the proposed new building floor slabs and external pavements should be completed in the following manner:

- The existing fill and natural silty clay soils will require proof rolling with eight passes of a minimum 14 tonne deadweight smooth drum vibratory roller.
- Proof rolling should be carried out under the direction of an experienced earthworks superintendent or geotechnical engineer to assist in the detection of soft or unstable areas not disclosed by this investigation.
- Any soft or unstable areas identified during proof rolling should be locally excavated down to a competent base and replaced with engineered fill as described in Section 4.1.4, below. Care should be taken not to over compact the clay subgrade.
- Areas of clay subgrade that contain shrinkage cracks should be watered and rolled until the shrinkage cracks disappear.
- Care will need to be exercised close to nearby existing structures, rail lines, paved surfaces and any buried services as ground borne vibrations caused by the proof rolling may cause damage. Ground vibrations should be qualitatively monitored by the site supervisor and if there are any causes for concern during proof rolling, then further advice should be sought and/or the non-vibration (static) mode of the roller used.

We note that any areas where floor slabs are to be suspended then no subgrade preparation would be required.

4.1.3 Subgrade Drainage

The existing subgrade will comprise clayey or clayey gravel fill and natural silty clays. The clays may be found to be unstable if proper site drainage is not implemented during construction. It is therefore important to provide good drainage in order to promote run-off and reduce ponding. Earthworks platforms should be graded to maintain cross-falls during construction. If the clays are exposed to periods of rainfall, softening may result and site trafficability will be poor. If softening occurs, the subgrade should be over-excavated to below the depth of moisture softening. The material removed should be replaced with engineered fill. Such considerations may be mitigated by the early construction of the floor slabs and external pavements.

4.1.4 Engineered Fill

Fill required to raise site levels should comprise engineered fill. The existing generally clayey fill materials and natural silty clays sourced from any localised excavations may be re-used as engineered fill provided all organic material and other deleterious substances are removed. However, engineered fill will most likely need to be imported.

Engineered fill should have a maximum particle size of 75mm. Engineered fill comprising clayey materials should be compacted in layers no greater than 200mm loose thickness to a density strictly between 98% and 102% of SMDD and within 2% of SOMC. We note that the laboratory testing indicated that the natural clays were 'wet' of optimum and so some moisture conditioning may be required to achieve the above specification and may cause delays to the construction programme.

If preferred, imported well graded granular material (ripped or crushed sandstone or building rubble) free of deleterious substances and having a maximum particle size of 75mm may also be used as engineered fill and compacted to a minimum density of 98% SMDD.

Backfill to conventional retaining walls should comprise engineered fill. Well graded granular materials such as ripped or crushed sandstone and demolition rubble would be suitable for this purpose. Such fill should be compacted in horizontal layers as above using a hand held plate compactor. Care will be required to ensure excessive compaction stresses are not transferred to the retaining walls.

Any proposed permanent fill batters should be no steeper than 1Vertical (V) in 2 Horizontal (H) and should be protected from erosion by quickly establishing a grass cover. However, for ease of maintenance a batter of 1V in 3H is more appropriate.

As noted in Section 4.3.1 below, the piling rig working platform (if required) may be incorporated into the engineered fill required to raise site surface levels. During the works, the working platform will be disturbed and, assuming that it will remain in place, some re-working of the upper portion will be required before construction of floor slabs and external pavements. This final re-working will need to allow for achieving a DGB20 compaction to 98% MMDD prior to placement of pavement construction materials.

4.1.5 Compaction Control Testing of Engineered Fill

Density tests, as outlined below, should be regularly carried out on the engineered fill to confirm the above specifications are achieved:

- The frequency of density testing for general engineered fill should be at least one test per layer per $2500m^2$ or one test per $500m^3$ distributed reasonably evenly throughout the full depth and area, or 3 tests per lot, whichever requires the most tests. A lot is an area of work that is essentially homogeneous in relation to material type and moisture condition, rolling response and compaction technique, and which has been used for the assessment of the relative compaction of an area of work.
- The frequency of density testing for trench backfill should be at least one test per two layers per 40 linear metres.
- For backfilling of localised excavations, such as localised soft spots, testing should consist of one test per two layers per $50m^2$.

As the proposed slabs-on-grade and external pavements are to be relatively heavily loaded, we recommend that Level 1 control of fill placement and compaction, in accordance with AS3798-2007, be carried out. This also applies to trench backfill. Due to inherent conflicts of interest, the geotechnical inspection and testing authority (GITA) should be directly engaged by the Client and not by the earthworks contractor or subcontractors.

4.2 Temporary Excavation Batters and Permanent Retention

4.2.1 General

We consider that temporary excavation batter slopes of 1 Vertical (V) in 1 Horizontal (H) are appropriate through the existing clayey fill and natural silty clays. Conventional retaining walls for the maintenance pit may be constructed at the toe of the batters and subsequently backfilled. The retaining walls will be founded in the natural silty clays and further advice on footings is provided in Section 4.3, below.

4.2.2 Retention Design Parameters

The following characteristic earth pressure coefficients and subsoil parameters may be adopted for the design of the proposed maintenance pit retaining walls:

- If the walls will be propped by the structure prior to backfilling, they may be designed using a triangular lateral earth pressure distribution, based on an 'at rest' earth pressure coefficient, k_o, of 0.55, assuming a horizontal retained surface.
- If the walls are to be free standing cantilever walls and movements are of less concern, they may be designed using a triangular lateral earth pressure distribution and an 'active' earth pressure coefficient, K_a, of 0.35 for the soil profile, assuming a horizontal retained surface.
- A bulk unit weight of $20kN/m^3$ should be adopted for the retained profile.
- Any surcharge loads affecting the walls (e.g. traffic loading, construction loads, adjacent floor slabs, compaction stresses etc) should be allowed for in the design using the appropriate earth pressure coefficient from above.
- The maintenance pit walls should be designed for pressures due to external groundwater levels in addition to lateral earth pressures; further advice is provided in Section 4.2.3, below.
- If the bases of the maintenance pit walls are not propped by the structure then lateral toe restraint may be provided by the passive pressure of the soil below the design subgrade level in front of the wall. The toe restraint may be designed using a triangular lateral earth pressure distribution and a 'passive' earth pressure coefficient, K_p, of 3, provided a Factor of Safety of 2 is used in order to reduce deflections. The upper 0.3m below subgrade level together with any localised excavations for buried services etc should be taken into account in the design.

4.2.3 Design Groundwater Levels and Uplift

We recommend that the maintenance pit walls be designed assuming a groundwater level coincident with surrounding surface levels to allow for any long term seepage and localised raising of groundwater levels, or inundation following heavy or prolonged rainfall, or possibly leakage from damaged water carrying pipelines.

Such groundwater levels may cause uplift and the design of the maintenance pit should be checked in this regard. If the self weight of the structure does not control potential uplift forces, then permanent ground anchors will be required. If permanent anchors are selected, they should be bonded into the residual silty clay of at least very stiff strength using an allowable bond strength of 50kPa. All anchors should be proof tested to 1.3 times the working load under the supervision of an experienced engineer or construction superintendent, independent of the anchor contractor. We recommend that only experienced contractors be considered for the anchor installation.

We note that permanent anchors would need to be designed for corrosion resistance and for long term durability.

Alternatively, the potential groundwater pressures may be alleviated by providing the maintenance pit with drainage and a pump-out system.

4.3 Footings

4.3.1 Site Classification and Shrink-Swell Movements

We note that AS 2870-2011 does not apply for this type of development. However, due to the presence and thickness of uncontrolled clayey fill at the site a ‘P’ site classification in accordance with the AS 2870 applies.

Based on the laboratory test results, the residual silty clays will be moderately to highly reactive and therefore subject to shrink-swell movements with changes in moisture content. We have carried out an indicative assessment of shrink-swell movements using approximate instability index values based on linear shrinkage test results. Assuming the trees are removed well ahead of construction (i.e. at least 2 years), the predicted shrink-swell movements are between 50mm and 55mm. If tree removal is delayed or if the trees remain in place the predicted shrink-swell movements increase to 95mm. On this basis, we recommend that all new high level footings and floor slabs be designed with due regard for the recommendations contained in AS2870-2011 for a

Class H1 site (if all the trees are removed) or a Class E site if some trees remain and/or new trees are planted. We also draw attention to the precautionary advice in AS 2870 with regard to trees in close proximity to buildings.

We also warn that removal of the existing external paved areas may expose areas of clayey subgrade and if left exposed to the elements, may trigger shrink swell movements causing differential movements beneath the existing footings. Such movements could cause damage to existing buildings (if supported on high level footings) and we recommend that any exposed clayey subgrades are appropriately protected and/or new floor slabs and external paved areas constructed without delay.

4.3.2 Pile Footings

We note that the serviceability column loads are expected to be 150kN although we have not been provided with any information regarding potential uplift loads acting on the buildings or the crane to be located within the new factory building.

We recommend that the new buildings and crane be supported on pile footings socketted into the weathered shale bedrock. If floor slabs are suspended void formers will need to be provided beneath the floor slab to accommodate potential shrink-swell movements in the residual silty clay soils below subgrade level.

We note that our assessment of the shale bedrock provided in Section 3.2, above has indicated that Class V shale bedrock was encountered at depths between about 6.6m and 7m below existing surface level. Class IV shale bedrock was encountered at depths between about 7.8m and 9.8m below existing surface level.

Design parameters for pile footings founded in bedrock are set out in the following table.

PILE DESIGN PARAMETERS				
Bedrock Class	**Allowable End Bearing Pressure MPa**	**Allowable Shaft Adhesion (in compression) MPa**	**Allowable Shaft Adhesion (in tension) MPa**	**Allowable Lateral Bearing Pressure MPa**
Class V	0.7	0.07	0.035	0.25
Class IV	1	0.1	0.05	0.35

We note that the lateral load carrying capacity of pile footings may be assumed to act over a zone equivalent to three times the pile diameter.

Bored piles are considered to be suitable for the site. We recommend that provision be made for temporary liners in the event that any bored pile holes encountered groundwater which may cause localised pile wall instability in the soil or bedrock profile at, or close to, the seepage depth. The piling contractor should be provided with a copy of this geotechnical report in order that appropriate piling rigs and equipment are brought to site. In particular the comments with respect to rock strength and rock class in Section 3.2, above must be given due consideration.

The drilling of bored piles should be witnessed by a geotechnical engineer in order to confirm that the appropriate quality shale and design socket length has been achieved. The above allowable bearing pressures and shaft adhesion values assume that the pile bases are thoroughly cleaned of loose material or 'fall-in' prior to pouring concrete and that the side walls are appropriately roughened. In addition, the shale bedrock will be susceptible to softening in the presence and any water softened materials should be over-drilled to a sound base prior to pouring concrete.

We note that the piling contractor may require a working platform. The assessment of a working platform thickness would need to be completed by a geotechnical engineer based on the methodology outlined in BRE 2004 *'Working Platforms for Tracked Plant'*. Where a working platform is required it would need to be formed using engineered fill comprising durable granular material (such as DGB20 or similar as approved by the geotechnical engineer). Where engineered fill is to be placed to raise site surface levels this may comprise the working platform fill provided it meets the specification requirements. This should be taken into account when selecting engineered fill.

If certification of the working platform is required, then a geotechnical engineer should visit site to confirm that the thickness of the working platform has been achieved and to review the density test results carried out on the working platform material. We may then be in a position to certify the working platform, provided the thickness and minimum density requirements have been met; this certification would be more readily achievable if Level 1 control of fill placement and compaction, in accordance with AS3798-2007, is adopted.

4.3.3 High Level Footings

The maintenance pit walls may be supported on strip footings founded in the residual silty clays of at least very stiff strength and designed on the basis of an allowable bearing pressure of 200kPa, subject to geotechnical inspection.

The residual silty clays are susceptible to softening in the presence of water and so all footings should be excavated, cleaned, inspected and poured with minimal delay i.e. within the same day. All footings should be free from all loose or softened materials prior to pouring. If water ponds in the bases of the footing excavations it should first be pumped dry and then over excavated to remove all loose and softened materials. A blinding layer of concrete may be provided to protect the shallow footing excavation bases that are to be left open.

4.4 On-Grade Floor Slabs, External Pavements and Drainage

4.4.1 On-Grade Floor Slabs

Slab-on-grade construction for the proposed floor slabs is considered feasible provided the subgrade is prepared as discussed above in Section 4.1.2. The on-grade floor should be constructed independent of the building footings and walls (i.e. designed as “floating” slabs) to permit relative movement.

The subgrade for the proposed on-grade floor slabs will comprise existing clayey or granular fill, possibly engineered fill and/or residual silty clay. Based on the laboratory test results, we recommend that the design of on-grade concrete floor slabs be based on a CBR value of 1% or a long-term Young’s Modulus of 15MPa for the clayey fill subgrade.

Slabs-on-grade should be supported on at least a 100mm thick sub-base of good quality fine crushed rock such as RTA Specification 3051 unbound base (e.g. DGB20), and compacted to a minimum density of 98% of Modified Maximum Dry Density (MMDD). Adequate moisture conditioning to within 2% of Modified Optimum Moisture Content (MOMC) should be provided during placement so as to reduce the potential for material breakdown during compaction. The sub-base layer should be compacted in maximum 200mm thick loose layers using a large smooth drum roller. The sub-base material would provide more uniform slab support and would reduce “pumping” of subgrade “fines” at joints. Slab joints should be designed to resist shear forces but not bending moments by providing dowelled or keyed joints.

Density tests should be regularly carried out on the sub-base layer to confirm the above specification is achieved. The frequency of density testing should be at least one test per layer per $1000m^2$, or three tests per layer, or three tests per visit, whichever requires the most tests. Level 2 testing of fill compaction is the minimum permissible in AS3798-2007. The geotechnical testing authority (GTA) should be directly engaged by the Client.

Consideration should be given to protection of the edge of ground floor slabs from excessive shrink/swell movement associated with the residual silty clay or clayey fill subgrades. Where surrounding pavements or slabs do not abut the proposed buildings, we recommend that there should be an edge thickening extending to at least 0.5m below external finished grade. Further precautions with regard to the protection of on-grade floor slabs are provided in Section 4.4.2, below.

4.4.2 External Pavements and Drainage

The advice provided below assumes that the subgrade is prepared and engineered fill placed in accordance with the recommendations given in Section 4.1 above.

The preliminary pavement design outlined below has been based on advice provided in the following publication:

- 'Guide to Pavement Technology' Part 2: Pavement Structural Design (AUSTROADS May 2008).

Based on the investigation results, we recommend a design soaked CBR value of 1%, an equivalent modulus of subgrade reaction of 20kPa/mm (750mm diameter plate) or a short term Youngs Modulus of 7MPa be adopted for the residual silty clay subgrade. Where appropriate, we have assumed that any engineered fill required to raise site surface levels will also comprise excavated residual silty clay. If better quality granular fill is imported and used as engineered fill then the preliminary pavement designs provided below may need to be revised.

In accordance with the advice provided in the above referenced AUSTROADS publication, for a CBR < 2% a 150mm thick Lean Mix Concrete (LMC) sub-base may be used and an effective CBR value of 5% adopted for design.

Using the provided design traffic loadings for the proposed rigid driveway pavements at the Plasser Crescent and Kurrajong Road frontages of $4.5x10^5$ HVAGs and $7.3x10^3$ HVAGs, respectively, the preliminary pavement designs are as follows:

Plasser Crescent

For a jointed reinforced concrete pavement with no concrete shoulder and a load safety factor of 1.2, the pavement design would be:

- 205mm thick concrete base (design concrete flexural strength 4MPa)
- 150mm thick LMC sub-base.

We note that if a concrete shoulder is provided the concrete base thickness may be reduced to 175mm.

Kurrajong Road

For a jointed reinforced concrete pavement with no concrete shoulder and a load safety factor of 1.2, the pavement design would be:

- 175mm thick concrete base (design concrete flexural strength 4MPa)
- 150mm thick LMC sub-base.

We note that if a concrete shoulder is provided the concrete base thickness may be reduced to 150mm.

The concrete base should be provided with reinforcement and effective shear connection at joints by using dowels or keys. If repeated truck movements are expected, the use of steel fibre reinforcement may be preferred to improve abrasion resistance.

Sub-soil drains should be provided along the perimeter of pavements, with inverts not less than 0.2m below subgrade level. The drainage trenches should be excavated with a longitudinal fall to appropriate discharge points so as to reduce the risk of water ponding. The pavement subgrade should be graded to promote water flow or infiltration towards sub-soil drains.

It appears that the proposed buildings will be surrounded by external sealed pavements. Due to the shrink-swell nature of the residual silty clays and any clayey fill subgrades, any garden beds should be avoided adjacent to the proposed buildings as moisture ingress into the subgrade at these locations could cause movement and damage to nearby structural elements. If planter boxes are proposed, then they should be completely encased in concrete with base drainage connected to the stormwater system. Furthermore, to reduce rainwater sheeting flows off the external walls from entering the subgrade, we recommend that all joints between the buildings and external pavements be infilled using a flexible “Mastic” sealer.

Where the pavement edge is lined by landscaping strips, we recommend that an edge thickening be provided for protection against erosion and the effects of possible future topsoil stripping.

4.5 Soil Aggression

Based on the advice provided in Table 4.8.1 of AS3600-2009 “Concrete Structures” we note that the laboratory chemical test results have indicated that an A2 Exposure Classification applies.

For concrete pile footings, based on the advice provided in AS2159-2009 “Piling Design and Installation” for corrosion protection and durability, a ‘Mild’ Exposure Classification would apply (based on Table 6.4.2(C) of AS2159).

4.6 Further Geotechnical Input

Provided below is a summary of additional geotechnical input outlined in the preceding sections of this report:

- Piling rig working platform thickness design.
- Proof-rolling inspections.
- Density testing of all engineered fill.
- Witnessing drilling of bored pile footings.
- High level footing inspections.

5 GENERAL COMMENTS

The recommendations presented in this report include specific issues to be addressed during the construction phase of the project. As an example, special treatment of soft spots may be required as a result of their discovery during proof-rolling, etc. In the event that any of the construction phase recommendations presented in this report are not implemented, the general recommendations may become inapplicable and JK Geotechnics accept no responsibility whatsoever for the performance of the structure where recommendations are not implemented in full and properly tested, inspected and documented.

The long term successful performance of floor slabs and pavements is dependent on the satisfactory completion of the earthworks. In order to achieve this, the quality assurance program should not be limited to routine compaction density testing only. Other critical factors associated with the earthworks may include subgrade preparation, selection of fill materials, control of moisture content and drainage, etc. The satisfactory control and assessment of these items may require judgment from an experienced engineer. Such judgment often cannot be made by a technician who may not have formal engineering qualifications and experience. In order to identify potential problems, we recommend that a pre-construction meeting be held so that all parties involved understand the earthworks requirements and potential difficulties. This meeting should clearly define the lines of communication and responsibility.

Occasionally, the subsurface conditions between and below the completed boreholes may be found to be different (or may be interpreted to be different) from those expected. Variation can also occur with groundwater conditions, especially after climatic changes. If such differences appear to exist, we recommend that you immediately contact this office.

This report provides advice on geotechnical aspects for the proposed civil and structural design. As part of the documentation stage of this project, Contract Documents and Specifications may be prepared based on our report. However, there may be design features we are not aware of or have not commented on for a variety of reasons. The designers should satisfy themselves that all the necessary advice has been obtained. If required, we could be commissioned to review the geotechnical aspects of contract documents to confirm the intent of our recommendations has been correctly implemented.

A waste classification will need to be assigned to any soil excavated from the site prior to offsite disposal. Subject to the appropriate testing, material can be classified as Virgin Excavated Natural Material (VENM), General Solid, Restricted Solid or Hazardous Waste. If the natural soil has been stockpiled, classification of this soil as Excavated Natural Material (ENM) can also be undertaken, if requested. However, the criteria for ENM are more stringent and the cost associated with attempting to meet these criteria may be significant. Analysis takes seven to 10 working days to complete, therefore, an adequate allowance should be included in the construction program unless testing is completed prior to construction. If contamination is encountered, then substantial further testing (and associated delays) should be expected. We strongly recommend that this issue is addressed prior to the commencement of excavation on site.

This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose. If there is any change in the proposed development described in this report then all recommendations should be reviewed. Copyright in this report is the property of JK Geotechnics. We have used a degree of care, skill and diligence normally exercised by consulting engineers in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation, the client alone shall have a licence to use this report. The report shall not be reproduced except in full.

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SOIL TEST SERVICES
ABN 43 002 145 173

TABLE A
MOISTURE CONTENT, ATTERBERG LIMITS AND LINEAR SHRINKAGE TEST REPORT

Client: JK Geotechnics
Project: Proposed Rail Yard Extension
Location: 2 Plasser Crescent, St Marys, NSW

Ref No: 27578ZR
Report: A
Report Date: 24/07/2014
Page 1 of 1

AS 1289	TEST METHOD	2.1.1	3.1.2	3.2.1	3.3.1	3.4.1
BOREHOLE NUMBER	**DEPTH m**	**MOISTURE CONTENT %**	**LIQUID LIMIT %**	**PLASTIC LIMIT %**	**PLASTICITY INDEX %**	**LINEAR SHRINKAGE %**
1	1.50-1.95	14.7	41	16	25	10.5
1	7.50-7.80	12.3				
1	9.00-9.30	12.3				
2	1.50-1.95	13.5	44	14	30	11.0
3	0.50-0.95	23.0	60	22	38	15.5
3	10.30-10.50	1.3				

Notes:
- The test sample for liquid and plastic limit was air-dried & dry-sieved
- The linear shrinkage mould was 125mm
- Refer to appropriate notes for soil descriptions
- Date of receipt of sample: 16/07/2014

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SOIL TEST SERVICES
ABN 43 002 145 173

TABLE B
FOUR DAY SOAKED CALIFORNIA BEARING RATIO TEST REPORT

Client: JK Geotechnics
Project: Proposed Rail Yard Extension
Location: 2 Plasser Crescent, St Marys, NSW

Ref No: 27578ZR
Report: B
Report Date: 24/07/2014

BOREHOLE NUMBER	3	4
DEPTH (m)	0.30 - 1.00	0.50 - 1.00
Surcharge (kg)	9.0	9.0
Maximum Dry Density (t/m^3)	1.60 STD	1.55 STD
Optimum Moisture Content (%)	18.2	16.8
Moulded Dry Density (t/m^3)	1.57	1.52
Sample Density Ratio (%)	98	98
Sample Moisture Ratio (%)	99	98
Moisture Contents		
Insitu (%)	23.4	20.0
Moulded (%)	17.9	16.5
After soaking and After Test, Top 30mm(%)	29.5	31.5
Remaining Depth (%)	21.9	25.8
Material Retained on 19mm Sieve (%)	0	0
Swell (%)	3.0	4.5
C.B.R. value: @5.0mm penetration	1.5	1.0

NOTES:

- Refer to appropriate Borehole logs for soil descriptions
- Test Methods :
  - (a) Soaked C.B.R. : AS 1289 6.1.1
  - (b) Standard Compaction : AS 1289 5.1.1
  - (c) Moisture Content : AS 1289 2.1.1
- Date of receipt of sample: 16/07/2014

NATA

NATA Accredited Laboratory
Number:1327

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Authorised Signature / Date
(A. Tatikonda) 24/7/14

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SOIL TEST SERVICES

ABN 43 002 145 173

TABLE C
POINT LOAD STRENGTH INDEX TEST REPORT

Client: JK Geotechnics
Project: Proposed Rail Yard Extension
Location: 2 Plasser Crescent, St Marys, NSW

Ref No: 27578ZR
Report: C
Report Date: 21/07/2014
Page 1 of 1

BOREHOLE NUMBER	DEPTH m	$I_{S(50)}$ MPa	ESTIMATED UNCONFINED COMPRESSIVE STRENGTH (MPa)
2	10.41-10.45	0.3	6
	10.84-10.88	0.2	4
	11.27-11.31	0.4	8
	11.75-11.78	0.3	6
	12.06-12.09	0.4	8
	12.64-12.67	2.7	54

NOTES:

1. In the above table testing was completed in the Axial direction.
2. The above strength tests were completed at the 'as received' moisture content.
3. Test Method: RMS T223.
4. For reporting purposes, the $I_{S(50)}$ has been rounded to the nearest 0.1MPa, or to one significant figure if less than 0.1MPa
5. The Estimated Unconfined Compressive Strength was calculated from the point load Strength Index by the following approximate relationship and rounded off to the nearest whole number :
   U.C.S. = 20 $I_{S(50)}$

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BOREHOLE LOG

Borehole No.
1
1/2

Client: PLASSER AUSTRALIA PTY LTD
Project: PROPOSED RAIL YARD EXTENSION
Location: 2 PLASSER CRESCENT, ST MARYS, NSW

Job No. 27578ZR
Method: SPIRAL AUGER JK350
R.L. Surface: ≈ 39.4m
Date: 14-7-14
Datum: AHD
Logged/Checked by: A.P.C./P.R.

Groundwater Record	Samples (ES / U50 / DB / DS)	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION & AFTER 3 HRS			0			FILL: Clayey gravel, fine to coarse grained igneous, grey and brown, with roots and root fibres.	D			GRASS COVER
		SPT 11/50mm REFUSAL				FILL: Gravelly clay, medium plasticity, orange brown and grey, fine to coarse grained sandstone and igneous gravel, trace of slag.	MC<PL			
			1		CL	SILTY CLAY: medium plasticity, light grey mottled orange brown, with fine to medium grained ironstone gravel, trace of root fibres.	MC>PL	H		
		N = 30 7,12,18							>600 >600 >600	
			2							
		N = 41 14,19,22	3						300 300 300	
			4			as above, but with occasional XW shale bands.				
		N > 38 14,26, 12/50mm REFUSAL							>600 580 550	
			5							
		N > 49 10,21, 28/100mm REFUSAL	6		CH	SILTY CLAY: high plasticity, grey and brown, with fine to medium grained ironstone gravel, and occasional L strength shale bands.			>600 >600 >600	
					-	SHALE: grey and brown, with clay bands.	XW-DW	EL-VL		VERY LOW 'TC' BIT RESISTANCE
			7							

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BOREHOLE LOG

Borehole No. 1

Client: PLASSER AUSTRALIA PTY LTD
Project: PROPOSED RAIL YARD EXTENSION
Location: 2 PLASSER CRESCENT, ST MARYS, NSW

Job No. 27578ZR
Date: 14-7-14
Method: SPIRAL AUGER JK350
R.L. Surface: ≈ 39.4m
Datum: AHD
Logged/Checked by: A.P.C./P.R.

Groundwater Record	SAMPLES (ES, U50, DB, DS)	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
						SHALE: grey and brown, with clay bands.	XW-DW	EL-VL		VERY LOW RESISTANCE
		N > 35 12,35/ 150mm REFUSAL							>600 >600 >600	
			8							
		N > 30 11,30/ 150mm REFUSAL	9						>600 >600 >600	
			10			SHALE: dark grey and brown, with XW bands.	DW	VL-L		LOW RESISTANCE
								L		LOW TO MODERATE RESISTANCE
			11							
								M		MODERATE TO HIGH RESISTANCE
			12			END OF BOREHOLE AT 12.0m				
			13							
			14							

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BOREHOLE LOG

Borehole No. **2**

Client: PLASSER AUSTRALIA PTY LTD
Project: PROPOSED RAIL YARD EXTENSION
Location: 2 PLASSER CRESCENT, ST MARYS, NSW

Job No. 27578ZR **Method:** SPIRAL AUGER JK350 **R.L. Surface:** ≈ 39.5m
Date: 14-7-14 **Datum:** AHD
Logged/Checked by: A.P.C./P.R.

Groundwater Record	Samples (ES, U50, DB, DS)	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION OF AUGERING			0			FILL: Clayey gravel, fine to coarse grained igneous, dark grey and dark brown.	D MC<PL			GRASS COVER
		N = 16 4,5,11			CL	FILL: Gravelly clay, low to medium plasticity, dark brown, with fine to coarse grained igneous and shale gravel, trace of roots and root fibres.	MC>PL	VSt	380 350 350	
			1			SILTY CLAY: medium plasticity, light grey mottled orange and red brown, with fine to coarse grained ironstone gravel, trace of roots and root fibres.				
		N = 23 7,10,13						H	580 560 550	
			2							
		N = 30 6,10,20	3					VSt	280 250 280	
			4			as above, but occasional iron indurated bands and XW shale bands.		H		
		N > 49 18,19, 30/100mm REFUSAL							>600 580 580	
ON COMPLETION OF CORING			5							
					CH	SILTY CLAY: high plasticity, light grey and brown, occasional XW shale bands.				
		N = 50 11,20,30	6						>600 >600 >600	
			7							

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BOREHOLE LOG

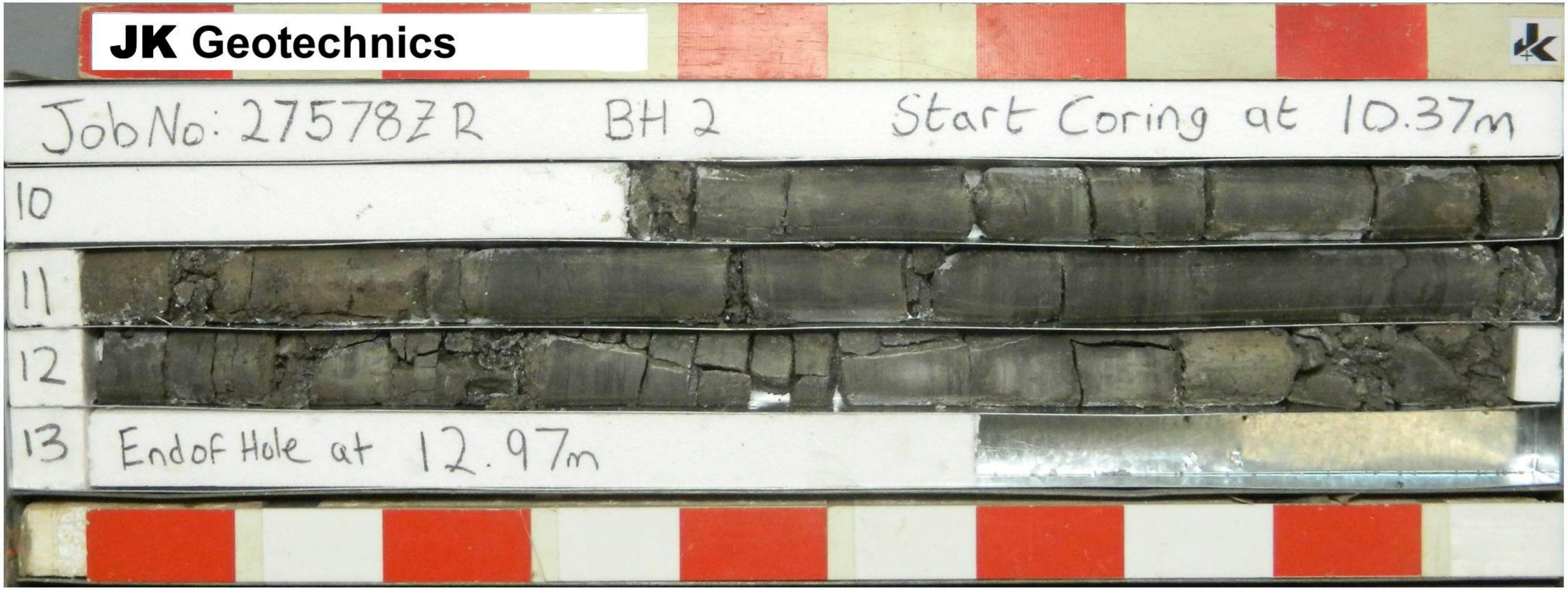
Borehole No.
2

Client: PLASSER AUSTRALIA PTY LTD
Project: PROPOSED RAIL YARD EXTENSION
Location: 2 PLASSER CRESCENT, ST MARYS, NSW

Job No. 27578ZR
Date: 14-7-14
Method: SPIRAL AUGER JK350
R.L. Surface: ≈ 39.5m
Datum: AHD
Logged/Checked by: A.P.C./P.R.

Groundwater Record	SAMPLES ES	U50	DB	DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
					N > 30 15,30/ 150mm REFUSAL				SHALE: orange brown mottled grey, with clay bands.	XW-DW	EL-VL		VERY LOW 'TC' BIT RESISTANCE
						8				DW	VL		VERY LOW TO LOW RESISTANCE
						9			SHALE: light grey.		L		LOW RESISTACE
						10							
						11			REFER TO CORED BOREHOLE LOG				
						12							
						13							
						14							

Ref: 27578ZR Borehole 2



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CORED BOREHOLE LOG

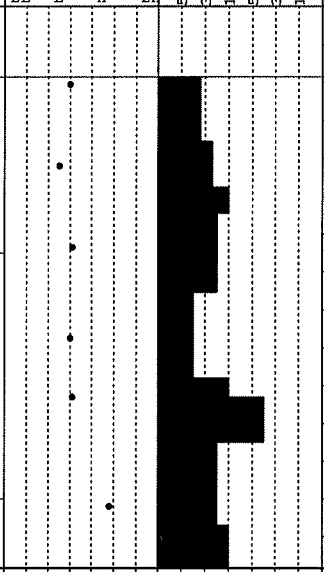
Borehole No. **2**

Client: PLASSER AUSTRALIA PTY LTD
Project: PROPOSED RAIL YARD EXTENSION
Location: 2 PLASSER CRESCENT, ST MARYS, NSW

Job No. 27578ZR	**Core Size:** NMLC	**R.L. Surface:** ≈ 39.5m
Date: 14-7-14	**Inclination:** VERTICAL	**Datum:** AHD
Drill Type: JK350	**Bearing:** -	**Logged/Checked by:** A.P.C./P.R

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	DEFECT DETAILS – DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific	General
		10		START CORING AT 10.37m				
FULL RETURN				SHALE: dark grey.	DW	L	- XWS, 5°, 50mm.t - CS, 5°, 30mm.t	
		11					- CS, 5°, 2mm.t - XWS, 5°, 30mm.t - CS, 3°, 140mm.t - CS, 2°, 10mm.t	
						M	- XWS, 10°, 20mm.t - J, 60°, P, S	
		12		SHALE: dark grey and light grey, interbedded with fine grained sandstone.			- XWS, 2°, 20mm.t - CS, 5°, 2mm.t - CS, 2°, 10mm.t - CS, 5°, 2mm.t - J, 65°, P, S - XWS, 10°, 5mm.t - 2xJ, SUBVERTICAL, P, S - CS, 10°, 15mm.t	
						H	- J, SUBVERTICAL, Un, R - CS, 5°, 80mm.t - J, SUBVERTICAL, P, S - J, SUBVERTICAL, P, S - CS, 45°, 50mm.t	
		13		END OF BOREHOLE AT 12.97m				
		14						
		15						
		16						

POINT LOAD STRENGTH INDEX $I_s(50)$ (EL, VL, L, M, H, VH, EH) — DEFECT SPACING (mm) (500, 300, 100, 50, 30, 10)



JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

BOREHOLE LOG

Borehole No.
3
1/2

Client: PLASSER AUSTRALIA PTY LTD
Project: PROPOSED RAIL YARD EXTENSION
Location: 2 PLASSER CRESCENT, ST MARYS, NSW

Job No. 27578ZR **Method:** SPIRAL AUGER JK350 **R.L. Surface:** ≈ 39.5m
Date: 14-7-14 **Datum:** AHD
Logged/Checked by: A.P.C./P.R.

Groundwater Record	SAMPLES (ES, U50, DB, DS)	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION & AFTER 1 HR			0			FILL: Silty clay topsoil, high plasticity, dark brown, with roots and root fibres.				GRASS COVER
		N = 8 1,3,5			CH	SILTY CLAY: high plasticity, red brown, with roots and root fibres, fine to medium grained ironstone gravel.	MC>PL	St	120 150 110	
			1							
		N = 30 7,10,20				SILTY CLAY: high plasticity, light grey mottled orange brown, with fine to medium grained ironstone gravel.		VSt-H	>600 >600 >600	
			2							
		N > 37 15,23 14/100mm REFUSAL	3						230 250 220	
			4							
		N = 32 9,12,20						H	>600 580 >600	
			5							
		N > 25 15,25/ 100mm REFUSAL	6			SILTY CLAY: high plasticity, light grey and orange brown, with occasional XW shale bands.			>600 >600 >600	
			7							

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GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

BOREHOLE LOG

Borehole No. **3**

2/2

Client: PLASSER AUSTRALIA PTY LTD

Project: PROPOSED RAIL YARD EXTENSION

Location: 2 PLASSER CRESCENT, ST MARYS, NSW

Job No. 27578ZR **Method:** SPIRAL AUGER JK350 **R.L. Surface:** ≈ 39.5m

Date: 14-7-14 **Datum:** AHD

Logged/Checked by: A.P.C./P.R.

Groundwater Record	SAMPLES ES	U50	DB	DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
									SHALE: orange brown.	XW-DW	EL-VL		VERY LOW 'TC' BIT RESISTANCE
						8			SHALE: grey and orange brown.	DW	VL		VERY LOW TO LOW RESISTANCE
						9			SHALE: grey.		L		LOW RESISTANCE
						10					H		HIGH RESISTANCE
									END OF BOREHOLE AT 10.5m				
						11							
						12							
						13							
						14							

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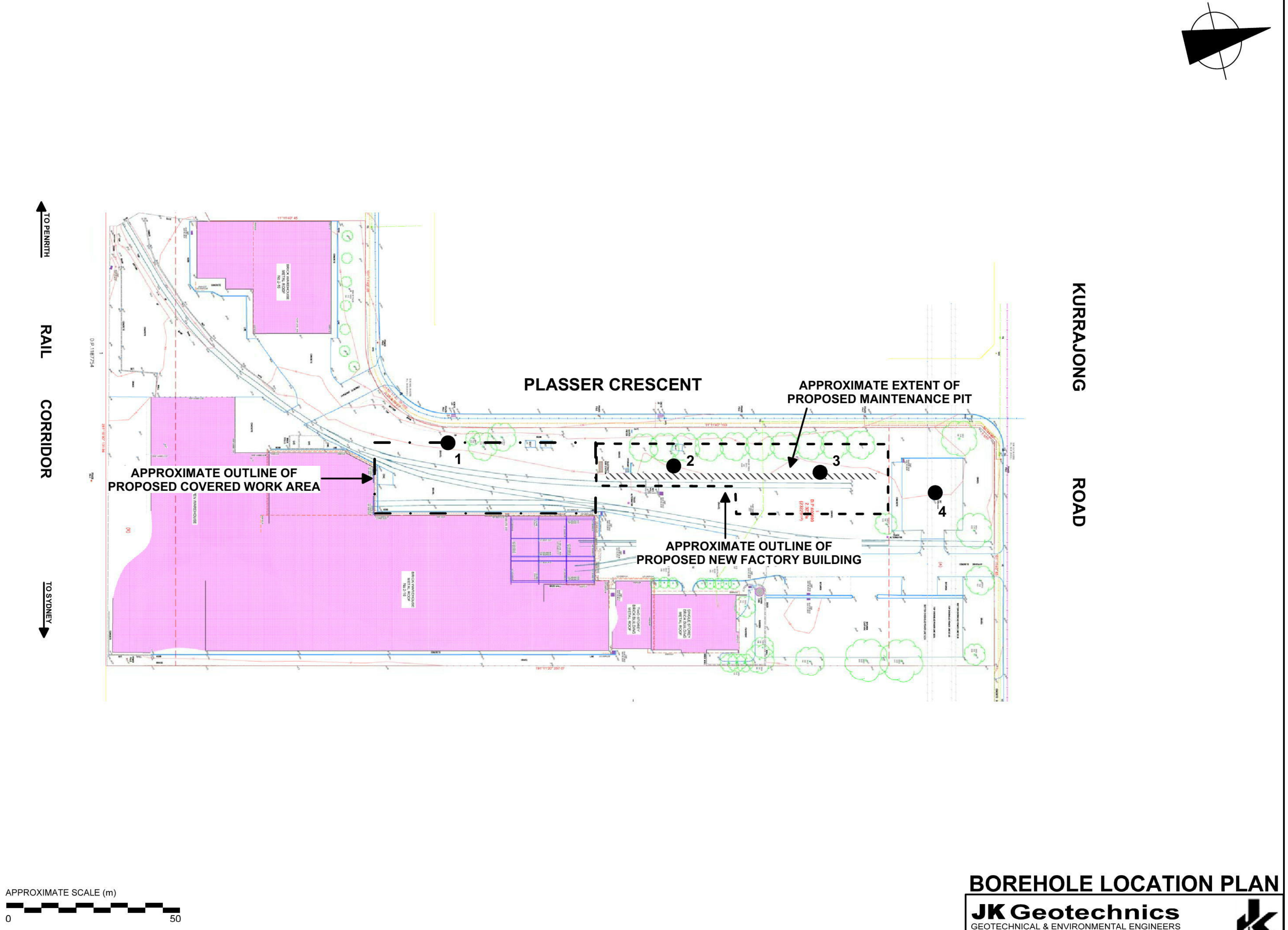
BOREHOLE LOG

Borehole No. **4**
1/1

Client: PLASSER AUSTRALIA PTY LTD
Project: PROPOSED RAIL YARD EXTENSION
Location: 2 PLASSER CRESCENT, ST MARYS, NSW

Job No. 27578ZR **Method:** SPIRAL AUGER JK350 **R.L. Surface:** ≈ 39.5m
Date: 14-7-14 **Datum:** AHD
Logged/Checked by: A.P.C./P.R.

Groundwater Record	SAMPLES (ES, U50, DB, DS)	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION			0		-	ASPHALTIC CONCRETE: 30mm.t	D			ROADBASE
	DB				CH	FILL: Sandy gravel, fine to coarse grained igneous, grey, fine to coarse grained sand.	MC>PL			
	DS	N > 41 12,23, 18/50mm REFUSAL			CL-CH	SILTY CLAY: high plasticity, red brown and light grey.			>600 >600 >600	
			1			SILTY CLAY: medium to high plasticity, light grey, with fine to coarse grained ironstone gravel.				
	DS	N = 36 15,16,20							>600 >600 >600	
			2			END OF BOREHOLE AT 1.95m				
			3							
			4							
			5							
			6							
			7							



BOREHOLE LOCATION PLAN

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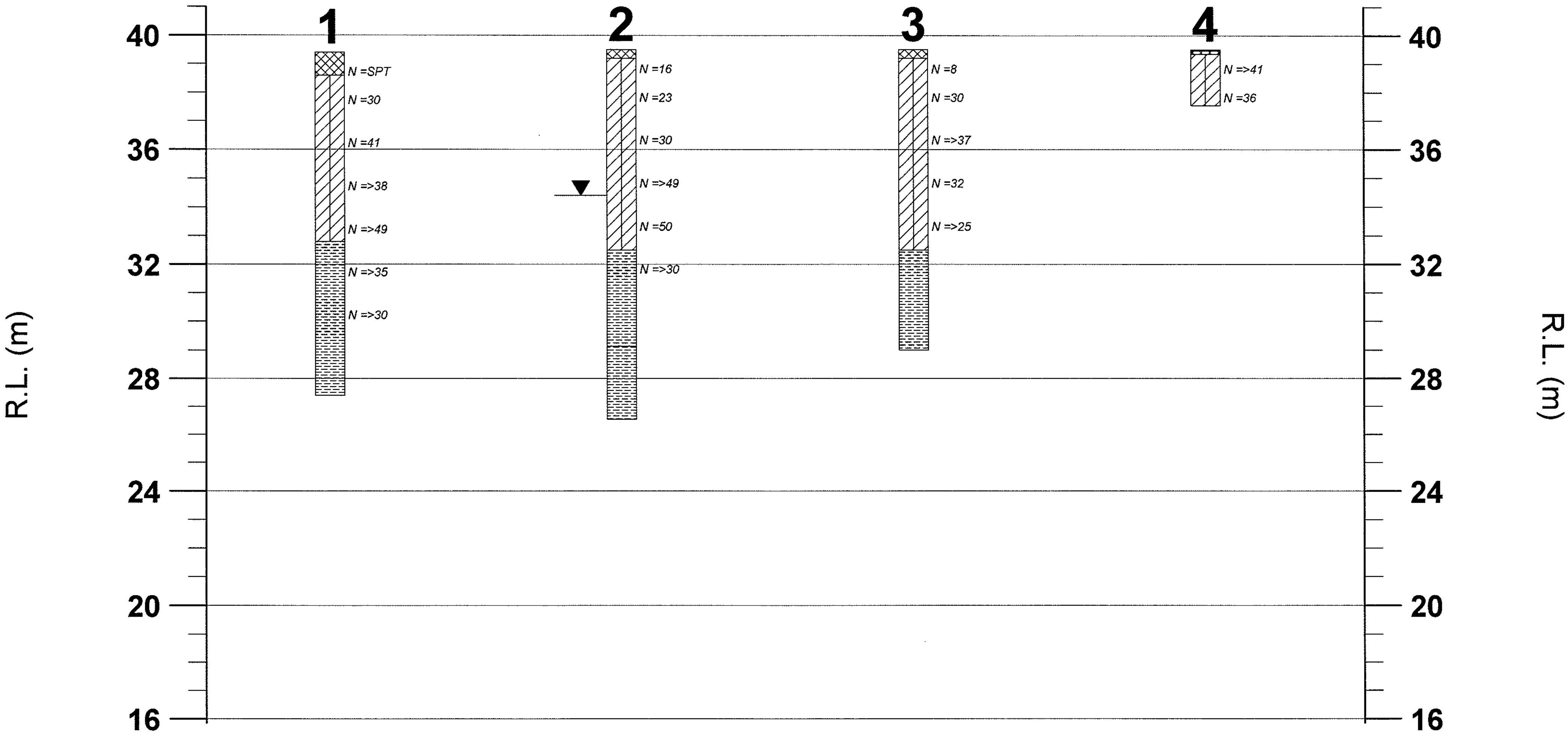
Report No. 27578ZR   Figure No. 1

GRAPHICAL BOREHOLE SUMMARY



Fill
Silty Clay
Shale
Asphaltic/ Bituminous Paving or Coal
Observed water level
N SPT "N" VALUE
Nc SOLID CONE BLOW COUNTS PER 150mm

NOTE: REFER TO BOREHOLE LOGS

Scale: 1 : 200 (vert) ; NTS (horiz)

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Job No.: 27578ZR

Figure No.: 2

REPORT EXPLANATION NOTES

INTRODUCTION

These notes have been provided to amplify the geotechnical report in regard to classification methods, field procedures and certain matters relating to the Comments and Recommendations section. Not all notes are necessarily relevant to all reports.

The ground is a product of continuing natural and man-made processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Geotechnical engineering involves gathering and assimilating limited facts about these characteristics and properties in order to understand or predict the behaviour of the ground on a particular site under certain conditions. This report may contain such facts obtained by inspection, excavation, probing, sampling, testing or other means of investigation. If so, they are directly relevant only to the ground at the place where and time when the investigation was carried out.

DESCRIPTION AND CLASSIFICATION METHODS

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, the SAA Site Investigation Code. In general, descriptions cover the following properties – soil or rock type, colour, structure, strength or density, and inclusions. Identification and classification of soil and rock involves judgement and the Company infers accuracy only to the extent that is common in current geotechnical practice.

Soil types are described according to the predominating particle size and behaviour as set out in the attached Unified Soil Classification Table qualified by the grading of other particles present (e.g. sandy clay) as set out below:

Soil Classification	Particle Size
Clay	less than 0.002mm
Silt	0.002 to 0.075mm
Sand	0.075 to 2mm
Gravel	2 to 60mm

Non-cohesive soils are classified on the basis of relative density, generally from the results of Standard Penetration Test (SPT) as below:

Relative Density	SPT 'N' Value (blows/300mm)
Very loose	less than 4
Loose	4 – 10
Medium dense	10 – 30
Dense	30 – 50
Very Dense	greater than 50

Cohesive soils are classified on the basis of strength (consistency) either by use of hand penetrometer, laboratory testing or engineering examination. The strength terms are defined as follows.

Classification	Unconfined Compressive Strength kPa
Very Soft	less than 25
Soft	25 – 50
Firm	50 – 100
Stiff	100 – 200
Very Stiff	200 – 400
Hard	Greater than 400
Friable	Strength not attainable – soil crumbles

Rock types are classified by their geological names, together with descriptive terms regarding weathering, strength, defects, etc. Where relevant, further information regarding rock classification is given in the text of the report. In the Sydney Basin, 'Shale' is used to describe thinly bedded to laminated siltstone.

SAMPLING

Sampling is carried out during drilling or from other excavations to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on plasticity, grain size, colour, moisture content, minor constituents and, depending upon the degree of disturbance, some information on strength and structure. Bulk samples are similar but of greater volume required for some test procedures.

Undisturbed samples are taken by pushing a thin-walled sample tube, usually 50mm diameter (known as a U50), into the soil and withdrawing it with a sample of the soil contained in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling used are given on the attached logs.

INVESTIGATION METHODS

The following is a brief summary of investigation methods currently adopted by the Company and some comments on their use and application. All except test pits, hand auger drilling and portable dynamic cone penetrometers require the use of a mechanical drilling rig which is commonly mounted on a truck chassis.

Test Pits: These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the insitu soils if it is safe to descend into the pit. The depth of penetration is limited to about 3m for a backhoe and up to 6m for an excavator. Limitations of test pits are the problems associated with disturbance and difficulty of reinstatement and the consequent effects on close-by structures. Care must be taken if construction is to be carried out near test pit locations to either properly recompact the backfill during construction or to design and construct the structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

Hand Auger Drilling: A borehole of 50mm to 100mm diameter is advanced by manually operated equipment. Premature refusal of the hand augers can occur on a variety of materials such as hard clay, gravel or ironstone, and does not necessarily indicate rock level.

Continuous Spiral Flight Augers: The borehole is advanced using 75mm to 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling and insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected after withdrawal of the auger flights, but they can be very disturbed and layers may become mixed. Information from the auger sampling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability due to mixing or softening of samples by groundwater, or uncertainties as to the original depth of the samples. Augering below the groundwater table is of even lesser reliability than augering above the water table.

Rock Augering: Use can be made of a Tungsten Carbide (TC) bit for auger drilling into rock to indicate rock quality and continuity by variation in drilling resistance and from examination of recovered rock fragments. This method of investigation is quick and relatively inexpensive but provides only an indication of the likely rock strength and predicted values may be in error by a strength order. Where rock strengths may have a significant impact on construction feasibility or costs, then further investigation by means of cored boreholes may be warranted.

Wash Boring: The borehole is usually advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from "feel" and rate of penetration.

Mud Stabilised Drilling: Either Wash Boring or Continuous Core Drilling can use drilling mud as a circulating fluid to stabilise the borehole. The term 'mud' encompasses a range of products ranging from bentonite to polymers such as Revert or Biogel. The mud tends to mask the cuttings and reliable identification is only possible from intermittent intact sampling (eg from SPT and U50 samples) or from rock coring, etc.

Continuous Core Drilling: A continuous core sample is obtained using a diamond tipped core barrel. Provided full core recovery is achieved (which is not always possible in very low strength rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation. In rocks, an NMLC triple tube core barrel, which gives a core of about 50mm diameter, is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as CORE LOSS. The location of losses are determined on site by the supervising engineer; where the location is uncertain, the loss is placed at the top end of the drill run.

Standard Penetration Tests: Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils as a means of indicating density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" – Test F3.1.

The test is carried out in a borehole by driving a 50mm diameter split sample tube with a tapered shoe, under the impact of a 63kg hammer with a free fall of 760mm. It is normal for the tube to be driven in three successive 150mm increments and the 'N' value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

- In the case where full penetration is obtained with successive blow counts for each 150mm of, say, 4, 6 and 7 blows, as

  N = 13
  4, 6, 7

- In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm, as

  N>30
  15, 30/40mm

The results of the test can be related empirically to the engineering properties of the soil.

Occasionally, the drop hammer is used to drive 50mm diameter thin walled sample tubes (U50) in clays. In such circumstances, the test results are shown on the borehole logs in brackets.

A modification to the SPT test is where the same driving system is used with a solid 60° tipped steel cone of the same diameter as the SPT hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the SPT. The results of this Solid Cone Penetration Test (SCPT) are shown as "N_c" on the borehole logs, together with the number of blows per 150mm penetration.

Static Cone Penetrometer Testing and Interpretation: Cone penetrometer testing (sometimes referred to as a Dutch Cone) described in this report has been carried out using an Electronic Friction Cone Penetrometer (EFCP). The test is described in Australian Standard 1289, Test F5.1.

In the tests, a 35mm diameter rod with a conical tip is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the frictional resistance on a separate 134mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are electrically connected by wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20mm per second) the information is output as incremental digital records every 10mm. The results given in this report have been plotted from the digital data.

The information provided on the charts comprise:

- Cone resistance – the actual end bearing force divided by the cross sectional area of the cone – expressed in MPa.
- Sleeve friction – the frictional force on the sleeve divided by the surface area – expressed in kPa.
- Friction ratio – the ratio of sleeve friction to cone resistance, expressed as a percentage.

  The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1% to 2% are commonly encountered in sands and occasionally very soft clays, rising to 4% to 10% in stiff clays and peats. Soil descriptions based on cone resistance and friction ratios are only inferred and must not be considered as exact.

Correlations between EFCP and SPT values can be developed for both sands and clays but may be site specific.

Interpretation of EFCP values can be made to empirically derive modulus or compressibility values to allow calculation of foundation settlements.

Stratification can be inferred from the cone and friction traces and from experience and information from nearby boreholes etc. Where shown, this information is presented for general guidance, but must be regarded as interpretive. The test method provides a continuous profile of engineering properties but, where precise information on soil classification is required, direct drilling and sampling may be preferable.

Portable Dynamic Cone Penetrometers: Portable Dynamic Cone Penetrometer (DCP) tests are carried out by driving a rod into the ground with a sliding hammer and counting the blows for successive 100mm increments of penetration.

Two relatively similar tests are used:

- Cone penetrometer (commonly known as the Scala Penetrometer) – a 16mm rod with a 20mm diameter cone end is driven with a 9kg hammer dropping 510mm (AS1289, Test F3.2). The test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various Road Authorities.
- Perth sand penetrometer – a 16mm diameter flat ended rod is driven with a 9kg hammer, dropping 600mm (AS1289, Test F3.3). This test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.

LOGS

The borehole or test pit logs presented herein are an engineering and/or geological interpretation of the sub-surface conditions, and their reliability will depend to some extent on the frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will enable the most reliable assessment, but is not always practicable or possible to justify on economic grounds. In any case, the boreholes or test pits represent only a very small sample of the total subsurface conditions.

The attached explanatory notes define the terms and symbols used in preparation of the logs.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than "straight line" variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

GROUNDWATER

Where groundwater levels are measured in boreholes, there are several potential problems:

- Although groundwater may be present, in low permeability soils it may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes and may not be the same at the time of construction.
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole or 'reverted' chemically if water observations are to be made.

More reliable measurements can be made by installing standpipes which are read after stabilising at intervals ranging from several days to perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from perched water tables or surface water.

FILL

The presence of fill materials can often be determined only by the inclusion of foreign objects (eg bricks, steel etc) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult with limited testing and sampling to reliably determine the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density, strength and material type is much greater than with natural soil deposits. Consequently, there is an increased risk of adverse engineering characteristics or behaviour. If the volume and quality of fill is of importance to a project, then frequent test pit excavations are preferable to boreholes.

LABORATORY TESTING

Laboratory testing is normally carried out in accordance with Australian Standard 1289 *'Methods of Testing Soil for Engineering Purposes'*. Details of the test procedure used are given on the individual report forms.

ENGINEERING REPORTS

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building) the information and interpretation may not be relevant if the design proposal is changed (eg to a twenty storey building). If this happens, the company will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions – the potential for this will be partially dependent on borehole spacing and sampling frequency as well as investigation technique.
- Changes in policy or interpretation of policy by statutory authorities.
- The actions of persons or contractors responding to commercial pressures.

If these occur, the company will be pleased to assist with investigation or advice to resolve any problems occurring.

SITE ANOMALIES

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed that at some later stage, well after the event.

REPRODUCTION OF INFORMATION FOR CONTRACTUAL PURPOSES

Attention is drawn to the document *'Guidelines for the Provision of Geotechnical Information in Tender Documents'*, published by the Institution of Engineers, Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Copyright in all documents (such as drawings, borehole or test pit logs, reports and specifications) provided by the Company shall remain the property of Jeffery and Katauskas Pty Ltd. Subject to the payment of all fees due, the Client alone shall have a licence to use the documents provided for the sole purpose of completing the project to which they relate. License to use the documents may be revoked without notice if the Client is in breach of any objection to make a payment to us.

REVIEW OF DESIGN

Where major civil or structural developments are proposed or where only a limited investigation has been completed or where the geotechnical conditions/ constraints are quite complex, it is prudent to have a joint design review which involves a senior geotechnical engineer.

SITE INSPECTION

The company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related.

Requirements could range from:

i) a site visit to confirm that conditions exposed are no worse than those interpreted, to

ii) a visit to assist the contractor or other site personnel in identifying various soil/rock types such as appropriate footing or pier founding depths, or

iii) full time engineering presence on site.

GRAPHIC LOG SYMBOLS FOR SOILS AND ROCKS

SOIL

- FILL
- TOPSOIL
- CLAY (CL, CH)
- SILT (ML, MH)
- SAND (SP, SW)
- GRAVEL (GP, GW)
- SANDY CLAY (CL, CH)
- SILTY CLAY (CL, CH)
- CLAYEY SAND (SC)
- SILTY SAND (SM)
- GRAVELLY CLAY (CL, CH)
- CLAYEY GRAVEL (GC)
- SANDY SILT (ML)
- PEAT AND ORGANIC SOILS

ROCK

- CONGLOMERATE
- SANDSTONE
- SHALE
- SILTSTONE, MUDSTONE, CLAYSTONE
- LIMESTONE
- PHYLLITE, SCHIST
- TUFF
- GRANITE, GABBRO
- DOLERITE, DIORITE
- BASALT, ANDESITE
- QUARTZITE

DEFECTS AND INCLUSIONS

- CLAY SEAM
- SHEARED OR CRUSHED SEAM
- BRECCIATED OR SHATTERED SEAM/ZONE
- IRONSTONE GRAVEL
- ORGANIC MATERIAL

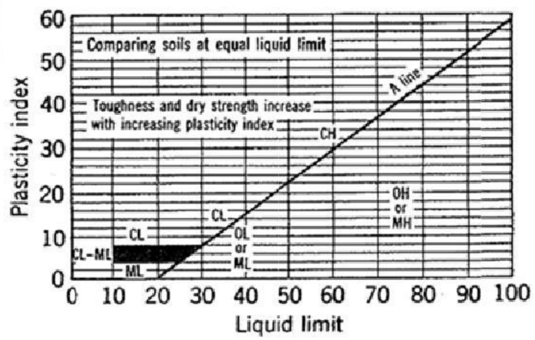
OTHER MATERIALS

- CONCRETE
- BITUMINOUS CONCRETE, COAL
- COLLUVIUM

UNIFIED SOIL CLASSIFICATION TABLE

Field Identification Procedures (Excluding particles larger than 75 μm and basing fractions on estimated weights)				Group Symbols a	Typical Names	Information Required for Describing Soils	Laboratory Classification Criteria		
Coarse-grained soils More than half of material is *larger* than 75 μm sieve size[b] (The 75 μm sieve size is about the smallest particle visible to naked eye)	Gravels More than half of coarse fraction is larger than 4 mm sieve size	Clean gravels (little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes	*GW*	Well graded gravels, gravel-sand mixtures, little or no fines	Give typical name; indicate approximate percentages of sand and gravel; maximum size; angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information; and symbols in parentheses For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics Example: *Silty sand*, gravelly; about 20% hard, angular gravel particles 12 mm maximum size; rounded and subangular sand grains coarse to fine, about 15% non-plastic fines with low dry strength; well compacted and moist in place; alluvial sand; (*SM*)	Use grain size curve in identifying the fractions as given under field identification. Determine percentages of gravel and sand from grain size curve. Depending on percentage of fines (fraction smaller than 75 μm sieve size) coarse grained soils are classified as follows: Less than 5% *GW, GP, SW, SP*; More than 12% *GM, GC, SM, SC*; 5% to 12% *Borderline* cases requiring use of dual symbols	$C_U = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			Predominantly one size or a range of sizes with some intermediate sizes missing	*GP*	Poorly graded gravels, gravel-sand mixtures, little or no fines			Not meeting all gradation requirements for *GW*	
		Gravels with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures see *ML* below)	*GM*	Silty gravels, poorly graded gravel-sand-silt mixtures			Atterberg limits below "A" line, or *PI* less than 4	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
			Plastic fines (for identification procedures, see *CL* below)	*GC*	Clayey gravels, poorly graded gravel-sand-clay mixtures			Atterberg limits above "A" line, with *PI* greater than 7	
	Sands More than half of coarse fraction is smaller than 4 mm sieve size	Clean sands (little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes	*SW*	Well graded sands, gravelly sands, little or no fines			$C_U = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			Predominantly one size or a range of sizes with some intermediate sizes missing	*SP*	Poorly graded sands, gravelly sands, little or no fines			Not meeting all gradation requirements for *SW*	
		Sands with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures, see *ML* below)	*SM*	Silty sands, poorly graded sand-silt mixtures			Atterberg limits below "A" line or *PI* less than 5	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
			Plastic fines (for identification procedures, see *CL* below)	*SC*	Clayey sands, poorly graded sand-clay mixtures			Atterberg limits below "A" line with *PI* greater than 7	

Identification Procedures on Fraction Smaller than 380 μm Sieve Size		Dry Strength (crushing characteristics)	Dilatancy (reaction to shaking)	Toughness (consistency near plastic limit)	Group Symbols	Typical Names	Information Required for Describing Soils
Fine-grained soils More than half of material is *smaller* than 75 μm sieve size	Silts and clays liquid limit less than 50	None to slight	Quick to slow	None	*ML*	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	Give typical name; indicate degree and character of plasticity, amount and maximum size of coarse grains; colour in wet condition, odour if any, local or geologic name, and other pertinent descriptive information, and symbol in parentheses For undisturbed soils add information on structure, stratification, consistency in undisturbed and remoulded states, moisture and drainage conditions Example: *Clayey silt*, brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; (*ML*)
		Medium to high	None to very slow	Medium	*CL*	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
		Slight to medium	Slow	Slight	*OL*	Organic silts and organic silt-clays of low plasticity	
	Silts and clays liquid limit greater than 50	Slight to medium	Slow to none	Slight to medium	*MH*	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
		High to very high	None	High	*CH*	Inorganic clays of high plasticity, fat clays	
		Medium to high	None to very slow	Slight to medium	*OH*	Organic clays of medium to high plasticity	
Highly Organic Soils		Readily identified by colour, odour, spongy feel and frequently by fibrous texture			*Pt*	Peat and other highly organic soils	



Plasticity chart
for laboratory classification of fine grained soils

Note: 1 Soils possessing characteristics of two groups are designated by combinations of group symbols (eg. GW-GC, well graded gravel-sand mixture with clay fines).
2 Soils with liquid limits of the order of 35 to 50 may be visually classified as being of medium plasticity.

LOG SYMBOLS

LOG COLUMN	SYMBOL	DEFINITION
Groundwater Record	▼	Standing water level. Time delay following completion of drilling may be shown.
	C	Extent of borehole collapse shortly after drilling.
	▶	Groundwater seepage into borehole or excavation noted during drilling or excavation.
Samples	ES	Soil sample taken over depth indicated, for environmental analysis.
	U50	Undisturbed 50mm diameter tube sample taken over depth indicated.
	DB	Bulk disturbed sample taken over depth indicated.
	DS	Small disturbed bag sample taken over depth indicated.
	ASB	Soil sample taken over depth indicated, for asbestos screening.
	ASS	Soil sample taken over depth indicated, for acid sulfate soil analysis.
	SAL	Soil sample taken over depth indicated, for salinity analysis.
Field Tests	N = 17 4, 7, 10	Standard Penetration Test (SPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration. 'R' as noted below.
	N_c = 5 7 3R	Solid Cone Penetration Test (SCPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration for 60 degree solid cone driven by SPT hammer. 'R' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	VNS = 25	Vane shear reading in kPa of Undrained Shear Strength.
	PID = 100	Photoionisation detector reading in ppm (Soil sample headspace test).
Moisture Condition (Cohesive Soils)	MC>PL	Moisture content estimated to be greater than plastic limit.
	MC≈PL	Moisture content estimated to be approximately equal to plastic limit.
	MC<PL	Moisture content estimated to be less than plastic limit.
(Cohesionless Soils)	D	DRY – Runs freely through fingers.
	M	MOIST – Does not run freely but no free water visible on soil surface.
	W	WET – Free water visible on soil surface.
Strength (Consistency) Cohesive Soils	VS	VERY SOFT – Unconfined compressive strength less than 25kPa
	S	SOFT – Unconfined compressive strength 25-50kPa
	F	FIRM – Unconfined compressive strength 50-100kPa
	St	STIFF – Unconfined compressive strength 100-200kPa
	VSt	VERY STIFF – Unconfined compressive strength 200-400kPa
	H	HARD – Unconfined compressive strength greater than 400kPa
	( )	Bracketed symbol indicates estimated consistency based on tactile examination or other tests.
Density Index/ Relative Density (Cohesionless Soils)		**Density Index (I_D) Range (%)** **SPT 'N' Value Range (Blows/300mm)**
	VL	Very Loose <15 0-4
	L	Loose 15-35 4-10
	MD	Medium Dense 35-65 10-30
	D	Dense 65-85 30-50
	VD	Very Dense >85 >50
	( )	Bracketed symbol indicates estimated density based on ease of drilling or other tests.
Hand Penetrometer Readings	300 250	Numbers indicate individual test results in kPa on representative undisturbed material unless noted otherwise.
Remarks	'V' bit	Hardened steel 'V' shaped bit.
	'TC' bit	Tungsten carbide wing bit.
	T 60	Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.

ROCK MATERIAL WEATHERING CLASSIFICATION

TERM	SYMBOL	DEFINITION
Residual Soil	RS	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
Extremely weathered rock	XW	Rock is weathered to such an extent that it has "soil" properties, ie it either disintegrates or can be remoulded, in water.
Distinctly weathered rock	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by ironstaining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Slightly weathered rock	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh rock	FR	Rock shows no sign of decomposition or staining.

ROCK STRENGTH

Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance in the direction normal to the bedding. The test procedure is described by the International Journal of Rock Mechanics, Mining, Science and Geomechanics. Abstract Volume 22, No 2, 1985.

TERM	SYMBOL	Is (50) MPa	FIELD GUIDE
Extremely Low:	EL		Easily remoulded by hand to a material with soil properties.
----------------------	-------------	0.03	
Very Low:	VL		May be crumbled in the hand. Sandstone is "sugary" and friable.
----------------------	-------------	0.1	
Low:	L		A piece of core 150mm long x 50mm dia. may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.
----------------------	-------------	0.3	
Medium Strength:	M		A piece of core 150mm long x 50mm dia. can be broken by hand with difficulty. Readily scored with knife.
----------------------	-------------	1	
High:	H		A piece of core 150mm long x 50mm dia. core cannot be broken by hand, can be slightly scratched or scored with knife; rock rings under hammer.
----------------------	--------------	3	
Very High:	VH		A piece of core 150mm long x 50mm dia. may be broken with hand-held pick after more than one blow. Cannot be scratched with pen knife; rock rings under hammer.
----------------------	--------------	10	
Extremely High:	EH		A piece of core 150mm long x 50mm dia. is very difficult to break with hand-held hammer. Rings when struck with a hammer.

ABBREVIATIONS USED IN DEFECT DESCRIPTION

ABBREVIATION	DESCRIPTION	NOTES
Be	Bedding Plane Parting	Defect orientations measured relative to the normal to the long core axis (ie relative to horizontal for vertical holes)
CS	Clay Seam	
J	Joint	
P	Planar	
Un	Undulating	
S	Smooth	
R	Rough	
IS	Ironstained	
XWS	Extremely Weathered Seam	
Cr	Crushed Seam	
60t	Thickness of defect in millimetres	

APPENDIX A

Envirolab Services Pty Ltd
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12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
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CERTIFICATE OF ANALYSIS **113152**

Client:
Environmental Investigation Services
PO Box 976
North Ryde BC
NSW 1670

Attention: Adrian Callus

Sample log in details:

Your Reference:	**27578ZR, North St Marys**
No. of samples:	3 Soils
Date samples received / completed instructions received	16/07/2014 / 16/07/2014

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	23/07/14 / 22/07/14
Date of Preliminary Report:	Not Issued

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

Miscellaneous Inorg - soil				
Our Reference:	UNITS	113152-1	113152-2	113152-3
Your Reference	-------------	BH2	BH2	BH3
Depth	------------	0.5-0.95	4.5-4.95	3.0-3.45
Date Sampled		14/07/2014	14/07/2014	14/07/2014
Type of sample		Soil	Soil	Soil
Date prepared	-	17/07/2014	17/07/2014	17/07/2014
Date analysed	-	18/07/2014	18/07/2014	18/07/2014
pH 1:5 soil:water	pH Units	5.0	5.5	4.6
Chloride, Cl 1:5 soil:water	mg/kg	550	1,600	1,300
Sulphate, SO4 1:5 soil:water	mg/kg	390	210	540

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 22nd ED, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA 22nd ED, 4110 -B.

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			18/07/2014	113152-1	17/07/2014 || 17/07/2014	LCS-1	17/07/2014
Date analysed	-			18/07/2014	113152-1	18/07/2014 || 18/07/2014	LCS-1	18/07/2014
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	113152-1	5.0 || 4.9 || RPD: 2	LCS-1	101%
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	113152-1	550 || 510 || RPD: 8	LCS-1	90%
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	113152-1	390 || 360 || RPD: 8	LCS-1	99%

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	113152-2	17/07/2014
Date analysed	-	[NT]	[NT]	113152-2	18/07/2014
pH 1:5 soil:water	pH Units	[NT]	[NT]	[NR]	[NR]
Chloride, Cl 1:5 soil:water	mg/kg	[NT]	[NT]	113152-2	#
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]	113152-2	#

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

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APPENDIX 11
DCP Compliance table

Penrith DCP 2010 – Compliance Table

PROVISION	COMPLIANCE
C1 SITE PLANNING AND DESIGN PRINCIPLES	
Clause 1.1.1 refers to the need for a site analysis	Complies - Site plan at Appendix 2
Clause 1.2.2 relates to energy efficiency and conservation of the built form.	Complies - A Green Star Report prepared by Northrop Engineers has been provided at Appendix 7 (refer Section 3.6 of SEE for further detail).
Clause 1.2.5. relates to the Principles of Crime Prevention Through Environmental Design (CPTED).	Complies - The subject site is surrounded by transparent security fencing and intercom controlled sliding gates and has clearly defined entrances which is consistent with Principles 1, 2 and 3 of CPTED relating to natural surveillance, access control and territorial control.
Clause 1.2.6 relates to maximising accessibility and adaptability.	Generally complies - The proposed development is for quite a specific use relating to the servicing of trains and has therefore been designed with this use in mind, making it difficult to implement some of the principles of this section. However, level access is provided to the development and entrances are clearly defined as encouraged by the principles of this section.
1.3.C Fencing Controls	
General	
a) The location and design of fences, including the materials used to construct the fencing, should: i) Be sympathetic to the natural setting and character in form, materials and colour; ii) Maximise natural surveillance from the street to the building and from the building to the street; iii) Minimise the opportunities for intruders to hide; iv) Not impede the natural flow of stormwater drainage; v) Be located wholly on the property and not encroach on another property without the consent of the adjoining property owner(s). This includes land that may be owned by Penrith City Council or another public authority; vi) Be constructed of non-combustible materials if located in an asset protection zone or in an area identified in a bushfire risk management plan; and vii) Be structurally adequate, in accordance with the Building Code of Australia, and meets the Dividing Fences Act 1991.	Complies - The existing fencing along the western boundary is proposed to be removed and replaced with xxxm high steel palisade fencing. This type of fencing is more attractive than security fencing and is transparent so it will provide natural surveillance, minimise hiding opportunities and allow for stormwater to flow through it. The proposed fencing will be wholly on the property.
Fencing in Industrial Zones	
a) Fencing proposals that require development consent shall be: i) positioned behind the landscaping and not along the front property boundary (as illustrated in Figure C1.4); and ii) a maximum height of 2.1 metres and of an "open" nature, e.g. decorative metal and coloured dark grey or black, or complement the adjacent fencing type.	Does not comply however acceptable in circumstances - The proposed fencing will not be positioned behind the landscaping as suggested. Rather, the fencing will be located on the boundary as is the existing situation. The site has been designed like this because the staff will use the landscaped areas in their breaks and require direct access to the area.

PROVISION	COMPLIANCE
	The selected palisade fencing is an attractive fencing type for an industrial area and will contribute to an attractive streetscape character.
b) Fencing may be positioned along the front property boundary only if: i) the site is not located on, facing or fronting: • Andrews Road, Castlereagh Road, Christie Street, Forrester Road, Great Western Highway, Mulgoa Road, Old Bathurst Road, Parker Street or any other classified road or major road; or • The main road or collector road of the industrial precinct; and ii) it is decorative fencing that has an open style appearance (metal, pool type fencing); and iii) the fencing is complementary to the landscaping.	Complies - Fencing will be located on the front boundary along Kurrajong Road which is a main road. The fencing will be new steel palisade fencing which will complement the landscaping.
c) Fencing shall be integrated with the overall design of the development and associated security structures, where possible.	Complies - The proposed fencing will complement the overall design and be a vast improvement on the existing chain mesh fence.
d) Where site security is required, fencing shall be constructed of black plastic coated 'Chain-link' fence or an approved alternative such as a metal palisade type fence. The overall height of fencing shall be no more than 2.4 metres. 'Chain-link' or similar fences are not suitable to the site frontage.	Complies - A metal palisade fence is proposed.
e) Consideration shall be given to the site's front fence being a reduced height particularly around the visitor or employee parking. Alternatively, the front of the premises shall be open to the street to provide a sense of address and to contribute to the streetscape	Complies - The front fence is proposed to be xxxm in height . The front gates accessing the parking area off Kurrajong Road will remain open when the site is attended.
f) Gates, security structures, letter boxes and signage must complement the fencing and be considered in the overall design of the development.	Complies - Sliding gates will complement the palisade fencing.
g) Landscaping adjacent to front fencing shall not form a tall dense screen, except where required to screen outdoor storage areas or plant and equipment.	Complies with intent - Landscaping along the Plasser Crescent frontage will be tall and dense to provide visual screening and to break up the building mass. However, landscaping along the Kurrajong Road primary frontage will be more open.
k) Fencing along secondary streets, unless of an open style design, must be setback behind the required landscaping.	Complies - Proposed fencing along Plasser Crescent is an open design.
l) Service yards visible from a street must be adequately screened.	Complies - The proposed development is to provide an enclosed (screened) building for a Services Workshop.
C3 WATER MANAGEMENT	
Chapter C3 relates to water management for the development and more specifically for this application, stormwater management, water quality and Water Sensitive Urban Design (WSUD).	Complies - The Stormwater Management Report prepared by Northrop in Appendix 13 of the SEE has been developed in accordance with this section of the DCP, Councils WSUD Technical Guidelines and best management practices for managing urban stormwater (refer Section 4.2.2 of SEE for further detail)

PROVISION	COMPLIANCE
C4 LAND MANAGEMENT	
Chapter C4 relates to land management for the development and more specifically site stability and earthworks, erosion and sedimentation control and contaminated lands.	
4.1 Site Stability And Earthworks This provision requires consent for earthworks unless work is ancillary to other development for which consent is given.	Complies - Consent is sought as part of the proposed development for required earthworks. The proposed finished floor reduced level (RL) of the new covered work area and factory building will be similar to the existing workshop, i.e. RL39.83m and localised raising of site surface levels by a maximum of about 0.4m will be required. The surface levels will be further reduced by 1.5m (i.e. RL38.35m) to accommodate the wash down pit and maintenance area for the proposed crane in the services workshop. A Geo-Technical Assessment prepared by JK Geotechnics had been provided at Appendix 10 as required by the Controls listed in 4.1 3(a)(i). The Geo-technical report provides detailed management measures on earthworks and excavation to be addressed during the construction phase of the project.
4.3 Erosion and Sedimentation The key requirement for this part is to provide an Erosion and Sediment Control Plan (ESCP).	Complies - An ESCP is provided at Appendix 4 in the Civil Design Plans. The proposed Erosion and Sediment Control measures include: • Installation of a sediment basin • Installation of site security fencing • Installation and maintenance of sandbags at existing stormwater pits • Installation and maintenance of sediment filters and traps to propped and existing pits • A site stockpile • Construction of a stabilised access. The measures proposed above also address the additional requirements for sites over 2500 square metres outlined in 4.3 (3).
4.4 Contaminated Lands This section contains key requirements in relation to contaminated lands.	Complies - As detailed in section 4.4.1 of the SEE a Phase 1 Environmental Site Assessment has been prepared for the proposal and is provided at Appendix 8.
C5 WASTE MANAGEMENT	
A Waste Management Plan is not a requirement for the proposed development as the addition to the building will not result in 50% increase in the gross floor area.	Not applicable - However a Waste Management Overview has been provided at Appendix 15, which includes details of types of waste, bin storage types and sizes and frequency and location of pick-up. Waste collection will be primarily from Plasser Crescent, away from the primary frontage.

PROVISION	COMPLIANCE
C6 LANDSCAPE DESIGN	
This section requires the submission of a Landscape Concept Plan for Category 2 development.	Complies - A Landscape Concept Plan has been prepared by GSA Architects and is provided at Appendix 3.
C9 ADVERTISING AND SIGNAGE	
This section includes requirements for signs including business identification signs in an industrial zone.	Complies - The proposal includes the Plasser Australia logo on the western elevation and the words "Plasser Australia" on the northern elevation as shown on Drawing No. 3000 of the Architectural Plans provided in Appendix 2. Both proposed signs will be visible from the surrounding road network, but will impose no road safety issues (9.1.C.2), nor are they considered to be inappropriate signs (9.1.C.3). Both proposed signs are "flush wall" signs which are considered acceptable as per 9.1.C.4. Given the scale of the buildings, the proposed signs are to be located on the upper portion of the building which is consistent with 9.4.C.(a) and Figure C9.3 of this chapter.
C10 TRANSPORT ACCESS AND PARKING	
This section requires the submission of a traffic impact assessment for certain types of development as determined by Council.	Complies – A Traffic Impact Assessment has been prepared and is provided at Appendix 12 (refer section 4.2.1 for further detail).
C12 NOISE AND VIBRATION	
This section requires the preparation of a Noise Impact Statement by a qualified acoustic consultant for noise generating industrial development. The Statement is to demonstrate acoustic protection measures necessary to achieve an indoor environment meeting residential standards, in accordance with relevant noise criteria, as well as relevant Australian Standards.	Complies – An Acoustic Report has been prepared and is provided at Appendix 14 (refer section 4.2.3 for further detail).
C13 INFRASTRUCTURE AND SERVICES	
This section includes controls in relation to easements, services and utilities, on site sewage management and engineering and construction standards.	Complies – A 30m wide electrical easement runs for the length of the northern boundary. No development is proposed within the easement other than the resurfacing of an existing car parking area and the provision of a new access. Provision of water, sewerage and stormwater services are addressed in the Stormwater Management Report at Appendix 13 and the Services Information at Appendix 5.

PROVISION	COMPLIANCE
D4 INDUSTRIAL DEVELOPMENT	
4.3 BUILDING SETBACKS AND LANDSCAPE	
4.3 C. Controls	
1. Setbacks	
1. Setbacks a) Setbacks for industrial development are to be in accordance with the standard specified in Table D4.1. These setback areas are to be landscaped, but may incorporate an off-street parking area if it can be demonstrated that the location of the car parking area: i) Is within a setback which is at least 13 metres wide and set behind a landscaped area which is at least 4 metres wide; ii) Promotes the function and operation of the development; iii) Enhances the overall design of the development by implementing design elements, including landscaping, that will screen the parking area and is complementary to the development; and iv) Does not detract from the streetscape values of the locality.	Complies - The required setback in Table D4.1 for the development is 9m to Kurrajong Road and 5m to Plasser Crescent. The proposed addition complies with the standard as it will be setback 30m from Kurrajong Road and 5m from Plasser Crescent. However the electrical substation will be relocated to the property boundary within the Plasser Crescent setback. The substation will be enclosed by a steel palisade / timber fencing which will assist it to blend in with the landscaped areas and be less visually intrusive in the streetscape. The Plasser Crescent setback will be landscaped. The Kurrajong Road setback will generally remain unchanged from the existing arrangement other than the provision of a new vehicle crossing.
2. Visual Impact of Buildings and Hardstand Areas	
a) The landscape design within setbacks should consider the scale of the building and where appropriate, select and locate plants to help reduce the bulk and scale of the building.	Complies - The Plasser Crescent setback will contain Willow Myrtle virtually along the whole western façade of the proposed addition. The trees which will grow to 10m x 8m will provide effective screening of the building mass.
b) The visual impact of large expanses of wall should be reduced in scale by architectural treatment as well as by dense grove planting or other landscape design solutions.	Complies - The western façade of the proposed addition will use three different materials (metal cladding, translucent wall clad and masonry) to break up the sheer wall. The unenclosed addition will also break up the western façade. The above landscape treatment will also help reduce the visual impact.
c) Where an industrial development contains large expanses of hardstand or paved areas, the applicant must demonstrate how the development application reduces the 'heat effect' and visual impact of these large expanses.	Complies - The hardstand car parking areas in the front setback will be shaded the existing landscaping and by the proposed landscaping along the eastern façade and to the east of the reinstated parking areas.
3. Vegetation and Landscape	
a) The siting and layout of a development should preserve all on site trees, significant stands of vegetation, and remnant or native bushland in accordance with the requirements of Chapter C2 'Vegetation Management' and C6 'Landscape Design'. Where this is not practical, the development application must justify the loss of vegetation and outline what measures are to be taken to replace it.	See section 3.3 of SEE and Appendix 3 & 9 for compliance with this Control.
c) Applicants should refer to Chapter C6 'Landscape Design' regarding the implementation and maintenance of landscaping for the site.	The proposal is a Category 2 development in accordance with Table C6.2 and a Landscape Plan (Appendix 3) and Arborist Report (Appendix 9) have been provided pursuant to Table C6.3.

PROVISION	COMPLIANCE
d) Smaller scale and less visually prominent planting should be provided to add variety and interest in the appearance of the site.	Complies - Understorey planting will be provided along the Plasser Crescent setback as per the Landscape Plan provided which will add variety and interest to landscaped areas.
e) Landscape materials should cause minimal detrimental visual impact, and the use of subtle coloured materials and block or brick paving is encouraged.	Complies - The proposed landscaping will have a positive visual impact on the development.
f) Paving and structures shall complement the architectural style of existing buildings.	Complies - The only landscaping structures will be the relocation of the existing seating and shelters.
g) Outdoor staff break areas should be provided and integrated into landscape areas. These areas should be provided with shade and reasonable amenity.	Complies - The sheltered seated will be located within the landscaped areas and will be shaded by the proposed trees.
h) Shade trees should be provided in outdoor staff break areas and along pedestrian paths and walkways.	Complies - See above. Landscaping is already provided around walkways and the entrances to buildings.
i) Plant species should be carefully selected to meet service authority requirements in easement locations.	Complies - Wilga trees are proposed to be planted in the electrical easement and are considered to be a suitable species to be planted in an easement.
4.4.BUILDING DESIGN	
4.4 C. Controls	
a) Non-residential developments including mixed use developments, with a construction cost of $1 million or more are to demonstrate a commitment to achieving no less than 4 stars under Green Star or 4.5 stars under the Australian Building Greenhouse Rating system (now part of the National Australian Built Environment Rating System (NABERS)).	Complies – the proposal includes a commitment to achieve a 4 star Green Star rating as outlined in the Sustainability Report at Appendix 7.
c) Prominent elevations, such as those with a frontage to the street or public reserves or those that are visible from public areas, must present a building form of significant architectural and design merit. The construction of large, blank wall surfaces is not permitted.	Complies - The nature of the activity, servicing large trains, requires a particularly large building to be constructed and the constraints of the site necessitate the western elevation of the proposed Services Workshop to be a prominent elevation on the Plasser Crescent frontage. As discussed in sections above, the use of different materials on the walls and the planting of appropriately sized screening trees will be used to reduce the visual bulk in the streetscape. A "Plasser Australia" logo will also be painted on the western elevation to break up the blank wall.
d) Large elevations should be articulated by structural variations and/or a blend of external finishes including brick, masonry, pre-coloured metal cladding, appropriately finished 'tilt-slab' concrete or a combination of these materials (see Figure D4.17).	Complies - A blend of pre-coloured metal cladding, translucent wall cladding and masonry will be used on the buildings facades as encouraged by this standard. The unenclosed section of the proposed building will help

PROVISION	COMPLIANCE
	to provide some articulation and additional visual interest on the western elevation.
e) Large unrelieved expanses of wall or building mass will not be supported by Council. They should be broken up by the use of suitable building articulation, fenestration or alternative architectural enhancements.	Complies - The three different materials to be used on the façade will have differing angles so they are not flat to the wall. This has been done to match the existing building and to break up the expanse of wall.
f) Particular care should be taken in regard to: i) Designing roof elements; and ii) Locating plant and mechanical equipment including exhausts, so as screen them from a public place.	Complies - The roof will be a low pitch skillion to match the existing building. No plant and mechanical equipment will be visually prominent from public places.
g) Architectural features, consistent with the overall design of the building, may be used to: i) Highlight entrances to buildings; and ii) Accentuate pedestrian areas and provide improved climatic amenity, particularly for buildings that will experience high volumes of pedestrian movements, using techniques such as verandahs and awnings (see Figure D4.17).	Generally complies - The proposed addition is part of the working factory and it is not considered appropriate to highlight entrances to the building. It is preferred that pedestrian traffic continue to be directed to the existing office entrance and architectural features and landscaping exist to achieve this.
h) The development must incorporate a variety of external finishes in terms of both colour and type of material used. The external finishes (walls, roof, awnings etc.) of the development are to be: i) Made from durable high quality, low maintenance, non reflective materials; ii) Compatible with the overall design and form of the development; iii) Selected for all built forms to ensure the entire development presents a homogeneous form; iv) Considered in association with proposed plantings and landscape treatment; v) Considered for their ability to provide visual relief in large wall surfaces and elevations; and vi) Selected to ensure the development complements the surrounding environment while reducing the temptation to vandalism and graffiti.	Complies - The use of varied materials to provide visual relief has been discussed above. The proposed materials have been chosen to match the existing buildings which will ensure the entire development present a homogenous form. Vandalism and graffiti is unlikely given the site is secured.
k) Development applications for new buildings or additions to existing buildings are to be accompanied by a Schedule of External Finishes and Colours, demonstrating compliance with the above requirements.	Complies - A Schedule of External Finishes and Colours is provided with the Architectural Plans in Appendix 2.
l) Any office and administration component is to be located to the main frontage of the building and be designed as an integral part of the overall building, rather than a 'tack on' addition.	Complies - The existing office building is located adjacent to car parking areas and will remain an integral part of the overall development.
m) The main office administration component is to have a designated entry point that is highly visible and directly accessible from visitor parking and the main street frontage.	Complies - The main office administration component has an existing designated entry point adjacent to the existing parking area and is highlighted by landscaping and paving.
n) The entry, design and layout of the main office or administration component is to consider the principles of Universal Design and incorporate, if possible: i) A level or graded path from the carpark area to the entrance;	Complies - The office is an existing building, but complies with these requirements.

PROVISION	COMPLIANCE
ii) A level entry (no steps); iii) An accessible toilet; iv) Easy access doors and corridors; and v) Accessible placement of switches, power points and window controls.	
o) Where the nature of the industrial development will attract clients/visitors to the site, consideration should be given to incorporating the above accessibility features into that part of the building likely to be used by clients/visitors.	Not applicable - The nature of the proposed industrial development will not attract a significant number of clients/visitors.
p) All loading areas should be located towards the rear of allotments. Where possible, loading areas should be screened from the view of main road frontages through physical and/or vegetation screening (see Figures D4.11 and D4.13).	Complies - The main loading area is accessed off Plasser Crescent, which is the secondary and least prominent frontage of the site. The area will be screened by vegetation where possible.
4.5 STORAGE OF MATERIALS AND CHEMICALS	
4.5 C Controls	
a) External storage of goods must be avoided, wherever possible. Where the nature of the activity or the materials means that internal storage is impractical, all external storage areas must be located behind the front building setback. In addition, when assessing development applications involving external storage of goods, Council will take into consideration: i) The proposed height and on-site arrangement of stored goods; ii) The visual impact of the storage area and how this is proposed to be minimised (orientation, screening with landscaping and/or solid fencing, etc.); iii) Access arrangements; and iv) Safety issues.	Complies - All chemicals will be stored inside the buildings. Some external storage of materials is located at the rear of the building.
b) For sites with multiple frontages, either to roads or to the main western railway line, the location and orientation of external storage areas shall minimise visual impact from all potential view points (see Figures D4.13 and D4.18).	Complies - Including, the western railway line, the subject site has three frontages and there is insufficient space to store any goods on the eastern boundary which has no frontage. It is considered appropriate to have some external storage along the western railway line given the industrial character of the area.
c) Rain water tanks are not to be visually intrusive from the main street frontage or other public areas (see Figures D4.13 and D4.18).	Complies - A minimum 55,000L rainwater will be located in the landscaped area along Plasser Crescent. The tank will be screened by vegetation and will not be visually intrusive.
4.6 ACCESSING AND SERVICING THE SITE	
4.6C Controls	
d) Industrial development shall, where appropriate, be designed to: i) Allow all vehicles to enter and leave the site in a forward direction; ii) Accommodate heavy vehicle parking and manoeuvring areas; iii) Avoid conflict with staff, customer and visitor vehicular and cycle movements; and iv) Ensure satisfactory and safe operation with the adjacent road system.	Complies - All vehicles are able to enter and leave the site in a forwards manner. The majority of heavy vehicular movements will be confined to the Plasser Crescent access, which is to be widened as part of this proposal. An

PROVISION	COMPLIANCE
	additional heavy vehicle access is proposed to Kurrajong Road which will be used 3-4 times a year. The proposed access arrangements will assist in avoiding conflict with staff, customer and visitor vehicular and cycle movements. The proposed access arrangements were determined to be satisfactory and safe with the adjacent road system as demonstrated through the TIS provided at Appendix 12.
e) In determining access and servicing requirements, Council will take the following into consideration: i) The location, type and scale of the proposed development; ii) The compatibility of the location and design of the car park with adjoining properties; iii) Traffic Authority Guidelines and comments of the Local or Regional Traffic Committee(s); and iv) The potential for the development to generate heavy vehicle movements.	Complies – Refer section 4.2.1 and TIS at Appendix 12 for assessment of access and servicing requirements.
f) Full details of the volume, frequency and type of vehicle movements shall be submitted with the development application.	Complies - No significant increase in vehicle movements is expected as part of the proposed development (refer TIS at Appendix 12 for further details).
g) In general, turning circles will be required to be provided to accommodate the largest type of truck which could reasonably be expected to service the site. All developments must be designed and operated so that a standard truck may complete a 3-point or semi-circular turn on the site without interfering with parked vehicles, buildings, landscaping or outdoor storage and work areas. Large scale developments shall be designed to accommodate semi-trailers. In the case of the conversion of an existing development, should it appear that a truck turning circle may prove difficult, a practical demonstration may be required.	Complies - See Site Plan in Appendix 2 for turning circle compliance.
h) Council will assess the suitability of manoeuvring areas provided for large vehicles by reference to the Standard Vehicle Turning Templates which appear in Figures A.5a (small rigid truck), A.7a (large rigid truck) and A.9a (large articulated truck) of the Roads and Traffic Authority publication "Policies Guidelines and Procedures for Traffic Generating Developments".	Complies - See Site Plan in Appendix 2 for turning circle compliance.
i) Adequate space is to be provided within the site for the loading, unloading and fuelling (if applicable) of vehicles. These areas shall be screened from the road.	Complies - The main loading area is accessed off Plasser Crescent, which is the secondary and least prominent frontage of the site. The area will be screened by vegetation where possible.
j) Carparks, aisles and manoeuvring areas shall be designed with function and safety in mind, and have minimum dimensions conforming with the Australian Standards 2890 Parking Facilities. The relevant parts of this standard are AS2890. 1 Offstreet parking, AS2890.2 Commercial vehicle facilities and AS2890.3 Bicycle parking facilities. In addition, the following elements should also be considered:	Complies - Other than resurfacing of the existing car park area to the north of the proposed service workshop, the existing car parking arrangements will remain unchanged and no additional conflict with parking areas is anticipated.

PROVISION	COMPLIANCE
i) Where the nature of the industrial development will attract clients/visitors to the site, the following elements shall be included in the carpark design: • The internal (vehicular) circulation network is to be free of disruption to circulating traffic and ensure pedestrian safety; and The carpark should, where possible, be designed with wheel stop kerbs only, rather than a barrier kerb between parking areas and pedestrian pathways; and • The movement of pedestrians throughout the carpark is clearly delineated by all users of the carpark and minimises conflict with vehicles; ii) Where parking spaces are to be provided for people with disabilities, these spaces are to be: • Suitably located near entrances to the building, lifts and access ramps (if required); • Provided in accordance with AS1428.1 Design for Access and Mobility; and • Supplemented by the installation of appropriate tactile pavement treatments where required; iii) Major developments such as multi unit industrial developments, bulky good outlets and other significant industrial developments shall make adequate provision for bicycle parking.	
4.7 LIGHTING	
4.7C Controls	
a) Lighting details shall be provided as part of any relevant development application.	Complies - As detailed in the Electrical Statement of Compliance at Appendix 5 the proposed external lighting will be designed in accordance with AS1158 and AS4282
b) Lighting design should address the principles of CPTED (see Chapter C1 'Site Planning and Design Principles') where there is significant pedestrian activity, late night work shifts or safety and security issues.	??
c) Adequate lighting should be provided to meet security requirements without excessive energy consumption. Lighting powered by solar batteries or other renewable energy sources is encouraged. The use of sensor lighting both internally and externally should also be considered.	??
d) External lighting shall be provided around doorways and windows, and in areas where goods and equipment are stored outside.	??
e) Where premises are used outside daylight hours, car parks and entrances shall be adequately illuminated.	??
f) Lighting is to be designed or directed so as to not cause light spill onto adjoining sites where there could be an impact on the adjoining site's operations, safety or amenity.	??
g) The use of lighting poles and fixtures in adjacent developments should be considered for improved precinct amenity.	??
h) All lighting shall comply with Australian Standard AS4282.	Complies - As detailed in the Electrical Statement of Compliance at Appendix 5 the proposed external lighting will be designed in accordance with AS1158 and AS4282

APPENDIX 12
Traffic impact assessment

PARKING & TRAFFIC

CONSULTANTS

Driving success through valuable advice

Client

Plasser Australia

Project

25 Kurrajong Road, St Marys
Traffic Impact Statement

(Ref. No. T2-1108)

Plasser Australia

Date

August 2014

Contact

Andrew Morse
02-8920 0800
0414 618002
andrew.morse@parkingconsultants.com

TABLE OF CONTENTS

1 Introduction

1.1 Project Summary

Parking and Traffic Consultants (PTC) have been engaged by Plasser Australia to prepare an assessment of the traffic and parking related considerations associated with the proposed expansion of the existing Plasser facility to accommodate an additional area of 2,700m^{2}GFA. The Plasser facility is located at 25 Kurrajong Road in St Marys.

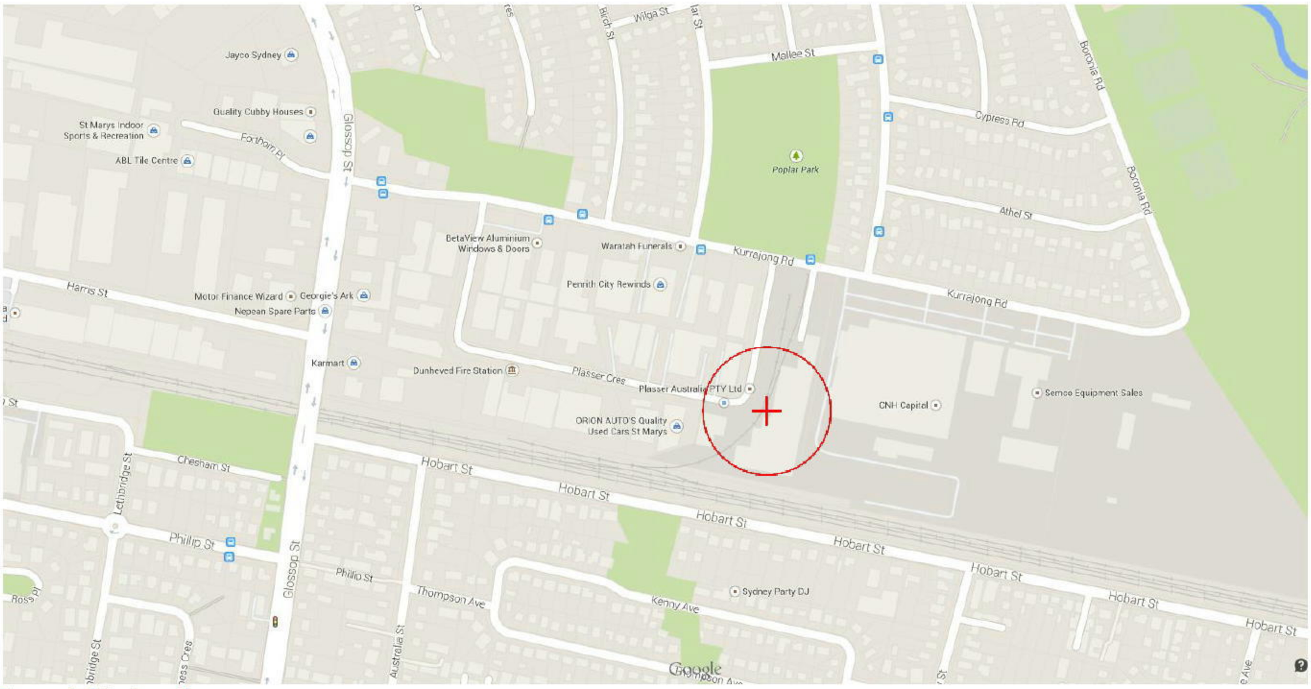


Figure 1-Site Location

1.2 Purpose of this Report

This report has been prepared to accompany a Development Application to Penrith City Council for the expansion of the existing Plasser Australia facility to accommodate an additional covered area of 2,700m^2.

Plasser Australia is a supplier of rail maintenance and construction equipment. In 1980 Plasser Australia commenced operation at the subject facility which occupies an area of approximately 2.5 hectares.

The proposed expansion involves the construction of a warehouse style building which will be utilised by the existing servicing unit. In this regard, the proposed expansion will not result in any increase in production capacity or an increase in staff numbers.

This report presents the following considerations relating to the Traffic and Parking assessment of the proposal:

Section 2	-	A description of the project,
Section 3	-	A description of the road network serving the development property,
Section 4	-	Determination of the traffic activity associated with the development proposal, and the adequacy of the surrounding road network,
Section 5	-	Assessment of the proposed parking provision in the context of the relevant planning control requirements,
Section 6	-	Assessment of the proposed car park, vehicular access and internal circulation arrangements in relation to compliance with the relevant standards,
Section 7	-	Summary

2 Proposal

2.1 The Site

The site is located at 25 Kurrajong Road, St Marys within the Penrith City Council LGA. The site is located at the south western corner of the intersection of Plasser Crescent and Kurrajong Road. The site is located within predominantly industrial area and is bounded by Kurrajong Road to the north, industrial units to the east, rail lines to the south and Plasser Crescent to the west. The site has frontages on both Plasser crescent and Kurrajong Road.

A warehouse style workshop is constructed at the southern section of the site which occupies an area of approximately 6,610m^2 GFA and the northern section of the site is occupied by the car park.

The site has an on-site parking provision of 70 parking spaces which are accessible via the driveway located on the Kurrajong Road frontage. This driveway is controlled utilising a sliding gate which can be extended if access to larger vehicle type is required.

In addition to the above driveway the site is also accessible via a secondary driveway located on the Plasser crescent frontage which is predominantly utilised by service vehicles.

A small proportion of the on-site parking provision is reserved and the remaining parking provision is accessible to the general staff. The facility currently, employs a total of 140 staff members comprising 120 permanent staff and 20 casual staff.

Figure 2-Site Location

2.2 Development Proposal

The proposal involves the construction of an extension to the existing facility building which will interiorise existing rail infrastructure having a floor area of 2,700m^2. The proposed extension will be occupied by the existing servicing unit and will not result in any increase in the production capacity of the facility or an increase in staff numbers.

The existing vehicular access arrangement to the site via the driveways located on the Kurrajong Road and Plasser Crescent frontages will be retained. Additionally, a new secondary driveway will be constructed along the Kurrajong Road frontage, located to the west of the existing driveway. This driveway will provide access to the proposed servicing unit and will be utilised only 3-4 times a year for the collection of finished products. During this operation, the existing parking spaces located within a car park on the approach to the proposed driveway will not be available to use.

As access from the secondary driveway located on Kurrajong Road is required occasionally (approximately 3-4 time a year), the parking spaces will be available to use most time of the year and in this regard, the proposal will retain the existing on-site parking provision of 70 parking spaces.

Details of the proposal are presented on the architectural drawings prepared by Group GSA Architects and those illustrating the parking and access arrangements are included as Attachment 1.

3 Existing Transport Facilities

3.1 Road Hierarchy

The site is located within the suburb of St Marys which is served by the Great Western Highway and Gossip Street. The road network serving the area comprises State Roads, making the site easily accessible from different regions of the metropolitan area.

Figure 3-Road Hierarchy Source: RTA Road Hierarchy Review

State Road (red line)	State Road
Regional Road (blue line)	Regional Road
Local Road (grey line)	Local Road

The NSW administrative road hierarchy comprises the following road classifications, which align with the generic road hierarchy as follows:

State Roads - Freeways and Primary Arterials (RMS Managed)
Regional Roads - Secondary or sub arterials (Council Managed, Part funded by the State)
Local Roads - Collector and local access roads (Council Managed)

The road network serving the site includes:

Great Western Highway is classified as a State Road and connects the western region of the Blue Mountains to Sydney CBD. Within the vicinity of St Marys, the highway is aligned parallel to and north of the M4 Motorway and provides an alternate route to the motorway. Within the vicinity of St Marys, the carriageway generally carries three traffic lanes in each direction.

Gossip Street is classified as a Regional Road and follows north-south alignment. Gossip Street connects Great Western Highway and Forrester Road. The intersection of Gossip Street with the Great Western Highway is controlled by signals. Generally, the carriageway is divided and comprises two traffic lanes in each direction. It has a posted speed limit of 60km/hr.

Kurrajong Road is classified as a Local Road and provides primary vehicular access to the site. Within the vicinity of the site the carriageway is undivided and comprises of one traffic lane in each direction with on-street parking permitted on both sides. The intersection of Kurrajong Road with Gossip Street operates as a signalised intersection and permits all vehicle movements. It has a posted speed limit of 50km/hr.

Plasser Crescent is a classified as a Local Road and provides secondary vehicular access to the site. The carriageway has a width of 13.5m and accommodates one traffic lane in each direction with on-street parking permitted on both sides.

3.2 Public Transport

Public transport is available in the vicinity of the site and the bus services are provided by Busways which are accessible via the bus stop located on Kurrajong Road.

Route 745 is a limited service and operates only on Monday to Saturday. This service connects the St Marys Interchange with Castle Hill via St Marys North. This service operates at a peak frequency of 1 service per hour.

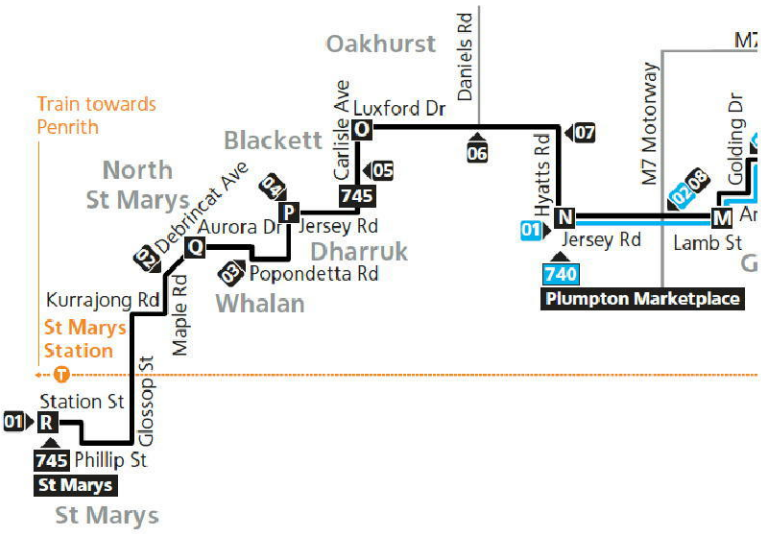


Figure 4-Route Map for Bus Route 745 (Source Transport Infoline Website)

Route 782 is a regular service. This service also connects the Penrith Station with the St Marys Interchange Station via St Marys North. This service operates at a peak frequency of 2 services per hour.

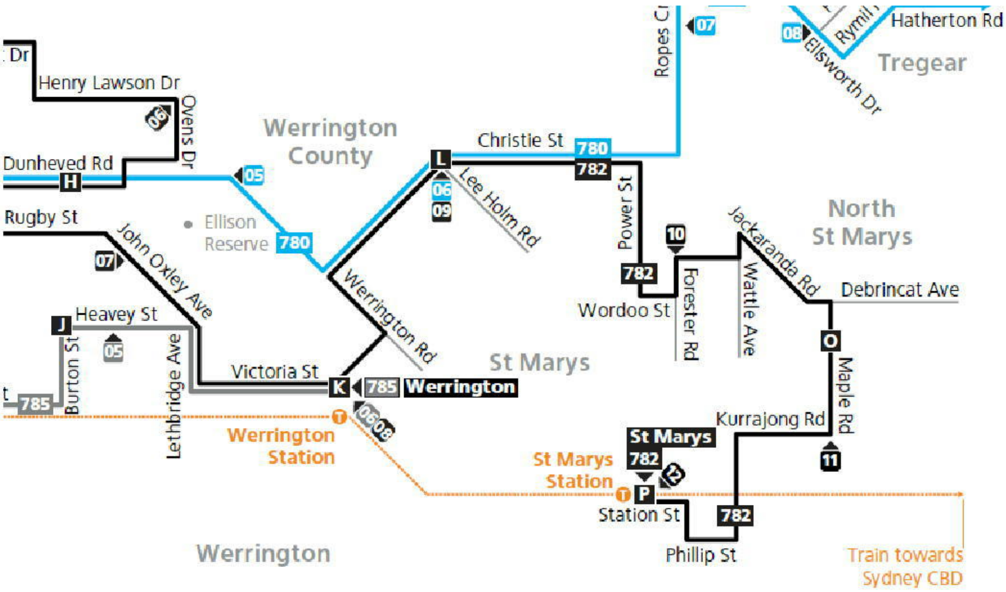


Figure 5-Route Map for Bus Route 782 (Source Transport Infoline Website)

4 Development Traffic Assessment

4.1 Traffic Generation

Typically, the traffic generation activity associated with a development or land-use can be derived through reference to publish data, for example the RMS Guide to Traffic Generating Developments or data published by the Institute of Traffic Engineering (US Data). It is important to note that the traffic generation rates presented in the RMS Guides are based on surveys of standalone facilities.

The proposal involves the expansion of the existing facility and it is therefore considered preferable to determine the traffic activity based on existing use rather than the traffic generation activity with reference to published data.

The proposed warehouse facility will be utilised by the existing servicing unit and will not result in an increase in production capacity of the facility or an increase in staff numbers.

In this regard, the traffic activity associated with the proposed expansion will not result in any increase in traffic activity and will not cause any notable impact upon the operation of the overall road network.

4.2 Service Vehicle Activity

The proposal involves the construction of a new driveway, located along the Kurrajong Road frontage and to the west of the existing driveway. The proposed driveway will service the proposed extension and information obtained from Plasser Australia (end user of the development) indicates that the operation will involve access by a total of 3-4 service vehicles per year. This activity is required for the collection of finished equipment and involves a prime mover with 10 axle configuration with a gross weight of 132 tonnes. This vehicle type currently services the site via the driveway located on the Kurrajong Road frontage.

In order to efficiently load the finished equipment, the proposal involves realignment of the existing rail line within the site to match the proposed driveway configuration. Given the size of the service vehicle that is likely to access the site via the proposed driveway, we recommend a detailed traffic management plan should be developed to assist service vehicle accessing the facility.

The number of service vehicle movements are low and insignificant and are not likely to result in any notable impact on the operation of the surrounding road network.

5 Car Parking Provision

5.1 Planning Policy Requirements

Typically, parking requirements are established with reference to the local planning controls i.e. Development Control Plan (DCP) and Local Environment Plan (LEP). In regard to the proposed warehouse site which is located within the Penrith City Council LGA, Table C10.2 of the Penrith City Council DCP specifies the following parking provision rates for industry use:

- 1 space per 75m^{2}GFA or 1 space per 2 employees, whichever is the greater

The site currently accommodates an industrial warehouse building accommodating an area of 6,610m^{2}GFA and the proposal involves expansion of the existing warehouse building accommodating an area of 2,700m^{2}GFA resulting in a total area of 9,310m^{2}GFA.

The industrial facility currently accommodates 140 staff member comprising 120 full-time staff member and 20 casual staff member and the proposed expansion will not result in any increase in the production capacity of the facility or an increase in staff numbers. Therefore, post expansion; the facility will retain the existing staff numbers i.e. 140 staff.

Application of the above parking rates results in the following parking provision:

- In relation to the area of the facility-124 spaces;
- In relation to the staff numbers-70 spaces.

The site has an on-site parking provision of 70 car spaces which represents a shortfall in relation to parking provision associated with the floor area however; the existing on-site parking provision is consistent with the staff number.

During our site visit we observed that a minimum of five on-site parking spaces were vacant indicating that the on-site parking provision was adequate to cater the facility.

Given that the proposal will not result in any increase in any staff numbers, the existing on-site parking provision is considered adequate to cater for the facility.

6 Access and Carpark Assessment

6.1 Vehicular Access

The site is accessible via the existing driveways located on the Kurrajong Road and Plasser Crescent frontages, additionally; the proposal includes the provision of a new driveway along the Kurrajong Road frontage located to the west of the existing driveway. This driveway will provide direct vehicular access to the proposed warehouse building. Information provided by Plasser Australia indicates that this driveway will be utilised approximately 3-4 time a year for deliveries of completed equipment and will be utilised by a prime mover accompanied by 10 axle wheel base with a gross weight of 132 tonnes. Refer to **Attachment 2** for vehicle specifications.

In order to verify, the width of the proposed driveway, we have undertaken swept path analysis using Auto Track and utilising the above vehicle type and the output turning paths are presented as **Attachment 3**.

6.2 Sight Distance

The sight distance requirements are described in Section 3.4.5 of AS2890.2 and are prescribed on the basis of the sign posted speed limit or 85th percentile vehicle speeds along the frontage road. Kurrajong Road has a posted speed limit of 50kph, which requires a minimum desirable visibility distance of 69 metres (based on 5 seconds gap acceptance).

The proposed driveway is located on a straight section of Kurrajong Road, where unobstructed visibility is available.

7 Summary

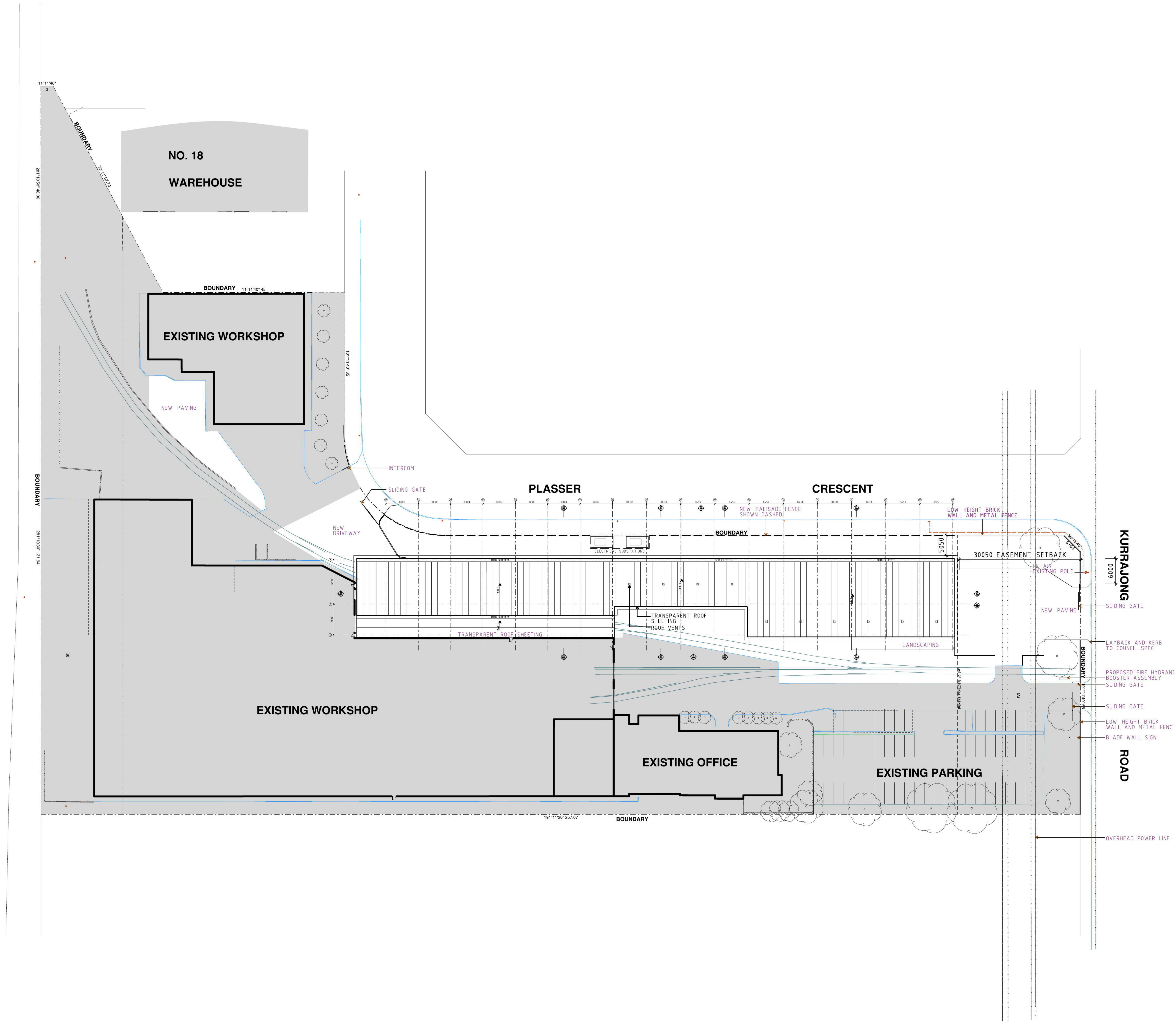
In summary, the proposal involves construction of a warehouse style building accommodating a floor area of 2,700m^2GFA which will be occupied by the existing servicing unit. The proposal involves introduction of a new secondary driveway along the Kurrajong Road frontage located to the west of the existing driveway.

The assessment has concluded that the proposed warehouse will not result in any increase in traffic activity compared with the existing traffic activity of the facility. In this regard, the proposal will have no notable detrimental impact upon the operation of surrounding road network.

The proposal involves retaining the existing on-site parking provision of 70 car spaces, given that the proposed development will not result in any increase in any staff numbers, the existing on-site parking provision was considered fully compliant and adequate to cater the facility.

The vehicular access arrangements have been designed in accordance with the relevant standard, being AS2890 Parts 2.

Attachment A- Architectural Drawings



Amendments
Issue Description | Date

08.08.2014

DRAFT

LEGEND

- EXISTING BUILDING WORKS NOT IN SCOPE
- NEW WORKS IN SCOPE

Client

Plasser Australia

Architect

GROUPGSA

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architecture interior design urban design landscape
nom architect M. Sheldon 3990

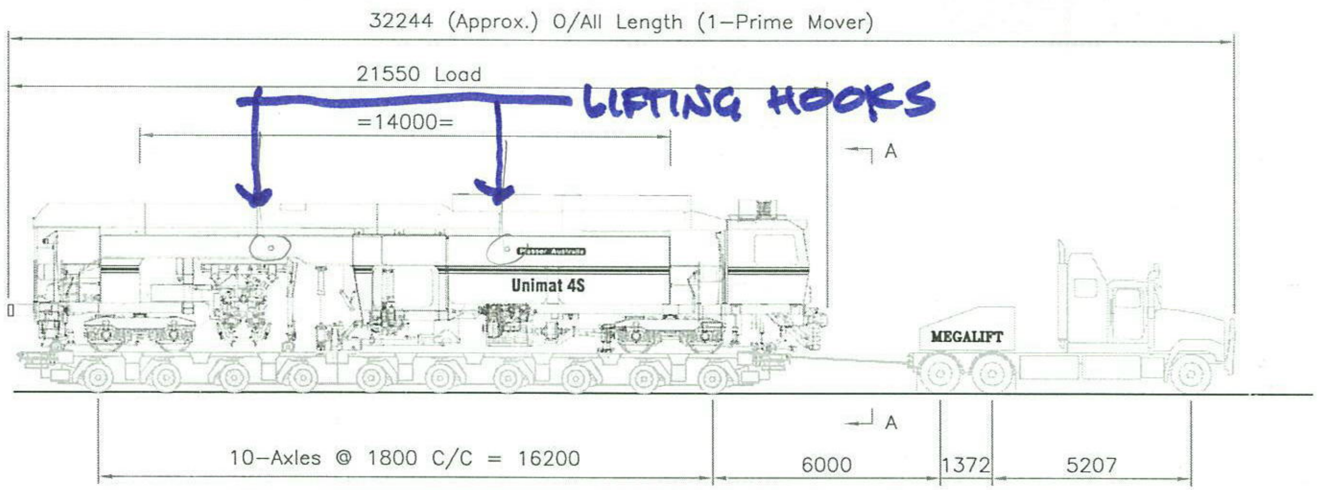
N

Project Title
25 KURRAJONG RD
NORTH ST. MARYS

Drawing Title
SITE PLAN

Scale	1:500@B1
Drawing created	17/06/2014
By	AA
Plotted and checked by	AA
Verified	MT
Approved	MT
Drawing No 1100	Issue -
14030	
File	Plot Date
A-1100.dgn	8/08/2014

Attachment 2- Dimensions of the Largest Vehicle Type

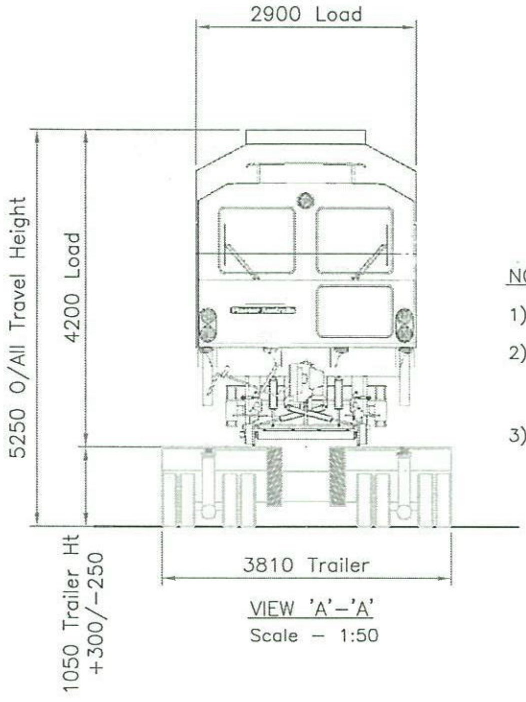


ELEVATION VIEW

WEIGHT TABLE:

TRAILER TYPE	10 AXLE 3810mm WIDE COMETTO
PAY LOAD	82.0 Te
TRAILER	50.0 Te
GROSS WT.	132.0 Te
AXLE LOAD	13.20 Te/Axle
TYRE LOAD	1.65 Te/Tyre
GROUND BEARING (AVE.)	2.16 Te/Sq M 21.20 kPa

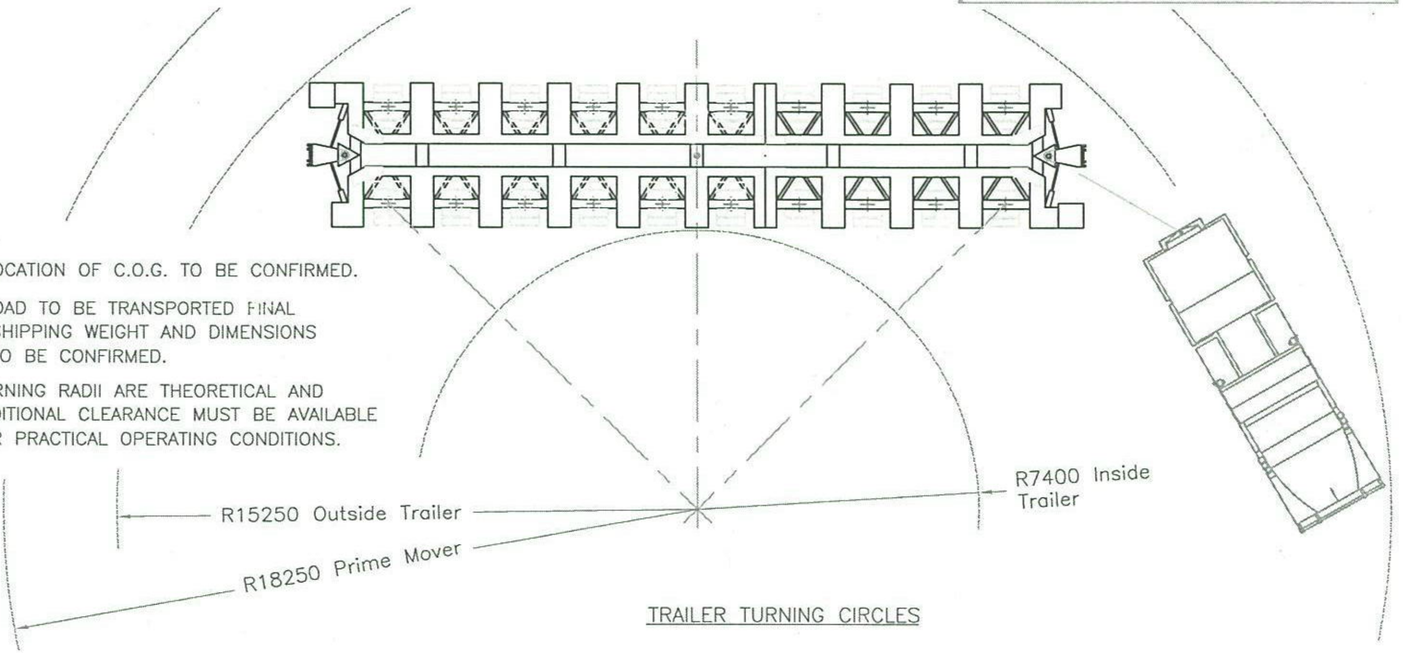
PRELIMINARY
ISSUED FOR INFORMATION ONLY
NOT FOR CONSTRUCTION



VIEW 'A'–'A'
Scale – 1:50

NOTE:

1) LOCATION OF C.O.G. TO BE CONFIRMED.
2) LOAD TO BE TRANSPORTED FINAL SHIPPING WEIGHT AND DIMENSIONS TO BE CONFIRMED.
3) TURNING RADII ARE THEORETICAL AND ADDITIONAL CLEARANCE MUST BE AVAILABLE FOR PRACTICAL OPERATING CONDITIONS.



TRAILER TURNING CIRCLES

A	31.03.11	

DO NOT SCALE
IF IN DOUBT ASK

NOTICE
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TRACK MACHINE 08–475–4S MAIN FRAME
PROPOSED TRANSPORT GENERAL ARRANGEMENT
PLASSER AUSTRALIA PTY LTD
ST MARYS, NSW TO PORT HEDLAND, WA

MEGALIFT PTY. LTD.

B. WEAVELL	B.W. 31.03.11
31.03.11	
1:100 UNO	S9271
S9271–01	1/1 A3 A

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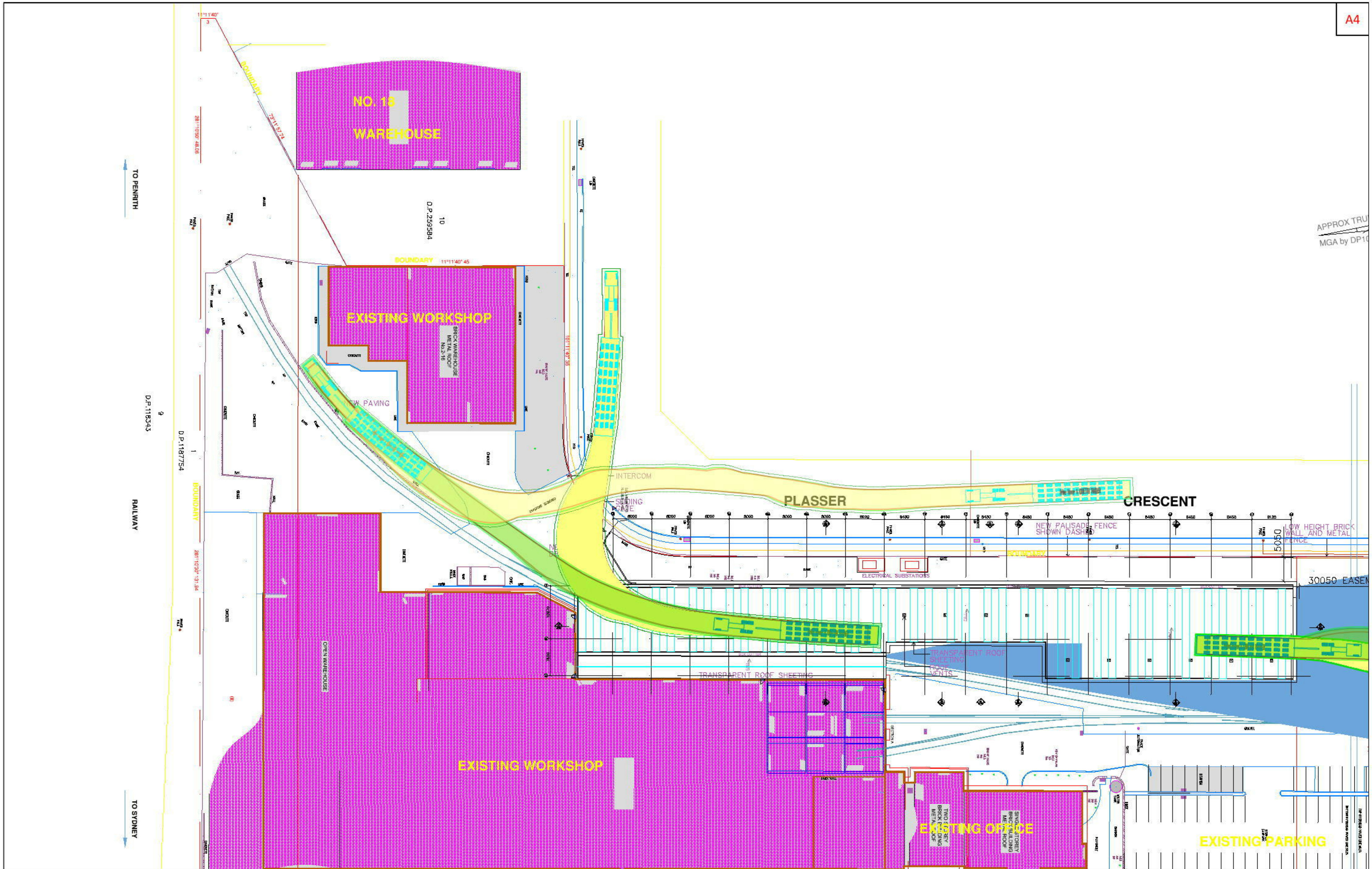
Version: 1, Version Date: 02/09/2014

Attachment 3- Swept Path Analysis of the Proposed Driveway



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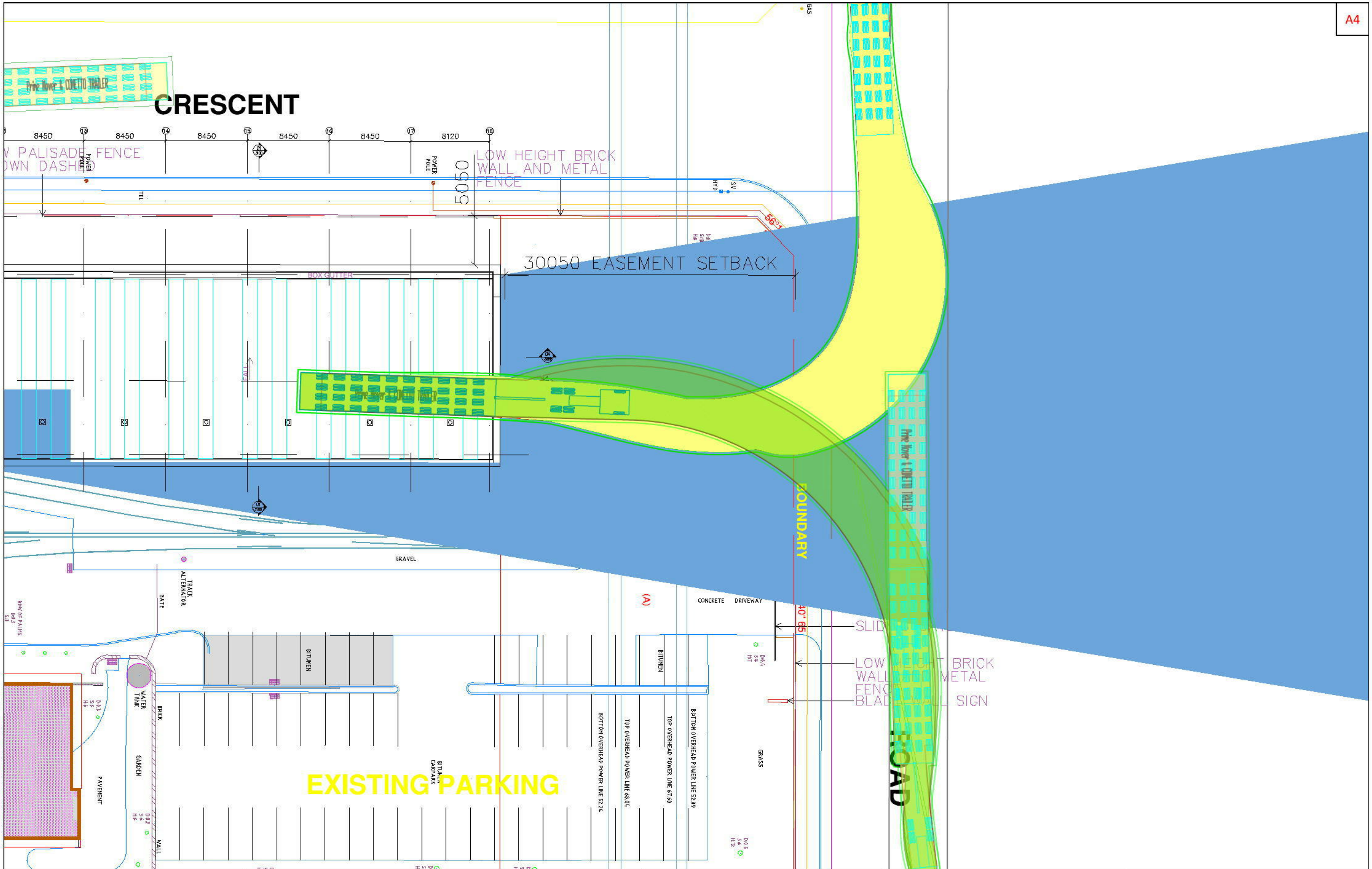
NOTES:
The turning paths illustrated in this drawing have been prepared using the Autotrack vehicle modelling software in conjunction with AutoCAD. The vehicle model was prepared by Analytico Pty Ltd based upon vehicle data provided by Austroads. While this modelling represents a conservative assessment of the vehicles ability, it is not possible to account for all vehicle types/characteristics or driver ability.

PROJECT:
PLASSER AUSTRALIA
25 KURRAJONG RD

DRAWING TITLE:
TURNING PATH ASSESSMENT DEMONSTRATING A PRIME MOVER AND 10 AXLE COMETTO TRAILER ACCESSING THE LOADING AREA

CLIENT:	GROUP GSA ARCHITECTS
DRG. #:	TP01
VERSION #:	1
SCALE:	1:1000
PROJECT #:	T2-1108
DATE:	11/08/14



PARKING & TRAFFIC CONSULTANTS parkingandtrafficconsultants.com wayfindingforum.com tel +612 8920 0800 fax +612 8076 8665 suite 102, 506 miller street, cammeray nsw 2062	NOTES: The turning paths illustrated in this drawing have been prepared using the Autotrack vehicle modelling software in conjunction with AutoCAD. The vehicle model was prepared by Analytico Pty Ltd based upon vehicle data provided by Austroads. While this modelling represents a conservative assessment of the vehicles ability, it is not possible to account for all vehicle types/characteristics or driver ability.	PROJECT: PLASSER AUSTRALIA 25 KURRAJONG RD	DRAWING TITLE: TURNING PATH ASSESSMENT DEMONSTRATING A PRIME MOVER AND 10 AXLE COMETTO TRAILER ACCESSING THE LOADING AREA

CLIENT:	GROUP GSA ARCHITECTS		
DRG. #:	TP02		
VERSION #:	1	SCALE:	1:500
PROJECT #:	T2-1108	DATE:	11/08/14

APPENDIX 13

Stormwater Management Report

NORTHROP

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Sydney NSW 2000
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T (02) 9241 4188 F (02) 9241 4324
E sydney@northrop.com.au

Job No: 140074

21st August 2014

Mr. Stephen Mee
Rider Levett Bucknall
Level 5, 41 McLaren Street
North Sydney NSW 2060

Dear Mr. Mee

RE: Plasser Australia Stormwater Management Report – Development Application Submission

1.0 Introduction

Northrop Consulting Engineers have been engaged by Rider Levett Bucknall to prepare documentation in support of a Development Application (DA) submission to Penrith City Council for the construction of a new industrial factory building at the Plasser Australia site, located at 2 Plasser Crescent, St Marys.

This document has been prepared to outline the proposed stormwater management strategy for the proposed development and should be read in conjunction with the civil/stormwater DA design drawings issued by Northrop, dated 21st August 2014 (attached). This letter will briefly discuss flooding in relation to the proposed development.

2.0 Existing Site Conditions

The site is located at 2 Plasser Crescent St. Marys, which is located in an industrial precinct within Council's Local Government Area (LGA). The site covers an area of approximately 2.3 Ha and is bound by Kurrajong Road and Poplar Park to the North, Plasser Crescent and private industrial properties to the west, a private industrial property to the east and the Sydney Trains T1 Western Railway Line to the south. A plan illustrating the locality of the site is presented in **Figure 1**.

The site is an existing industrial site currently in use by Plasser Australia. The site currently has two large industrial workshop sheds, which cover an area of approximately 8,600 m^2. The remainder of the site comprises of car parking areas, working hard stand areas (comprising of gravel) and some landscaping. Based on aerial images and survey information, the site has an impervious percentage of approximately 75%.

The site is generally flat, however a majority of the site falls to the west towards Plasser Crescent. The catchment that falls towards Plasser Crescent covers an area of approximate 2.0 Ha. A secondary sub-catchment exists across the site. This secondary catchment covers an area of approximately 0.3 Ha and falls to the south. It should be noted that no defined overland flowpaths have been identified across the site.

Both catchments are managed by an internal drainage network which collects runoff from the site and discharges runoff into Council's stormwater drainage network prior to discharge into a tributary of South Creek, located approximately 2.0 km to the west of the site.

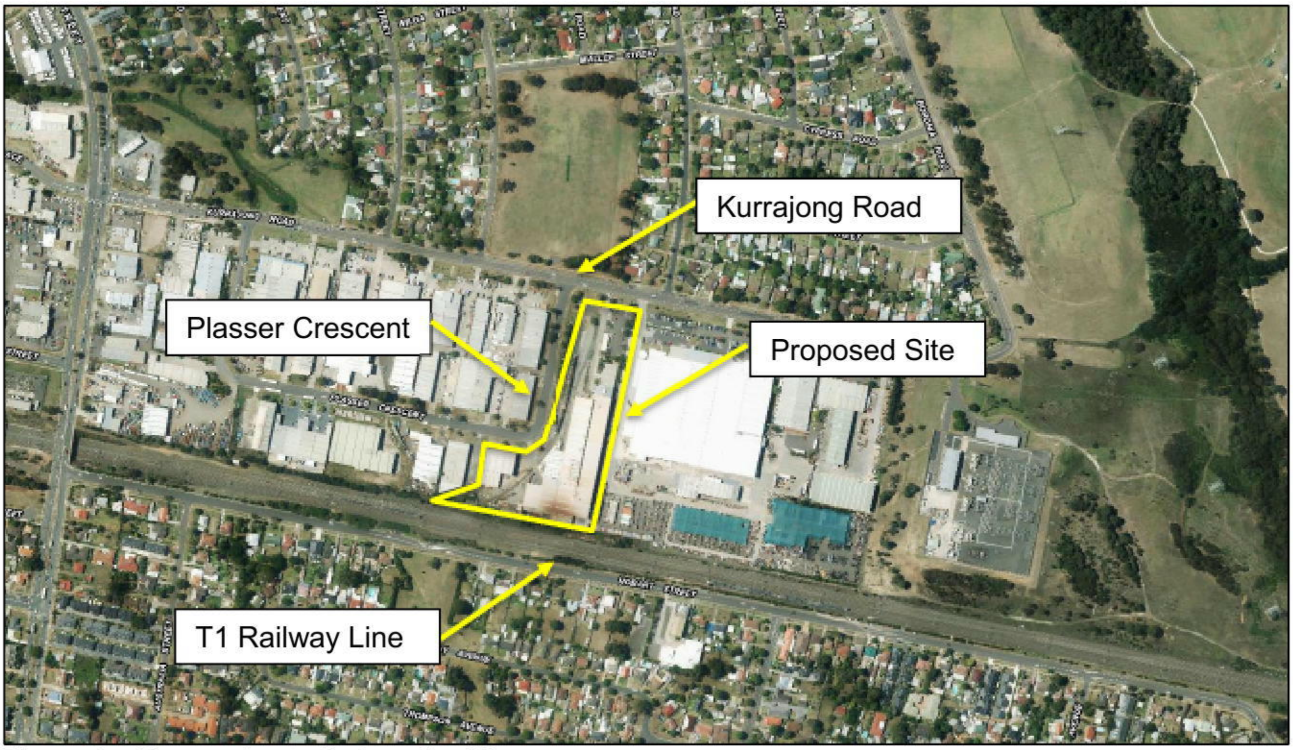

Figure 1 – Plasser Australia Locality Plan

3.0 Proposed Development

The extent of the proposed works will primarily involve the construction of a new factory facility located along the western boundary of the site. The new workshop will comprise of two structures. The first will include an enclosed workshop/factory facility which will cover an area of approximately 1,400 m^2. The second structure will include a covered structure which will cover a new hardstand working area. The covered structure will cover an area of approximately 1,300 m^2.

The proposed works will also include associated infrastructure works such as new stormwater management facilities, retaining structures and the construction of new driveway entrances into the site. Based on the proposed works, the impervious percentage of the site will increase from 75% to 78%. The marginal increase in impervious area is due to the fact that the majority of the new hardstand areas are located over existing hardstand or gravel areas.

For more details, refer to architectural drawings prepared by GroupGSA Architects.

4.0 Proposed Stormwater Management Strategy

The Stormwater Management Strategy developed for the site has been developed in general accordance with section C3 (Water Management) of Council's Development Controls Plans 2010 (DCP), Councils WSUD Technical Guidelines and best management practices for managing urban stormwater.

There are three main areas in relation to stormwater management that need to be addressed as per Council's requirements. These items are addressed in the following sub-sections.

4.1 Stormwater Drainage Infrastructure

In accordance with Section C3 of Council's DCP, the site's stormwater drainage infrastructure needs to be developed to ensure that the runoff generated from the site will not have an adverse effect or damage the built and natural environment. As such, the drainage infrastructure has to ensure that the stormwater discharge does not exceed the capacity of the existing drainage network, minimizes hardstand area, minimise nuisance flows of stormwater runoff and ensure that an adequate and environmentally acceptable method of removing surface water and stormwater is implemented

In order to achieve the above requirements, a majority of the existing drainage infrastructure located at the site will be retained to manage stormwater runoff generated off the site. New stormwater pits and pipes will be provided to manage stormwater runoff generated off new hardstand areas proposed as part of the development. The new sections of stormwater drainage infrastructure will connect to the existing stormwater drainage network.

The proposed stormwater drainage network will eliminate nuisance stormwater flows from affecting the existing and proposed buildings and downstream environments. The new drainage infrastructure will also ensure stormwater runoff generated across the site will safely convey stormwater runoff from the site. While there is a minor increase in impervious area across the site, the proposed development is unlikely to generate a significant increase in peak stormwater runoff for a majority of storm events as the proposed drainage infrastructure will capture and convey most of the flows generated across the site via sub-surface drainage.

Northrop have liaised with Council's stormwater engineers (Leo Chow, on the 6th June 2014) to identify whether or not on-site detention (OSD) would be required for the development. Following discussions with Council, it has been identified that the site sits outside of the Oxley Park OSD catchment area. As a result OSD is not required as part of the developments stormwater drainage infrastructure.

The new pit and pipe infrastructure will be design and constructed in accordance with the Australian Standards. For more details, refer to the Stormwater Management Plan (Drawing 140074-DA6.01-6.02 Rev 5) provided as part of Northrop's civil/stormwater DA design drawings.

4.2 Water Sensitive Urban Design

Council WSUD Technical Guidelines requires new industrial developments to incorporate WSUD principles as part of the stormwater drainage infrastructure to minimise the volume of stormwater discharged from the site.

In order to achieve Council's requirements, rainwater reuse will be incorporated as part of the stormwater management strategy. Council's WSUD guideline require a rainwater tank to be sized to provide 80% of the site external water demand e.g. irrigation use. The proposed rainwater tank will be designed to collect runoff from the total area of the new factory facility and will be sized to provide 90% of the site irrigation demand. In doing so, the proposed stormwater management strategy will satisfy Council's WSUD Technical Guideline and Council's GreenStar accreditation requirements.

For more details regarding the design of the proposed rainwater tank, refer to Section 4.3 of this report and/or Northrop's Stormwater Management Plan.

4.3 Water Quality

Since the proposed development will not result in a significant change to the land use of the site, a stormwater treatment train will be developed to ensure that the proposed development will not result in a net increase in pollutant discharged from the site in comparison to existing conditions. This approach to managing stormwater quality complies with best management practices in managing urban stormwater quality and generally complies with Council's Catchment Management and Water Quality objectives as specified in Section 3.2 Councils DCP.

4.4 MUSIC Modelling

The MUSIC software package has been used to quantitatively assess the effectiveness of the proposed stormwater treatment train for the site. The main pollutants that will be assessed will include total suspended solids, total phosphorus and total nitrogen.

Input Parameters

The following modelling input parameters have been adopted in

- Pluvio rainfall data from the Bureau of Meteorology Penrith Lakes AWS Rainfall station (Station Number 67113, 1999 - 2008).
- Average Areal Potential Evapo-Transpiration Data as provided by Councils WSUD Technical Guidelines
- Pollutant EMC values from the DRAFT NSW MUSIC Modelling Guidelines (August 2010)
- MUSIC Rainfall-Runoff Parameters for Penrith as per Councils WSUD Technical Guidelines
- External Irrigation reuse based on 4 ML/year/ha as per Councils WSUD Technical Guidelines

Two MUSIC models have been prepared as part of this assessment. The first model will reflect the site under existing conditions, while the second model will reflect the proposed development with corresponding stormwater management strategy and treatment devices.

The first model has been prepared based on the following catchment areas.

Sub-Catchment	Adopted EMC's Values	Catchment Area (ha)	Impervious Percentage
Roof	Roof	0.860	100%
Hardstand/Car Park	Industrial	0.885	100%
Landscape/Pervious	General Urban	0.577	0%
Total		***2.320***	***75%***

The second model has been revised to reflect the proposed development and has been modelled based on the following catchment areas.

Sub-Catchment	Adopted EMC's Values	Catchment Area (ha)	Impervious Percentage
Roof to Rainwater Tank	Roof	0.232	100%
Roof By-passing Rainwater Tank	Roof	0.905	100%
Hardstand/Car Park to Enviropods	Industrial	0.100	100%
Hardstand/Car Park by-passing Enviropods	Industrial	0.567	100%
Landscape/Pervious	General Urban	0.516	0%
Total		***2.320***	***78%***

Proposed Treatment Devices

The following treatment devices have been proposed as part of the sites stormwater treatment train.

- Stormwater360 Enviropods or approved equivalent litter basket – Enviropods will be strategically installed in selected existing and proposed stormwater pits to capture pollutants that are generated across the site. A total of three Enviropods have been nominated for the proposed site. For details regarding the location of Enviropods, refer to Northrop's civil/stormwater DA design drawings.
- Rainwater Tank – A rainwater tank will be introduced to capture and re-use rainwater to minimise the total volume of stormwater discharge from the site, as discussed in **Section 4.2**. The MUSIC water balance function identified that the rainwater tank will have a detention volume of approximately 55 kL in order to achieve Council's Greenstar accreditation. Reuse values have been adopted from Council's WSUD Technical Guideline, which stipulates irrigation reuse rates of 0.4kL/year/m^2.

A screenshot of the two MUSIC models are shown in **Figure 2**.

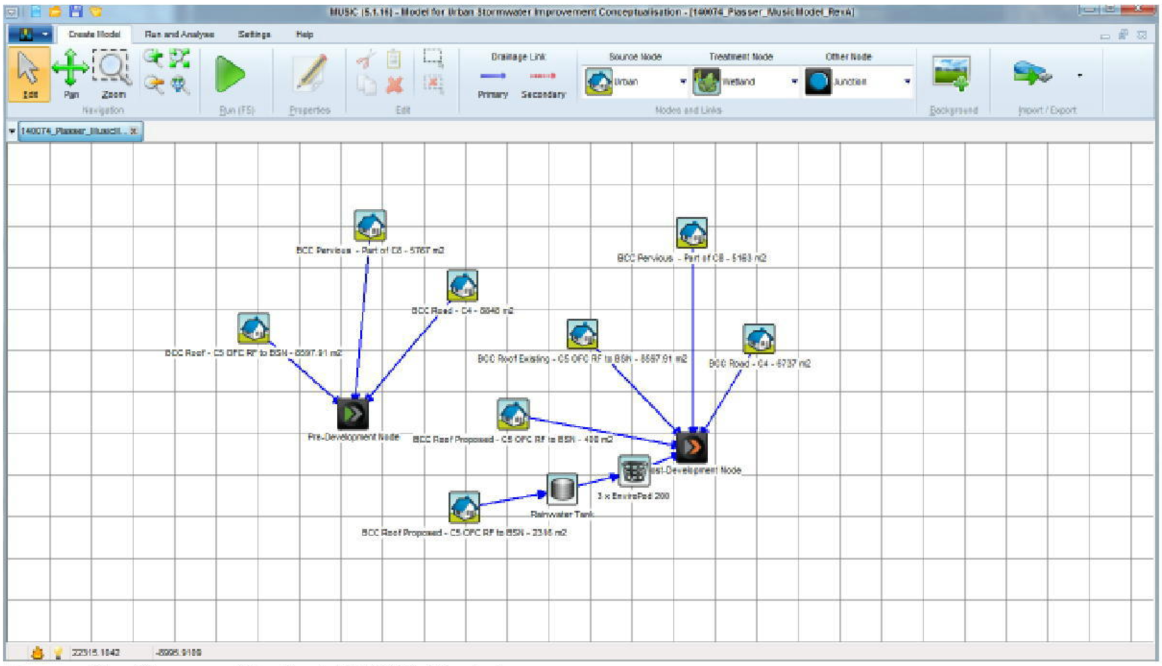

Figure 2 – Screen Shot of MUSIC Model

MUSIC Results

The above stormwater treatment devices have been incorporated into the MUSIC model. The modelling results for each of the models are presented below.

	Modelling Results of Site Under Existing Conditions	Modelling Results of Site Under Developed Conditions with onsite treatment
Total Suspended Solids (kg/yr.)	2,040	1,490
Total Phosphorus (kg/yr.)	4.07	3.16
Total Nitrogen (kg/yr.)	24.9	23
Gross Pollutants (kg/yr.)	289	249

Based on the results presented above, the MUSIC model illustrates that the proposed stormwater treatment train will reduce the total volume of pollutant runoff generated across the site in comparison to existing site conditions. The results demonstrates that the proposed stormwater management strategy adequately capture and manage stormwater pollutants generated from the site to achieve the water quality objectives and treatment targets discussed in **Section 4.3**.

5.0 Flooding

As discussed earlier, there are no defined overland flows that traverse the site. The site is generally flat and sits on a local highpoint. As such, the site will not be exposed to stormwater runoff generated from an external catchment. Furthermore, given the topography of the site, stormwater runoff generated across the site will discharge diffusely from the site. An assessment of Council's Flood Planning Maps within Council' Local Environmental Plan has found that the site will not be affecting by flood inundation arising from a major flood event within South Creek and/or Ropes Creek (located approximately 1 km to the east of the site).

Based on the information provided, the proposed development will not be affected by flood inundation. Further, the proposed development is unlikely to increase the impact of flooding on existing infrastructure, downstream environments or adjoining properties.

6.0 Conclusion

This document has been prepared to outlines the proposed stormwater management strategy for the proposed development. The proposed stormwater management strategy has been developed in accordance with Councils Council's Development Controls Plans 2010 (DCP), Councils WSUD Technical Guidelines and best management practices for managing urban stormwater

The proposed stormwater management strategy will involve utilizing a majority of the existing stormwater infrastructure to manage stormwater flows generated across the site. New stormwater drainage pits and pipes will be incorporated to capture runoff from new hardstand areas proposed across the site. The proposed drainage infrastructure will safely convey stormwater from the site, without significantly impacting existing infrastructure, downstream or adjoining properties and environments.

As part of the stormwater management strategy, a stormwater treatment train has been developed to manage the volume of pollutants generated and discharged from the site. The treatment train involves the implementation of Enviropods and a Rainwater tanks. Detailed investigations have been undertaken which have demonstrated that the proposed stormwater management strategy and treatment train adequately address Council stormwater management requirements as specified in Councils Council's Development Controls Plans 2010 (DCP), Councils WSUD Technical Guidelines

We hope that this report satisfactorily addresses Council's stormwater requirements.. If there are any further queries relating to the stormwater management across the site, feel free to contact the undersigned on 9241 4188.

Yours faithfully

James Hoang
Civil Engineer
Northrop Consulting Engineers

Attached – Northrop's Civil/Stormwater DA Design Drawings

APPENDIX 14
Acoustic Report

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TABLE OF CONTENTS

1 INTRODUCTION

ALC have been engaged by Plasser Australia to undertake an assessment of operational noise likely to be associated with a proposed new Services Workshop on the existing site at 2 Plasser Crescent, St Marys (also known as 25 Kurrajong Road).

In this report we will:

- Identify relevant Council and EPA noise emission criteria applicable to the development.
- Identify nearby noise sensitive receivers and operational noise sources with the potential to adversely impact nearby development.
- Predict operational noise emissions and assess them against acoustic criteria.
- If necessary, determine building and/or management controls necessary to ensure ongoing compliance with noise emission goals.

This report is based on the following drawings:

Table 1 –Architectural Drawings Used for Assessment

Architect	Drawing number	Date
Group GSA, Project 14030	LSK01, 1100, 2000, 3100, 3000	17/06/2014

2 SITE DESCRIPTION AND PROPOSED WORKS

The proposed development is located on the corner of Plasser Crescent and Kurrajong Road.

The following work is proposed on the existing site:

- Construction of a new Services Workshop building along the western side of the site, parallel to Plasser crescent. The work conducted in this new building is machine servicing, which is currently being undertaken within a small existing workshop at the rear of the site.

- Construction of a new concrete driveway from the proposed workshop onto Kurrajong Road. This driveway is proposed to be used only for delivery of completed projects at a frequency of 3-4 times per year (i.e. no change to the existing frequency of use) and with its use in accordance with Roads and Maritime restrictions.

- Construction of a covered outdoor workspace, to the south of the new workshop and adjacent to the existing main workshop building. This predominant use of this space is the cleaning of machinery before progressing to the Services Workshop.

- No additional staff are required as part of the proposal.

- No additional car parking spaces are proposed.

The normal hours of operation of the Services Workshop are:

- 7am – 5:30pm Monday to Friday.

The nearest noise sensitive development to the site are the residential properties to the north, on the far side of Kurrajong Road with public open space "Poplar Park" adjacent.

Adjacent to the subject site to the east on Kurrajong Road is an existing light industrial site and the nearby receivers on Plasser Crescent are also light industrial.

The primary existing noise sources impacting the site and nearby development is steady traffic noise from Glossop Street and light traffic on Kurrajong Road including heavy vehicles going to/from adjacent sites, occasional general activity noise from the industrial sites and occasional movements on the rail line to the south of the site.

See aerial photograph below.

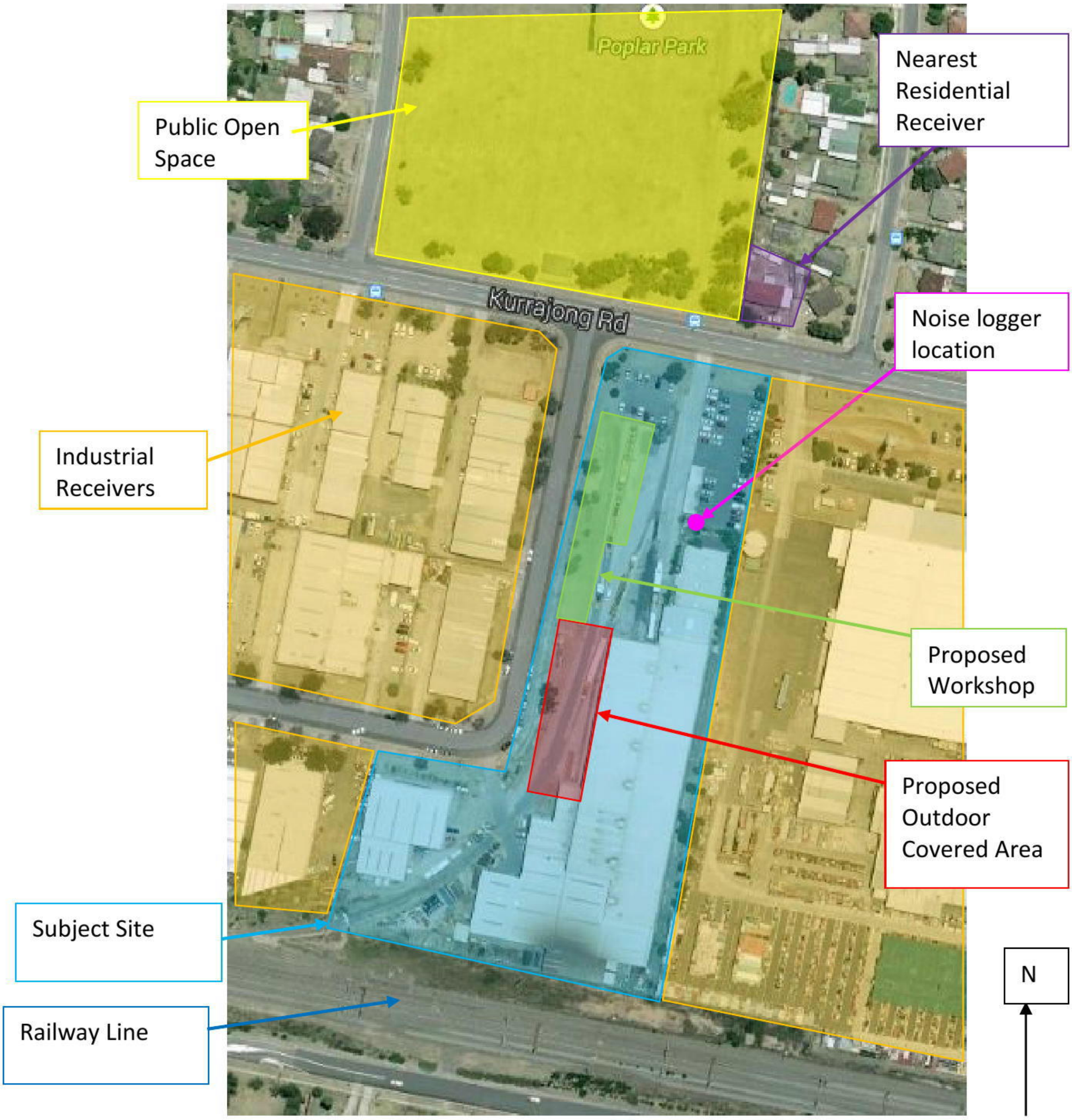


Figure 1 – Aerial Photo

3 NOISE DESCRIPTORS

Environmental noise constantly varies. Accordingly, it is not possible to accurately determine prevailing environmental noise conditions by measuring a single, instantaneous noise level.

To accurately determine the environmental noise a 15-20 minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters.

In analysing environmental noise, three-principle measurement parameters are used, namely L_{10}, L_{90} and L_{eq}.

The L_{10} and L_{90} measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement intervals.

The L_{10} parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced by the source.

Conversely, the L_{90} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the 15 minute period. L_{eq} is important in the assessment of traffic noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of environmental noise.

L_1 levels represent is the loudest 1% noise event during a measurement period.

4 SURVEY OF BACKGROUND NOISE

A survey of existing ambient noise at the site was undertaken using long term unattended monitoring. Long term monitoring was conducted using a noise monitor installed on to the site (see aerial photo in section 2).

Monitoring was conducted from 10 to 17 July 2014 using an Acoustic Research Laboratories noise monitor set to A-weighted fast response. The monitor was calibrated at the start and end of the monitoring period using a Rion NC-73 calibrator. No significant drift was noted.

Results are presented below. Noise logging data is attached, appendix 1.

Table 2 – Background Noise Levels

Location	Time of Day	Rating Background Noise Level dB(A)L_{90}
2 Plasser Cres/ 25 Kurrajong Road	Daytime (7am-6pm)	43
	Evening (6pm-10pm)	40
	Night time (10pm-7am)	36
	Early Morning (5:30am-7am)	41

5 SURVEY OF ACTIVITY NOISE ON SITE

5.1 ON SITE MEASUREMENTS

During site attendance on the 17th July 2014, attended measurements were undertaken of activity noise on site using a Norsonics 140 sound level meter. Measurements were undertaken of the following existing operations:

- Main workshop - use of angle grinders, drills, hammers, welding, operation of the internal hoist/crane, operation of the shotblaster, dropping of metal offcuts - 78dB(A) L_{eq} with maximum of 93dB(A) L_{max}.
- Services overhaul workshop, the average noise level was 71dB(A). This was dominated by noise emissions from the shotblaster in close proximity to the workshop.
- Paint workshop, the average noise level with extraction fans running was 86dB(A). Fans are only required to operate when actively spraying.
- Mobile crane – average noise level 96dB(A) L_{eq}.

5.2 DATA HELD ON FILE

The new covered work area is proposed to include a wash bay with a diesel powered high pressure water cleaner (i.e. Karcher). Measurement of a similar unit was undertaken previously by this office. The measured Sound Power Level for the noise of water spraying onto metal was 92dB(A)L_{eq}. This is in keeping with the Karcher published data for the proposed unit.

6 NOISE EMISSION CRITERIA

The following noise controls will be considered in this assessment:

- Penrith Council DCP.
- EPA Industrial Noise Policy.
- EPA Environmental Criteria for Road Traffic Noise.
- EPA guidelines for sleep arousal.

6.1 PENRIITH CITY COUNCIL DCP

Section C12 of the Penrith DCP notes the importance of assessing potential noise generation by new industrial developments:

a. Ensure that industrial development does not adversely impact on the amenity of neighbouring residential development and other sensitive land uses; and

b. Ensure that the amenity of development surrounding commercial development and licensed premises is not adversely impacted.

We note, however, that the DCP does not state a specific noise emission requirement. In the absence of this, the noise emission requirements for the EPA Industrial Noise Policy (including sleep disturbance guidelines) and the EPA Road Traffic Policy will be reviewed (as discussed below).

6.2 EPA INDUSTRIAL NOISE POLICY

Noise generated within the proposed development (on site) will be assessed with reference to the EPA Industrial Noise Policy, Intrusiveness and Amenity Criteria, as required by the DCP.

Noise sources covered by this code will include vehicle noise (generated on the site), loading dock noise and mechanical services noise.

6.2.1 INP - Intrusiveness Assessment

Intrusiveness criteria are calculated with reference to the existing background noise levels, and are presented below.

Table 3 – EPA Intrusiveness Criteria

Location	Time of Day	Background noise Level - $dB(A)L_{90}$	Intrusiveness Noise Objective $dB(A)L_{eq(15min)}$ (Background + 5dB)
All Potentially Affected Residential Properties	Day Time (7am – 6pm)	43	48
	Evening (6pm – 10pm)	40	45
	Night (10pm-7am)	36	41
	Early Morning (5:30am-7am)	41	46

6.2.2 INP - Amenity Assessment

The typically adopted EPA Amenity Criteria for suburban areas are presented below.

Table 4 - Amenity Criteria

Receiver Location	Land Type	Time of Day	Amenity Noise Emission Objective $dB(A)L_{eq(Period)}$
All Potentially Affected Residential Properties	Suburban	Day Time (7am – 6pm)	55
		Evening (6pm – 10pm)	45
		Night (10pm-7am)	40
		Early Morning (5:30am-7am)	47.5
Industrial Receivers	Industrial	When in Use	70-75
Poplar Park	Active Recreation	When in Use	55-60

6.3 SLEEP AROUSAL ASSESSMENT

Potential sleep arousal impacts should be considered for noise generated before 7am. Short duration, intermittent noise events (such as cars driving into the car park) are typically assessed with reference to additional acoustic criteria specifically to assess potential sleep disturbance. Normal hours of use of the site are from 7am. Given that this could see use of the carpark prior to 7am, an assessment of sleep arousal from use of the carpark is included.

Potential impacts have been assessed using the recommended procedure in the Application Notes to the EPA Industrial Noise Policy. As recommended in the Application Notes, when assessing potential sleep arousal impacts, a two stage test is carried out:

- Step 1 - An "emergence" test is first carried out. That is, the L_1 noise level of any specific noise source should not exceed the background noise level (L90) by more than 15 dB(A) outside a resident's bedroom window between the hours of 10pm and 7am. If the noise events are within this, then sleep arousal impacts are unlikely and no further analysis is needed. This is consistent with the Noise Guide for Local Government. The guideline level is set out below.

Table 5 – Sleep Arousal (Emergence Criteria)

Location	Background Noise Level (5:30am-7am) dB(A)L_{90}	Emergence Level dB(A) $L_{1(1min)}$
All Potentially Affected Residential Properties	41	56

- Step 2 - If there are noise events that could exceed the emergence level, then an assessment of sleep arousal impact is required to be carried out taking into account the level and frequency of noise events during the night, existing noise sources, etc. This test takes into account the noise level and number occurrences of each event with the potential to create a noise disturbance. As is recommended in the explanatory notes of the EPA Industrial Noise Policy, this more detailed sleep arousal test is conducted using the guidelines in the EPA Road Noise Policy. Most relevantly, the Road Noise Policy states:

  For the research on sleep disturbance to date it can be concluded that:

  - *Maximum internal noise levels below 50-55dB(A) are unlikely to awaken people from sleep.*
  - *One to two noise events per night with maximum internal noise levels of 65-70dB(A) are not likely to affect health and wellbeing significantly.*

The internal noise level guidelines have been adopted in this assessment.

6.4 NOISE FROM INCREASED TRAFFIC GENERATION ON PUBLIC STREETS

The subject proposal does not result in any increase in traffic generation on public streets and hence an assessment of noise associated is not required.

7 NOISE EMISSION ASSESSMENT

The operational noise emissions will be assessed below. Assessment of the following noise sources will be undertaken:

- Sleep disturbance noise events will be assessed with reference to the EPA application notes to the Industrial Noise Policy.

- Noise from the use of the workshop including mechanical services will be assessed with reference to the Industrial Noise Policy.

In all cases, all predicted noise levels in the following sections are based on the proviso that the acoustic treatments/management controls recommended in section 7 are implemented.

7.1 PEAK NOISE EVENTS (SLEEP AROUSAL)

As the carpark may be used prior to 7am, a sleep arousal assessment of peak noise events from the car park and loading dock has been conducted.

As the workshop may be set up prior to work normally starting at 7am, a sleep arousal assessment of peak noise events from the workshop has been conducted.

7.1.1 Car Park Noise

The assessment of operational noise from the staff car park will be based on the following assumptions:

- The loudest typical peak noise event from the use of the car park will be from a car door closing or a car starting, both with an sound power level of 91dB(A)$L_{1(1min)}$.

- The noise event examined is that from the closing of a car door at northern most parking space on the site, (the space nearest the residential development on Kurrajong Road).

The prediction takes into account the relative position of noise source and receiver, and noise attenuation over distance.

Predicted level is as follows:

Table 6 – Sleep Arousal Assessment (5:30am-7am)

Receiver Location	Noise Source	Predicted Noise Level	Acoustic Criteria	Complies?
Residential Properties on Kurrajong Road	Car Door Close	52dB(A)$L_{1(1min)}$	56dB(A)$L_{1(1min)}$	Yes

All peak noise events comply with the "background+15dB(A)" preliminary assessment at the closest surrounding residential properties on Mulgoa Road, and is therefore satisfactory.

7.1.2 Use of the Workshops

The assessment of operational noise from the new Services Workshop will be based on the following assumptions:

- The loudest typical peak noise event in the use of the workshop will be from use of hand tools (such as angle grinder, drill, hammer).
- Measurements of existing operations within the main workshop were undertaken on site. Activities undertaken during the measurement were use of angle grinders, drills, hammers, welding, operation of the internal hoist, dropping of metal offcuts. This presents a worst case assessment as Servicing work is generally less intensive. The average maximum noise level from a sweep of the existing operations was 93dB(A) L_{max}.

The prediction takes into account the relative position of noise source and receiver, and noise attenuation over distance.

Predicted level is as follows:

Table 7 – Sleep Arousal Assessment (5:30am-7am)

Receiver Location	Noise Source	Predicted Noise Level	Acoustic Criteria	Complies?
Residential Properties on Kurrajong Road	Normal Use of Workshop	$\leq$55dB(A)$L_{1(1min)}$	56dB(A)$L_{1(1min)}$	Yes

All peak noise events comply with the "background+15dB(A)" preliminary assessment at the closest surrounding residential properties on Mulgoa Road, and is therefore satisfactory.

7.2 MECHANICAL SERVICES NOISE

The proposed Services Workshop will contain a factory compressed air line for powering hand tools. This line will run off the existing compressor which located is at the rear of the site i.e. no new plant is required.

The new covered work area is proposed to include a wash bay with a diesel powered high pressure water cleaner (i.e. Karcher or similar). Measurement of a similar unit yielded a Sound Power Level of 92dB(A) L_{eq} for the noise of water spraying onto metal. Assuming a Sound Power Level of 92dB(A) also for the motor of the power cleaner, the predicted noise level to the residents is 34dB(A) which easily complies with the project noise emission goals.

Detailed acoustic assessment of remaining mechanical plant/substations is not typically undertaken at DA stage as plant selections and locations are not finalised.

We recommend that a detailed review of any new plant items be undertaken at Construction Certificate stage, once mechanical plant selections have been undertaken. All plant items will be capable of complying with EPA INP acoustic guidelines.

7.3 ACTIVITY NOISE

Noise emissions from the operation of the proposed new workshop have been calculated, based on measurements of the existing operations on site and taking into account acoustic attenuation from the distance to the receivers, barrier effects, and the duration of noise.

The source noise levels have been assessed and are not tonal in accordance with the NSW EPA Industrial Noise Policy hence no correction needs to be applied for tonality.

The average noise level measured in the existing main workshop was 78dB(A) L_{eq}. This included noise from grinders, hammers, drills, welding, shotblaster, the internal crane system and general activity noise such as staff talking and occasional dropping of metallic items.

The average noise level measured in the existing services overhaul workshop was 71dB(A) L_{eq}, which was dominated by noise emissions from the shotblaster in close proximity to the workshop.

The average noise level measured in the existing paint workshop was 86dB(A) L_{eq} when the extraction fans were running and approximately 70dB(A) L_{eq} otherwise.

The assumed noise level of the high pressure water motor is 92dB(A) L_{eq} Sound Power Level.

The following table presents the predicted noise emissions to the residents at 16 Kurrajong Road. Compliance at this receiver also indicates compliance at the adjacent public open space.

Table 8 – Predicted noise emissions from use of the workshops to 16 Kurrajong Road

Source	Predicted Noise Level dB(A) L_{eq}	Noise Emission Criteria dB(A) $L_{eq(15min)}$	Complies
All existing workshops operating normally, outdoor covered area and new Services Workshop	≤46dB(A) L_{eq}	48dB(A) Day Time 45dB(A) Evening 41dB(A) Night Time 46dB(A) Early Morning	Complies Early Morning and Day Time. Possible minor exceedance in evening.
Paint Workshop only	≤45dB(A) L_{eq}	48dB(A) Day Time 45dB(A) Evening 41dB(A) Night Time 46dB(A) Early Morning	Complies early morning, day and evening

The following table presents the predicted noise emissions to the industrial receivers to the west.

Table 9 – Predicted noise emissions from use of the workshops to 16 Kurrajong Road

Source	Predicted Noise Level dB(A) L_{eq}	Noise Emission Criteria dB(A) $L_{eq(15min)}$	Complies
All existing workshops operating normally, outdoor covered area and new Services Workshop	68dB(A) L_{eq}	70dB(A) When in Use	Complies

7.4 INCREASED TRAFFIC ON PUBLIC STREETS

No changes are proposed to the generated movements to/from the site, therefore no increase in traffic on public streets is predicted.

8 RECOMMENDATIONS

We recommend the following acoustic treatments/management controls be implemented:

- The new Services Workshop and Outdoor Covered Work Area is not to operate before 5:30am or after 10pm. Normal hours of use are 7am to 5:30pm.

- The northern doors of the new Services Workshop must be closed until 7am but can remain open otherwise.

- Detailed review of mechanical plant items is to be undertaken at CC stage (once plant is selected/located) and acoustic design should be undertaken to ensure plant noise will be compliant with the EPA Industrial Noise Policy.

Provide that the above is done, no further building/management controls are required to ensure compliance with the Penrith DCP and EPA noise emission guidelines.

9 CONCLUSION

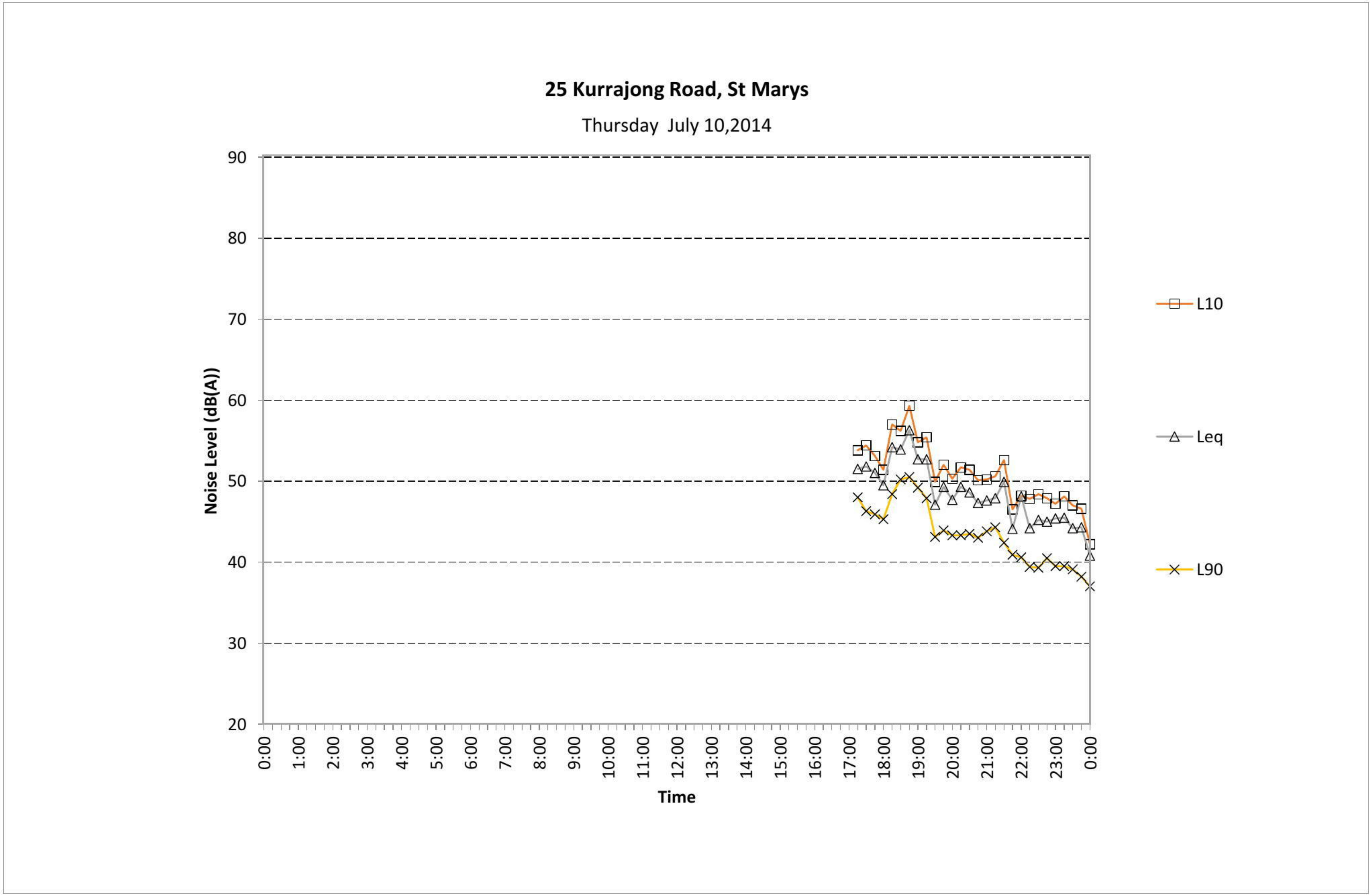
Noise emissions associated with the proposed new Services Workshop and Outdoor Covered Work Area at the Plasser Australia site at 2 Plasser Ave (25 Kurrajong Road) St Marys have been assessed with reference to relevant EPA and Council acoustic guidelines.

With the recommendations presented in section 8 of this report adopted, noise emissions from the operation of the site will comply with acoustic criteria, ensuring no unacceptable noise impact on the nearest surrounding residential properties.

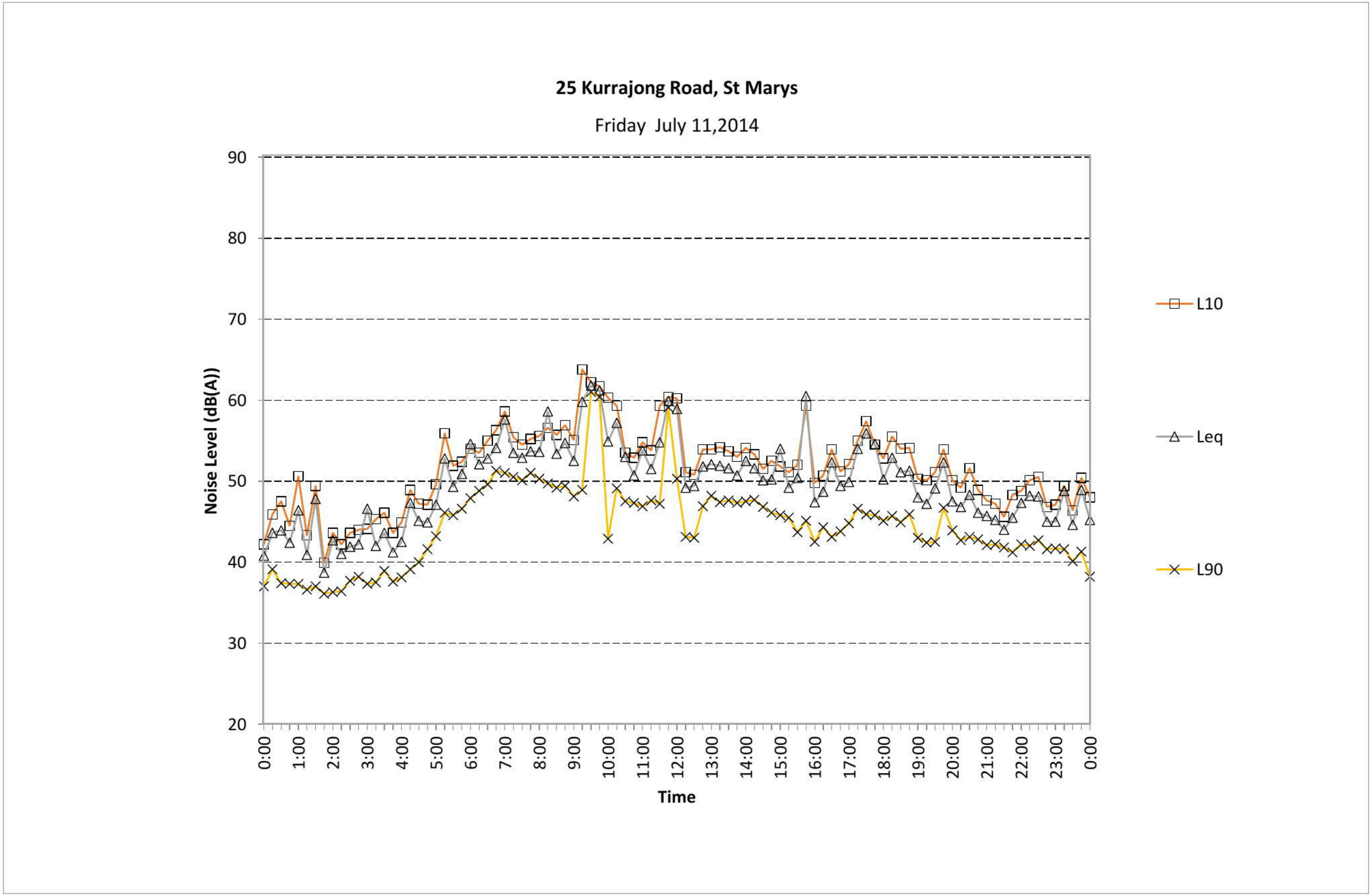
We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,

Acoustic Logic Consultancy Pty Ltd
Hilary Pearce



25 Kurrajong Road, St Marys
Thursday July 10,2014
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time
L10
Leq
L90



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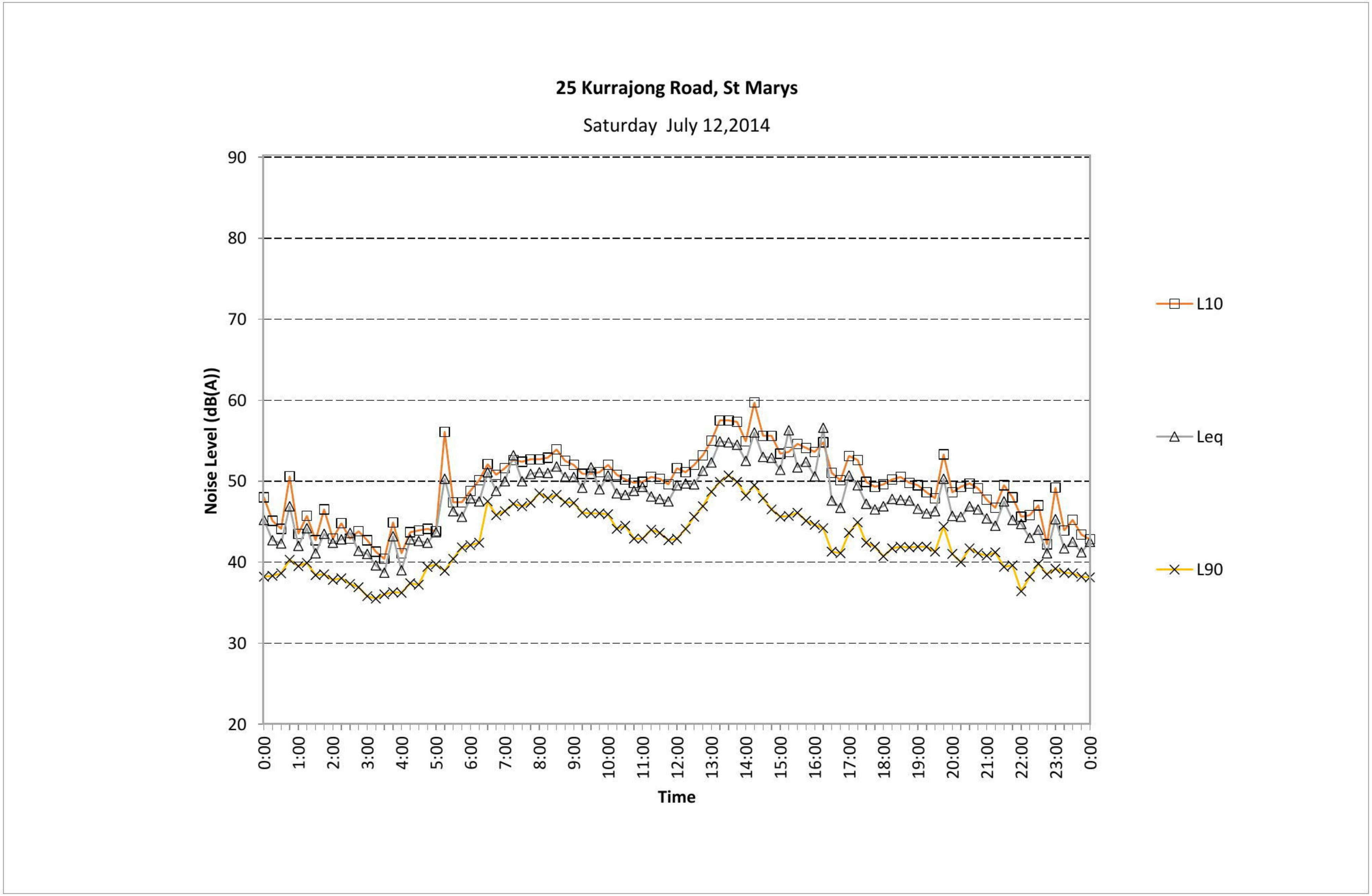

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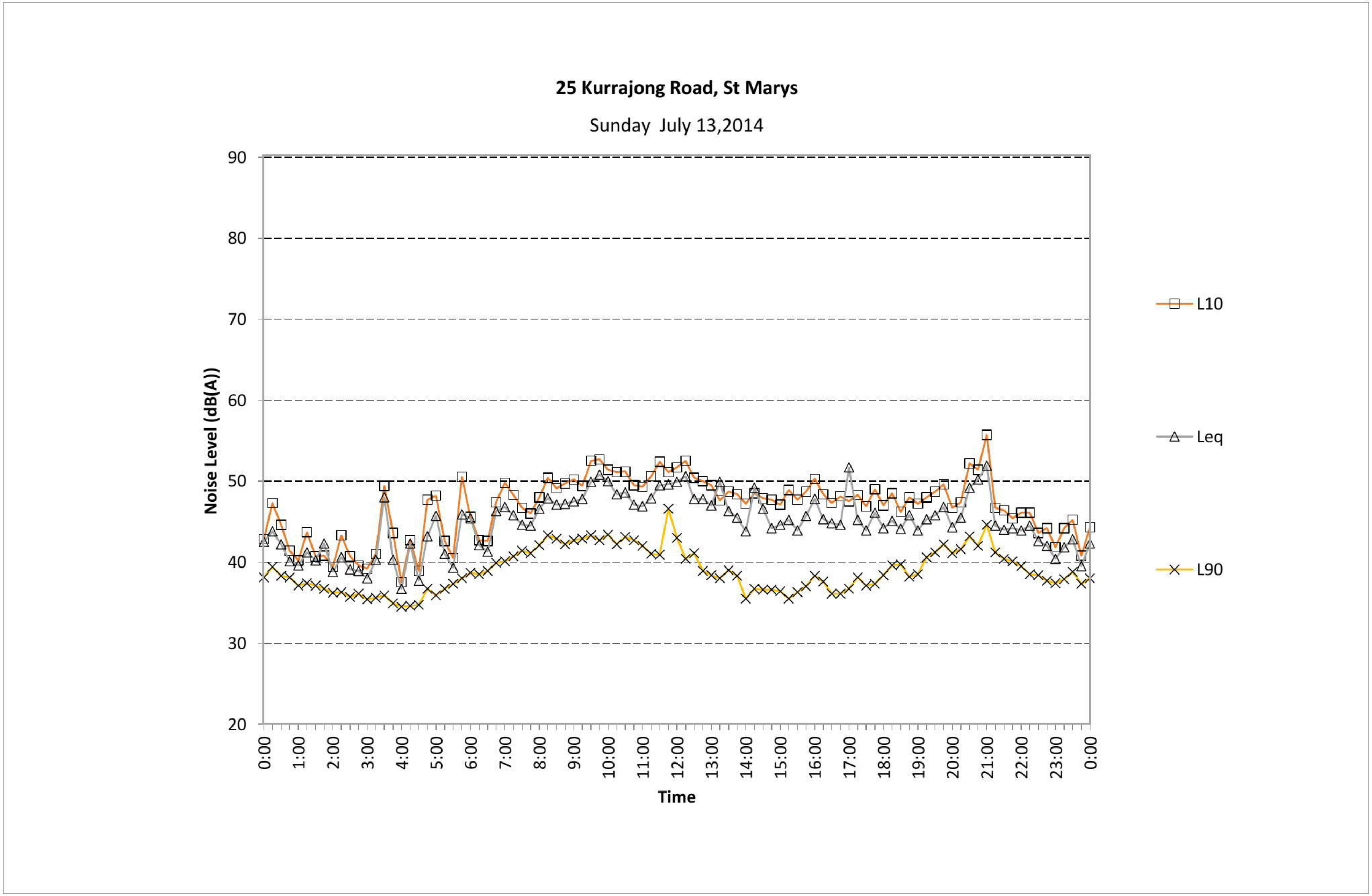

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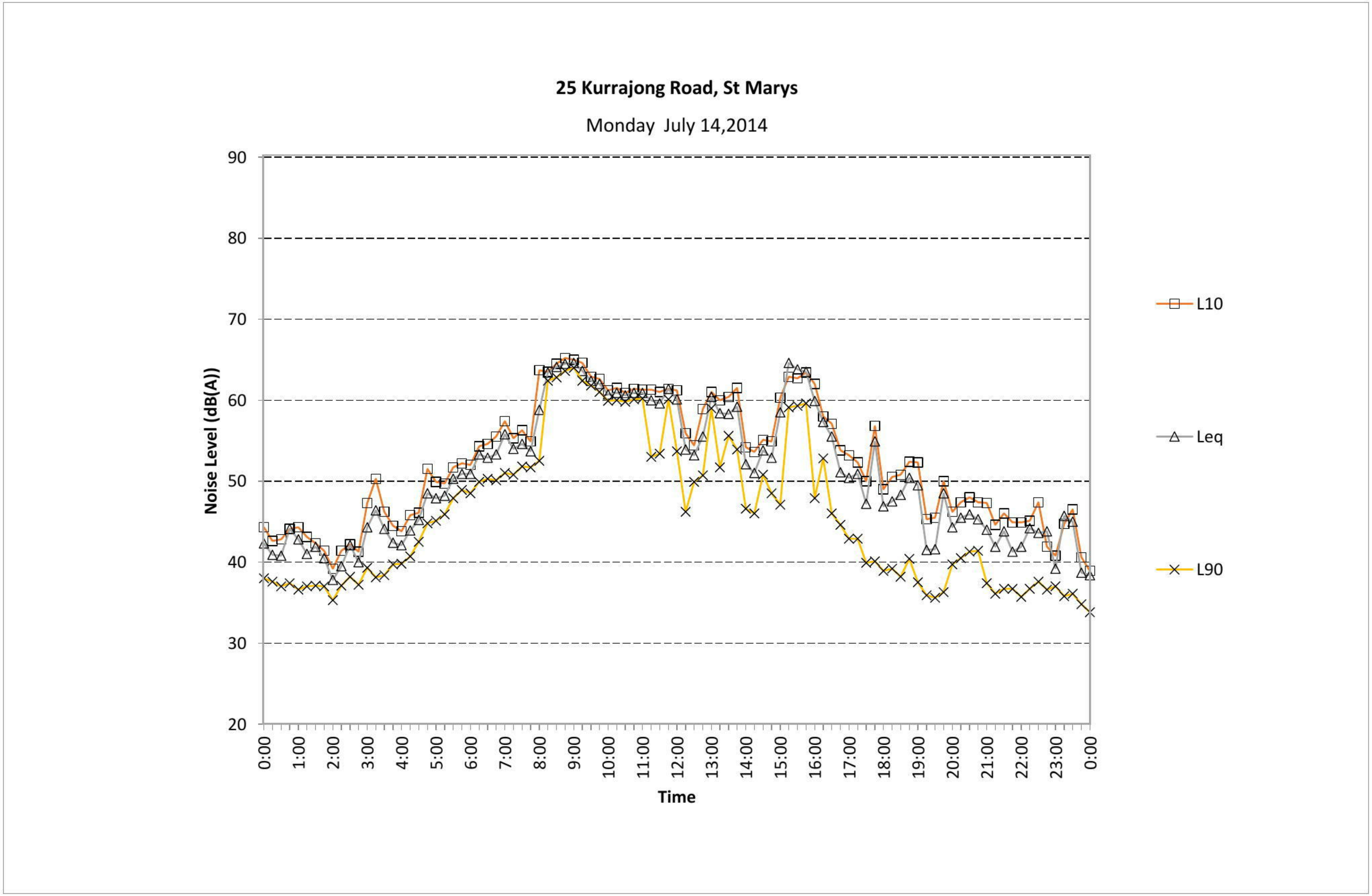
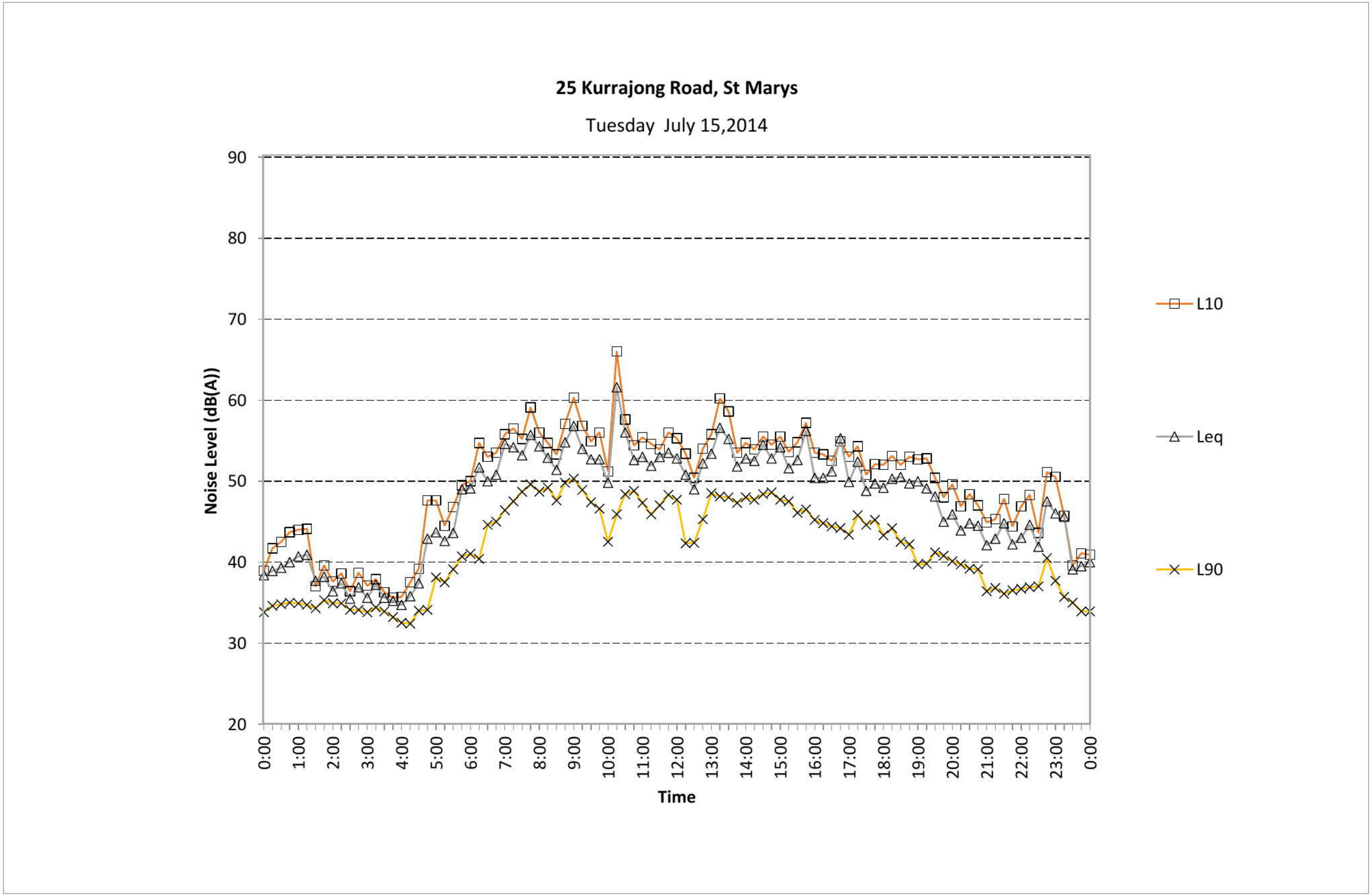

25 Kurrajong Road, St Marys
Monday July 14,2014
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time
L10
Leq
L90



25 Kurrajong Road, St Marys
Tuesday July 15,2014
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
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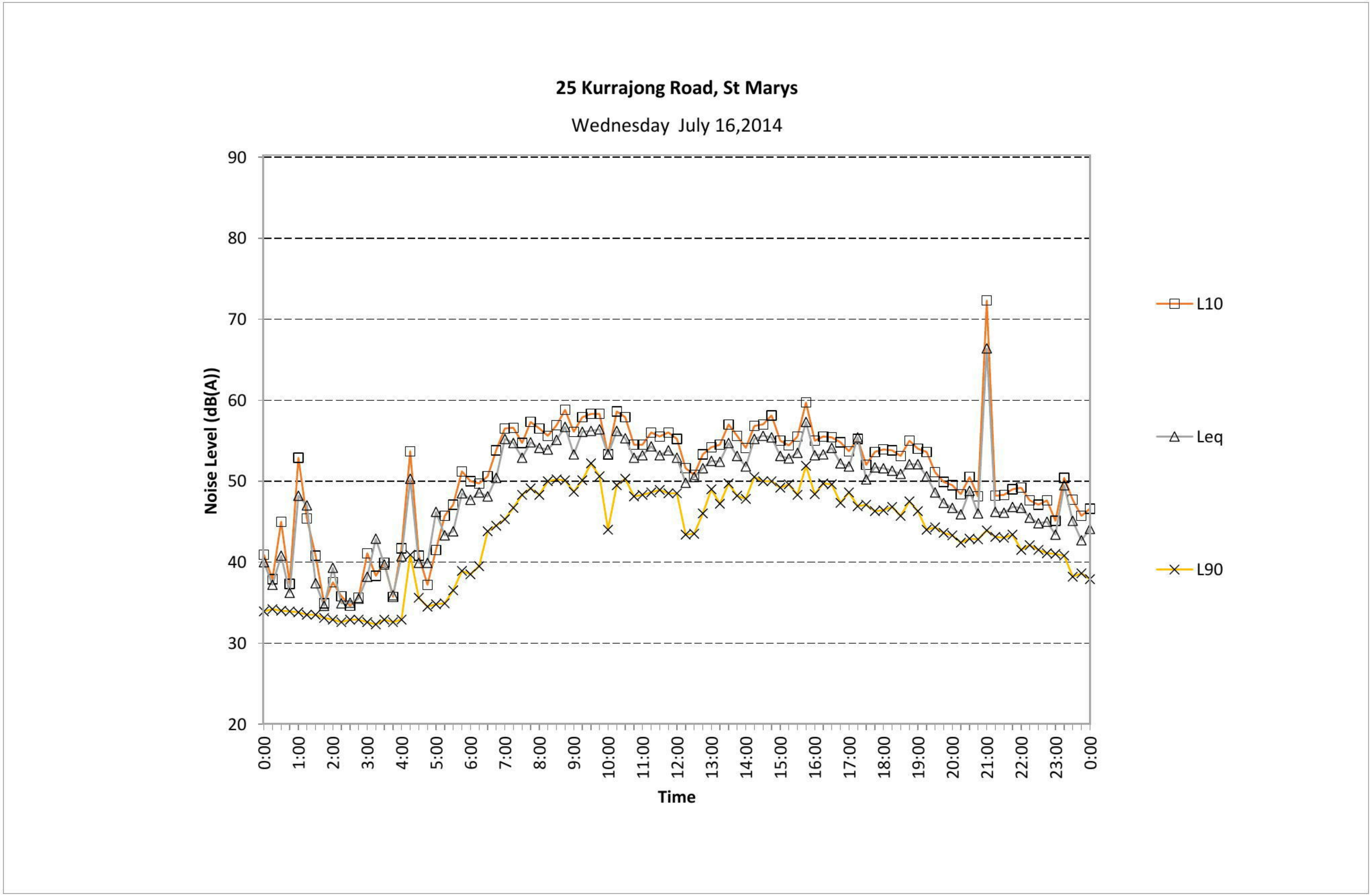
Time
L10
Leq
L90



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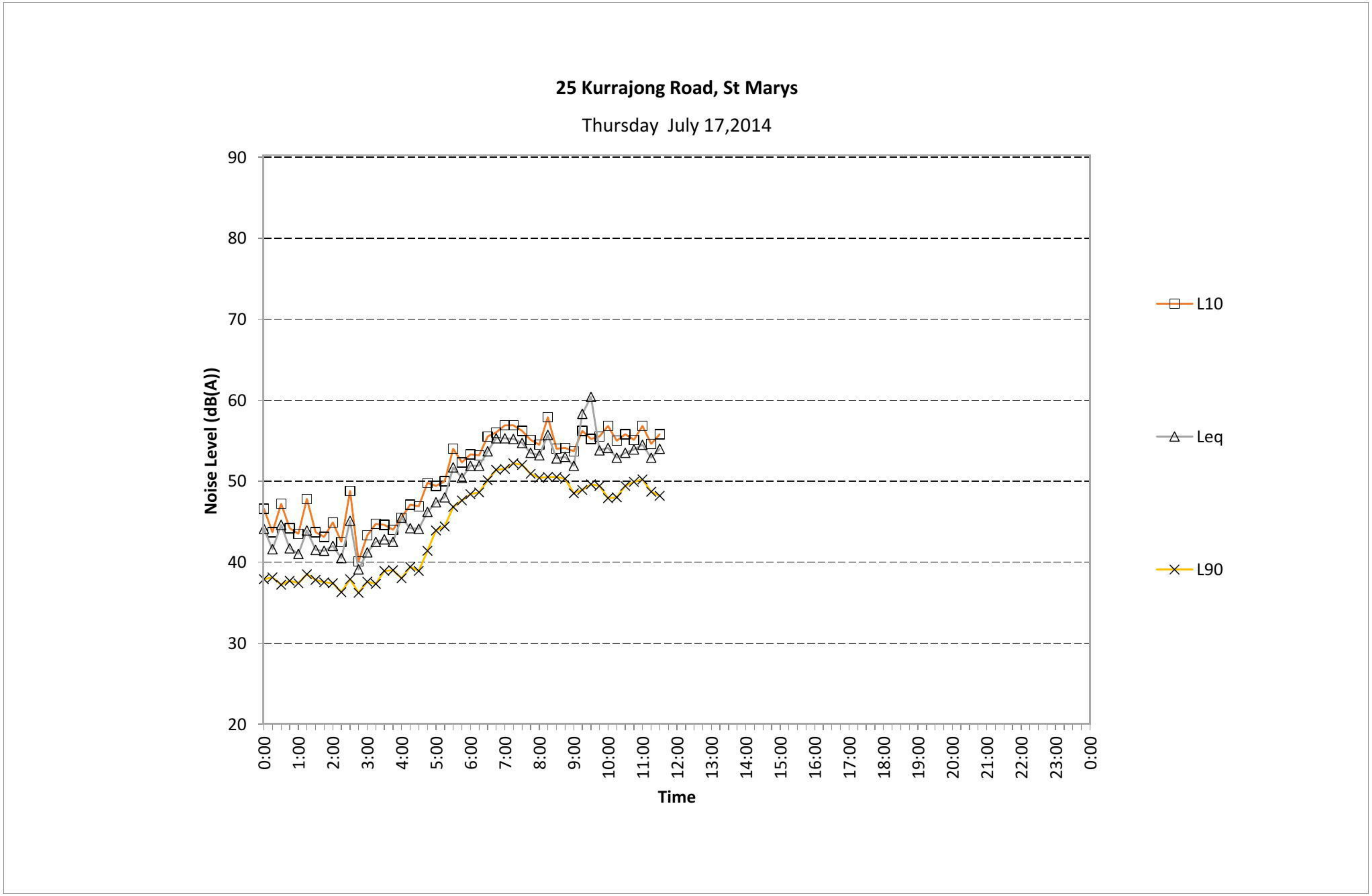

2Plasser_data_Sta_graphed