Monteath & Powys Pty Ltd

SURVEYING, PLANNING, ENGINEERING DESIGN, PROJECT MANAGEMENT






PROPOSED MIXED USE DEVELOPMENT (BEING A RESIDENTIAL FLAT BUILDING AND COMMERCIAL PREMISES) INCLUDING THE DEMOLITION OF THE EXISTING BUILDINGS

32-44 BROOKS PARADE, 2-10 SHARP STREET & 5-11 EDGAR STREET, BELMONT

Amended Statement of Environmental Effects

Liability limited by a scheme approved under Professional Standards Legislation

Quality ISO 9001 Certified System

This Report was prepared by:
Monteath & Powys Pty Ltd
Suite 13 Tonella Commercial Centre
125 Bull Street,
Newcastle West New South Wales 2302
Australia
(PO Box 2270, Danger NSW 2302)

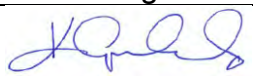
T: (02) 4926 1388 **F:** (02) 4929 3475
E: survey@monteathpowys.com.au
W: www.monteathpowys.com.au

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PROJECT	Demolition of Existing building and Construction of a Mixed Use Development (Residential Flat Building and Commercial Premises)
CLIENT	KML Joint Venture and Coeve Design (VIC) Pty Ltd
OUR REFERENCE	2013/0524
DATE	05/02/2018
AUTHOR	Konrad Grinlaubs Senior Town Planner MPIA
CERTIFICATION	I hereby certify that this Statement of Environmental Effects has been prepared in accordance with the requirement of the *Environmental Planning and Assessment Act 1979* and its associated Regulations. I certify that to the best of my knowledge the information contained within this Report is neither false nor misleading.
SIGNATURE	
CHECKED BY	Darren Holloway B.Sci. (Hons), MBEnv Manager Planning and Environment Registered Planner
SIGNATURE	

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APPENDIX B – Architectural Statement, SEPP 65 Design Verification Statement, and Part 3 and 4 Apartment Design Guide, prepared by *Coeve Design (Vic) Pty Ltd.*

APPENDIX C – Urban Design Review, prepared by *Monteath and Powys Pty Ltd*.

APPENDIX D – CPTED Report, prepared by *Monteath and Powys Pty Ltd*.

APPENDIX E – Landscape Plan, prepared by *Forum Urban Sanctum Landscape Design.*

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APPENDIX H – Geotechnical and Site Contamination Report, prepared by *Regional Geotechnical Solutions***.**

APPENDIX I – Traffic and Parking Impact Assessment Report, prepared by *McLaren Traffic Engineering*.

APPENDIX J – Acoustic Assessment, and Addendum Acoustic Assessment, prepared by *Spectrum Acoustics*.

APPENDIX K – Economic Impact Assessment Report, prepared by *Monteath and Powys Pty Ltd*.

APPENDIX L – Social Impact Assessment Report, prepared by *Monteath and Powys Pty Ltd*.

APPENDIX M – Limited Flood Study Investigation Report, and Stormwater Plans prepared by *Forum Consulting Engineers*.

APPENDIX N – Searches, prepared by *Monteath and Powys*.

APPENDIX O – Clause 4.6 Height Assessment, prepared by *Monteath and Powys*.

APPENDIX P – Review of the Town Centres DCP and Belmont Area Plan for 32 Brooks Parade Belmont, prepared by *Lake Macquarie Council's Integrated Planning Department.*

APPENDIX Q – Aboriginal Heritage Due Diligence Assessment, prepared by *McCardle Cultural Heritage Pty Ltd*.

APPENDIX R – Waste Management Plan, prepared by *Monteath and Powys.*

APPENDIX S – Erosion and Sediment Control Plan, prepared by *ACOR Consulting*.

APPENDIX T - Environmental Site Assessment, prepared by *Regional Geotechnical Solutions.*

APPENDIX U - Air Quality Assessment, prepared by *NorthStar Air Quality.*

1. INTRODUCTION

This Statement of Environmental Effects (SoEE) has been prepared on behalf of KML Joint Venture Pty Ltd by Monteath & Powys Pty Ltd. This statement is to accompany an amended Development Application (DA) to Lake Macquarie City Council for the demolition of existing dwellings and structures, and the construction of a mixed use, multi storey development comprising 140 residential units, 4 retail/commercial areas, 1 communal multi-purpose area, basement car parking and associated landscaping at 32-44 Brooks Parade, 2-10 Sharp Street and 5-11 Edgar Street, Belmont.

The proposal seeks consent for an architecturally designed residential flat building and commercial premises that is consistent with the provisions under the Lake Macquarie LEP 2014 and the Lake Macquarie DCP 2014 and adequately responds to the community housing need.

The proposed use is permissible with consent in the '***B4 Mixed Use***' zone and is compliant with the objectives of the planning controls and design requirements. The application relies upon the provisions Clause 4.6 in relation to the height with, the justification for this departure being considered acceptable in the particular circumstances of this case. Furthermore, the height proposed is consistent with the '*Review of the Town Centres DCP and Belmont Area Plan for 32 Brooks Parade Belmont, prepared by Lake Macquarie Council's Integrated Planning Department'* and provided to the applicant and subsequently relied on. A copy is included at ***Appendix P***.

The DA and statement has been prepared on behalf of the applicant and addresses the matters referred to in Section 4.15 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the matters required to be considered by the consent authority.
The purpose of this SOEE is to:

- *Describe the existing environment to which the DA relates and the character of the surrounding area;*
- *Describe the proposed development;*
- *Outline the statutory planning framework within which the DA is assessed and determined; and*

- *Assess the proposed development in considering the relevant heads of consideration (Section 4.15(1) of the EP&A Act).*

The following consultant documents have been prepared in support of the application and this documentation should be read in conjunction with the statement:

- Architectural Plans, prepared by *Coeve Design (Vic) Pty Ltd.*
- Architectural Statement, SEPP 65 Design Verification Statement, and Part 3 and 4 Apartment Design Guide, prepared by *Coeve Design (Vic) Pty Ltd.*
- Urban Design Review, prepared by *Monteath and Powys Pty Ltd*.
- CPTED Report, prepared by *Monteath and Powys Pty Ltd*.
- Traffic and Parking Impact Assessment Report, prepared by *McLaren Traffic Engineering*.
- Economic Impact Assessment Report, prepared by *Monteath and Powys Pty Ltd*.
- Social Impact Assessment Report, prepared by *Monteath and Powys Pty Ltd*.
- Aboriginal Heritage Due Diligence Assessment, prepared by *McCardle Cultural Heritage Pty Ltd*.
- Waste Management Plan, prepared by *Monteath and Powys Pty Ltd.*
- Erosion and Sediment Control Plan, prepared by *ACOR Consulting*.

1.1 Owner and Site Details

The Applicant

KML Joint Venture Pty Ltd
C/- Monteath & Powys
PO Box 2270
DANGAR NSW 2309
Contact: Darren Holloway
Phone: (02) 4926 1388

The Owner(s)

Land ownership of the site is detailed in **Table 1** below.

Table 1 - Land ownership of the site (Title searches – 7/2015)

Lot	Sec	DP	Area	Owner
11	B	585	813	Marcus Investment (Australia) Pty Ltd
10	B	585	Pt of 261 (262)	Marcus Investment (Australia) Pty Ltd
A	-	400644	514.4	Marcus Investment (Australia) Pty Ltd
B	-	400644	729.8	Anthony M Brown, Kathryn L Brown & Marcus F Brown
2	-	353066	335.4	Kuta Lines Pty Ltd, Marcus Investment (Australia) Pty Ltd
1	-	353066	319.4	Marcus Investment (Australia) Pty Ltd, Kuta Lines Pty Ltd
4	-	12898	306	Lakesharp Developments Pty Ltd
5	-	12898	271.5	Kuta Lines Pty Ltd, Marcus Investment (Australia) Pty Ltd
6	-	12898	291.7	Kuta Lines Pty Ltd, Marcus Investment (Australia) Pty Ltd
8	-	12898	330	Kuta Lines Pty Ltd, Marcus Investment (Australia) Pty Ltd
B	-	339105	481.7	Anthony M Brown, Kathryn L Brown & Marcus F Brown
A	-	339105	470.2	Anthony M Brown, Kathryn L Brown & Marcus F Brown
4	B	585	815.6	Marcus Investment (Australia) Pty Ltd
3	B	585	813.3	Marcus Investment (Australia) Pty Ltd, Kuta Lines Pty Ltd
7	-	12898	329	Montgomery D Hughes & Jennifer E Hughes
Total sqm			7,083	

1.2 Background

The Development Application has been the subject of an extensive Pre-DA and post-lodgement process with Council, including presentation to the SEPP 65 Panel and the JRPP. In response to these discussion and meetings comments were provided, the applicant has made amendments to the proposal that results in a proposal that is consistent with anticipated outcomes or Belmont and relevant statutory requirements.

The various lots that comprise the subject site have been subject to various schemes presented to Council over a 10-year period. The current development application did not include 44 Brooks Parade, Belmont. The applicant had submitted to Council detailed confidential correspondence outlining the protracted history of options and negotiations that had taken place between the owners ("Hughes") of 44 Brooks Parade, Belmont ("Hughes Land") and the various joint venture development proposal partners, now known as KML Joint Venture ("KML"), for the purposes of acquiring Hughes Land.

Those negotiations commenced in 2006 and remained unresolved when the parties were first before the Joint Regional Planning Panel ("JRPP") on 23 November 2017. [*JRPP Reference – "2017HCC002 – Lake Macquarie – DA11/2017 at Brooks Parade and 5 Edgar Street, Belmont."*]. The JRPP at that meeting resolved to defer determination of the application, as follows:

> "*The Panel agreed to defer consideration of the development application as described in Schedule 1 to allow the applicant to make its best endeavour to negotiate the inclusion of 44 Brooks Parade, Belmont ("the isolated site") within the proposed development, and to strongly encourage the owner of the isolated site to enter into meaningful negotiations in a timely manner and noting he has indicated his willingness to do so.*
>
> *In the event that agreement cannot be reached between the parties within 4 weeks of the Panel Meeting (i.e. by 21 December 2017) then the Panel invites the applicant to submit:*
>
> 1. *Documentation of the negotiations held, offers made and responses from the owner of the isolated site; and*
> 2. *To submit amended plans to demonstrate compliance with Lake Macquarie LEP and DCP and the Apartment Design Guide, and to address the urban design issues and other technical matters raised in the Council's assessment report.*
>
> *In the event that the applicant cannot reach agreement with the owner of the isolated site and chooses not to amend the application, then the matter be referred to the Panel for an electronic meeting and determination.*"

The panel also listed a number of reasons in support of its deferral determination. Those reasons are contained within its Record of Deferral document, available on the Department of Planning and Environment website portal.

It is acknowledged that the overriding benefit in KML acquiring Hughes Land, is that the development may proceed to determination without the complex planning consideration of the creation of an isolated lot. This not only services the development footprint, future

planning in the location, the overall urban design and amenity of the location, but also, benefits Hughes.

As such, the parties conducted extensive negotiations during the course of December 2017. The KML partners attended in person. Hughes was represented by Lynette Allison of PRD real estate and her husband Mr Dean Allison, both of which were present at the JRPP meeting of 23 November 2017.

The negotiations resulted in KML successfully meeting Hughes demands for the acquisition of the isolated lot. KML have since entered into a contract for the acquisition of Hughes Land. The parties have exchanged contracts and KML have paid the requisite deposit amount. The parties have agreed to a delayed settlement period, primarily to accommodate Hughes present and future plans, as well as, in further consideration of other developer costs.

Hughes have also executed other relevant documents, including provision of land owner consent, to facilitate the amendment of KML's application, which now incorporates Hughes Land.

The parties have to date, done all things necessary to remove the impediment created by the isolated lot, from any further consideration of it, in relation to the assessment of the development proposal.

The amended design has been developed considering the correspondence and consultation with Council through, meetings with Council and the SEPP 65 Design Review Committee. In addition, the November 2013 document prepared by Council's Strategic Development Department entitled '*Review of the Town Centres DCP and Belmont Area Plan for 32 Brooks Parade Belmont* (BTCR) has a significant role to play in the future outcome for the site. The BTCR outlines viable and appropriate future development proposals and objectives for the subject site. The BTCR submitted that several amendments be proposed to the current DCP, including building setbacks, separation and building height be applied to the site. The BTCR provided the applicant an understanding on the outcomes and objectives for the area and these have been utilised with this proposal.

As discussed with Council at various meetings, and upon review the current DCP, the setbacks and building separation requirements do not fully align within different sections of the DCP and as such make it impossible to design a conforming development or alternatively, conformity creates unviability.

The BTCR which is appended to this report recommends a review of these provisions and Coeve Design have prepared the proposed mixed-use proposal with additional height providing "book end" adjacent to Belmont Towers. The development is designed as a six and eight storey building over four separate towers. The upper storeys are setback and contained to the centre of the building towers. The resulting development is a responsive urban outcome that, on balance, responds to the site constraints and facilitates a development that complies with the objectives and aims of the Lake Macquarie LEP 2014, the Lake Macquarie DCP 2014, SEPP 65 and relevant State Planning Instruments and consistent with the recommended outcomes within the BTCR Report.

In understanding these opportunities, and the reasoning behind the proposed increase in height it is worth noting that the proposal identified a number of limitations with the current provisions, particularly height and block controls. This includes a lack of any technical feasibility relating to the intended outcomes of the built form for the Belmont town centre.

The proposed building envelope ensures that a tower on the south east corner of the site will reflect the current and evolving character of the urban context of this section of Belmont. As noted above will complete the Belmont ‘bump’, consider both in the urban design review, peer reviewed by Peter Annand and Associates and the Council’s BTCR.

The proposal uses a traditional, site responsive materials in contemporary ways. The continuity of the material across the podium is a direct and successful response to the issue of sea level rise. The development, design, character and materiality provide block pattern that has a good balance between providing a cohesive, podium and the need to design for a good level of daylight and natural ventilation and the inclusion of appropriate commercial floor plates.

The subject site is identified as being part of ‘Belmont Town Centre’ under the Lake Macquarie DCP 2014. The Belmont town Centre includes the recently approved

development the Belmont Central Apartments at 13-17 Edgar Street, Belmont, comprising ground floor commercial/retail and residential living above

Belmont Town Centre also comprises four other adjacent properties, Santorini Apartments (6 storey) at 24-26 Brooks Parade, Belmont. Belmont Towers (9 storey) at 46 Brooks Parade, Belmont, Deck Apartments (6 Storey) include ground floor café at 54-56 Brooks Parade, Belmont. Belmont Wharf Apartments (7 storey) at 58 Brooks Parade, Belmont.

The proposal is a response to the existing grit, grain and character of Belmont and is a well-considered design outcome. The location of a ground floor commercial offerings on the corner provides excellent opportunities for streetscape activation during the day, and opportunities for additional subtle lighting to the pedestrian realm at night and is considered an excellent response.

Overall the proposal is considered suitable and consistent in the context of the surrounding high density development within the Belmont area surrounding the development site.

2. SITE DETAILS

2.1 Location and Context

The subject site is located in the town of Belmont in the Local Government Area of Lake Macquarie (refer to **Figure 1** below) approximately two hours' drive north of Sydney, and 17 kilometres from Newcastle CBD. The site comprises of fifteen lots in the Belmont Town Centre, bounded by Brooks Parade, Sharp Street and Edgar Street (see **Figure 2**).

The legal identification for each lot are shown below in **Table 2** below. The total site area is 7,083m².

Table 2 – Subject site lot details.

Lot	Section	DP
11	B	585
A	-	400644
B	-	400644
2	-	353066
1	-	353066
4	-	12898
5	-	12898
6	-	12898
8	-	12898
B	-	339105
A	-	339105
4	B	585
3	B	585
10	-	585 (Part of)
7	-	12898

The site is located in a prominent location on the Belmont foreshore. The site frontage to Brooks Parade is approximately 80 metres. The site has frontage to two other roads, Edgar Street the north-east and Sharp Street to the south-east.

Current uses on the site are predominantly for residential purposes being single storey dwellings and a two storey dwelling. Three premises along Brooks Parade are small scale commercial uses.



Figure1: Locality Map (Google Maps, 2015)



Figure 2: Subject Site (SixMaps, 2015)

2.2 Site Conditions

Topography and Drainage

There is a slight fall from Edgar Street toward Brookes Parade across the site. The site is slightly lower in topography than the Pacific Highway to the east. Stormwater from the existing dwellings drains directly to the street.

An open stormwater channel runs through the northern section of the site, across several lots, which connects the stormwater network in Edgar Street to the outfall into Lake Macquarie.

The land form of Belmont Town Centre and the surrounding area is a consistent grade, approximately 1°, rising from Lake Macquarie in the west, and reaching 16 metres in elevation at the eastern-most edge of development in the town centre.

Aboriginal Archaeology and European Heritage

An AHIMS search was undertaken and indicates that no items of Aboriginal heritage are located on the site and limited items within 200m of the subject site.

Additionally, a desktop search of the NSW State Heritage Inventory and Council's Heritage Register also indicated that no items of significance are located within the subject site.

An Aboriginal Heritage Due Diligence Assessment has been undertaken by McCardle Cultural Heritage Pty Ltd, refer ***Appendix Q***.

Bushfire

The subject site is not located within bushfire prone land, as per the Lake Macquarie Bushfire Prone Land Map.

Flooding

The site is identified as flood prone land, in accordance with Lake Macquarie Local Environmental Plan (LEP) 2014 flood mapping. The subject site has a current ground level ranging from 1.2 metres AHD – to RL 1.4 metres AHD across the site.

A stormwater channel also runs through the site and to the north of the site. The channel services the stormwater water network further north from Mark Street and connects to Lake Macquarie at the north-west corner of the site and Belmont foreshore park.

Road and Public Transport Network

Access to the site is available from Brooks Parade, Sharp Street and Edgar Street.

The subject site is within 400 metres of several major bus stop routes bus stops (see Figure 3 below).

Public transport is provided by government and private bus companies. Newcastle Buses provides several routes to various local centres, town centres, north to Newcastle City Centre and south to Swansea, and weekday services to Morisset Rail Station. Private bus companies also service Belmont town centre.



Figure 3 - Major transport routes and bus stops

Pedestrian Network

The pedestrian network in Belmont Town Centre is complete on one side of most streets. Brooks Parade and Edgar Street contain pedestrian access along both sides of the road, while Sharp Street contains pedestrian access along one side. The footpaths are standard in width, with the exception of the area along the Pacific Highway and the foreshore, which are wider.

Utility Services

Reticulated water and service, electricity, and telecommunications are available to the subject site.

Community Facilities and Services

Belmont town centre has a variety of community facilities that are located in close proximity and easy to access. Medical services are available in the town including several general practitioners including dentists, while Belmont Public Hospital is located within 1.3 kilometres of the subject site. Other personal services available within the area include pharmacies, hairdressers and beauty salons.

Belmont has retained various civic services. The local Court House operates daily and is supported by Belmont Police Station and Ambulance Station located Herbert Street approximately 200m from the subject site.

Education facilities in Belmont include two primary schools, a high school and the Hunter Institute of Technology Belmont Campus.

A variety of community facilities operate in Belmont, such as neighbourhood centre, Public Library, various sporting fields and courts, as well as commercial clubs including Belmont 16ft Sailing Club and Belmont Yacht Club.

Two shopping centres are located within close proximity to each other: Belmont Citi Centre and Belmont Central Shopping Centre. Major supermarkets such as Coles, Woolworths and Aldi are present in Belmont. Several major banks are represented, as well as local building societies, such as the Newcastle Permanent Building Society and the Greater Building Society.

Newsagencies, butchers, bakeries, the post office and various specialty shops are also located in the major shopping centres and the connecting streets, such as Macquarie Street and the Pacific Highway. Major food outlets, such as McDonalds and Subway, and cafes are scattered around the town centre to cater for weekday and weekend trade.

Overall, the social and civic facilities at Belmont are reflective of its status as a major sub-regional centre in Lake Macquarie.

Surrounding Development

The subject site is adjoined in each major direction by different forms of development within 300 metres. The key built forms for new development are tower blocks and rectangle blocks. Each urban block and built form use is discussed in detail below;

North

The urban block that accommodates the subject site, also accommodates:

- Rectangle-block, five storey mixed use development at the intersection of Brooks Parade and Maude Street (24-26 Brooks Parade), known as Santorini Apartments, and;
- Single storey residential development;
- An open stormwater channel that provides connection for the stormwater network to Lake Macquarie;
- A sewer pump station that is part of Hunter Water Corporation's infrastructure, which is immediately north of the channel and faces Brooks Parade.

Urban blocks beyond Maude Street are mostly characterised by detached single storey residential dwellings, and a limited number of two-storey unit blocks.

South

Sharp Street adjoins the site at the south. The urban block immediately south is characterised mostly by recent mixed use development, including:

- 46 Brooks Parade, tower block, eight storeys, directly opposite the subject site at the intersection of Brooks Parade and Sharp Street. Belmont Towers is a residential apartment building with large setbacks to the street and ground floor single garages that face the street;

- 13-17 Edgar Street, rectangle block, six storeys, at the intersection of Edgar Street and Sharp Street is a mixed use development, with ground floor commercial space and upper floors for residential use. The development was completed in 2010;
- 54-56 Brooks Parade, tower block, six storeys, is a mixed use development with ground floor cafe and single driveway access from Brooks Parade, and was completed in 2007;
- 58 Brooks Parade, tower block seven storeys, is currently under construction and will comprise mixed use development for a residential flat building.

East

Herbert Street runs perpendicular from the site to the Pacific Highway and creates two distinct urban blocks. The block on the north side of Herbert Street is predominantly detached single storey dwellings. The block on the south side of Herbert Street is mostly retail and commercial uses. The dominant development is Belmont Citi Centre shopping centre and open-air car park. The loading dock entrance at Herbert Street faces the subject site. Shop top development along the Pacific Highway edge of the urban block is further to the east.

West

Directly across the street is Belmont Lions Park, an open space area that separates the road (Brookes Parade) from the foreshore of Lake Macquarie. A pedestrian footpath runs through the park that connects to a small children's playground some 200 metres to the south, and public facilities at the end of Maude Street. The only built form on this site is a toilet block. Built forms exceeding one storey on this site are unlikely to be erected in the future. Several mature fig trees are located along the street edge of the park.

3. PROPOSED DEVELOPMENT

3.1 Summary

The proposed development involves the demolition of the existing structures and the construction of a part 6 and part 8 storey mixed use development. The development comprises a 140 units residential flat building and four (4) retail/commercial areas, one (1) communal multi-purpose area, landscaping, communal open space and basement car parking.

Summary of Proposed Development	
Number of units and unit mix (Residential)	23, one-bedroom + study units 11, two-bedroom units 67, two-bedroom + study units 13, three-bedroom units 26, three-bedroom + study units
Number of units and size (Retail/Commercial)	1, Building A, 301.30m² 1, Building B, 234.41m² 2, Building D, 84.66m² and 79.51m² *Total size 699.88m²*
Communal multi-purpose area	1, 47.74m²
Parking	Residential Parking – 121 Visitor Parking/Commercial – 44 spaces Motorbike Parking – 4 spaces Bicycle Parking – 52 spaces Total car parks provided – 165 including 17 accessible parks
Landscaping	1,333m²

Refer to ***Appendix A*** for detailed plans of the proposed development.

3.2 Demolition works / earthworks

The subject site currently contains numerous buildings and associated structures. It is proposed that all structures on site be demolished to facilitate the construction of the proposed development.

Where possible, materials will be salvaged for recycling and reuse. The remaining waste will be transported to a recognised waste facility.

As the subject site is currently developed, the site does not contain extensive vegetation and is primarily managed lands and gardens. It is proposed that all vegetation within the site also be removed to facilitate the proposed development.

All cut associated with the proposal will be undertaken in accordance with the relevant standards. Specific details will be provided at the Construction Certificate stage of the development.

3.3 Development Design

It is proposed that the site be developed as an infill development, located between the Belmont Citi shopping centre, 6 storey Santorini Apartment, 6 Storey Belmont Central Apartments and 8 storey Belmont Towers Apartments.

In developing the scheme, the applicant has considered adjoining approved buildings in terms of setbacks, building separation, privacy and overshadowing along with these elements internally to the site. Whilst an increase in height is proposed, the proposal generates an exemplary urban response to the site that responds to the high quality of the surrounding area and adjoining development. The proposal provides a better more active streetscape presentation that is of a scale, and amenity commensurate with the surrounding environment.

The building is designed in a northerly, southerly and westerly orientation with all apartments provided with expansive balconies. The development contains four (4) towers, three are six storey buildings, with the fourth tower an eight (8) storey building, located on the southern part of the site adjacent to the corner of Brooks Parade and Sharp Street. All four towers contain the fourth storey and above being setback.

Pedestrian entry into the development is provided from Edgar Street, Sharp Street and Brooks Parade, via the existing footpath. The residential entry and lobby of each tower is accessed via the new pedestrian central courtyard through the centre of the site. The lobbies are all accessible from the basement. The lobbies are clearly marked and with the use of landscaping and articulation provides a sense of entry and arrival. A pedestrian

pathway is provided along the northern boundary of the site connecting Edgar Street and Brooks Parade.

The proposal is designed with a face-brick finish in a Boral 'Nuvo Dimino' with aluminium privacy screens and aluminium louvres. Zinc wall cladding, render wall cladding in 'linseed', 'white duck', 'fair Bianca', 'eclectic' and 'mystical'. A use of glazing windows and balustrades and 'alucobond' screening provide variation and visually sympathetic design for the environment and surrounding amenity. The buildings respond to the rhythm of development in the area, with the proposed materials low-maintenance and durable, and suitably articulated to provide visual relief and interest.

The buildings have generous setbacks and allow for appropriate building separation providing solar access to the proposed apartments and minimise overshadowing as far as practical. The setbacks also provide opportunities for landscaped areas that include deep soil around the perimeter area that will provide a connection to the public realm and increase streetscape amenity.

Each apartment is designed with an open plan layout and includes a balcony off living areas. Additionally, each apartment has access to the common open space at the ground floor deep soil zone and buildings A and D to a smaller first floor communal recreation area.

The ground floor landscaped area includes paving and seating and given its orientation the landscaped area will form an accessible area, as opposed to an enclosed private open space. This way, the landscape areas performs as both a communal area for all residents as well as being accessible to all members of the public. Given the high density area, the provision of an open passive recreation area is an excellent sustainable outcome.

The level of solar access and ventilation resulting from the development, is considered acceptable. The development will improve the streetscape of Edgar Street, Sharp Street and Brooks Parade and aligns with the desired future character for the Belmont Town Centre. The proposal will provide additional housing and a mix of apartment housing supporting the population of Belmont and wider LGA. As the LGA continues to grow the proposal will assist in reducing the pressure on housing prices supporting changes in demographic makeup, housing production and future housing needs. The proposal will provide increased housing production and will accelerate housing supply. The subject site is

well supported by infrastructure including transport, utilities and social infrastructure such as schools, child care centres, health facilities, open space and recreation, retail services and employment opportunities.

The proposal is a suitable response to the planning controls under the LEP and DCP, and results in compliance with SEPP 65 and the Apartment Design Guide, by providing apartments that exhibit sustainable levels of amenity for future residents.

In addition to compliance with the SEPP 65 and Apartment Design Guide the proposed development consists of Gold Level residential apartments that are suitable for specialist disability accommodation (SDA). The Gold Level of the Apartment Design Guide provides more generous dimensions for most of the core liveable housing design elements in areas such as the kitchen and bathroom. These enhanced features enable the residential apartments to be suitable for SDA and will help provide much needed specialist accommodation for the community.

An elevator provides access to each floor of all four towers and fire stairs provide fire egress. The basement has a logical layout, incorporating resident parking, visitor parking, motorcycle and bicycle parking, storage, refuse rooms and services areas.

In summary, the proposed development will result in an enhanced planning outcome for the site and results in a development that is consistent with the desired future character for the locality.

The application results in the following calculations:

- Site Area: 7,083m^2
- Number of residential apartments: 140
- Area/size of apartments: 51m² to 114m²
- Number of retail/commercial tenancies: Four (4)
- Area/size of retail/commercial tenancies: 79.51m², 84.66m², 234.41m², and 301.30m² Totalling 699.88m^2
- Communal multi-purpose area: One (1) 47.74m^2
- Storeys: Part 6 (three towers) and part 8 storeys (one tower)
- Perimeter Deep soil area: 914m2 or 13.4%
- Solar access (living): 100/140 apartments or 71%

- Solar access (balcony): 101/140 apartments or 72%
- Cross ventilation: 97/140 apartments or 69%
- Adaptable apartments: 26 apartments or 19%
- Liveable Housing: 53/140 apartments or 38%
- Car parking: 165 car parking spaces
- Motorcycle parking: 4 parking spaces
- Bicycle parking: 52 spaces

3.4 Access and parking

The proposed Mixed Use proposal will be serviced via a convenient and safe access point located on Edgar Street to the basement. A secondary access for refuse and delivery vehicles is located via Sharp Street.

3.5 Landscaping

The landscaping plan, prepared by Forum Landscape Design, was specifically designed to provide a high standard of living throughout the development with treatment and plant selection taken predominantly from Lake Macquarie City Council Coastal Planting Guide, refer ***Appendix E***.

3.6 Stormwater and drainage

A stormwater management plan will be prepared due to the highly urbanised environment. A Water Cycle Management Plan can be undertaken to mitigate the effects of any stormwater on adjoining or downstream sites in accordance with Council's Water Cycle Management Guidelines. Conditions can be imposed to ensure that any water cycle management, shall comply with relevant standards.

A Limited Flood Study Investigation Prepared by Forum Consulting Engineers has been undertaken. The investigation concluded that the adoption of the Lake Macquarie Flood Study be adopted. The design takes into consideration the flood study recommendations so as to mitigate risks to life and/or property through design and positioning of the development.

Habitable rooms and commercial development have a finished floor height at least 500mm above the 100 year ARI (1% AEP) event. Buildings and other structures, including fences, are not considered to impede the flow of floodwaters or entrap debris as a 1% AEP event can be conveyed within the existing concrete lined drain, refer ***Appendix M***.

The development is located on designated flood prone land however evacuation and other emergency procedures are readily available. Further risk management measures are not considered necessary. The development will use flood compatible materials in its construction that will minimise potential damage by flooding. The development is considered unlikely to create any adverse impacts.

3.7 Servicing

The subject site currently has access to electricity, reticulated water and sewer, stormwater and telecommunications. Service connection and any capacity augmentation will be determined through application to the relevant service providers (Hunter Water, Ausgrid, Jemena, Telstra, NBN etc).

4. STATUTORY CONSIDERATIONS

This section deals with the proposal's consistency with the various statutory and non-statutory provisions. It also addresses the relevant matters for consideration under Section 4.15(1) of the *Environmental Planning and Assessment Act 1979* (as amended).

4.1 Commonwealth Legislation

Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth Environmental Protection and Biodiversity Conservation Act (EPBC) 1999, in conjunction with the Commonwealth Environmental Protection and Biodiversity Conservation Regulations 2000, provide the basis for national environmental protection and conservation. The EPBC Act specifically aims to:

- *Provide for the protection of the environment, especially matters of national environmental significance; and*
- *Conserve Australian biodiversity*
- *Provide a streamlined national environmental assessment and approvals process*
- *Enhance the protection and management of important natural and cultural places*
- *Control the international movement of plants and animals (wildlife), wildlife specimens and products made or derived from wildlife*
- *Promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources*
- *Recognise the role of Indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity*
- *Promote the use of Indigenous peoples' knowledge of biodiversity with the involvement of, and in cooperation with, the owners of the knowledge.*

The EPBC requires Commonwealth approval for development which significantly impacts upon matters relating to National environmental significance. The nine matters of national environmental significance protected under the EPBC Act include:

- *World heritage properties*
- *National heritage places*
- *Wetlands of international importance*
- *Listed threatened species and ecological communities*
- *Migratory species*
- *Commonwealth marine areas*

- *The Great Barrier Reef Marine Park*
- *Nuclear actions (including uranium mines)*
- *A water resources, in relation to coal seam gas development and large coal mining development*

It should be noted that the subject site is not situated on or near an area of environmental significance, and does not contain any of the aforementioned national environmental significance items.

4.2 Regional and Local Planning Considerations

Lower Hunter Regional Strategy

The Lower Hunter Regional Strategy (LHRS) was prepared by the NSW Department of Planning (DoP) in 2006 and applies to the subject site. The LHRS aims to plan for an additional 160,000 residents and 115,000 new residential dwellings between 2006 and 2035. Over this time frame, employment lands will be required for the forecast 16,500 additional jobs to the Hunter within existing, as well as newly, identified employment lands. The objectives and aims identified in the Strategy include:

1. Providing capacity with employment zones;
2. Maximising the use of existing and future infrastructure;
3. Providing for new dwellings in established areas;
4. Protecting and conserving environmental assets.

The subject site is located in Belmont. Belmont is identified as a commercial centre servicing the Lower Hunter. Towns such as Belmont are characterised by shopping and business activities, such as health and professional service for the district, as well as supplying medium and higher density development. Belmont is also central to other employment lands within one kilometre of the town centre and to industrial lands five kilometres away at Redhead.

The subject site can deliver higher levels of housing within a major centre, close to employment lands, making efficient use of existing infrastructure and providing good amenity. To support the implementation of this Strategy, Council has prepared and adopted the Lake Macquarie Town Centre Area Plans DCP 2014, which includes expected development in Belmont.

The proposed development will provide 140 dwellings, comprising 23 one (1) bedroom plus study units, 11 two (2) bedroom units, 67 two (2) bedroom plus study units, 13 three (3) bedroom units and 26 three (3) bedroom plus study units. Four (4) retail/commercial spaces, one (1) communal multi-purpose area and overall 158 car parking spaces.

The proposed development will also improve amenity for current and future residents within the local area, through the provision of new retail and commercial space, as well as energy efficient dwellings, assessed against the provisions of SEPP 65 Design Quality of Residential Flat Development and various local development controls.

Development of the site is considered consistent with the objectives of the Lower Hunter Regional Strategy and will make a positive contribution to realise the strategy through the provision of higher density development in a major sub-regional centre.

Hunter Regional Plan

The Hunter Regional Plan (HRP) was released in 2016 by the NSW Department of Planning and Environment. The Plan is the strategic plan and vision document for guiding growth in the Hunter to 2036. At its centrepiece is the strategic direction for the Greater Newcastle area, which includes Lake Macquarie. The Greater Newcastle area is anticipated to accommodate and extra 600,000 people to 2036. With that comes an anticipated 62,000 increase in job numbers.

The Plan identifies that the aims for Greater Newcastle include:

- Connect strategic centres in Greater Newcastle;
- Develop a national Centre of Excellence for Health and Education;
- Expand the capacity of Global Gateways – Newcastle port and airport; and
- Establish governance.

These aims are very broad. Nonetheless, the Belmont to Charlestown corridor is identified as an urban renewal corridor, with Belmont identified as a significant local centre. The proposed development will continue to emphasise Belmont as a town centre and address the urban renewal potential of Belmont.

Greater Newcastle Metropolitan Plan – Draft

The draft Greater Metropolitan Plan (GNMP) sets out strategies and actions that will drive sustainable growth across Cessnock City, **Lake Macquarie City**, Maitland City, Newcastle City and Port Stephens communities.

The GNMP delivers a collaborative framework for a significant part of the Regional Plan by setting out the outcomes and strategies to be an integrated metropolitan city.

The draft Plan also identifies catalyst areas which are places of metropolitan significance where a planned approach will drive the transformation of Greater Newcastle as a metropolitan city. These catalyst areas are located in the strategic centres of Broadmeadow, Callaghan, East Maitland, John Hunter Hospital, Kotara, Newcastle City Centre, the global gateways of Newcastle Airport at Williamtown and Newcastle Port, as well as the major trading hubs at Beresfield-Black Hill and Tomago. These locations will underpin new job opportunities in specialised employment areas for health, defence, education and research, as well as new mixed employment areas, with a focus on integrating land use and infrastructure, open space and urban design.

The proposed development of the site is considered consistent with the objectives of the draft GNMP and will make a positive contribution to realise the strategy through the provision of higher density mixed use development in the locality of Belmont.

Lake Macquarie City - Life Style 2030 Strategy

Lifestyle 2030 Strategy is the eminent Strategic plan prepared by Lake Macquarie City Council to inform the development of the LGA. The current strategy was adopted by Council in March 2013.

The LGA area surrounds the shores of Lake Macquarie, extending north to the border with Newcastle Local Government area, south to Wyong Shire Council, east the Pacific Ocean, and west to the Watagan State forest before adjoining Cessnock LGA. The extent of Lake Macquarie LGA and its urban structure are illustrated in **Figure 4** below.

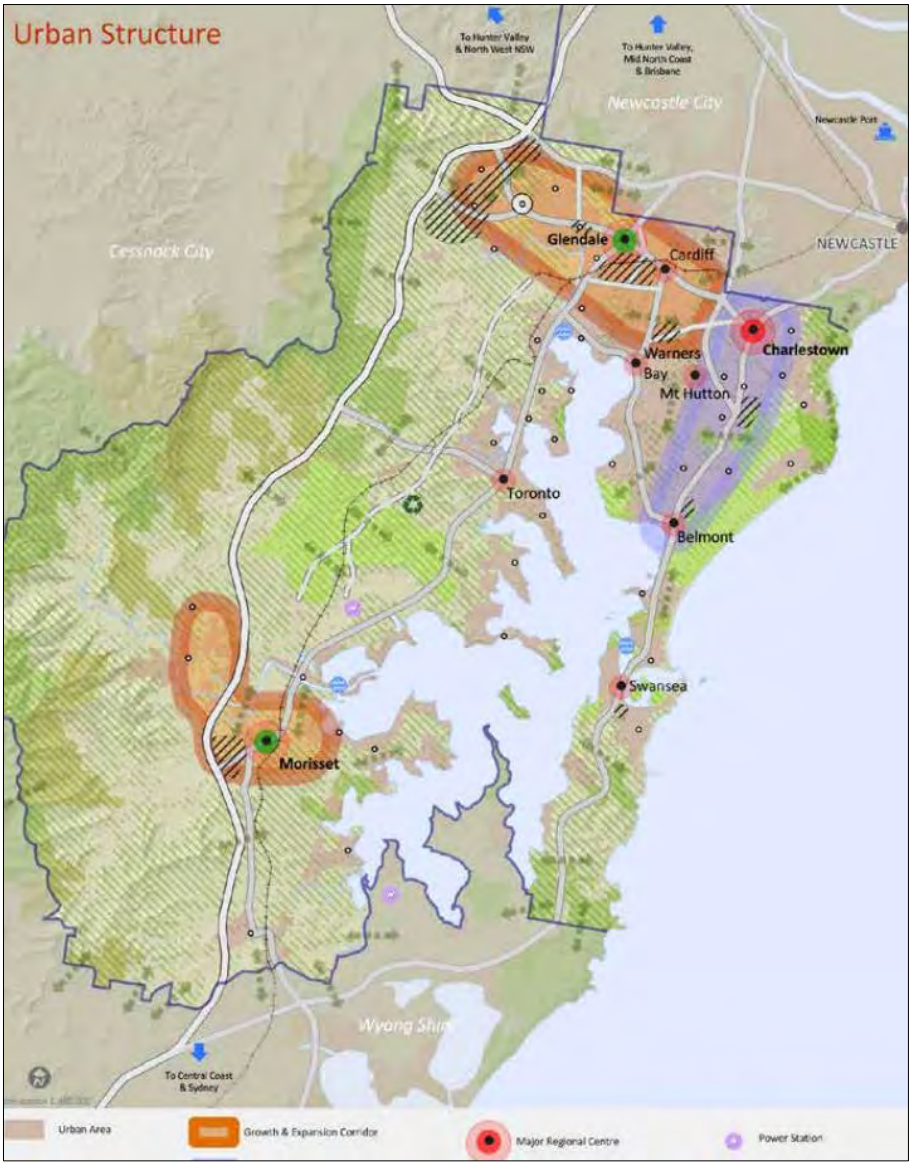


Figure 4 - Urban Structure (Lifestyle 2030)

Belmont Town Centre

Belmont is identified in the Strategy as a Town Centre within the 'East Lake Intensification Corridor'. The strategy expects urban zoned land in the corridor to be developed for multi-unit housing close to centres and well serviced by public transport routes, as well as employment, community services and facilities. The intensification for housing assists to maintain the supply of industrial land for manufacturing activities in the corridor, such as Redhead and Bennetts Green, which plays an important role in the local and regional economy. Intensification limits the growth of the urban footprint, protecting ecological lands along the along the east and west sides of the corridor from Belmont to Charlestown.

Strategic Directions

Lifestyle 2030 has seven strategic directions, each illustrated by numerous statements of the desired outcomes. The key desired outcomes for each strategic direction are supported by the potential development of the site and presented in Table 3 below.

Table 3 - Lifestyle 2030 Strategic Directions Development Response

	City Strategic Direction	**Development response**
1.	A city responsive to the environment	The development is located within the existing urban footprint of Belmont. Habitable areas within the site will be elevated to protect against the effects of flooding and/or sea-level rise. The scenic quality of the area is preserved by high quality urban design and maintaining view corridors to the lake from the Belmont town centre.
2.	A city that make an equitable contribution to global sustainability	Though the construction of the new dwellings will require some materials with higher levels of embodied energy, the development will provide long term water and energy efficiency measures in accordance with BASIX requirements, as well as reduced dependence on fossil fuels for transportation by locating development closer to complimentary activities and high frequency public transport routes (e.g. Pacific Highway).
3.	A well designed adaptable and liveable city	Stronger function and urban design relationships between the Lake and Belmont town centre is facilitated by the proposed development. A break between the unit blocks provides a view and pedestrian corridor through the development site to the Lake. Building setbacks above the forth storey can be incorporated into the development to reduce scale and mass of development and allow wind and solar access to the street and surrounding development. Site frontage facing the Lake will be landscaped with gardens including active frontages that provide pedestrian access through the development, as well as around the perimeter of the development site.

		Finally, the potential development will offer different bedroom/study combinations for the dwellings for different household sizes.
4.	A well serviced and equitable city	Belmont is identified by Council as suitable for further urban infill development and adopted a Town Centre Development Control Plan. The proposed development is consistent with the controls. Car parking is provided within the development site; however two public transport route are accessible, both pass the site (Brooks Parade) with stops within 400 metres (50 metres) of the site in both directions. These services provide connections to other town centres in Lake Macquarie, such as Warners Bay and Charlestown, and onwards to Newcastle. A slightly further option (250 metres) are a further six (6) routes accessible from the Pacific Highway. Pedestrian and cycle networks are available along the Lake Macquarie foreshore in front of the proposed development on Brooks Street, which connect to Belmont 16ft Sailing Club and further to local parks, such as Green Point Reserve.
6.	A city responsive to the wellbeing of its residents	The proposed development will provide a range of dwelling configurations and sizes to respond to the demographic changes occurring in the city. Different bedroom/study combinations for the dwellings for different household sizes will be offered. The proposed development will provide quality housing along the popular foreshore and enhance the streetscape and improve the wellbeing for pedestrians through landscaping and diverse retail opportunities. Commercial/retail services will also be available within the development. The subject site is also located centrally to shopping centres,

		health services and various community centres that are vital for community wellbeing.
7.	A city that practices participatory democracy and is well governed	State and local government strategic planning policies (e.g. climate change considerations) have been incorporated into the development. The ground floor level is elevated to mitigate the impacts associated with climate change that may affect the foreshore of Lake Macquarie. Council is responsive to the need for higher residential development and to create and apply appropriate development controls.

Overall, the proposed development is consistent with the objectives of the Lake Macquarie Lifestyle 2030 Strategy.

4.3 State Legislation

Environmental Planning and Assessment Act 1979

The following demonstrates the proposal's compliance with the relevant heads of consideration in Section 4.15 (1) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) as amended, in particular:

- *Environmental planning instruments that are in force, proposed or exhibited (Section 4.15(1)(a))*
- *Development control plans (Section 4.15(1)(a))*
- *Likely impacts to natural and built environments, society and economy (Section 4.15(1)(b))*
- *Suitability of the site for the proposed development (Section 79(1)(c))*
- *Submissions (Section 4.15(1)(d))*
- *Public interest (Section 4.15(1)(e))*

Under Section 4.46 of the *Environmental Planning and Assessment Act 1979 (EP&A Act*), a development application lodged on this site would be considered Integrated Development and would require concurrence from Office of Water.

Other Acts

Consideration was afforded to other legislation, including legislation concerning whether the proposal is integrated development. Integrated development is development that, in order for it to be carried out, requires development consent and one or more of the following approvals:

- *Fisheries Management Act 1994*
- *Heritage Act 1977*
- *Coal Mine Subsidence Compensation Act 2017*
- *National Parks and Wildlife 1974*
- *Petroleum Act 1991*
- *Protection of the Environment Operations Act 1997*
- *Roads Act 1993*
- *Rural Fires Act 1997*
- *Water Management Act 2000*

Fisheries Management Act 1994

No authorisation required.

Heritage Act 1977

No authorisation required. No State heritage items were identified on the site, or impacted by the proposed development.

Coal Mine Subsidence Compensation Act 2017

The site is not identified in a Mine Subsidence District Map as within a mine subsidence area, and therefore does not need concurrence from the Mine Subsidence Board.

National Parks and Wildlife Act 1974

No authorisation required.

Protection of the Environment Operations Act 1997

An Environment Protection Licence (EPL) is not required for the development.

Roads Act 1993

The *Roads Act 1993* details objectives for classified roads. As the proposed development does not involve the disruption or development of a classified road, no authorisation is required.

Rural Fires Act 1997

The subject site is not identified as being with bushfire prone land, and therefore does not require concurrence from the RFS.

Water Management Act 2000

The Water Management Act 2000 aims to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations.

Under the Water Management Act, Activity Approvals are required for certain development. In this instance, a controlled activity approval is required as the proposed development is located on waterfront land.

Under the Water Management Act 2000 (WM Act), waterfront land means:

> *(a) the bed of any river, together with any land lying between the bed of the river and a line drawn parallel to, and the prescribed distance inland of, the highest bank of the river, or*
>
> *(a1) the bed of any lake, together with any land lying between the bed of the lake and a line drawn parallel to, and the prescribed distance inland of, the shore of the lake, or*
>
> *(a2) the bed of any estuary, together with any land lying between the bed of the estuary and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the estuary, or*
>
> *(b) if the regulations so provide, the bed of the coastal waters of the State, and any land lying between the shoreline of the coastal waters and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the coastal waters,*

where the prescribed distance is 40 metres or (if the regulations prescribe a lesser distance, either generally or in relation to a particular location or class of locations) that lesser distance. Land that falls into 2 or more of the categories referred to in paragraphs (a), (a1) and (a2) may be waterfront land by virtue of any of the paragraphs relevant to that land.

Where a development requires a controlled activity approval, water use approval or a water management work approval under the *Water Management Act 2000* (*WM Act*), the Development Application must be referred to the NSW Office of Water.

4.4 State Environmental Planning policies

A review was conducted of the State Environmental Planning Policies (SEPP) which may apply to the development: -

- *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development*
- *State Environmental Planning Policy No. 55 – Remediation of Land*
- *State Environmental Planning Policy No. 71 – Coastal Protection*
- *State Environmental Planning Policy (Affordable Rental Housing) 2009*
- *State Environmental Planning Policy No. 65 – Design Quality of Residential Flat Development; and*
- *State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004.*

State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004

The State Environmental Planning Policy was enacted to ensure dwellings are designed to use less potable water and minimise greenhouse gas emissions by setting energy and water reduction targets for residential houses and units.

The aims of the SEPP include:

1) *Regulations under the Act have established a scheme to encourage sustainable residential development (**the BASIX Scheme**) under which:*

   An application for a development consent, complying development certificate or construction certificate in relation to certain kinds of residential development, must be accompanied by a list of commitments by the applicant as to the manner in which the development will be carried out.

The carrying out of residential development pursuant to the resulting development consent, complying development certificate or construction certificate, will be subject to a condition requiring such commitments to be fulfilled.

BASIX is an online program that is accessible to anyone. The designer enters data relating to the house or unit design such as location, size, building materials etc. into the BASIX tool. BASIX analyses this data and determines how it scores against the Energy and Water targets.

The design of the residential units must pass specific targets (which vary according to location and building type) before the user can print the BASIX Certificate. A BASIX assessment has been undertaken as part of the proposed development, by Building Sustainability Assessments, the assessment is located at ***Appendix G***.

SEPP 33 – Hazardous and Offensive Development

The aim of *SEPP 33 – Hazardous and Offensive Development* is to ensure the protection of the community and environment from hazardous and offensive industries. Under Clause 12 of the *SEPP* a development for the purposes of a potentially hazardous industry must be accompanied by a preliminary hazard analysis, in accordance with the current circulars or guidelines published by the Department of Planning. The relevant guideline in this instance is *Applying SEPP 33* (DOPI 2011).

The proposed development is not considered to be a 'potentially hazardous or offensive industry' under the definition of SEPP 33, as such no further assessment is therefore considered necessary.

State Environmental Planning Policy No 55 – Remediation of Land

The objective of the Policy is to provide for a uniform planning approach to the remediation of contaminated land in NSW.

Clause 7(1) of the Policy requires the consent authority to consider whether:

1. *The land is contaminated, and*
2. *If the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and*

3. *If the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.*

The subject site is entirely within a residential area albeit zoned B4. No notices have been issued for the site under the *Contaminated Land Management Act 1997*, nor have any licences been issued under the POEO Act for the site. As the subject site and the surrounding have been used for residential activities for more than 50 years, with some buildings facing Brooks Parade have been adapted for mall scale retails uses. The land provides no indication further investigations are considered necessary.

State Environmental Planning Policy – Coastal Management 2018

State Environmental Planning Policy (Coastal Management) 2018 updates and consolidates into one integrated policy SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection), including clause 5.5 of the Standard Instrument – Principal Local Environmental Plan. These policies are now repealed.

The Coastal Management SEPP gives effect to the objectives of the Coastal Management Act 2016 from a land use planning perspective, by specifying how development proposals are to be assessed if they fall within the coastal zone.

An integrated and coordinated approach to land use planning is promoted by the new SEPP. It defines the four coastal management areas in the Act through detailed mapping and specifies assessment criteria that are tailored for each coastal management area. Councils and other consent authorities must apply these criteria when assessing proposals for development that fall within one or more of the mapped areas.

The subject site is mapped in an area known as a 'Coastal Environment Area' and land within the 'Coastal Use Area'.

The Coastal Environment Area includes land and waterbodies identified as being ecologically sensitive to impacts from coastal development activity.

The Coastal Use Area will include lands to which controls concerning urban design, location and scale will apply.

The aim of this Policy is to promote an integrated and coordinated approach to land use planning in the coastal zone in a manner consistent with the objects of the *Coastal Management Act 2016*, including the management objectives for each coastal management area, by:

(a) managing development in the coastal zone and protecting the environmental assets of the coast, and

(b) establishing a framework for land use planning to guide decision-making in the coastal zone, and

(c) mapping the 4 coastal management areas that comprise the NSW coastal zone for the purpose of the definitions in the Coastal Management Act 2016.

Under this SEPP, Clause 13 and 14 matters for consideration apply. Refer to the table(s) below **(Table 4 & Table 5).**

Table 4: SEPP – (Coastal Management) 2018 – Coastal Environment Area matters considered with respect to the proposed development

SEPP – (Coastal Management) 2018 Clause 13 Coastal Environment Area – Matters for consideration	**Response**
(1) Development consent must not be granted to development on land that is within the coastal environment area unless the consent authority has considered whether the proposed development is likely to cause an adverse impact on the following:	
(a) the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment	The development will have little impact on these matters. As the proposal will be built on an existing built area, it is considered that the nature of the development will not significantly alter the attributes of the coastal environment

SEPP – (Coastal Management) 2018 Clause 13 Coastal Environment Area – Matters for consideration	Response
	area zone.
(b) coastal environmental values and natural coastal processes	The proposed development will not impact on the coastal environmental values or natural processes. The coastal environment will not be significantly impacted as the development contains generous setbacks, four clearly distinguishable towers. The proposed development minimises impacts from shading and loss of amenity. The proposal will provide and enhanced streetscape pedestrian connection and overall provides a positive outcome.
(c) the water quality of the marine estate (within the meaning of the *Marine Estate Management Act 2014*), in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1,	The proposed development is not located within proximity or locality of the identified sensitive coastal lakes as listed in Schedule 1 of the SEPP – (Coastal Management) 2018.
(d) marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms,	A search of the Office of Environment and Heritage Bio Net Atlas was conducted in June 2018. The search result noted no threatened species or ecological communities on the subject site. The site is clear of any significant vegetation and as a result will not impact or provide adequate habitation for the wildlife of the surrounding area.

SEPP – (Coastal Management) 2018 Clause 13 Coastal Environment Area – Matters for consideration	Response
	It is unlikely that the proposed development will have a detrimental impact on animals and plants or their habitats. The site is not considered to be a corridor, and as such conservation measures have not been proposed as part of this application nor are they considered necessary. The site does not contain any aquatic species The development will not impact on any known rock platforms or underdeveloped headlands.
(e) existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,	Not applicable. The proposed development will not affect or alter public access to and along the foreshore area.
(f) Aboriginal cultural heritage, practices and places,	No items of aboriginal significance were noted in the AHIMS database for the subject site. Despite this, as the land is already developed, it is not likely that the site contains relics. Refer to **Appendix Q** for further details.
(g) the use of the surf zone,	Not applicable. The development/ site is not located within proximity to a surf zone.
(2) Development consent must not be granted to development on land to which this clause applies unless the consent	

SEPP – (Coastal Management) 2018 Clause 13 Coastal Environment Area – Matters for consideration	Response
authority is satisfied that:	
(a) the development is designed, sited and will be managed to avoid an adverse impact referred to in subclause (1), or	The proposed development will not impact on the coastal environment area and has shown to be consistent with the matters for consideration referred to in subclause (1).
(b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or	No impacts have been determined from the proposed development and have shown to be consistent with the matters for consideration referred to in subclause (1).
(c) if that impact cannot be minimised—the development will be managed to mitigate that impact.	No impacts have been determined from the proposed development and have shown to be consistent with the matters for consideration referred to in subclause (1).

Table 5: SEPP – (Coastal Management) 2018 – Coastal Use Area matters considered with respect to the proposed development

SEPP – (Coastal Management) 2018 Clause 14 Coastal Use Area – Matters for consideration	Response
(1) Development consent must not be granted to development on land that is within the coastal use area unless the consent authority:	
(a) has considered whether the proposed development is likely to cause an adverse impact on the following:	

SEPP – (Coastal Management) 2018 Clause 14 Coastal Use Area – Matters for consideration	Response
(i) existing, safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,	The site is not located along a beach, headland or rock platform. The site however is located within the foreshore area. Despite this, the proposed development will not affect or alter public access to and along the foreshore area.
(ii) overshadowing, wind funnelling and the loss of views from public places to foreshores,	The proposed development will not adversely alter the original design nor dramatically increase the impact of overshadowing, wind funnelling and the loss of views from public places to the foreshore. Adjoining uses area predominately residential apartments with the rear adjoining Belmont City Shopping Centre. The development contains generous setbacks and four clearly distinguishable towers. The proposed development minimises impacts from shading and loss of amenity. The proposal will provide and enhanced streetscape pedestrian connection and overall provides a positive outcome.
(iii) the visual amenity and scenic qualities of the coast, including coastal headlands,	The proposed development has been designed to ensure compatibility and continued compliance with the relevant controls and development standards. Each built form is considered to be of a

SEPP – (Coastal Management) 2018 Clause 14 Coastal Use Area – Matters for consideration	Response
	scale and design suitable for the land form and the emerging urban pattern of the surrounding area. Consideration was afforded to previous options and discussions with Council and other potential issues. The proposed development is consistent with the character of the streetscape and positively contributes to the identity of the locality. The proposal has a distinctive built form, incorporating a diversity of materials, which complement the mixed use character of the locality and reinforces the site's location. In particular, the building is massed towards the street frontage to further emphasise its location. It provides for a stepped built form to ensure an appropriate transition in scale. Building entries are inviting and activate the frontages allowing visual permeability from the street.
(iv) Aboriginal cultural heritage, practices and places,	No items of aboriginal significance were noted in the AHIMS database for the subject site. Despite this, as the land is already developed, it is not likely that the site contains relics. Given the site has a history of disturbance and is a fully developed urban area, it is unlikely that the

SEPP – (Coastal Management) 2018 Clause 14 Coastal Use Area – Matters for consideration	Response
	proposed development will have a significant impact on the cultural places, values, customs, beliefs and traditional knowledge of Aboriginal people. In addition, the site does not comprise any items identified for their European heritage, archaeological or historic significance. Refer to **Appendix Q** for further details.
(v) cultural and built environment heritage, and	The subject site is not identified as having any Aboriginal artefacts, cultural heritage or built environment heritage items.
(b) is satisfied that:	
(i) the development is designed, sited and will be managed to avoid an adverse impact referred to in paragraph (a), or	The proposed development will not impact on the coastal environment area and has shown to be consistent with the matters for consideration referred to in paragraph (a).
(ii) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or	No impacts have been determined from the proposed development and have shown to be consistent with the matters for consideration referred to in paragraph (a).
(iii) if that impact cannot be minimised—the development will be managed to mitigate that impact, and	No impacts have been determined from the proposed development and have shown to be consistent with the matters for consideration referred to in paragraph (a).
(iv) has taken into account the surrounding	The development is considered

SEPP – (Coastal Management) 2018 Clause 14 Coastal Use Area – Matters for consideration	Response
coastal and built environment, and the bulk, scale and size of the proposed development.	generally consistent with the controls of the DCP and LEP. The proposed bulk, scale and size of the development is proposed to continue to respect the natural scenic quality of the surrounding area.

As outlined above, the proposed development has been assessed against the matters for consideration listed under the Coastal Management *SEPP.* It is concluded that the proposed development will not contravene the aims of the *SEPP*.

4.5 Local Environmental Plans (LEP)

Lake Macquarie Local Environmental Plan 2014

Land Use Zoning

The Lake Macquarie Local Environmental Plan (LMLEP) 2014 is the current environmental planning instrument that governs this development. The site is currently zoned B4 Mixed Use, as shown in LM LEP 2014 zoning map (**Figure 5**).

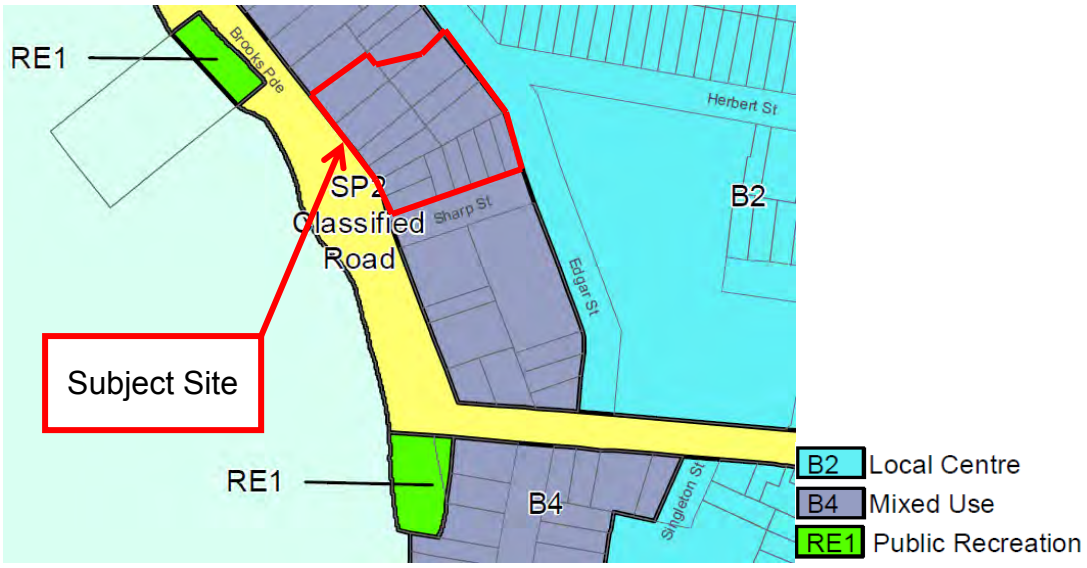


Figure 5 - Land Use Zone Map (LM LEP 2014)

The zone aims to:

To provide a mixture of compatible land uses

To integrate suitable business, office, residential, retail and other development in accessible locations so as to maximise public transport patronage and encourage walking and cycling

To enable development that complements and enhances the core retail function and trading performance of Zone B2 Local Centre and Zone B3 Commercial Core

The permissible uses include the following:

Boarding houses; Child care centres; ***Commercial premises****; Community facilities; Educational establishments; Entertainment facilities; Function centres; Home industries; Hostels; Hotel or motel accommodation; Information and education facilities; Medical centres; Multi dwelling housing; Passenger transport facilities; Recreation facilities (indoor); Registered clubs;* ***Residential flat buildings****; Respite day care centres; Restricted premises; Roads; Seniors housing; Shop top housing.*

It is considered that the proposed development is in keeping with the zone objectives and is permissible under the LM LEP zoning of the subject site.

Clause – 4.3 Height of Buildings

Under the LMLEP 2014, the subject site has a maximum Height of Building (HOB) of 22m.

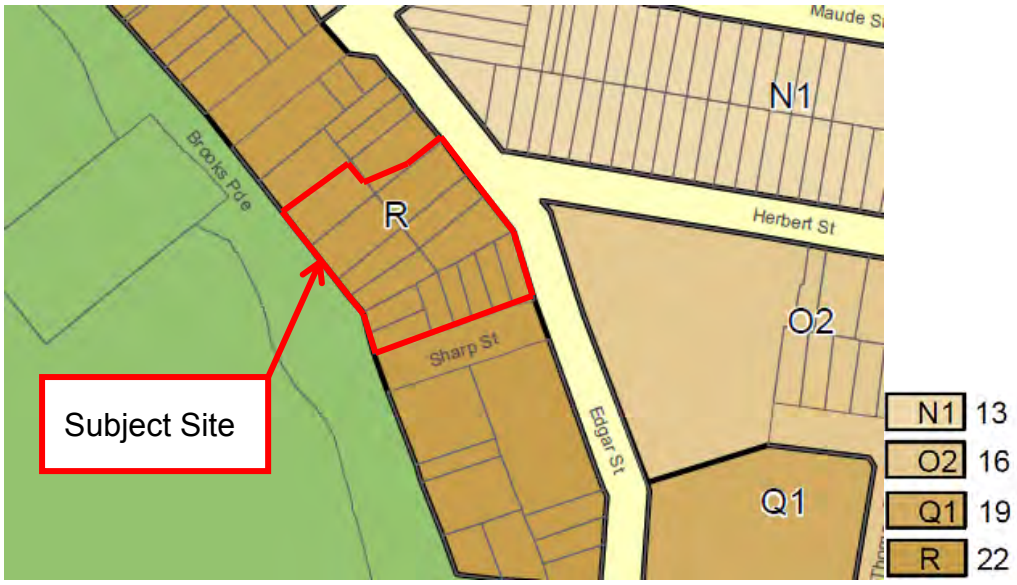


Figure 6 – Building Height Map (LM LEP 2014)

The proposed development involves a maximum height of 30m, which does not comply with the LM LEP HOB requirements. Nonetheless, the proposal will maintain a consistency in visual form with adjoining development. The proposal is also consistent with the '*Review of*

the Town Centres DCP and Belmont Area Plan for 32 Brooks Parade Belmont, prepared by Lake Macquarie Council's Integrated Planning Department'.

Clause – 5.5 Development within Coastal Zone

The proposed development will not have an impact on the current coastal environment. The existing coastal zone will be maintained along with its associated ecosystems, ecological processes and biological diversity and water quality.

Existing opportunities for pedestrian public access to and along the coastal foreshore, will remain.

The proposed development recognises and accommodates for potential long term coastal processes and climate change with a raised podium. The development does not impact on any rock platforms, beach environments and/or existing beach amenity. The proposed development will not create any significant overshadowing of the coastal foreshore, and any loss of existing views from a public place to the coastal foreshore.

The proposed development will not impede or diminish the physical, land-based right of access of the public to or along the coastal foreshore. All existing water quality will not be impacted by the development, and the proposed development will not be significantly affected by coastal hazards, or increase the risk of coastal hazards in relation to any other land within the area.

Clause – 7.1 Acid Sulfate Soils

The objective of Clause 7.1 is to ensure that development does not disturb, expose or drain acid sulfate soils and cause environmental damage. Development consent is required for any works which may result in adverse effects to the environment.

The site is identified as containing Class 2 acid sulphate soils which indicate a potential for the hazard. Under Class 5 soils, development consent is required if:

- *works below the natural ground surface, or works by which the water-table is likely to be lowered*.

The proposed development involves construction earthworks on lands identified a class 2 and will likely involve the lowering of the water table.

Clause – 7.2 Earthworks

The proposed development involves construction earthworks as a result of the proposed demolition, vegetation clearance and works associated with basement construction. These earthworks will involve disturbance to the existing land.

These works are not considered to have a detrimental impact on environmental functions and processes, or on neighbouring uses on the surrounding land, and *'before granting development consent for earthworks, the consent authority must consider the following matters'*:

a) the likely disruption of, or any detrimental effect on, existing drainage patterns and soil stability in the locality of the development.	The proposal requires minimal fill although a moderate level of cut will occur within the proposed development site. Given the nature of earthworks, minimal disruption to drainage patterns and soil stability will result.
b) the effect of the proposed development on the likely future use or redevelopment of the land.	The earthworks will facilitate the proposed development of the subject site and allow for the appropriate use and redevelopment of the land.
c) the quality of the fill or the soil to be excavated, or both.	The proposal requires minimal fill although a moderate level of cut will occur within the proposed development site. Regional Geotechnical Solutions (RGS) have assessed the potential cut material with all excavated material. It is noted that the site soil is acidic although at manageable levels. All disposed material will be done so according to Council's regulations and RGS recommendations.
d) the effect of the development on existing and likely amenity of adjoining properties.	It is not anticipated that the amenity of neighbouring properties will be significantly impacted. The construction earthworks will be short term, and will be limited to business hours

	during weekdays and between 8am and 1pm on Saturdays.
e) the source of any fill material and the destination of any excavated material.	It is anticipated that any excavated material will be disposed of according to Council's regulations. Any fill material as required will be sourced from a suitable supplier and be of the required standard.
f) the likelihood of disturbing relics.	A desktop search of the NSW Heritage Register, and AHIMS concluded that site does not contain any items of State, or Aboriginal heritage. Given the developed nature of the site it is not considered the site contains relics.
g) the proximity to and potential for adverse impacts on any watercourse, drinking water catchment or environmentally sensitive area.	The proposed earthworks are not located on or within close proximity to any water course, drinking catchment or environmentally water sensitive area.
h) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.	A development and construction management plan will be implemented to provide appropriate measures to avoid, minimise and mitigate the impacts during the earthworks including waste disposal.

It is considered that the proposed earthworks required for the construction will comply with Clause 7.2 of the LEP. Overall, it is considered that the proposed development generally complies with the requirements of the Lake Macquarie Council LEP 2014.

Clause – 7.3 Flood Planning

The site is separated from Lake Macquarie by Brooks Parade and a small pedestrian reserve. It is identified as being, and is unlikely to be, affected by inundation. Forum

Consulting Engineers have prepared a Limited Flood Study Report having regard to the nature of the site and any proposed use.

The report assesses the flood risk potential in relation to the drain and notes existing assessments undertaken by Lake Macquarie Council regarding Lake Macquarie flood levels. The development has a raised podium mitigating potential flood risk to life and property on the development.

The land is considered compatible with the land's identified flood hazard, and can avoid significant adverse impacts on flood behaviour and the environment. The report from Forum Consulting Engineers recommendation will have no notable increase in flood levels or noticeable effects on localised flood levels. The development is unlikely to adversely affect flood behaviour and/or any resulting impacts on other development or properties.

Clause – 7.4 Coastal Risk Planning

The proposed development involves construction of a mixed use development that sets a minimum ground floor level of 2.36 AHD. The development is located in a coastal urban area. The site and development is situated and designed to enable the evacuation or proceed to a safe position in an emergency.

The development is separated from the coast by existing infrastructure and the development will not increase the potential risks of coastal hazards, or change existing coastal processes with the area. The increased ground floor level has regard to the potential impacts of sea level rise.

Clause – 7.6 Limited Development on Foreshore Areas

The proposed development located in close proximity to the foreshore area. The proposed development will not impact on natural foreshore processes or affect the significance and amenity of the area.

No existing boat sheds, coastal protection works, wharves, slipways, jetties, waterway access stairs, swimming pools, fences, cycleways, walking trails, picnic facilities, recreation areas or water recreation structures will be impacted by the proposed development.

The development will contribute to achieving the objectives for the zone in which the land is located, and the appearance of any proposed development, from both Lake Macquarie and the foreshore areas, will be compatible with the surrounding area.

The proposal will not have an adverse effect on existing drainage patterns, refer Forum Consulting, Limited Flood Study, at ***Appendix M***.

The proposed development will not cause congestion both from a traffic or pedestrian perspective or generate conflict between people using the adjacent open space areas or Lake Macquarie. Existing continuous public access along the foreshore will be maintained.

4.6 Lake Macquarie Development Control Plans (DCP)

The Lake Macquarie Development Control Plan 2014 (LMDCP 2014) provides detailed direction about aspects of development that must be considered prior to submitting a Development Application. The provisions of the LMDCP to the extent that they apply to the proposed development are presented below.

Table 6: Elements of the LMDCP that apply to the Proposed Development

Development Control	Relevance to Proposed Development	
Part 4 – Development in Business Zones		
2 Context and Setting		
2.1 Site Analysis a. To encourage good site planning, built form and landscape outcomes informed by an understanding of the site and its context. b. To illustrate how a development responds to a site and its relationship with the locality. c. To identify the opportunities and constraints of sites, and the prevailing characteristics of a locality.	A Site Analysis Plan has been prepared and identifies the existing conditions relating to the subject site and the surrounding influences. The Site Analysis Plan provides a comprehensive view of the constraints and opportunities of the development site and factors that have guide the design. The proposal is consistent with the surrounding environment and mitigated any undue impacts and results in a suitable urban outcome for the site.	Complies
2.2 Scenic Values	The topography and exiting built form	Complies –

The Landscape Settings and Significant Natural Landscape Features Maps identify the Landscape Setting boundaries and the relevant Scenic Management Zone for each Landscape Setting. The maps are a guide to the scenic quality associated with lands within the City of Lake Macquarie and are contained within the Scenic Management Guidelines. The Scenic Management Guidelines provide supporting documentation to this DCP. The Landscape Settings and Significant Natural Landscape Features Maps identify the Landscape Setting boundaries and the relevant Scenic Management Zone for each Landscape Setting. The maps are a guide to the scenic quality associated with lands within the City of Lake Macquarie and are contained within the Scenic Management Guidelines. The Scenic Management Guidelines provide supporting documentation to this DCP.	combine to provide vistas and view corridors. The hill in Belmont town centre provides prominent vistas from the vicinity of Victoria Street, George Street and Gen Street off the Pacific Highway in all directions. The subject site is not visible from these locations given topography and existing urban form. Vistas from outside the town centre toward the centre exist from other hilltops. Several streets north of Evans Street have views south to the town centre; the top of Wommora Avenue with views to the south west; Belmont North looking south, and; the vicinity of Green Point looking south east. Marine craft users on Lake Macquarie have uninterrupted vistas of the Belmont foreshore. The proposed development will not interfere with views of prominent landscape points and will have a scale and bulk consistent with the predominant built form within the area. Several view corridors in the town centre are available to the Lake and these will not be interrupted. The key view corridor to the Lake is provided between buildings from the Pacific Highway down Macquarie Street, which terminates at the Lions Club Park. Mark Street, Maude Street. Sharp Street provides short view corridors as a result of the change in direction of the streets. Mark Street provides a corridor 300 metres long, however it is not a significant street. Maude Street changes direction 140 metres before the foreshore, while Sharp Street does not align with Herbert to continue the corridor.	Consistent with the character of the area.

	View corridors through urban blocks in the town centre have not been achieved and are challenged by environmental constraints to deal with solar access, flooding and inundation. As identified above there are view corridors into the subject site. However, as previously noted there are some viewpoints from which the site is barely visible, even with potential heights of 8 storeys, given the topography of the Belmont area. The most prominent views are from the Lake. Apartments on Edgar Street block the views into the site such that Belmont Towers is barely visible even from this short distance away. Even with current one and two storey buildings the site is barely visible and is unlikely to be seen if redevelopment occurs in accordance with the current controls under LEP 2014. As noted topography is an important aspect of the view corridors in the area. South of Macquarie Street the site is barely visible and when looking north and north west. The site is also barely visible from the Pacific Highway to the west. In this sense the potential view corridors are localised. Consideration was afforded to views from the hillslopes to the north of the site. Clearly most of Belmont town centre is visible from areas to the north (e.g. Tingira Heights, Floraville), however, if future development is consistent with current controls the subject site will not be	

	prominent given the potential surrounding development.	
2.3 Geotechnical a. To minimise potential damage to buildings/structures resulting from land movement.	A geotechnical report was prepared by Regional Geotechnical Solutions which assessed the soil and ground conditions and reviewed surrounding structures, refer Geotech report at ***Appendix H***. Conditions can be imposed to ensure that potential damage can be monitored and addressed as and if required	Complies
2.4 Cut and Fill a. To minimise land shaping, particularly outside the building footprint. b. To ensure development is on a stable site. c. To minimise the impact on groundwater flow. d. To ensure that development does not concentrate surface water flows to adjoining properties. e. To minimise the extent of earthworks, stormwater infrastructure and retaining structures and the associated costs.	The proposal requires minimal fill although a moderate level of cut will occur within the proposed development site. Given the nature of earthworks, minimal disruption to drainage patterns and soil stability will result. Regional Geotechnical Solutions (RGS) have assessed the potential cut material with all excavated material. It is noted that the site soil is acidic although at manageable levels. All disposed material will be done so according to Council's regulations and RGS recommendations.	Complies
2.5 Mine Subsidence a. To minimise risks to buildings and structures associated with potential mine subsidence	The subject site is not identified as being with a potential mine subsidence area.	Complies
2.6 Contaminated Land a. To ensure that contaminated land is identified through appropriate investigations. b. To ensure that contaminated land at a site is appropriately and effectively remediated prior to development taking place.	The subject site is entirely within a residential area. No notices have been issued for the site under the *Contaminated Land Management Act 1997*, nor have any licences been issued under the POEO Act for the site. As the subject site and the surrounding area appear to have been used for residential	Complies

c. To ensure that changes to land use will not increase the risks to public health or the environment as a result of contaminated land on, or adjacent to the site.	activities for more than 50 years, the land is not believed to be contaminated, and no further investigations are therefore considered necessary.	
2.7 Acid Sulfate Soils a. To ensure that disturbance of Acid Sulfate Soils or Potential Acid Sulfate Soils is minimised, to prevent adverse environmental impacts on soil conditions. b. To ensure that water quality and associated receiving waters are not detrimentally affected by the effects of Acid Sulfate Soils. c. To ensure that habitat is not detrimentally affected by the effects of Acid Sulfate Soils. d. To ensure that built structures and infrastructure are not detrimentally affected by Acid Sulfate Soils.	A geotechnical report was prepared by Regional Geotechnical Solutions (RGC) including ASS investigations. Development can be sited and designed to avoid the disturbance of Acid Sulfate Soils. Potential Acid Sulfate Soils are likely to be disturbed and the Preliminary Acid Sulfate Soil Assessment report by RGC is in accordance with the NSW Acid Sulfate Soils Planning Guidelines. The report identifies potential adverse impacts, management and identifies an analysis plan and mitigation measures.	Complies
2.8 Stormwater Management a. To ensure that development does not adversely affect water quality or availability, including ground water. b. To ensure that watercourses and associated riparian vegetation are maintained so as to contribute to water quality, and to mitigate sedimentation of the Lake Macquarie waterway. c. To minimise any adverse impacts on downstream built or natural environments, or on nearby land due to increased development. d. To incorporate Water Sensitive	A preliminary Water Cycle Management Plan to mitigate the effects of stormwater on adjoining or downstream locations is attached at ***Appendix M.*** Conditions can be imposed to ensure that any water cycle management, shall comply with relevant standards.	Can comply.

Urban Design techniques into all new developments. e. To minimise the volume and rate of stormwater leaving a development site		
2.9 Catchment Flood Management a. To ensure that development is sited and designed to minimise potentially adverse impacts of flooding on the proposed development, or on other properties. b. To ensure that measures are implemented to reduce the impact of flooding and flood liability on owners and occupiers of flood prone property. Such measures must also reduce private and public losses resulting from flooding, and manage risks to property and life from flood events.	A Limited Flood Study Investigation Prepared by Forum Consulting Engineers has been undertaken. The investigation concluded that the adoption of the Lake Macquarie Flood Study be adopted. The design takes into consideration the flood study recommendations so as to mitigate risks to life and/or property through design and positioning of development. Habitable rooms and commercial development have a finished floor height at least 500mm above the 100 year ARI (1% AEP) event. Buildings and other structures, including fences, are not considered too impede the flow of floodwaters or entrap debris as a 1% AEP event can be conveyed within the existing concrete lined drain, refer ***Appendix M***. The development is located on designated flood prone land, however evacuation and other emergency procedures are readily available. Further risk management measures are not considered necessary. The development will use flood compatible materials in its construction that will minimise potential damage by flooding.	Complies
2.10 Lake Flooding and Tidal Inundation This section applies to land on	The proposed development will be constructed of flood-proof materials.	Complies.

and near the Lake Macquarie foreshore that is shown as 'Lots Affected by Lake Flooding controls' on Council's 'Flood Control Lots' map. The map is indicative only and property information should be checked to confirm if a lot is a Lake flood control lot. Some lots are affected by both catchment flooding and Lake flooding. The development controls that apply to these lots depend on the type of development, and further advice should be sought from Council. Provisions regarding Catchment Flooding are contained in section 2.9 of this Part of DCP 2014. The floor height requirements in Table 3 below must only be used for development on lots shown as 'Lots Affected by Lake Flooding controls' on Council's 'Flood Control Lots' map.	The development site is located within an identified flooding area. A Limited Flood Study Investigation Prepared by Forum Consulting Engineers has been undertaken. The investigation concluded that the adoption of the Lake Macquarie Flood Study be adopted. A minimum floor height of 2.82AHD for the four commercial areas and for residential units, has provided as an appropriate level of flood control measure.	
2.11 Natural Water Systems a. To protect and maintain the water regime of natural water systems. b. To ensure that development does not adversely affect aquatic fauna. c. To ensure that development does not adversely affect water quality or availability, including ground water. d. To ensure that watercourses and associated riparian vegetation are maintained to contribute to water quality, and to	The subject site is not located adjacent to or over a natural water system or vegetated riparian zones. Lake Macquarie will not be impacted by the proposed development with appropriate water quality measures being able to be put in place and minimise nutrient and sediment run-off. The existing concrete drain adjoining the site will be managed so that there is not damage and works will minimise nutrient and sediment run-off entering this constructed drainage line.	Complies

mitigate sedimentation of the Lake Macquarie waterway. e. To ensure that natural water systems and associated vegetation and landforms are protected to improve the ecological processes and ensure that land is adequately buffered from development. f. To ensure that the pre-development water quality of receiving waters is maintained or improved.		
2.12 Bushfire a. To ensure that risks associated with bushfire are appropriately and effectively managed on the development site. b. To ensure that bushfire risk is managed in connection with the preservation of the ecological values of the site and adjoining lands.	The site is located within a built up urban area and not a bushfire hazard area.	Complies
2.13 Flora and Fauna a. To avoid and minimise impacts on native flora and fauna. b. To protect and enhance native flora and fauna, vegetation communities, and native habitat on the site, and on surrounding development sites. c. To protect and enhance ecological corridors and increase the connections between habitats. d. To ensure rehabilitation of degraded areas.	The subject site is located within a built up urban area and does not contain native vegetation or fauna habitat.	Complies
2.14 Preservation of Trees and Vegetation a. To ensure that trees listed on	The site has been heavily modified from previous land uses and development. The site is largely covered with grass and	

Council's Significant Tree register are not adversely affected by development. b. To maintain and enhance the natural bushland or vegetated character of the city. c. To retain trees for the urban amenity, microclimate, scenic, air and water quality, and the social benefits that they provide.	contains a few stands of trees, one to the south and two towards the northern boundary. The proposed development will remove the existing vegetation within the subject area. The proposal would not result in the loss of native vegetation indigenous to the locality or any significant ecological values. Given the condition of the land and location it is considered to have marginal to negligible ecological value and/or local biodiversity. Future development incorporates appropriate landscaping consistent the surrounding area.	
2.15 European Heritage a. To protect and maintain European heritage items and their facades. b. To retain, preserve and promote the adaptive re-use of heritage-listed buildings and contributory buildings in particular, and other buildings that contribute to the heritage character of the locality. c. To appropriately manage demolition of items of heritage significance, when all other alternatives to demolition have been fully investigated. d. To ensure that development is sympathetic to heritage items, adjoining heritage items and contributory buildings.	The site is not a heritage item, is not located within a heritage conservation area and is not adjacent to any heritage items.	Complies
2.16 Aboriginal Heritage a. To protect and conserve	An AHIMS search was undertaken and indicates that no items of Aboriginal	Complies

Aboriginal cultural, spiritual, and sacred sites within the City.	heritage are located on the site or within 200m of the subject site. Additionally, a desktop search of the NSW State Heritage Inventory and Council's Heritage Register also indicated that no items of significance are located within the subject site. Aboriginal Heritage Due Diligence Assessment has been undertaken by McCardle Cultural Heritage Pty Ltd, refer ***Appendix Q***.	
2.17 Natural Heritage a. To ensure the protection of items of natural heritage significance. b. To ensure that insect fossil beds and fossilised trees are maintained, along with features of scientific interest in their natural state. c. To facilitate public appreciation and scientific investigation of insect fossil beds and geological features of scientific interest, without destruction or damage.	A desktop search of the NSW State Heritage Inventory and Council's Heritage Register also indicated that no items of significance are located within the subject site. Contractors will be informed of responsibilities should items be identified during construction with requirements included in a Construction Environmental Management Plan.	Complies
2.18 Social Impact. a. To ensure that development takes into consideration the likely social impacts that may arise, including any effects on equity, access, participation and rights. b. To ensure that development occurs in appropriate locations, and is supported by adequate services and facilities to support the community and its needs. c. To ensure that services and	The proposed development provides several positive social impacts including the provision of diversity of housing as well as a development that utilises existing social and recreational infrastructure, including public transport provision. Jobs will be created by the proposed works. The development will provide private recreation space, however, there is sufficient open space in the immediate vicinity of the site as previously identified by Council.	Complies

facilities are accessible to all members of the community. d. To facilitate availability of active and passive recreation, natural landscapes, educational opportunities, employment opportunities, health services, public transport, and neighbouring centres, as well as maintaining or enhancing the aesthetics and amenity of the area.	The proposed development provides several positive social impacts. The proposal is consistent with local and regional strategies, increasing density within the Belmont town centre. There is sufficient and existing social and recreational infrastructure in the Belmont area to support the proposed development of 140 units (approximately 224 persons). No additional social or recreational infrastructure is required. The proposal will provide construction jobs for the local economy. During the construction process a construction environmental management plan should be prepared and the recommendations of the disability access report, noise report and traffic report prepared for the DA should also be implemented. Refer to the Social Impact Assessment undertaken by Monteath and Powys at ***Appendix L***.	
2.19 Economic Impact. a. To ensure that development supports the Lake Macquarie hierarchy of centres and positively contributes to the City by supporting existing development in the locality and the community through the creation of employment opportunities. b. To ensure development contributes through additional local employment and economic benefits.	The proposed development provides a number of positive economic outcomes including the provision of employment opportunities during the construction phase but also post construction with operational businesses.	Complies, refer to economic assessment attached at ***Appendix K***.

2.20 Lot Amalgamation. a. To avoid isolated lots with limited development potential. b. To support efficient development and increase floor space yields on amalgamated sites. c. To accommodate the desired built form of the town centre. d. To minimise the number of driveway crossings from the street or lane.	The proposal will amalgamate the subject allotments reducing driveway crossings and creating a streetscape appropriate with a lakeside town centre environment. Lot amalgamation can be appropriately conditioned.	Complies
2.21 Utility Infrastructure a. To identify utility requirements and new infrastructure at an early stage of development. b. To ensure utilities structures are integrated in the site planning and design of development. c. To protect and improve the visual amenity of the primary street frontage	Utility infrastructure augmentation will occur through the detailed design phase. The subject site currently has access to electricity, reticulated water and sewer, stormwater and telecommunications. Service connection and any capacity augmentation will be determined through application to the relevant service providers (Hunter Water, Ausgrid, Jemena, Telstra, NBN etc).	Complies, infrastructure will be planned and future designs will ensure visual amenity and street frontages are protected.
2.22 Sites where a Concept Plan is required. a. To capture the opportunities for public benefit that planning and development of larger sites permit. b. To ensure that a thorough urban design analysis of the site, and its urban context, is used to inform the site planning and design process. c. To allow the site layout, building scale form and height, approximate yield and public benefit of a development proposal to be determined early in the development assessment	A detailed urban design analysis was undertaken, refer ***Appendix A and C*** and has been peer reviewed by Peter Annand and Associates. The analysis demonstrated that the proposed development on the site, represents an appropriate and efficient use of a significant site in the Belmont town centre, and provides high quality development in a prominent location on Lake Macquarie's foreshore. The proposal will contribute to realising the Lower Hunter Regional Strategy aims to provide new dwellings in established areas, better utilise existing infrastructure, and locate new dwellings close to employment areas. The proposal provides numerous levels of public benefit	Complies with overall objective refer Urban Design Analysis ***Appendix C***.

process. d. To allow consideration of a proposal that varies from the specified block controls in the Town Centre Area Plans.	from street improvements, housing diversity, and employment opportunities. The proposal provides pedestrian thoroughfare close to the town centre and lake foreshore.	
3 Streets and Public Space		
3.1 Pedestrian Lanes. a. To provide pedestrian lanes between key destinations in each town centre. b. To focus pedestrian traffic and sustain retail activity along each lane. c. To ensure a pedestrian lane is open, accessible, safe, well lit, and has active frontages	The site is not in a location that requires a pedestrian lane. None the less pedestrian access through the site is provided.	Complies
3.2 Pedestrian Links through Buildings. a. To improve pedestrian access and ease of circulation through town centres. b. To provide pedestrian access through buildings that is easy to navigate, pleasant, safe and well lit.	A significant view corridor is provided and pedestrian access through the site, providing improved circulation connectivity between the Lake and shopping area of Belmont Town Centre. The pedestrian ways are easy to navigate, legible, pleasant, and can be made safe and well lit.	Complies with overall objective refer Urban Design Analysis ***Appendix C*** and CPTED Report ***Appendix D***.
3.3 Footpath Dining a. To support footpath dining in appropriate locations. b. To maintain safe and functional pedestrian access. c. To make efficient use of footpath dining space on active frontages. d. To integrate footpath dining with other footpath uses and infrastructure. e. To encourage the use of large wall openings and retractable windows or doors at the street	Footpath dining is not proposed. However, may be considered later. Subsequent application and documentation will be provided.	N/a

level for café uses.		
3.4 Streetscape Improvements. a. To provide high quality infrastructure such as pedestrian paving, kerb extensions, drainage, and cycleways that support walking, cycling and access to public transport. b. To enhance the amenity of the street for pedestrians. c. To develop the character of each town centre character through a consistent selection of materials, trees, furniture and design details. d. To provide opportunities for public art.	The proposal will improve and enhance the street amenity and character of the surrounding area. Opportunities for street art are available and material and street tree planting will be consistent with surrounding character.	
3.5 Non-Discriminatory Access. a. To ensure that development accommodates all people regardless of mobility. b. To ensure universal design that provides non-discriminatory access and equitable use. c. To minimise the scale and visual impact of ramp structures on the footpath and building façade. d. To ensure that design for flooding and sea level rise does not preclude non-discriminatory access.	The proposed development ensures non-discriminatory access is provided between the footpath and the ground floor. Dedicated parking is provided in the basement with lift access to all floors. External access ramps are to be provided at the street frontages providing access from the street level to the podium ground floor level. Furthermore, an earlier Access Report has been prepared by BCA Access Solutions, which concluded, '*generally, the plans assessed shows that compliance is achievable*', refer ***Appendix F***. The proposal has maintained access however lifts have been replaced with ramps as per Council's request.	Achievable, subject to specific elements being considered prior to the issue of a construction certificate.
3.6 Lighting.	Lighting will ensure safe pedestrian	Complies

a. To ensure safe and convenient pedestrian movement on footpaths and through public spaces. b. To provide energy efficient external lighting. c. To allow for cost effective maintenance of external lighting. d. To ensure that the impact of light and glare on surrounding residential development is minimised.	movement, reduce glare and comply with relevant Australian Standards.	
4 Active Street Frontage		
4.1 Ground Floor Residential Uses in the Business Zones. a. To maximise the extent of ground floor business, retail or community uses at the street frontage in the B3 Commercial Core and B2 Local Centre zones. b. To support development of ground floor small offices or home offices, in conjunction with residential development, in the B4 Mixed Use zone.	The ground floor contains a mix of residential uses and retail/commercial tenancies. The character of the area and major public spaces will not be impacted. The building has regard to the fabric and character of locality and is of a scale, proportion, alignment consistent with the area. The proposed materials and finishes reinforce distinctive attributes and qualities of built form. The proposal will maintain a predominantly active frontage and appropriate transition from public to private spaces. Visual amenity and streetscape will be enhanced.	Complies
4.2 Ground Floor Levels. a. To ensure non-discriminatory access between the public footpath and ground floor space. b. To allow a line of sight between the public footpath and ground floor space.	The proposed development ensures non-discriminatory access is provided between the footpath and the ground floor. Dedicated parking is provided in the basement with lift access to all floors.	Complies given the adopted floor level has been set to address minimum flood levels.

c. To adapt floor levels close to the street where general ground floor levels are raised to meet Sea Level Rise Policy.	Sightlines are maintained as the podium level is set back from the foot path and maintains connection between and public footpath and podium level.	
4.3 Ground Floor Entries. a. To ensure that entries are located on the street frontage and are clearly recognisable. b. To ensure that entries are easily accessible for all users	Entries to the four towers are located centrally via a large open courtyard. The location is logical and clearly recognisable. Entry points to the buildings are readily accessible to all users.	Considered an acceptable alternative solution.
4.4 Ground Floor Glazing. a. To ensure that development allows a visual connection between the street and the ground level activity.	The proposal sits at a ground level podium, above the street level. Brooks Parade, Sharp Street and Edgar Street frontages contain retail/commercial uses providing activity and visual connection to the street. Edgar Street frontage is also the primary rear pedestrian access point and provides residential units facing the street. These features provide a connection and level of activity that provides a relationship between the street and ground level activity.	Complies
4.5 Street Awnings. a. To provide shelter and shade for pedestrians and footpath activity in pedestrian priority areas. b. To create a consistent pedestrian scale and space, by stepping awnings with the slope of the footpath.	The proposed development complies with the required setbacks and podium level ground floor. The surrounding area is not considered to be a pedestrian priority area. The scale of the development is considered consistent to the development within the surrounding area. Shade and shelter is available on the site.	Considered an acceptable alternative solution.
5 Access and Parking		
5.1 Traffic and Vehicle Access. a. To minimise the impacts of traffic generation.	The proposal considered the potential traffic impacts, refer Traffic and Parking Impact Assessment, by McLaren Traffic	Complies

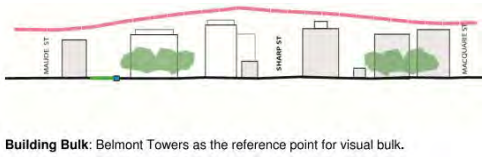
b. To maximise the retail frontage to streets in the town centre. c. To minimise vehicle crossing points along pedestrian footpaths. d. To maximise vehicle access along the rear of properties. e. To ensure adequate space for turning from a rear laneway into private property.	Engineering, refer ***Appendix I***. The proposal is supportable in terms of traffic impacts. Existing vehicle crossing have been minimised to two from the existing twelve. Existing crossing will be closed, and kerb reinstated. Basement parking and manoeuvring ensures vehicles enter and leave in a forward direction.	
5.2 Design of Parking and Service Areas. a. To ensure that on-site car parking and driveways do not dominate or detract from the appearance of the development or the local streetscape. b. To support basement parking where there is adequate site area. c. To maximise pedestrian safety and amenity. d. To encourage co-operative approaches to car parking provision between adjoining small lots, such as amalgamation of car parks and shared access and egress points. e. To ensure the safe and efficient movement of vehicles within, entering and leaving properties.	The proposal considered the potential traffic impacts, refer Traffic and Parking Impact Assessment, by McLaren Traffic Engineering, refer ***Appendix I***. The proposal is supportable in terms of traffic impacts. Vehicle crossing have been located and designed into the visual fabric of the building as far as practicable. Existing vehicle crossing have been minimised to two from the existing twelve. Basement parking and manoeuvring ensures vehicles enter and leave in a forward direction. The Loading Dock utilises a Turning Platform to ensure vehicles enter and leave in a forward motion.	Complies
5.3 Bike Parking and Facilities. a. To provide convenient and safe bike access, movement and parking. b. To encourage travel to work by bike with convenient and secure	Bike parking facilities for up to 52 bicycles are provided within the basement. This location is both convenient and safe.	Complies

end of trip facilities.		
5.4 Motorbike Parking. a. To provide convenient and safe motor bike access, movement and parking. b. To ensure that the number of motorbike parking spaces is sufficient to support the intended use.	Motorbike parking facilities for up to 4 bikes are provided within the basement secured parking area. These locations are both convenient and safe.	Complies
5.5 Car Parking rates a. To ensure that the number of car parking spaces is sufficient to support the intended use. b. To ensure that the number of car parking spaces does not discourage the use of public transport or other modes of transport.	165 Car parking spaces are provided, sufficient for the intended use. Public transport facilities (bus) are readily available from Brooks Parade and slightly further to the south east within 400m is the Pacific Highway.	Complies
6 Development Design		
6.1 Front Setbacks – Shopping Centres in B1 and B2 Zones. a. To ensure that stand alone shopping centres relate to the street. b. To encourage small public outdoor trading areas with good sun aspect and adjacent to a main entry.	N/a	N/a
6.2 Front Setbacks – Main Street Shops in B1 B2 and B3 Zones. a. To maximise building mass and floor space at the street boundary. b. To define the spatial character of the street. c. To ensure privacy and amenity on upper levels.	N/a	N/a
6.3 Front Setbacks – B4 Zone. a. To provide for landscape	The building is well articulated and the frontages along Brooks Parade, Sharp	Alternate Solution – Front setback to

plantings in the front setback area. b. To support building articulation at the street frontage.	Street and Edgar Street providing a softening of the built form, visual amenity and a transition between the public and private realms.	Sharp Street is 5m instead of 6m.
6.4 Façade Articulation. a. To define smaller scale shopfronts, windows and doorways by articulation of the building façade. b. To provide interest and detail at a pedestrian scale and level. c. To avoid potentially unsafe places or opportunities for anti-social behaviour. d. To contribute to the existing character or desired future character of the street as described in each Town Centre Area Plan in Part 10.	The proposed development enhances Public and private space has been clearly defined through a well-articulated built form and delineation of public and private areas at street level. In particular, the proposal includes the provision of a pedestrian way to create connections between he foreshore and Edgar Street enhancing the pedestrian experience and connectivity and shall enliven the locality. This creates a new space that will positively contribute to the character of the area.	Complies
6.5 Building Exteriors. a. To ensure that buildings contribute positively to the streetscape and public domain, by means of high quality architecture, material selection and finishes. b. To provide richness of detail and architectural interest at the street level. c. To provide appropriate design responses to nearby development, which complement the streetscape and contribute to the efficiency of the building interior. d. To ensure that development contributes to the interest, character and sustainability of the street.	The proposed development is consistent with the character of the streetscape and positively contributes to the identity of the locality. The provision of the pedestrian way shall create a new recreational space within the Belmont Centre. The proposal is an architecturally designed built form with high quality materials and finishes. In this regard, the development provides aesthetic stimulation to the area and enhances the streetscape presentation. The proposal is considered to create interest within the locality. The proposed design is considered to be an appropriate form that is sympathetic and compatible with the emerging character in this area. The proposed	Complies

e. To avoid glare or nuisance from highly reflective roofs, walls or windows. f. To ensure that materials are chosen based on environmental and life cycle considerations	development aligns with the emerging high density character of the area. The building has been positioned away from the adjoining tall buildings to maximise sunlight penetration to the apartments and minimise adverse impact on the adjoining properties. The proposed height and density generate minimal adverse impacts, and the proposal is considered to be an exemplary development of architectural excellence. The materials, finishes and colours are of a high quality and are complimentary to the streetscape. The proposal is well articulated to provide visual interest and to minimise any adverse impact upon bulk and scale. Contemporary designs features have been utilised in the development.	
6.6 Building Separation. a. To ensure an appropriate level of amenity for building occupants and neighbouring residents, including solar access, ventilation, outlook view sharing and privacy.	The building has been positioned away from the adjoining tall buildings and sites to maximise sunlight penetration and minimise adverse impact on the adjoining properties from view sharing and loss of privacy.	Generally, complies with the objectives. Overall outcome is an acceptable solution.
6.7 Side and Rear Setbacks. a. To support development of a continuous built form at street level in town centres. b. To ensure an appropriate level of amenity for building occupants and neighbouring residents, including natural light and ventilation, outlook, view sharing,	The buildings have been positioned away from the adjoining buildings and internally to the site to maximise sunlight penetration and minimise adverse impact on the adjoining properties from view sharing and loss of privacy and wind shelter.	Complies

wind shelter, and privacy.		
6.8 Minimum Landscaped Area. a. To provide areas of landscape planting that improve visual amenity, privacy, outlook, views and recreational opportunities for residents and occupants within a development. b. To ensure that mixed use commercial and residential development includes areas for planting on podium and roof structures. c. To ensure that mixed use commercial and residential development in the B4 Zone includes areas for the mature growth of trees and large shrubs in deep soil. d. To ensure landscape areas are integrated into the design of the development. e. To encourage design of landscape planting on podium and roof structures that is suited for communal use by residents.	The proposal provides a landscaped area of 1,333sqm with 914sqm being deep soil. The landscaped areas form part of the common open space as it can be utilised by all residents within the site and the public. Additionally, a roof terrace is provided for more private open space. The proposed landscaping is considered to be consistent with the objectives and controls within Council's DCP. Additionally, the development proposes to carry out public domain works. They are considered to result in a better urban outcome and shall improve the overall streetscape along this portion of the Belmont Town Centre.	Complies
6.9 Building Depth. a. To allow for natural light and ventilation to residential floor space. b. To allow for efficient floor plans for retail and office space	The building is designed to allow natural light and ventilation and has an efficient floor plan.	Complies
6.10 Maximum Occupied Area. a. To reduce the impact of building mass and bulk on neighbouring development.	The development is separated into four (4) towers separating and overall building mass, providing view corridors and reducing the visual bulk of the development on neighbouring development.	Complies
6.11 Setbacks from Residential	N/a, the site does not adjoin or is it	N/a

Zoned Land. a. To minimise the impacts of visual bulk and scale, privacy, ventilation, and solar access on the residential amenity of neighbouring dwellings. b. To ensure adequate separation distances between buildings. c. To encourage deep soil zones to maximum opportunities for landscaping and natural site drainage	adjacent to residential zoned land.	
6.12 Building Height. a. To allow solar access and restrict overshadowing of adjoining properties. b. To ensure that views from neighbouring dwellings are not unduly compromised. c. To ensure that the building height does not overwhelm the public street and is compatible with the scale of surrounding developments.	A Clause 4.6 exception is provided included at ***Appendix O***. The proposed height provides a contextually appropriate height transition with the adjoining development and remains consistent with the identified Belmont bump. This is further identified within the BTCR with the development consistent with the identified objectives and outcomes and relied on with the development design, refer to ***Appendix P***.  **Building Bulk**: Belmont Towers as the reference point for visual bulk. Building Bulk Page 18 of BTCR. 	Considered an acceptable alternative solution. Also refer to clause 4.6 exception.

	Building Height outcomes, page 19 of the BTCR The DCP however stipulates a 6 storey height or 22 metres. The proposed 8 storey height is considered appropriate, given the nature and character of the adjoining buildings which include an 8 storey development (Belmont Towers). The proposal will provide a suitable transition in height between surrounding buildings and is considered visually complementary to the surrounding area. There is negligible environmental planning impact as a result of the height departure; the proposal maintains compliance with the objectives of the standard and that there are planning grounds particular to the circumstances of the case to support the departure. Notwithstanding the above, the proposed building height does not generate any adverse impact and retains compliance with the objectives of the standard. Shadow Diagrams for mid-winter are submitted with the application to determine solar access and generate the proposed shadow created by the building. The proposal while creating a shadow, solar access is available during periods of the day. Therefore, there are negligible impacts that result from the subject application. The proposed development has been oriented to allow for solar access into the	

	apartments and complies with the SEPP 65 provisions.	
6.13 Building Height at the Street. a. To maximise the building mass and floor space at the street. b. To define and reinforce the spatial character of the street. c. To emphasise each corner of a block with additional height and/or building mass.	The proposal provides appropriate setbacks to all boundaries. The development has a mass with additional height at all four corners of the development site. The proposal will provide a defined statement emphasising spatial character creating a relationship between the street and the built form. The proposal will maintain a visual continuity of mass and form consistent with the surrounding area and identified within the BTCR.  **Building Bulk**: Belmont Towers as the reference point for visual bulk.	Acceptable solution
6.14 Floor to Ceiling Heights. a. To ensure flexible use of commercial and mixed-use commercial-residential buildings.	The ceiling height of each storey will be a minimum 2.7 metres throughout each apartment. The ground floor has a ceiling height of 3.6 metres which allows for increased solar access to the lower level apartments and optional mixed use opportunities.	Complies
6.15 Roofs. a. To ensure that roofs and roof structures create minimum visual intrusion.	The roof design is generally flat. Each tower has a centrally located roof structure coving lift overrun and services. Roofs and associated structure are not considered to be visually intrusive.	Complies
6.16 Views. a. To allow for the reasonable sharing of views. b. To ensure that existing canopy trees have priority over views.	The development is separated into four (4) towers separating and overall building mass, providing view corridors and providing reasonable levels of view sharing.	Complies
6.17 Balconies and Communal	The balconies and communal spaces are	Complies

Open Space. a. To reinforce the street wall by recessing lower level balconies in the building volume. b. To ensure balconies are functional and responsive to the environment thereby promoting the enjoyment of outdoor living for dwellings. c. To provide suitable privacy and amenity for users of balconies close to the street. d. To ensure that communal open space is consolidated, configured and designed to be useable and attractive.	functional and responsive to the environment. Each apartment has a well-designed and located balcony greater than 8sqm enabling resident's enjoyable outdoor opportunities, with the provision of privacy and amenity. Additional communal is located in a consolidated central courtyard and additional roof terrace. The configurations are useable and attractive.	
6.18 Planting on Structures. a. To enhance the quality and amenity of open space on roof tops, internal courtyards, and over car parking structures. b. To encourage the establishment of vegetation in urban areas. c. To maintain privacy of neighbouring residents.	Planting and landscaping will occur on rooftops or structures. Sufficient depth and for planting will be provided to ensure sustainability.	Complies
6.19 Solar Access and Orientation. a. To ensure that reasonable access to sunlight is maintained for occupants of new and existing dwellings in the residential component of mixed-use development. b. To ensure solar access is maintained to adjoining open space and public domain areas. c. To ensure that the design for solar access is not outweighed by	Over 70% of apartment's private open space receive sunlight during mid-winter. However, the proposal complies with the current SEPP 65 solar access requirements. A number of dwellings contain a single aspect facing south. Due to the size of the subject site this cannot be avoided. The apartment subject to these aspect limitations have been designed with adequate levels of natural light penetration into habitable areas of the	Considered an acceptable alternative solution.

the desire for views.	dwelling, with the use of large windows, door, other openings and ventilation.	
6.20 Energy Efficiency and Generation. a. To ensure building orientation maximises solar access and natural cross ventilation. b. To ensure energy efficiency is achieved in all developments. c. To allow opportunities for future installation of renewable energy generation and low carbon technology. d. To minimise the economic impacts of increasing electricity costs and any requirements to disclose energy efficiency when selling or leasing a property. e. To promote increased levels of energy efficiency in large-scale developments. f. To ensure that development minimises the use of water and non-renewable resources	The proposed orientation and location of window openings have been positioned to maximise natural cross ventilation, solar access and reduction in energy consumption.	Complies
6.21 Visual Privacy. a. To ensure that the design of buildings provides an acceptable level of internal and external visual privacy for new and existing dwellings on subject and surrounding land.	An acceptable level of privacy is provided to each apartment and that of adjoining properties. The use a screening and separation minimises direct views and protecting privacy.	Complies
6.22 Acoustic Privacy. a. To ensure that noise emissions do not unreasonably impact on the amenity of the area or result in noise intrusion that would be unreasonable for occupants, users or visitors. b. To ensure that dwellings have	An acoustic report has been prepared, refer ***Appendix J***. The proposed development is capable of compliance with the acoustic requirements.	Complies

an acceptable level of acoustic privacy		
6.23 Front Fences a. To limit the use of front fences. b. To ensure that any fence on the front boundary allows clear lines of sight from the street to car parks and building entries.	Front fencing is proposed to units facing Edgar Street. The fencing is well designed providing articulation and visual interest. The fencing is incorporated with landscaping and provides a level of privacy to the two units at podium level.	Complies.
6.24 Side and Rear Fences a. To provide privacy and security to residents and tenants on subject and adjoining land.	No side fencing is proposed or required due to existing stormwater drain.	Complies
6.25 Safety and Security. a. To ensure that development mitigates opportunities for crime, and perceived opportunities for crime.	The proposal has been designed to ensure opportunities for crime are mitigated. Most areas of the site are subject to passive and casual surveillance. There is clear delineation between private and public area. Potential opportunities for crime are avoided as far as practicable. A CPTED assessment and response is provided refer ***Appendix D***.	Complies
7 Landscape		
7.1 Landscape Design. a. To provide landscape design that complements the nature and scale of the development and contributes to the desired streetscape character. b. To provide landscape design that supports a functional, safe, and pleasant pedestrian environment. c. To provide landscape design that informs and responds well with the built form. d. To ensure that landscaping and architectural features are integrated and complementary.	The proposed landscaping is considered to be consistent with the objectives and controls within Council's DCP. The landscape design will complement the nature and scale of the development. The plantings will enhance the desired streetscape character, providing a safe, and pleasant pedestrian environment. The landscaping and architectural features are integrated and complementary with a robust design and will require minimum maintenance.	Complies

e. To design landscape works that are robust and require minimum maintenance.		
7.2 Street Trees and Streetscape Improvements. a. To enhance the amenity and desired character of the street. b. To provide tree shade and shelter for pedestrians. c. To ensure that paving and street furniture is constructed from high quality material that provide consistency and continuity of the streetscape.	The proposed landscaping is considered to be consistent with the objectives and controls within Council's DCP. Street tree planting will be provided in accordance with requirements providing consistency, shade and shelter for pedestrians.	Complies
7.3 Landscape and Tree Planting in Front Setback Areas. a. To allow for the planting and healthy growth of large canopy trees which enhance amenity and street character. b. To provide large-scale planting between the street and parking and service areas, that reduces the visual impact of development. c. To maintain sightlines from the street to carparks and entrances.	All three frontages include landscaping and tree planning reducing the visual impact of the built form. Landscaping is designed to ensure sightlines are not impacted and the development maintains an improved streetscape and amenity.	Complies
7.4 Landscape and Tree Planting in Car Parks. a. To provide broad canopy tree cover in car parks for shade and shelter. b. To reduce the visual impact of car parking areas. c. To maintain safety for car park users and sightlines below the tree canopy.	Not applicable - Car parking is located within a basement and ground floor covered parking area.	N/a
8 Operational Requirements		
8.1 Demolition and Construction Waste Management.	Waste will be generated from the work associated with the development. Waste	Complies

a. To ensure that reuse and recycling of building materials, demolition and construction waste is maximised to reduce waste going to landfill. b. To ensure that demolition and construction waste is appropriately and effectively managed.	disposal can be detailed in construction documentation and will likely involve transporting any construction waste to an approved waste disposal facility. A development and construction environmental management plan will be implemented to provide appropriate measures to avoid, minimise and mitigate the impacts during the earthworks including waste disposal. Outlines of requirements and management regimes have been included in the Waste Management Plan, refer ***Appendix R***.	
8.2 Waste Management. a. To ensure that waste/recyclables are managed and collected, and disposed of, reused, or recycled, effectively and efficiently, in order to provide a safe, healthy, and clean environment for the community, and to maintain the amenity of the City. b. To provide non-discriminatory access to waste management services, through the adoption of appropriate waste transfer arrangements. c. To ensure waste management, including servicing is integrated into the design of development.	A Waste Management Plan has been prepared to provide appropriate outline of measures to avoid, minimise and mitigate the impacts during the construction including waste disposal. Refer ***Appendix R***.	Complies
8.3 On-Site Sewage Management. a. To ensure that land is suitable for on-site sewage management, and that on-site sewage management systems are designed to operate sustainably,	Not applicable – On-site sewage is not proposed.	N/a

without resulting in environmental harm or risk to public health.		
8.4 Liquid Trade Waste and Chemical Storage. a. To ensure that liquid trade waste is disposed of appropriately, and does not enter the environment. b. To ensure that chemicals associated with a development are stored in a secure manner.	A development and construction management plan will be implemented to provide appropriate measures to avoid, minimise and mitigate the impacts of chemicals including waste disposal.	Complies
8.5 Erosion and Sediment Control. a. To ensure that development is designed to prevent erosion by minimising disturbance, retaining vegetation and reducing the need for earthworks. b. To prevent erosion and sediment-laden run-off during site preparation, construction and the ongoing use of land. c. To ensure that a number of integrated solutions, using a treatment train approach, are implemented for the control and treatment of erosion and sediment.	All works associated with the erosion control will be carried out in accordance with relevant standards. All works associated with the sediment control will be carried out in accordance with relevant standards. ACOR have prepared an Erosion and Sediment Control Plan, Refer Appendix S.	Complies
8.6 Air Quality. a. To ensure that development does not adversely affect air quality beyond the National Environment Protection Measure (Ambient Air Quality) standard for criteria air pollutants. b. To ensure that measures are implemented to maintain air quality. c. To ensure that odours and	The proposed use will not create odour or emissions. During construction, the proposed development may emit some odour and noise. A development and construction management plan will be implemented to provide appropriate measures to avoid, minimise and mitigate any impacts.	Complies

emissions do not have an unreasonable impact on the amenity of neighbouring properties, or the health of their occupants. d. To ensure that odours and emissions do not have an unreasonable impact on public health. e. To ensure that emissions do not have an unreasonable impact on natural environment.		
8.7 Noise and Vibration. a. To minimise the generation of noise and/or vibration, and to mitigate associated adverse impacts on the amenity of neighbouring properties and their occupants, and on occupants of the proposed development.	The proposed use will not generate excess noise or vibration. During construction, the proposed development will likely emit noise and vibration. A development and construction management plan will be implemented to provide appropriate measures to avoid, minimise and mitigate any impacts.	Complies
Part 9 – Specific Land Uses		
13 Residential flat Buildings		
13.1 Site Requirements. a. To ensure that Residential Flat Building developments are located on sites with sufficient size and street frontage to accommodate the required building envelope, car parking, landscaping, and private open space.	The proposed development is consistent with the character of the streetscape and positively contributes to the identity of the locality. The provision of the pedestrian way shall create a new recreational space within the Belmont Centre. The proposal is an architecturally designed built form with high quality materials and finishes. In this regard, the development provides aesthetic stimulation to the area and enhances the streetscape presentation. The proposal is considered to create interest within the locality.	Complies

	The development site is of a sufficient size to accommodate setbacks car parking and private open space.	
13.2 Housing Mix a. To provide a housing mix that supports diversity and promotes choice in housing types.	The proposal provides a mix of apartment living options. The proposal has a diverse range, from one bed plus study, two bed, two bed plus study, three bed and three bed plus study options.	Complies
13.3 Street Setback. a. To ensure that the development complements the existing setback pattern in the locality. b. To permit flexibility for developments that may be vulnerable to the impacts of flooding. c. To define the street edge and provide definition between public and private space. d. To encourage entries, windows, balconies and outdoor living areas that overlook the street.	The building is well articulated and has setbacks consistent with the established built form and pattern within the area. The frontages along Brooks Parade, Sharp Street and Edgar Street provide a softening of the built form with landscaping, improving visual amenity and a transition between the public and private realms.	Alternate Solution – The building is setback 5m in lieu of 6m to Sharp Street.
13.4 Side Setback a. To provide adequate separation between buildings to ensure that a reasonable level of privacy, amenity and solar access is maintained. b. To provide visual separation between buildings. c. To provide opportunities for the planting of vegetation	The buildings have been positioned away from the adjoining buildings and internally to the site to maximise sunlight penetration and minimise adverse impact on the adjoining properties from view sharing and loss of privacy and wind shelter. The setbacks and building position provides opportunities for landscape planting and a visual separation.	Complies
13.5 Site Coverage. a. To ensure that development maximises permeable surfaces, and maintains a balance between	The proposal will contain more than 65% site coverage by definition. This is due to the development complying with minimum flooding floor level requirements and as	Acceptable alternative solution.

built and unbuilt areas. b. To facilitate on-site stormwater infiltration and harvesting for re-use. c. To incorporate suitable measures to minimise run-off directly accessing the lake or its waterways	such having a podium level of greater than 1.2m. Than main towers do not exceed 65% therefore the overall development provided a balance between the built and perceived unbuilt forms.	
13.6 Landscape Area a. To enable landscape planting in the front setback that enhances the streetscape. b. To enable landscape planting in the side and rear setback that enhances residential amenity. c. To conserve significant vegetation. d. To promote on-site stormwater infiltration by encouraging pervious surfaces and landscaped areas	The landscape design will complement the nature and scale of the development. The plantings will enhance the desired streetscape character, providing a safe, and pleasant pedestrian environment. The landscaping and architectural features are integrated and complementary with a robust design and will require minimum maintenance.	Complies
13.7 Planting on Structures. a. To enhance the quality and amenity of open space on roof tops, internal courtyards, and over car parking structures. b. To encourage the establishment of vegetation in urban areas. c. To maintain privacy of neighbouring residents.	Planting and landscaping will occur on rooftops or structures. Sufficient depth and for planting will be provided to ensure sustainability. The landscaping has been designed to enhance amenity.	Complies
13.8 Landscape and Tree Planting in Front Setback Areas. a. To allow for the planting and healthy growth of large canopy trees which enhance amenity and street character. b. To provide large-scale planting between the street and parking	The proposed landscaping is considered to be consistent with the objectives and controls within Council's DCP. The landscape design will complement the nature and scale of the development. The plantings will enhance the desired streetscape character, providing a safe,	Complies

and service areas, that reduces the visual impact of development. c. To maintain sightlines from the street to carparks and entrances.	and pleasant pedestrian environment. The landscaping and architectural features are integrated and complementary with a robust design and will require minimum maintenance. Landscaping is designed to ensure sightlines are not impacted and the development maintains an improved streetscape and amenity.	
13.9 Street Trees. a. To enhance the amenity and desired character of the street. b. To provide tree shade and shelter for pedestrians.	The proposed landscaping is considered to be consistent with the objectives and controls within Council's DCP. Street tree planting will be provided in accordance with requirements providing consistency, shade and shelter for pedestrians.	Complies
13.10 Principal Private Open Space. a. To ensure that Residential Flat Building developments provide sufficient outdoor areas for residents' needs.	The principal communal open space is functional and responsive to the environment. Each apartment has a well-designed and located balcony with a communal consolidated central courtyard and additional roof terrace. The configurations are useable and attractive and sufficient for residential needs.	Complies
13.11 Services. a. To ensure that Residential Flat Building developments provide adequate services to cater for residents' needs.	The proposed development does not provide an on-site dedicated car wash area. However, Easy Wash Belmont is located on the corner of Maude Street and the Pacific Highway, 280 metres from the site. This facility has six (6) wash bays suitable to cater for the needs and services of the development. The development will provide fire hydrant and mechanical plant suitable for the site.	Considered an acceptable solution.

	Air-conditioning and other plant has a dedicated area within the basement, a substation to Edgar Street and all air-conditioners will be located centrally on rooftop locations and be acoustically insulated.	
13.12 Driveways and Parking Areas. a. To ensure that on-site car parking and driveways do not dominate or detract from the appearance of the development or the local streetscape. b. To ensure that vehicular access has minimal impact on neighbouring dwellings. c. To ensure that vehicular access points and parking is safe and convenient for residents, visitors and service providers.	The proposal considered the potential traffic impacts, refer Traffic and Parking Impact Assessment, by McLaren Traffic Engineering, refer ***Appendix I***. The proposal is supportable in terms of traffic impacts. Existing vehicle crossing have been minimised to two from the existing twelve and located on secondary frontages. Basement parking and manoeuvring ensures vehicles enter and leave in a forward direction. The driveways are two-way and all car parking complies with AS2890 Parking Facilities.	Complies
13.13 Adaptable Dwellings. a. To ensure that developments incorporate housing that is accessible to all members of the community.	The development has been designed with 26 adaptable dwelling units.	Complies
13.14 Waste Management. a. To ensure that waste/recyclables are managed, collected and disposed of, or re-used or recycled effectively and efficiently. This ensures a safe, healthy and clean environment for the community, as well as maintaining the amenity of the City.	A waste management plan has been prepared to provide appropriate measures to avoid, minimise and mitigate the impacts of waste and recyclables. Each tower is provided with refuse room within the basement to manage the collection of waste. Refer ***Appendix R***.	Complies

b. To provide non-discriminatory access to waste management services, through the adoption of appropriate waste transfer arrangements		
Part 10 – Town Centre Area Plans		
10.2 Belmont Town Centre		
2 Development Controls		
2.1 Block Controls. a. To improve the amenity and connectivity of the public domain. b. To improve vehicle circulation and access to public transport. c. To ensure that building scale, height and setback contributes to the desired future character of the town centre.	The existing landform, street grid and lot layout are suitable for potential development. The subject site is largely flat, with approximately 1° fall from east to west. The town centre has a slight slope, making pedestrian connection in the area relatively easy. Each built form is considered to be of a scale and design suitable for the land form and the emerging urban pattern of the surrounding area. Consideration was afforded to previous options and discussions with Council and other potential issues, such as to mitigate flood and inundation. Access and pedestrian circulation is significantly improved with the consolidation of the vehicle access points and improved pedestrian environment. The subject site comprises of a single urban block. This provides for the redevelopment of the block consistent with the area and is an efficient use of the land. The proposed development is consistent with the character of the streetscape and positively contributes to the identity of the locality. The proposal has a distinctive	Acceptable alternative solution

	built form, incorporating a diversity of materials, which complement the mixed-use character of the locality and reinforces the site's location. In particular, the building is massed towards the street frontage to further emphasise its location. It provides for a stepped built form to ensure an appropriate transition in scale. Building entries are inviting and activate the frontages allowing visual permeability from the street. The proposal is oriented towards Station Street and generally built to the street frontage. At ground level are five retail/commercial areas included to facilitate street front activation and help integrate the building with the surrounding area. In this regard, the development provides aesthetic stimulation to the area and enhances the streetscape presentation. The proposal is considered to create interest within the locality. The building is 8 storey over one tower with the other three towers 6 storeys high. The proposed height provides a contextually appropriate height transition with the adjoining development and remains consistent with the identified Belmont bump. This is further identified within the BTCR along with different setback and block control provisions. The DCP stipulates a 6 storey height or	

	22metres. The proposed 8 storey height is considered appropriate, given the nature and character of the adjoining buildings which include an 8 storey development (Belmont Towers). The proposal will provide a suitable transition in height between surrounding buildings and is considered visually complementary to the surrounding area.	
3 Context and Setting		
3.1 Sensitive Aboriginal Cultural Landscape. a. To ensure that the cultural and archaeological significance of a development site and its context are determined prior to any development. b. To manage and interpret the Sensitive Aboriginal Cultural Landscape in consultation with the local Aboriginal community.	An AHIMS search was undertaken and indicates that no items of Aboriginal heritage are located on the site or within 200m of the subject site. Additionally, a desktop search of the NSW State Heritage Inventory on 13 July 2015 and Council's Heritage Register also indicated that no items of significance are located within the subject site. The area is highly urbanised and the proposed development is consistent the surrounding area. An Aboriginal Heritage Due Diligence Assessment has been prepared, refer ***Appendix Q***.	
4 Street and Public Space		
4.1 Outlook to the Lake. a. To maintain public views along streets to the lake and landmark elements b. To ensure development provides large breaks between buildings located between Edgar Street to Lake Macquarie. c. To maintain and enhance the landscape corridor along existing stormwater channels.	Vistas from outside to the town centre are available and vice versa to the Lake. The key view corridor to the Lake is provided between buildings from the Pacific Highway down Macquarie Street, which terminates at the Lions Club Park. Mark Street, Maude Street and Sharp Street provides short view corridors as a result of the change in direction of the streets. These corridors will be maintained. View corridors through urban blocks in the	Complies

	town centre is difficult, however the proposal has view corridors in the north-south and east-west configuration. This has been achieved despite the challenge of environmental constraints to deal with solar access, flooding and inundation.	
4.2 Vehicle Lanes. a. To establish a safe and direct vehicle and pedestrian connection from Thomas Street to Herbert Street that provides service access to the rear of properties on the Pacific Highway. b. To establish a safe and direct vehicle and pedestrian connection from Maude Street to Herbert Street located on the alignment of Henry Street.	Not Applicable	N/a
4.3 Pedestrian Lane – Pacific Highway to Thomas Street. a. To establish a pedestrian lane with active frontage for direct pedestrian movement from the Pacific Highway through the future retail core to the lake foreshore.	Not Applicable	N/a
4.4 Public Place – Thomas Street Square. a. To clarify and improve vehicle and pedestrian circulation between Thomas and Edgar Streets. b. To provide an open air and north facing public space that is located in close proximity to extensive retail floor space, and readily accessible from surrounding streets.	Not Applicable	N/a
4.5 Public Place – Singleton	Not Applicable	N/a

Street Square. a. To provide a pleasant, safe and lively public space and outdoor trading space with good sun access and an elevated outlook to the north.		
4.6 Entries Located at Street Terminations. a. To support activity and pedestrian movement at the intersection of George St and Pacific Highway, at the intersection of Macquarie and Singleton Streets, and the intersection of Sharp and Edgar Streets.	The subject site is not located in the locations applicable to this clause. Nonetheless pedestrian entries are definable, safe and well lit.	Complies
4.7 Streetscape Improvements. a. To provide high quality infrastructure for pedestrians in the town centre.	The proposed landscaping is considered to be consistent with the objectives and controls within Council's DCP. Street tree planting will be provided in accordance with requirements providing consistency, shade and shelter for pedestrians.	Complies
5 Access and Parking		
5.1 Site Access a. To maximise the retail frontage and pedestrian amenity for streets in the town centre. b. To minimise impacts on traffic flow on the Pacific Highway	The proposal considered the potential traffic impacts, refer Traffic and Parking Impact Assessment, by McLaren Traffic Engineering, refer ***Appendix I***. The proposal is supportable in terms of traffic impacts. Existing vehicle crossing have been minimised to two from the existing twelve and located on secondary frontages. Site is not located on the Pacific Highway and will not impact on traffic flows. The driveways are two-way directional	Complies

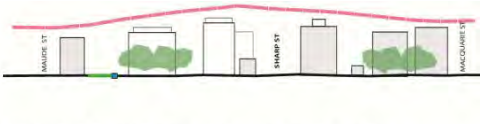
	and all car parking complies with AS2890 Parking Facilities.	
5.2 Parking Provision. a. To maximise retail floor space at street level along the southern side of Macquarie Street and the eastern side of Thomas Street. b. To maximise centralised public parking spaces on larger sites, either in basement excavations or on upper levels where sites are affected by flooding and sea level rise	Basement parking and manoeuvring ensures vehicles enter and leave in a forward direction and provided in a centralised basement. The car parking complies with AS2890 Parking Facilities.	Complies
Building Design		
6.1 Brooks Parade and Edgar Street. a. To establish view corridors from Edgar Street to Brooks Parade and the lake. b. To break up the mass of development along Brooks Parade and Edgar Street. c. To ensure that each apartment block has an individual character that contributes to the overall streetscape character. d. To encourage a pedestrian scale built form at street level along Brooks Parade and Edgar Street with single storey retail floor space close to the street boundary. e. To support pedestrian movement and activity along the foreshore and Brooks Parade.	The proposed development enhances Public and private space has been clearly defined through a well-articulated built form and delineation of public and private areas at street level. In particular, the proposal includes the provision of a pedestrian way to create connections between he foreshore and Edgar Street enhancing the pedestrian experience and connectivity and shall enliven the locality. This creates a new space that will positively contribute to the character of the area. The proposed development is consistent with the character of the streetscape and positively contributes to the identity of the locality. The provision of the pedestrian way shall create a new recreational space within the Belmont Centre. In this regard, the development provides aesthetic stimulation to the area and enhances the streetscape presentation.	

	The proposal is considered to create interest within the locality. The proposed design is considered to be an appropriate form that is sympathetic and compatible with the emerging character in this area. The proposed development aligns with the emerging high density character of the area. The building has been positioned away from the adjoining tall buildings to maximise sunlight penetration to the apartments and minimise adverse impact on the adjoining properties. The proposed height and density generate minimal adverse impacts, and the proposal is considered to be an exemplary development of architectural excellence. The proposal is well articulated to provide visual interest and to minimise any adverse impact upon bulk and scale. Contemporary designs features have been utilised in the development.	
6.2 Building to the Street Boundary. a. To define the spatial character of the northern entry on the Pacific Highway. b. To maximise building mass, floor space and activity at the street boundary in the town core.	The ground floor contains a mix of residential uses and retail/commercial tenancies. The proposal will maintain a predominantly active frontage and appropriate transition from public to private spaces. Visual amenity and streetscape will be enhanced. The proposal has a distinctive built form, incorporating a diversity of materials,	

	which complement the mixed-use character of the locality and reinforces the site's location. In particular, the building is massed towards the street frontage to further emphasise its location. It provides for a stepped built form to ensure an appropriate transition in scale. Building entries are inviting and activate the frontages allowing visual permeability from the street. The proposal is oriented towards Station Street and generally built to the street frontage. At ground level are five retail/commercial area included to facilitate street front activation and help integrate the building with the surrounding area.	
6.3 Front Setbacks a. To define the spatial character and proportions of each street. b. To maintain a wider landscape setback for the southern entry to Belmont on the Pacific Highway. c. To provide a suitable interface to residential zoned land on the north side of Maude Street.	The proposed north east front corner of Building C varies slightly to the block control setbacks. The proposed setback is consistent with the character of the existing streetscape. Landscaping and architectural designs soften the setback from built form and compliments the proposed pedestrian way. The building setbacks to Sharp Street are 5m. The proposal has a distinctive built form, incorporating a diversity of materials, which complement the mixed-use character of the locality and reinforces the site's location. In particular, the building is massed towards the street frontage to further emphasise its location. The proposed built form responds to the streetscape, utilising various cladding	Acceptable alternative solution

	materials which complement the uses in the area and softens the appearance of the development and maintain a quality consistent with the proposal's use and the adjoining uses. The building's design aims to create an appropriate transition between the lower scale commercial uses and the higher intensity residential development. In accordance with the objectives, the proposal provides a stepped built form that prevents any significant visual bulk or amenity impacts to the surrounding Streets. The choice of materials and façade articulation ensures that the ground floor is visually prominent. In particular, the ground floor provides greater floor to floor heights and incorporates larger windows. Combined these design elements will emphasise its mixed usage and improve the proposal's contribution to the activation of the street. The upper levels incorporate smaller windows and balustrades, which combined ensure the massing does not present as visually dominant. The building's frontage demarcates the mixed-use ground floor from the upper residential levels and minimises the proposal's bulk at street level, providing for a more human scale.	
6.4 Side and Rear Setbacks. a. To ensure an appropriate level of amenity for building occupants, including natural light and ventilation, outlook, view sharing, wind shelter and privacy.	The proposal complies with side and rear block control setbacks.	Complies

b. To allow natural light and ventilation from the front and rear of properties		
6.5 Building Height. a. To ensure that developments do not overwhelm the public street, and are of compatible scale with the surrounding, or desired future built environment. b. To encourage higher density development in the core area between the Pacific Highway, Macquarie Street, Edgar Street and Herbert Street. c. To allow view lines between buildings from Edgar Street to Brooks Parade.	The building is 8 storey over one tower with the other three towers 6 storeys high. The proposed height of the 8 storey tower results in a 2 storey departure from the standard. The proposed height provides a contextually appropriate height transition with the adjoining development. The DCP stipulates a 6 storey height. The proposed 8 storey height is considered appropriate, given the nature and character of the adjoining buildings which include an 8 storey development (Belmont Towers). The proposal will provide a suitable transition in height between surrounding buildings and is considered visually complementary to the surrounding area. There is negligible environmental planning impact as a result of the height departure; the proposal maintains compliance with the objectives of the standard and that there are planning grounds particular to the circumstances of the case to support the departure. A Clause 4.6 exception is provided, refer ***Appendix O***. The proposed height provides a contextually appropriate height transition with the adjoining development and remains consistent with the identified Belmont bump. This is further identified within the BTCR with the development	Acceptable alternative solution.

	consistent with the identified objectives and outcomes and relied on with the development design, refer to ***Appendix P***.  **Building Bulk**: Belmont Towers as the reference point for visual bulk. Building Bulk Page 18 of BTCR. Notwithstanding the above, the proposed building height does not generate any adverse impact and retains compliance with the objectives of the standard.  Building Height outcomes, page 19 of the BTCR. The DCP however stipulates a 6 storey height or 22 metres. The proposed 8 storey height is considered appropriate, given the nature and character of the adjoining buildings which include an 8 storey development (Belmont Towers). The proposal will provide a suitable transition in height between surrounding buildings and is considered visually complementary to the surrounding area.	

	Shadow Diagrams for mid-winter are submitted with the application to determine solar access and generate the proposed shadow created by the building. The proposal while creating a shadow, solar access is available during periods of the day. Therefore, there are negligible impacts that result from the subject application. The proposed development has been oriented to allow for solar access into the apartments.	
6.6 Maximum Occupied Area. a. To reduce the bulk and impact of a building mass on residential amenity within the development site, or on neighbouring sites.	The proposal complies with the block control and the nature of the proposed development separated into four towers reduces he visual bulk and mass and there are considered negligible impacts on residential amenity.	Complies
6.7 Building Exteriors. a. To reduce the bulk and impact of a building mass on residential amenity within the development site, or on neighbouring sites.	The proposed development is consistent with the character of the surrounding area and will positively contribute to the identity of the locality. The proposal is an architecturally designed built form with high quality materials and finishes of predominately muted tones, refer concept finishes board. In this regard, the development provides aesthetic stimulation to the area and enhances the presentation from the foreshore and lake. The proposal is considered to create interest within the locality. The proposed design is considered to be an appropriate form that is sympathetic and compatible with the emerging character in this area. The proposed	

	development aligns with the emerging high density character of the area.	
6.8 Balconies on the Pacific Highway. a. To provide suitable privacy and amenity for users of balconies on the Pacific Highway.	The site is not located on the Pacific Highway	N/a
7 Landscape		
7.1 Planting on Private land. a. To provide broad canopy trees along the Pacific Highway entry to Belmont from the north. b. To enhance the amenity of the Brooks Parade waterfront with landscape planting on private land. c. To provide a landscape buffer between mixed use development and residential zoned land.	The proposed landscaping is considered to be consistent with the objectives and controls within Council's DCP. The landscape design will complement the nature and scale of the development. The plantings will enhance the desired streetscape character, providing a safe, and pleasant pedestrian environment. The landscaping and architectural features are integrated and complementary with a robust design and will require minimum maintenance. Landscaping is designed to ensure sightlines are not impacted and the development maintains an improved streetscape and amenity. Sufficient space is available to provide 1 clear-trunked broad-canopy tree for every 50m2 of landscape area.	Complies
8 Block Controls	The proposal is considered to be generally compliant with identifies block controls. The existing landform, street grid and lot layout are suitable for potential development. The subject site is largely flat, with approximately 1° fall from east to west. The town centre has a slight slope, making pedestrian connection in the area	Acceptable alternate solution.

	relatively easy. Each built form is considered to be of a scale and design suitable for the land form and the emerging urban pattern of the surrounding area. Consideration was afforded to previous options and discussions with Council and other potential issues, such as to mitigate flood and inundation. Access and pedestrian circulation is significantly improved with the consolidation of the vehicle access points and improved pedestrian environment. The subject site comprises almost entirely of a single urban block. This provides for the redevelopment of the block consistent with the area and is an efficient use of the land.	

Given the above, it is considered that the proposed development Impacts to the built environment and social environments will be within acceptable and anticipated limits. It is envisaged that the development will provide additional housing and commercial opportunities within an area designated for higher density development, consistent with the desired future character of the area as outlined by Council's planning controls.

The social and economic outcomes are considered to be positive, given that employment opportunities will be generated during construction and in the provision of retail/ commercial floor space on the ground floor, as well as additional housing opportunities located close to public transport, schools and employment.

Impacts on the natural environment are negligible as the proposal does not involve hazardous materials or processes. As discussed in the previous sections of this report, the proposed development will not result in any significant adverse environmental impacts. The scheme will not incur any unreasonable impacts to the character of the locality. No unacceptable safety, security and traffic implications are expected. Safe and efficient vehicular and pedestrian access will be possible from the established road system. In this case, the proposal's likely impacts are positive.

5. ENVIRONMENTAL IMPACT ASSESSMENT

The likely impacts of the proposed development are considered and discussed below. Monteath and Powys has undertaken an assessment of the proposal against potential environmental impacts, site suitability and the public interest in accordance with Section 79C of the EP & A Act. The potential environmental impacts and their mitigation measures are discussed below.

5.1 Built form and Public Domain

The locality is currently undergoing a transition with a number of one and two storey residential dwellings being replaced with mixed use residential flat buildings and commercial/retail tenancies between 6-8 storeys in height. The scale and height of the proposal is generally consistent with other developments in the locality.

The proposed built form will not create any additional significant overshadowing impacts over and above that which could occur with a fully compliant development. The proposal will have limited privacy impacts to the adjoining neighbours. Appropriate setbacks, window positions and balcony locations which also have been incorporated privacy screens are proposed.

The topography and proposed built form combine to provide vistas and view corridors. The hill in Belmont town centre provides prominent vistas from the vicinity of Victoria Street, George Street and Gen Street off the Pacific Highway in all directions. Vistas from outside the town centre toward the centre exist from other hilltops. Several streets north of Evans Street have views south to the town centre; the top of Wommora Avenue with views to the south west; Belmont North looking south, and; the vicinity of Green Point looking south east. Finally, marine craft users on Lake Macquarie have uninterrupted vistas of the Belmont foreshore.

Several view corridors in the town centre are available to the Lake and these will not be interrupted. The key view corridor to the Lake is provided between buildings from the Pacific Highway down Macquarie Street, which terminates at the Lions Club Park. Mark Street, Maude Street. Sharp Street provides short view corridors as a result of the change in direction of the streets. Mark Street provides a corridor 300 metres long, however it is not a significant street. Maude Street changes direction 140 metres before the foreshore, while Sharp Street does not align with Herbert to continue the corridor.

View corridors through urban blocks in the town centre have not been achieved and are challenged by environmental constraints to deal with solar access, flooding and inundation. As identified above there are view corridors into the subject site. However, as previously noted there are some viewpoints from which the site is barely visible, even with potential heights of 8 storeys, given the topography of the Belmont area. The most prominent views are from the Lake.

Apartments on Edgar Street block the views into the site such that Belmont Towers is barely visible even from this short distance away. Even with current one and two storey buildings the site is barely visible and is unlikely to be seen if redevelopment occurs in accordance with the current controls under LEP 2014.

The proposed development is consistent with the character of the streetscape and positively contributes to the identity of the locality. The provision of the pedestrian way shall create a new recreational space within the Belmont Centre.

The proposal is an architecturally designed built form with high quality materials and finishes. In this regard, the development provides aesthetic stimulation to the area and enhances the streetscape presentation. The proposal is considered to create interest within the locality. The proposed design is considered to be an appropriate form that is sympathetic and compatible with the emerging character in this area. The proposed development aligns with the emerging high density character of the area.

The building has been positioned away from the adjoining tall buildings to maximise sunlight penetration to the apartments and minimise adverse impact on the adjoining properties. The proposed height and density generate minimal adverse impacts, and the proposal is considered to be an exemplary development of architectural excellence. The materials, finishes and colours are of a high quality and are complimentary to the streetscape. The proposal is well articulated to provide visual interest and to minimise any adverse impact upon bulk and scale. Contemporary designs features have been utilised in the development.

5.2 Air Quality

There is likely to be negligible impact to air quality and micro-climate by the proposed development given it is predominately residential in nature.

5.3 Heritage

As discussed in Section 2.1, desktop searches were undertaken of the NSW State Heritage Inventory, Council's Heritage Register and an AHIMS search was undertaken on and no items were identified.

No items of Aboriginal heritage are located on the site. An aboriginal heritage due diligence assessment has been prepared and included at ***Appendix Q***.

5.4 Traffic and Access

The DA is accompanied by a Traffic and Parking Report, prepared by McLaren Traffic engineering (***Appendix I***).

Traffic Generation

The proposal will result in additional trips when compared with the current land uses and existing traffic conditions. The net traffic volume increase is considered to be low order and would have no material impact on the operation or performance of the surrounding road network. The report concludes that no external road/intersection improvements would be required to facilitate the development.

Vehicle Access

The development generally proposes two-way flow internally, with a ramp from Edgar Street designed for two-way flow. This will mean multiple vehicles can enter/exit the car parks at any one time.

In addition a separate vehicle services bay is provided to Sharp Street with access to a loading dock and turning platform.

For this reason, the report suggests all accesses will be operated within acceptable limits without delays, and in a safe and efficient manner.

Pedestrian Access

The DA is accompanied by a Disability Access Audit (refer to ***Appendix F***) prepared by BCA Access Solutions which provides an assessment of the proposal against relevant accessibility requirements. The report provides an assessment against the Deemed to

Satisfy provisions in the BCA and premises standards. Where there is a compliance departure the report provides recommendations to ensure compliance is readily achievable. The report also provides an assessment against the relevant Australian Standards and provides guidance in relation to these matters. An updated audit will be provided with the new design and can readily achieve compliance with the BCA and DCP requirements.

5.5 Noise and Vibration

Noise levels arising from the proposal will initially be noise impacts from construction. These will be short term and will be managed in accordance with OEH requirements. A detailed Traffic and Construction Management Plan will be provided at the Construction Certificate stage to ensure the amenity of the surrounding development during the construction of the proposed development.

The internal amenity of the proposed development has been assessed with regard to the criteria for dwellings specified in the Development Control Plan and the Australian Standard. The predominant noise source surrounding the site includes traffic movement on surrounding roadways including and mechanical plant.

Noise monitoring was conducted during 8-14 April 2016 and identified traffic noise levels of 64 dB(A) Leq at Brooks Parade and 55 dB(A) Leq at Edgar Street. These levels exceed the internal noise goals for houses and apartments near roads as detailed in AS2107. In order to manage traffic noise, the report recommends the acoustic attenuation measures a minimum glazing standard, refer to the Acoustic Report at ***Appendix J***.

Mechanical ventilation and air conditioning placement should not be located within clear line of sight to achieve satisfactory internal noise levels with open windows. It is noted the proposed masonry external wall construction of the building façade will be acoustically acceptable without additional acoustic treatments and the proposed external construction is acoustically acceptable without additional acoustic treatment.

The report concludes that provided the recommended acoustic treatments above be incorporated into the proposal, the internal noise levels will satisfy the requirements of the outlined criteria.

Noise Emissions and potential sources of noise emissions during the operational phase of the proposed development will involve mechanical plant and from use of indoor and outdoor communal areas.

The nearest potential noise receiver are all residential dwellings surrounding the site to the north, south and west. It is proposed that a detailed acoustic review should be undertaken at CC stage to determine whether appropriate acoustic treatments such duct lining, acoustic silencers and enclosures are necessary. Additionally, the outdoor communal areas will be managed in such a way to ensure that the acoustic amenities of adjoining sensitive receivers are not unduly disturbed.

5.6 Utilities

The proposed development will be connected to mains water, gas and sewer, as well as telecommunications. Furthermore, the development will comply with water efficiency requirements of BASIX.

An Infrastructure and Services Report including electrical, mechanical, fire, hydraulics, civil and sustainability services will be prepared detailing the installation of new and augmentation/upgrade of existing utilities as required.

Water and sewer utility provisions are likely capable of complying with the relevant standards and controls.

Power, based on initial advice indicates, the existing network has sufficient capacity to provide power to the new development. However, as the building occupies majority of the property footprint and is anticipated maximum demand a chamber substation is likely required. Details of the proposed substation location are included as part of the Proposal Plans.

Telecommunications will include an application for connection to the NBN during the design and construction phase to confirm rollout timeframes. In the interim, existing copper services from Telstra will service the site and a private internet service provider will be required. In the event the NBN is active the Telstra copper network will not provide services to the new development.

The provision of fire hydrants and fire extinguishers will be detailed during the design and construction phase and confirmed with NSW Fire and Rescue.

All servicing requirements will be obtained from the relevant service provider prior to issue of the construction certificate.

5.7 Stormwater Management and Flood Hazard

Due to the highly urbanised environment, a Water Cycle Management Plan can be undertaken to mitigate the effects of any stormwater on adjoining or downstream sites in accordance with Council's Water Cycle Management Guidelines. Conditions can be imposed to ensure that any water cycle management, shall comply with relevant standards.

A Limited Flood Study Investigation Prepared by Forum Consulting Engineers has been undertaken. The investigation concluded that the adoption of the Lake Macquarie Flood Study be adopted. The design takes into consideration the flood study recommendations so as to mitigate risks to life and/or property through design and positioning of development.

Habitable rooms and commercial development have a finished floor height at least 500mm above the 100 year ARI (1% AEP) event.

Buildings and other structures, including fences, are not considered too impede the flow of floodwaters or entrap debris as a 1% AEP event can be conveyed within the existing concrete lined drain, refer ***Appendix M***.

The development is located on designated flood prone land. Further risk management measures are not considered necessary. The development will use flood compatible materials in its construction that will minimise potential damage by flooding.

The development is considered to unlikely create any adverse impacts.

5.8 Soil and Geotechnical

The DA is accompanied by a Geotechnical Report (refer to ***Appendix H***) prepared by Regional Geotechnical Solutions who have undertaken a desktop study, reviewed geological maps and undertook geotechnical subsurface investigations at the site. The report provides

preliminary comments on likely excavation conditions, retention requirements, acid sulfate soils, footings, groundwater and basement floor slabs.

Geotechnical Issues

From a geotechnical perspective, the report considers that the site is suitable for the proposed development and will involve relatively common construction techniques and methodologies. The report details the main geotechnical issues which are summarised below:

- The testing indicated the sands overlaying the site are slightly acidic however and the acid is not sulfuric in nature.
- Detailed geotechnical site investigation should be completed and consideration given to construction of the floor slab;
- Given the size of the proposed building, and the likely structural loads, a new base perimeter wall; and a fully tanked basement will be required.

Excavation Conditions

The report recommends dilapidation surveys be undertaken for neighbouring buildings and structures which will include a detailed inspection of the properties with all defects rigorously described prior to excavation.

Hydrogeological Issues

Based on the results groundwater will be encountered above the bulk excavation level. Therefore details of the groundwater levels should be carried out during the detailed geotechnical investigation of the site. Groundwater volumes will require a tanked basement (i.e. a basement floor slab designed for hydrostatic uplift pressures).

5.9 Waste

Waste management measures have been prepared to understand the details regarding site waste generated during the demolition and construction phase of the development. Waste storage facilities will be provided to meet the predicted requirements of the development calculated in accordance with Council policy.

Post development waste storage rooms will be the collection locations of waste and collected by a private waste contractor tailored to suit the final operational characteristics of the building. Waste will be collected outside of peak traffic hours and managed by the strata caretaker. Bins will be moved to the service bay lift for collection and returned to the relevant garbage rooms once emptied.

As such, no adverse impacts are anticipated as a result of waste storage and collection from the site and the ongoing operation can be appropriately conditioned. Refer, waste management plan at ***Appendix R***.

5.10 Climate Change

The proposed development is unlikely to have an impact on local climate conditions or have any direct or indirect impact on a micro-climate.

5.11 Crime Prevention

This section provides an assessment against the principles of CPTED. These principles aim to reduce crime by using design and place management concepts to decrease the likelihood that the constituents of crime events (victim, offender, opportunity) come together in space and time. More specifically, CPTED aims to:

- Increase the perception of risk to criminals by increasing the possibility of detection, challenge and capture;
- Increase the effort required to commit crime by increasing the time, energy or resources that need to be expended;
- Reduce the potential rewards of crime by minimising, removing or concealing “crime benefits”; and
- Remove the conditions that create confusion about required norms of behaviour.

CPTED Principles

The key CPTED principles have been assessed as follows:

Surveillance

The development offers ample opportunities for passive surveillance. The development will activate the street frontages along Brooks Parade, Sharp Street and Edgar Street. The units predominately face out to street frontages or to the central communal open space area. The main access points are carefully designed and positioned to avoid opportunities for non-

residents to shelter or congregate in these areas. Furthermore, the ground floor units will create further passive surveillance to the street frontages.

Access Control

The main residential entries will be readily accessible by future residents and the entries will be clearly defined and easily distinguishable.

Territorial enforcement

The building and landscaping design encourages a close relationship between future residents and the public domain through multiple entries and multiple balconies that overlook the street. These features promote activity along the street and compel residents to feel some responsibility for the surrounding public areas and their condition. The landscaping and access points to the front setback will act as a physical barrier which will clearly define the public and private realm.

Space management

The proposal has no features that would hinder the application of appropriate space management measures, such as site cleanliness, rapid repair of vandalism and graffiti, the replacement of burned out pedestrian and car park lighting and the removal or refurbishment of decayed physical elements.

Overall, the proposal meets the overriding principles of CPTED, refer to the attached CPTED assessment at ***Appendix D***.

5.12 Social

The proposed development provides a number of positive social impacts including the provision of affordable housing as well as a development that utilises existing social and recreational infrastructure, including public transport provision. Some jobs will be created by the proposed works. The development will mean the loss of private recreation space, however, there is sufficient open space in the immediate vicinity of the site as previously identified by Council. The site development will not create additional social or recreational infrastructure needs to be provided as a result of the development. The developer will be required to pay development contributions which can be used by Council to manage existing infrastructure in the area. Refer ***Appendix L*** for further details.

6. ECOLOGICALLY SUSTAINABLE DEVELOPMENT

The principles of ecologically sustainable development (ESD) have been considered in preparing this SoEE. Schedule 2 of the Environmental Planning and Assessment Regulation 2000 note that ecologically sustainable development requires the effective integration of economic and environmental considerations in decision-making processes.

The Act goes on to note that ecologically sustainable development can be achieved through the implementation of the following principles and programs:-

The Precautionary Principle - Namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:-

i. Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and

ii. An assessment of the risk-weighted consequences of various options.

Inter-generational Equity - *Namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.*

Conservation of Biological Diversity and Ecological Integrity - *Namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.*

Improved Valuation, Pricing and Incentive Mechanisms - *Namely, that environmental factors should be included in the valuation of assets and services, such as:-*

Polluter pays - that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement.

The users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.

Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

The principles of ESD have been considered in the preparation of this SoEE and development design. The proposed development is considered to be able to comply with the ESD objectives for the site.

7. SITE SUITABILITY

This Statement of Environmental Effects has determined that the site is suitable for the proposed development. It also explains how it meets the DCP requirements re character, scale, dwelling type, standards, access, stormwater, and parking.

The SoEE has demonstrated in detail that the site is suitable for the proposed development. In summary, suitability is achieved given:

- The proposed development is permissible and will be consistent with the relevant zone objectives.
- The development is of high quality and will set an example for regeneration of the locality, as anticipated in Council's controls. The development will therefore have a positive environmental impact.
- The Site is ideally located adjacent to a range of public and private services and transport options.
- The development will respect the existing and desired future character of the immediate and surrounding locality.
- There are no prohibitive constraints posed by the site or those adjacent.

8. SUBMISSIONS

The proposal has been notified in accordance with the requirements of Council's DCP, providing opportunity for the public to comment on the development. A number of submissions were received. All reasonable concerns raised in these submissions will be considered.

9. PUBLIC INTEREST

The public interest is best served by promoting sustainable development that is rational, orderly and economic. The proposed development will generate positive social, environmental and economic benefits.

Approval of the application is not contrary to the public interest given:

- The proposed development will provide an appropriate mixed use development outcome in an accessible location in accordance with the desired future character of the area, as expressed by the B4 – Mixed Use zoning.
- The proposal will facilitate redevelopment of the Brooks Parade corridor to a high standard.
- The local supply and choice of housing form will be supplemented by the proposal.
- The environmental impacts of the proposal are reasonable and within anticipated limits.

10. CONCLUSION

This Statement of Environmental Effects has been prepared to accompany a development application for the demolition of existing dwellings and structures, and construction of a mixed use, multi storey development comprising 140 residential units, 4 retail/commercial area, communal and recreation spaces, basement car parking and associated landscaping at 32-44 Brooks Parade, 2-10 Sharp Street and 5-11 Edgar Street, Belmont.

The proposal seeks consent for an architecturally designed residential flat building that is consistent with the provisions under the Lake Macquarie LEP 2014 and the Lake Macquarie DCP 2014 and adequately responds to the communities housing need.

The design of the proposed development has been primarily guided by the surrounding environment and character; the requirements for apartment buildings in the Apartment Design Guide; the need for the built form to provide a strong central element on the high quality location and good planning practice.

The proposed use is permissible with consent in the '***B4 Mixed Use***' zone and is compliant with the objectives of the planning controls and design requirements. The application relies upon the provisions Clause 4.6 in relation to the height with, the justification for this departure being considered acceptable in the particular circumstances of this case. Furthermore, the height proposed is consistent with the '*Review of the Town Centres DCP and Belmont Area Plan for 32 Brooks Parade Belmont, prepared by Lake Macquarie Council's Integrated Planning Department'* and provided to the applicant and subsequently relied on.

The proposal has been well considered and will result in functional commercial spaces on the ground floor, good traffic circulation within basements, and a high standard of amenity for residents and minimal impacts on neighbours. The proposal will therefore achieve Council's objectives for the site in particular and the wider Belmont Town Centre.

It is therefore submitted that Council approve the proposal.

32 BROOKS PARADE
ASSESSMENT AGAINST PARTS 3 & 4 OF THE APARTMENT DESIGN CODE

3A Site analysis	
Objective 3A-1 Site analysis illustrates that design decisions have been based on opportunities and constraints of the site conditions and their relationship to the surrounding context	
Design guidance	
Each element in the Site Analysis Checklist should be addressed (see Appendix 1)	The submitted architectural, landscape and stormwater control plans together with the SEE prepared by Monteath and Powys and the various reports included in the SEE is considered to have addressed all the items listed in the Checklist.
3B Orientation	
Objective 3B-1 Building types and layouts respond to the streetscape and site while optimising solar access within the development	
Design guidance	
Buildings along the street frontage define the street, by facing it and incorporating direct access from the street (see figure 3B.1)	The buildings face the 3 street frontages. Access to the residential buildings are via the elevated podium required to meet Council's Sea Level Rise policy. Access to the commercial areas is also via the elevated podium required to meet Council's Sea Level Rise policy but at a lower level.
Where the street frontage is to the east or west, rear buildings should be orientated to the north	There are no rear buildings as street frontage is provided on 3 sides of the site

Where the street frontage is to the north or south, overshadowing to the south should be minimised and buildings behind the street frontage should be orientated to the east and west (see figure 3B.2)	The buildings have been orientated to maximise units facing north. The units along Brooks Parade have been orientated to face the street frontage and the magnificent views over Lake Macquarie and mainly face west.
Objective 3B-2 Overshadowing of neighbouring properties is minimised during mid winter	
Design guidance	
Living areas, private open space and communal open space should receive solar access in accordance with sections 3D Communal and public open space and 4A Solar and daylight access Solar access to living rooms, balconies and private open spaces of neighbours should be considered	These items have been addressed in detail in the response to sections 3D Communal and public open space and 4A Solar and daylight access. There are no adjoining properties to the south, east, and west.

Where an adjoining property does not currently receive the required hours of solar access, the proposed building ensures solar access to neighbouring properties is not reduced by more than 20%	There are no adjoining properties to the south, east, and west. The shadows cast by the building only affect sections of the adjoining buildings facing Sharp Street in mid winter as follows: **Belmont Central** • Commercial Ground Floor from 1.00 pm to 3.00 pm • Residential First Floor from 1.30 pm to 3.00 pm • Residential Second Floor from to 2.30 pm to 3.00 pm • Residential Third Floor from to 3.00 pm **Belmont Towers** • Garages Ground Floor from 12.00 noon to 3.00 pm • Residential First Floor from 1.00 pm to 3.00 pm • Residential Second Floor from to 1.30 pm to 3.00 pm • Residential Third and Fourth Floors from to 2.00 pm to 3.00 pm • Residential Fifth Floor from to 2.00 pm to 3.00 pm Shadow diagrams showing the effect on the adjoining buildings are shown on drawing DA45.
If the proposal will significantly reduce the solar access of neighbours, building separation should be increased beyond minimums contained in section 3F Visual privacy	Refer above. The proposal will not significantly reduce the solar access of neighbours
Overshadowing should be minimised to the south or down hill by increased upper level setbacks	The site is a level site and the buildings have been set back at Ground Floor level and at the upper levels

It is optimal to orientate buildings at 90 degrees to the boundary with neighbouring properties to minimise overshadowing and privacy impacts, particularly where minimum setbacks are used and where buildings are higher than the adjoining development	The site is a corner site bounded by streets on 3 sides and a canal on the fourth side. The properties on the north side of the canal comprise a lot reserved by Hunter Water for infrastructure and a residential lot to the north and east. The buildings do not overshadow either of these properties. The owners have negotiated the purchase of a strip of land from the adjoining residential property to provide a pedestrian link to the north of the canal. The minimum set back of the building line at Ground Floor level from the adjusted boundary with the adjoining property is 8.1m.
A minimum of 4 hours of solar access should be retained to solar collectors on neighbouring buildings	The shadows cast by the buildings only affect sections of the adjoining buildings facing Sharp Street and do not overshadow any solar collectors on neighbouring buildings.
3C Public domain interface	
Objective 3C-1 Transition between private and public domain is achieved without compromising safety and security	
Design guidance	
Terraces, balconies and courtyard apartments should have direct street entry, where appropriate	2 apartments have been provided with direct access off Edgar Street as well as from within the building. Commercial tenancies face onto Sharp Street and Brooks Parade.
Changes in level between private terraces, front gardens and dwelling entries above the street level provide surveillance and improve visual privacy for ground level dwellings (see figure 3C.1)	The changes in level are set by Council's Sea Level Rise policy, as such the visual privacy of the residential apartments at Ground Floor level is not impaired.

Upper level balconies and windows should overlook the public domain	All the apartments on the upper levels that align with street alignment are provided with windows or balconies that overlook the public domain.
Front fences and walls along street frontages should use visually permeable materials and treatments. The height of solid fences or walls should be limited to 1m	The front fences on the 2 apartments with direct access off Edgar Street are proposed at 1700 high. The fences have been articulated and provided with sections of post and rail fencing to provide permeability without adversely affecting privacy.
Length of solid walls should be limited along street frontages	Solid walls along the street boundaries are limited to a small section of Edgar Street and no wall is greater than 6.8m in length.
Opportunities should be provided for casual interaction between residents and the public domain. Design solutions may include seating at building entries, near letter boxes and in private courtyards adjacent to streets	As the development is a mixed use development with commercial areas and courts facing onto the streets, the interaction between residents and the public domain as well as the various commercial areas has been catered for.
In developments with multiple buildings and/or entries, pedestrian entries and spaces associated with individual buildings/entries should be differentiated to improve legibility for residents, using a number of the following design solutions: • architectural detailing • changes in materials • plant species • colours	The entries to the individual buildings that comprise the development project forward from the building line as a portico and are by their very nature well defined. The materials and finishes proposed will be different from the adjoining areas. The landscaping proposed further defines the entries by means of planter beds and paving.

Opportunities for people to be concealed should be minimised	Opportunities for concealment have been minimised and residential balconies are located either immediately above or to one side of the entries. A pedestrian link has been provided between Edgar Street and Brooks Parade on the north side of the canal. A low level planting zone has been created along both sides of the canal to soften the appearance of the canal and the pedestrian link without providing security issues. The pedestrian link is overlooked by all the apartments that face north and a projecting viewing platform located in the primary communal open space on the Ground Floor A Crime Prevention Report has been prepared and forms part of the submission
Objective 3C-2 Amenity of the public domain is retained and enhanced	
Design guidance	
Planting softens the edges of any raised terraces to the street, for example above sub-basement car parking Mail boxes should be located in lobbies, perpendicular to the street alignment or integrated into front fences where individual street entries are provided	The site is subject to Council's Sea Level Rise policy and the commercial areas and residential apartments are set at approximately 1.1m and 1.6m above natural ground level respectively. In general setbacks ranging from 3m to 6m are provided. These areas are generally dedicated to deep soil planting. Planting against the podium walls which are generally set back 3m from the street boundaries is tiered to further soften the visual bulk of the development. A low level planting zone has been created along both sides of the canal to soften the appearance of the canal and the pedestrian link without providing security issues.
The visual prominence of underground car park vents should be minimised and located at a low level where possible	All carpark venting is proposed to extend to the roof

Substations, pump rooms, garbage storage areas and other service requirements should be located in basement car parks or out of view	All services are located within the basement. A chamber substation is proposed for the site and is located in the Ground Floor of Building C.
Ramping for accessibility should be minimised by building entry location and setting ground floor levels in relation to footpath levels	The site is subject to Council's Sea Level Rise policy and the commercial areas is set at approximately 1.1m above natural ground level. As such it is not possible to set any entries at footpath level. Access is provided by means of stairs and DDA compliant ramps at the main access points.
Durable, graffiti resistant and easily cleanable materials should be used	Given that the building is set back from the street alignment and planting is provided in this setback, the building does not lend itself to graffiti attack. The lower sections of the podium will be treated with an anti graffiti paint.
Where development adjoins public parks, open space or bushland, the design positively addresses this interface and uses a number of the following design solutions: • street access, pedestrian paths and building entries which are clearly defined • paths, low fences and planting that clearly delineate between communal/private open space and the adjoining public open space • minimal use of blank walls, fences and ground level parking	The proposed development does not adjoin any public parks, open space or bushland. Notwithstanding this, the owners have negotiated the purchase of a strip of land from the adjoining residential property to provide a pedestrian link to the north of the canal linking Edgar Street to Brooks Parade and the foreshore beyond. A low-level planting zone has been created along both sides of the canal to soften the appearance of the canal and the pedestrian link without providing security issues. The pedestrian link is overlooked by all the apartments that face north and a projecting viewing platform located in the primary communal open space on the Ground Floor.
On sloping sites protrusion of car parking above ground level should be minimised by using split levels to step underground car parking	The site is a level site and no visible above ground carparking is provided.

3D Communal and public open space	
Objective 3D-1 An adequate area of communal open space is provided to enhance residential amenity and to provide opportunities for landscaping	
Design criteria 1. Communal open space has a minimum area equal to 25% of the site (see figure 3D.3) 2. Developments achieve a minimum of 50% direct sunlight to the principal usable part of the communal open space for a minimum of 2 hours between 9 am and 3 pm on 21 June (mid-winter)	1. The communal open space is provided on the Ground Floor between the buildings and on the roofs of all 4 buildings. The secure communal open space on the Ground Floor and at roof level is 1473m^2 and 297m^2 respectively which equates to 22% of the site area. This excludes the secure communal open space on the roofs of each of the 4 buildings or the communal open space shared with the commercial areas or the boardwalk link. 2. The main area of communal open space that receives uninterrupted sunlight is the area on the Ground Floor between buildings B and C and to a lesser extent the between buildings A and D. The communal open spaces that receive direct sunlight for the majority of the day on 21 June (mid-winter) are the roof top areas
Design guidance	
Communal open space should be consolidated into a well designed, easily identified and usable area	The communal open spaces are well designed and landscaped. Refer Landscape Drawings
Communal open space should have a minimum dimension of 3m, and larger developments should consider greater dimensions	The minimum dimensions of the communal open spaces are well in excess of 3 m and is greater than 12m on the Ground Floor.

Communal open space should be co-located with deep soil areas	The communal open spaces are located over the residential and visitors' carparks and at roof top level, as such they are not co-located with deep soil areas.
Direct, equitable access should be provided to communal open space areas from common circulation areas, entries and lobbies	The communal open space on the Ground Floor is accessible form all lift lobbies. The communal open spaces on the roofs are accessible from the internal lifts of each building. The development will be an access controlled development and card access to the communal open spaces.
Where communal open space cannot be provided at ground level, it should be provided on a podium or roof	As noted above, the communal open spaces are located over the residential and visitors' carparks at Ground Floor podium level.
Where developments are unable to achieve the design criteria, such as on small lots, sites within business zones, or in a dense urban area, they should: • provide communal spaces elsewhere such as a landscaped roof top terrace or a common room • provide larger balconies or increased private open space for apartments • demonstrate good proximity to public open space and facilities and/or provide contributions to public open space	Design criteria generally met. Refer comments above. The development is located across Brooks Parade from the foreshore reserve and lake.

Objective 3D-2 Communal open space is designed to allow for a range of activities, respond to site conditions and be attractive and inviting	
Design guidance	
Facilities are provided within communal open spaces and common spaces for a range of age groups (see also 4F Common circulation and spaces), incorporating some of the following elements: • seating for individuals or groups • barbecue areas • play equipment or play areas • swimming pools, gyms, tennis courts or common rooms	The communal open spaces have been designed for a range of age groups that will comprise the residents of the development and include the following elements: • seating for individuals or groups • barbecue areas Detailed landscape plans have been prepared and are included in this submission.
The location of facilities responds to microclimate and site conditions with access to sun in winter, shade in summer and shelter from strong winds and down drafts	The location of facilities responds to microclimate and site conditions. Detailed landscape plans have been prepared and are included in this submission.
Visual impacts of services should be minimised, including location of ventilation duct outlets from basement car parks, electrical substations and detention tanks	The visual impact of services on the communal open spaces are minimal. No services are visible from the Ground Floor and the services are screened by 1800 high louver enclosures at roof top level.

Objective 3D-3 Communal open space is designed to maximise safety	
Design guidance	
Communal open space and the public domain should be readily visible from habitable rooms and private open space areas while maintaining visual privacy. Design solutions may include: • bay windows • corner windows • balconies	The communal open spaces are readily visible from the habitable rooms and balconies of the apartments. The finished floor level of the balconies and apartments are a minimum of 500 above the finished level of the communal open spaces thus providing visual privacy to the occupants of the apartments
Communal open space should be well lit	The communal open space on the Ground Floor is heavily landscaped and will be well lit.
Where communal open space/facilities are provided for children and young people they are safe and contained	There are no specific provisions for separate play areas for children and young children.

Objective 3D-4 Public open space, where provided, is responsive to the existing pattern and uses of the neighbourhood	
Design guidance	
The public open space should be well connected with public streets along at least one edge	The owners have negotiated the purchase of a strip of land from the adjoining residential property to provide a pedestrian link at grade to the north of the canal. This will be the only dedicated public open space provided in the development. It will link Edgar Street to Brooks Parade and the foreshore beyond. Various areas of semi public open spaces have been provided off Brooks Parade and Sharp Street to service the commercial premises that will be leased as cafes as outdoor seating areas.
The public open space should be connected with nearby parks and other landscape elements	As described above, the owners have negotiated the purchase of a strip of land from the adjoining residential property to provide a pedestrian link at grade to the north of the canal. It will link Edgar Street to Brooks Parade and the foreshore beyond.
Public open space should be linked through view lines, pedestrian desire paths, termination points and the wider street grid	As described above, the owners have negotiated the purchase of a strip of land from the adjoining residential property to provide a pedestrian link at grade to the north of the canal. It will link Edgar Street to Brooks Parade and the foreshore beyond providing a through passage and view line link between the 2 streets.
Solar access should be provided year round along with protection from strong winds	As described above, the owners have negotiated the purchase of a strip of land from the adjoining residential property to provide a pedestrian link at grade to the north of the canal. The pedestrian link is located on the north boundary and is by its very location provide with solar access the year round.

Opportunities for a range of recreational activities should be provided for people of all ages	As described above, the owners have negotiated the purchase of a strip of land from the adjoining residential property to provide a pedestrian link at grade to the north of the canal. It will link Edgar Street to Brooks Parade and the foreshore providing access for people of all ages.
A positive address and active frontages should be provided adjacent to public open space	As described above, the owners have negotiated the purchase of a strip of land from the adjoining residential property to provide a pedestrian link at grade to the north of the canal. It will link Edgar Street to Brooks Parade and the foreshore. It is linked to the proposed commercial areas facing Brooks Parade at podium level. As discussed above, various areas of semi public open spaces have been provided off Brooks Parade and Sharp Street to service the commercial premises that will be leased as cafes as outdoor seating areas. By their very nature, they form an integral part of the active frontages of the buildings.
boundaries should be clearly defined between public open space and private areas	As described above, the owners have negotiated the purchase of a strip of land from the adjoining residential property to provide a pedestrian link at grade to the north of the canal. it is separate to the communal open spaces and links to the semi public open spaces.

<table>
<tr><td>3E Deep soil zones</td><td></td></tr>
<tr><td>Objective 3E-1
Deep soil zones provide areas on the site that allow for and support healthy plant and tree growth. They improve residential amenity and promote management of water and air quality</td><td></td></tr>
<tr><td>Design criteria</td><td></td></tr>
<tr><td>1. Deep soil zones are to meet the following minimum requirements</td><td></td></tr>
<tr><td>
<table>
<tr><th>Site area</th><th>Minimum dimensions</th><th>Deep soil zone (% of site area)</th></tr>
<tr><td>less than 650m2</td><td>-</td><td rowspan="4">7%</td></tr>
<tr><td>650m2 - 1,500m2</td><td>3m</td></tr>
<tr><td>greater than 1,500m2</td><td>6m</td></tr>
<tr><td>greater than 1,500m2 with significant</td><td>6m</td></tr>
</table>
</td><td>Significant deep soil zones have been provided well in excess of the recommendations proposed in Council's Strategic Development Department report entitled Review of the Town Centres DCP and Belmont Area Plan for 32 Brooks Parade Belmont.

A detailed landscape design has been prepared and forms part of this submission.

A site coverage of 9.5% has been provided for deep soil planting however the minimum dimension is 3.m. The site coverage is increased to 10.0% if the canal is excluded from the site area calculation.

.</td></tr>
</table>

Design guidance	
On some sites it may be possible to provide larger deep soil zones, depending on the site area and context: • 10% of the site as deep soil on sites with an area of 650m^2 - 1,500m^2 • 15% of the site as deep soil on sites greater than 1,500m^2	As described above 10.0% of the site is proposed as deep soil planting. This is well in excess of the minimum recommendations recommended in the ADG and that proposed in Council's Strategic Development Department prepared a report entitled Review of the Town Centres DCP and Belmont Area Plan for 32 Brooks Parade Belmont.
Deep soil zones should be located to retain existing significant trees and to allow for the development of healthy root systems, providing anchorage and stability for mature trees. Design solutions may include: • basement and sub basement car park design that is consolidated beneath building footprints • use of increased front and side setbacks • adequate clearance around trees to ensure long term health • co-location with other deep soil areas on adjacent sites to create larger contiguous areas of deep soil	The design envisages maintaining the majority of the existing trees on Edgar Street. There are no other significant trees that will be retained. The basement carpark has been designed so that it sits beneath building footprints.

Achieving the design criteria may not be possible on some sites including where: • the location and building typology have limited or no space for deep soil at ground level (e.g. central business district, constrained sites, high density areas, or in centres) • there is 100% site coverage or non-residential uses at ground floor level Where a proposal does not achieve deep soil requirements, acceptable stormwater management should be achieved and alternative forms of planting provided such as on structure	Although the design criteria has generally been met, a stormwater management plan has been prepared for the proposed development and forms part of this submission.

<table>
<tr><td>3F Visual privacy</td><td></td></tr>
<tr><td>Objective 3F-1
Adequate building separation distances are shared equitably between neighbouring sites, to achieve reasonable levels of external and internal visual privacy</td><td></td></tr>
<tr><td>Design criteria</td><td></td></tr>
<tr><td>1. Separation between windows and balconies is provided to ensure visual privacy is achieved. Minimum required separation distances from buildings to the side and rear boundaries are as follows:

<table>
<tr><th>Building height</th><th>Habitable rooms and balconies</th><th>Non-habitable rooms</th></tr>
<tr><td>up to 12m (4 storeys)</td><td>6m</td><td>3m</td></tr>
<tr><td>up to 25m (5-8 storeys)</td><td>9m</td><td>4.5m</td></tr>
<tr><td>over 25m (9+ storeys)</td><td>12m</td><td>6m</td></tr>
</table>
</td><td>Separation between windows and balconies is provided in accordance with the table shown. In a limited number of cases separation from balconies is not fully compliant and the balconies have been screened in such instances. Separation distances are shown on drawings DA05 and DA08.</td></tr>
</table>

Note: Separation distances between buildings on the same site should combine required building separations depending on the type of room (see figure 3F.2) Gallery access circulation should be treated as habitable space when measuring privacy separation distances between neighbouring properties	
Design guidance	
Generally one step in the built form as the height increases due to building separations is desirable. Additional steps should be careful not to cause a 'ziggurat' appearance	Three of the buildings have been stepped once at the Fourth Floor generally in accordance with Council's requirements. The fourth building, Building A, has been stepped back once on the north and east facades to allow the building to act as a "book end" to the eight storey Belmont Towers to the south across Sharp Street.
For residential buildings next to commercial buildings, separation distances should be measured as follows: • for retail, office spaces and commercial balconies use the habitable room distances • for service and plant areas use the non-habitable room distances	The residential portions of the buildings at the same level as the commercial portions do not overlook one another.
New development should be located and oriented to maximise visual privacy between buildings on site and for neighbouring buildings. Design solutions include: • site layout and building orientation to minimise privacy impacts (see also section 3B Orientation) • on sloping sites, apartments on different levels have appropriate visual separation distances (see figure 3F.4)	The site is a corner site bounded by streets on 3 sides and a canal on the fourth side. The properties on the north side of the canal comprise a lot reserved by Hunter Water for infrastructure and a residential lot to the north and east. The owners have negotiated the purchase of a strip of land from the adjoining residential property to provide a pedestrian link to the north of the canal. The minimum set back of the building line at Ground Floor level from the adjusted boundary with the adjoining property is 9.4m.

Apartment buildings should have an increased separation distance of 3m (in addition to the requirements set out in design criteria 1) when adjacent to a different zone that permits lower density residential development to provide for a transition in scale and increased landscaping (figure 3F.5)	The site is not adjacent to a different zone that permits lower density residential development.
Direct lines of sight should be avoided for windows and balconies across corners	The buildings have been designed to avoid direct lines of sight between windows and balconies across corners. Where this occurs screens and fins have been provided to provide privacy without adversely affecting the amenity of the individual apartments.
No separation is required between blank walls	There are no blank walls proposed.

Objective 3F-2 Site and building design elements increase privacy without compromising access to light and air and balance outlook and views from habitable rooms and private open space	
Design guidance	
Communal open space, common areas and access paths should be separated from private open space and windows to apartments, particularly habitable room windows. Design solutions may include: setbacks • solid or partially solid balustrades to balconies at lower levels • fencing and/or trees and vegetation to separate spaces • screening devices • bay windows or pop out windows to provide privacy in one direction and outlook in another • raising apartments/private open space above the public domain or communal open space • planter boxes incorporated into walls and balustrades to increase visual separation • pergolas or shading devices to limit overlooking of lower apartments or private open space • on constrained sites where it can be demonstrated that building layout opportunities are limited, fixed louvres or screen panels to windows and/or balconies	The site is subject to Council's Sea Level Rise policy which has set the level of the commercial areas at AHD 2.36m and the residential areas at AHD 2.86m, ie 0.5m higher. The communal open space on the Ground Floor is set at the commercial level. The communal open space on the First Floor is located over the residential carpark and is set 0.5m below the finished floor level of the apartments on this floor. The balconies and windows are generally screened with dense planting in planter beds. The balustrades of the balconies will be a combination of solid balustrades and opaque glass balustrades to 1.1m above the finished level of the balconies. There are no balconies or windows that are overlooked from the higher communal open space.

Bedrooms, living spaces and other habitable rooms should be separated from gallery access and other open circulation space by the apartment's service areas	None of the apartments adjoin any gallery access or other open circulation areas.
Balconies and private terraces should be located in front of living rooms to increase internal privacy	All balconies and private terraces are located in front of and with direct access to the main living areas of the apartments. In some cases, secondary balconies are provided and these are provided with direct access to the bedrooms of the units they service.
Windows should be offset from the windows of adjacent buildings	Windows are generally offset from the windows of adjacent buildings. In addition, separation between windows is as recommended in part 3F-1. Refer comment on part 3F-1.
Recessed balconies and/or vertical fins should be used between adjacent balconies	In general, balconies have not been recessed into the buildings but project forward as elements to further articulate the buildings. Privacy between balconies and between balconies and adjoining apartment windows is provided by a combination of fixed screens, louver screens and fins as shown on the drawing that form part of this submission.

3G Pedestrian access and entries	
Objective 3G-1 Building entries and pedestrian access connects to and addresses the public domain	
Design guidance	
Multiple entries (including communal building entries and individual ground floor entries) should be provided to activate the street edge	As discussed above, the site is subject to Council's Sea Level Rise policy which has set the level of the commercial areas at AHD 2.36m and the residential areas at AHD 2.86m, ie approximately 1.0m to 1.5m higher than natural ground. It is therefore inappropriate to access the lobbies off the street level. Access to the buildings is via 4 defined entries on the podium level. Access to the podium level is via stairs and DDA compliant ramps off Brooks Parade and Edgar Street.
Entry locations relate to the street and subdivision pattern and the existing pedestrian network	As discussed above, the site is subject to Council's Sea Level Rise policy which has set the level of the commercial areas at AHD 2.36m and the residential areas at AHD 2.86m, ie approximately 1.0m to 1.5m higher than natural ground. It is therefore inappropriate to access the lobbies off the street level. Access to the buildings is via 4 defined entries on the podium level. Access to the podium level is via stairs and DDA compliant ramps off Brooks Parade and Edgar Street. An existing bus stop is located approximately 50m from the access point off Brooks Parade. Belmont Citi Centre is located across Edgar Street from the access point off Edgar Street. Both access points are the logical and optimal points of access to the site.
Building entries should be clearly identifiable and communal entries should be clearly distinguishable from private entries	As described above, the entries to the individual buildings that comprise the development project forward from the building line as a portico and are by their very nature well defined. The materials and finishes proposed will be different from the adjoining areas. The landscaping proposed further defines the entries by means of planter beds and paving.

Where street frontage is limited and multiple buildings are located on the site, a primary street address should be provided with clear sight lines and pathways to secondary building entries	The street address will be 32 Brooks Parade. It will be located adjacent to the stairs and DDA compliant ramp on Brooks Parade.
Objective 3G-2 Access, entries and pathways are accessible and easy to identify	
Design guidance	
Building access areas including lift lobbies, stairwells and hallways should be clearly visible from the public domain and communal spaces	The buildings' entries and lobbies are directly off the communal open space on the Ground Floor.
The design of ground floors and underground car parks minimise level changes along pathways and entries	As discussed above, the site is subject to Council's Sea Level Rise policy which has set the level of the commercial areas at AHD 2.36m and the residential areas at AHD 2.86m, ie approximately 1.0m to 1.5m higher than natural ground. This has resulted in an elevated podium being created at the commercial flood level. A semi basement carpark is provided under the podium. On this basis, the change in levels are minimal, a 2/3 level below natural ground for the carpark and a 1/3 level above ground for the commercial areas.
Steps and ramps should be integrated into the overall building and landscape design	As discussed above, the site is subject to Council's Sea Level Rise policy which has set the level of the commercial areas at AHD 2.36m and the residential areas at AHD 2.86m, ie approximately 1.0m to 1.5m higher than natural ground. The podium is accessed at 3 points by means of stairs and DDA compliant ramps. These access points have been integrated into the landscape design that forms part of this submission.

For large developments 'way finding' maps should be provided to assist visitors and residents (see figure 4T.3)	'Way finding' maps will be provided to assist visitors and residents at the 2 main access points off Edgar Street and Brooks Parade.
For large developments electronic access and audio/video intercom should be provided to manage access	An audio/video intercom system will be provided to the 4 building entries, the carpark entries for visitors and access points between the visitors' carparks and the secure residential areas
Objective 3G-3 Large sites provide pedestrian links for access to streets and connection to destinations	
Design guidance	
Pedestrian links through sites facilitate direct connections to open space, main streets, centres and public transport	As discussed above, the owners have negotiated the purchase of a strip of land from the adjoining residential property to provide a pedestrian link at grade to the north of the canal. This boardwalk will link Edgar Street to Brooks Parade and the foreshore beyond. A low level planting zone has been created along both sides of the canal and adjacent to the boardwalk to soften the appearance of the canal and the pedestrian link without providing security issues. An existing bus stop is located adjacent to the connection of the boardwalk with Brooks Parade and is within 50m from the access point off Brooks Parade.

Pedestrian links should be direct, have clear sight lines, be overlooked by habitable rooms or private open spaces of dwellings, be well lit and contain active uses, where appropriate	As discussed above, the site is subject to Council's Sea Level Rise policy which has set the level of the commercial areas at AHD 2.36m and the residential areas at AHD 2.86m, ie approximately 1.0m to 1.5m higher than natural ground. The podium is accessed at 3 points by means of stairs and DDA compliant ramps. The residential apartments finished floor level is 0.5m above the communal open space. This allows for supervision of the pedestrian links within the site from the habitable rooms and balconies on the Ground Floor without impinging on the privacy of these apartments. The Pedestrian link between Brooks Parade and Edgar Street is located on the north side of the canal at approximately 0.3m above natural ground level. North facing balconies and habitable rooms of the apartments in buildings B and C overlook this pedestrian link. A low level planting zone has been created along both sides of the canal to the south of the board walk to soften the appearance of the canal and the pedestrian link without providing security issues.

3H Vehicle access	
Objective 3H-1 Vehicle access points are designed and located to achieve safety, minimise conflicts between pedestrians and vehicles and create high quality streetscapes	
Design guidance	
Car park access should be integrated with the building's overall facade. Design solutions may include: • the materials and colour palette to minimise visibility from the street • security doors or gates at entries that minimise voids in the facade • where doors are not provided, the visible interior reflects the facade design and the building services, pipes and ducts are concealed	The entry to the garage has been restricted to 1 entry which is well set back from the street frontage. The colour of the door will match the surrounding walls.
Car park entries should be located behind the building line	The entry to the garage is well set back from the street frontage and building lines
Vehicle entries should be located at the lowest point of the site minimising ramp lengths, excavation and impacts on the building form and layout	The site is a level site with minimal fall over the site. As discussed above, the site is subject to Council's Sea Level Rise policy which has set the level of the commercial areas at AHD 2.36m and the residential areas at AHD 2.86m, ie approximately 1.0m to 1.5m higher than natural ground. This has resulted in an elevated podium being created at the commercial flood level. A semi basement carpark is provided under the podium.
Car park entry and access should be located on secondary streets or lanes where available	The carpark entry is located on a minor road. A traffic report confirming the suitability of the access points has been prepared and forms part of this submission.

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ASSESSMENT AGAINST PARTS 3 & 4 OF THE APARTMENT DESIGN CODE

Vehicle standing areas that increase driveway width and encroach into setbacks should be avoided	The driveway does not contain any vehicle standing areas. A traffic report confirming the suitability of the design has been prepared and forms part of this submission.
Access point locations should avoid headlight glare to habitable rooms	The access point has been located to minimise potential headlight glare to habitable rooms. The carpark entry / exit is opposite the roundabout and aligns with Herbert Street.
Adequate separation distances should be provided between vehicle entries and street intersections	The carpark entry / exit connects to an existing roundabout providing the fourth leg of the roundabout. A traffic report confirming the suitability of the access points has been prepared and forms part of this submission.
The width and number of vehicle access points should be limited to the minimum	Only 1 access point is proposed to provide separate entry / exit to the visitors and residential carparks. A traffic report confirming the suitability of the access points has been prepared and forms part of this submission.
Visual impact of long driveways should be minimised through changing alignments and screen planting	As discussed above, the site is subject to Council's Sea Level Rise policy which has set the level of the commercial areas at AHD 2.36m and the residential areas at AHD 2.86m, ie approximately 1.0m to 1.5m higher than natural ground. This has resulted in an elevated podium being created at the commercial flood level. A semi basement carpark is provided under the podium. On this basis the change in levels are minimal, a 2/3 level below natural ground for the carpark and a 1/3 level above ground for the commercial areas. This has resulted in a relatively short driveway.
The need for large vehicles to enter or turn around within the site should be avoided	A loading dock is provided within the site boundary off Sharp Street. The dock is provided with an 8.5m diameter turn table to allow delivery vehicles to enter and exit the site in a forward direction. A traffic report confirming the suitability of the loading dock and the impact on the traffic in Sharp Street has been prepared and forms part of this submission.

Garbage collection, loading and servicing areas are screened	As discussed above, a loading dock is provided within the site boundary off Sharp Street. This will accommodate garbage collection, loading and servicing of the site. A traffic report confirming the suitability of the loading dock and the impact on the traffic in Sharp Street has been prepared and forms part of this submission.
Clear sight lines should be provided at pedestrian and vehicle crossings	There are no pedestrian crossings adjacent to the vehicle access points.
Traffic calming devices such as changes in paving material or textures should be used where appropriate	The carpark entry / exit is a short run and does not form part of shared zones. As such, traffic calming devices are not required.
Pedestrian and vehicle access should be separated and distinguishable. Design solutions may include: • changes in surface materials • level changes • the use of landscaping for separation	The carpark entry / exit and pedestrian access routes are separate and do not form part of shared zones.

3J Bicycle and car parking	
Objective 3J-1 Car parking is provided based on proximity to public transport in metropolitan Sydney and centres in regional areas	
Design criteria 1. For development in the following locations: • on sites that are within 800 metres of a railway station or light rail stop in the Sydney Metropolitan Area; or • on land zoned, and sites within 400 metres of land zoned, B3 Commercial Core, B4 Mixed Use or equivalent in a nominated regional centre the minimum car parking requirement for residents and visitors is set out in the Guide to Traffic Generating Developments, or the car parking requirement prescribed by the relevant council, whichever is less The car parking needs for a development must be provided off street	Bicycle and motorcycle parking has been provided in accordance with council's requirements as confirmed in the traffic report that forms part of this submission.
Design guidance	
Where a car share scheme operates locally, provide car share parking spaces within the development. Car share spaces, when provided, should be on site	A car share scheme is not applicable for the proposed development

Where less car parking is provided in a development, council should not provide on street resident parking permits	Car parking provided meets Council's requirements as confirmed in the traffic report that forms part of this submission.
Objective 3J-2 Parking and facilities are provided for other modes of transport	
Design guidance	
Conveniently located and sufficient numbers of parking spaces should be provided for motorbikes and scooters	Parking spaces for motorbikes have been provided to meet appropriate standards as confirmed in the traffic report that forms part of this submission.
Secure undercover bicycle parking should be provided that is easily accessible from both the public domain and common areas	Undercover bicycle parking has been provided in the carpark to meet Council's requirements. The bicycle facilities are reviewed and confirmed in the traffic report that forms part of this submission.
Conveniently located charging stations are provided for electric vehicles, where desirable	No charging stations are provided for electric vehicles.
Objective 3J-3 Car park design and access is safe and secure	
Design guidance	
Supporting facilities within car parks, including garbage, plant and switch rooms, storage areas and car wash bays can be accessed without crossing car parking spaces	All the supporting facilities within car parks, including garbage, plant and switch rooms, storage areas and the like can be accessed without crossing car parking spaces

Direct, clearly visible and well lit access should be provided into common circulation areas	The carparks will be well lit to meet Australian Standards and the Building Code of Australia.
A clearly defined and visible lobby or waiting area should be provided to lifts and stairs	The lifts are clearly identified and protected from vehicle movement
For larger car parks, safe pedestrian access should be clearly defined and circulation areas have good lighting, colour, line marking and/or bollards	The carparks will be well lit to meet Australian Standards and the Building Code of Australia. The pedestrian access areas will be clearly line marked as shown indicatively on drawing DA02
Objective 3J-4 Visual and environmental impacts of underground car parking are minimised	
Design guidance	
Excavation should be minimised through efficient car park layouts and ramp design	As discussed above, the site is subject to Council's Sea Level Rise policy which has set the level of the commercial areas at AHD 2.36m and the residential areas at AHD 2.86m, ie approximately 1.0m to 1.5m higher than natural ground. This has resulted in an elevated podium being created at the commercial flood level. A semi basement carpark is provided under the podium. On this basis the excavation is minimal and is equivalent to a 2/3 floor level below natural ground.
Car parking layout should be well organised, using a logical, efficient structural grid and double loaded aisles	The carpark layouts have been designed to maximise the number of spaces. The residential carpark adopts a perimeter zone and mainly double loaded aisles. The visitors' carpark adopts a double loaded aisle. The layouts have been reviewed and confirmed in the traffic report that forms part of this submission.

Protrusion of car parks should not exceed 1m above ground level. Design solutions may include stepping car park levels or using split levels on sloping sites	As discussed above, the site is subject to Council's Sea Level Rise policy which has set the level of the commercial areas at AHD 2.36m ie approximately 1.0m higher than natural ground. This has resulted in an elevated podium being created at the commercial flood level. The main basement carpark, the visitors and residential carpark is, as a result, a semi basement carpark under the podium.
Natural ventilation should be provided to basement and sub basement car parking areas	Given the extent and size of the residential carpark, it is proposed that it will be mechanically ventilated. The carpark will be fitted with CO monitors to minimise the mechanical ventilation required.
Ventilation grills or screening devices for car parking openings should be integrated into the facade and landscape design	Ventilation grills will be incorporated into the design of the facades and landscape design.
Objective 3J-5 Visual and environmental impacts of on-grade car parking are minimised	
Design guidance	
On-grade car parking should be avoided	No on-grade carparking is proposed.

Where on-grade car parking is unavoidable, the following design solutions are used: • parking is located on the side or rear of the lot away from the primary street frontage • cars are screened from view of streets, buildings, communal and private open space areas • safe and direct access to building entry points is provided • parking is incorporated into the landscape design of the site, by extending planting and materials into the car park space • stormwater run-off is managed appropriately from car parking surfaces • bio-swales, rain gardens or on site detention tanks are provided, where appropriate • light coloured paving materials or permeable paving systems are used and shade trees are planted between every 4-5 parking spaces to reduce increased surface temperatures from large areas of paving	No on-grade carparking is proposed.
Objective 3J-6 Visual and environmental impacts of above ground enclosed car parking are minimised	
Design guidance	
Exposed parking should not be located along primary street frontages	No exposed car parking is proposed

Screening, landscaping and other design elements including public art should be used to integrate the above ground car parking with the facade. Design solutions may include: • car parking that is concealed behind the facade, with windows integrated into the overall facade design (approach should be limited to developments where a larger floor plate podium is suitable at lower levels) • carparking that is 'wrapped' with other uses, such as retail, commercial or two storey Small Office/Home Office (SOHO) units along the street frontage (see figure 3J.9)	No above ground car parking is proposed.
Positive street address and active frontages should be provided at ground level	As discussed above, the site is subject to Council's Sea Level Rise policy which has set the level of the commercial areas at AHD 2.36m ie approximately 1.0m higher than natural ground. This has resulted in an elevated podium being created at the commercial flood level. The podium has also been set back from the street boundaries to meet Council's requirements and more importantly, Council's Strategic Development Department prepared a report entitled Review of the Town Centres DCP and Belmont Area Plan for 32 Brooks Parade Belmont. Active shopfronts have been created along Sharp Street and Brooks Parade at podium level.

Part 4 Designing the building	
4A Solar and daylight access	
Objective 4A-1 To optimise the number of apartments receiving sunlight to habitable rooms, primary windows and private open space	
Design criteria	
1. Living rooms and private open spaces of at least 70% of apartments in a building receive a minimum of 2 hours direct sunlight between 9 am and 3 pm at mid winter in the Sydney Metropolitan Area and in the Newcastle and Wollongong local government areas	71% of the apartment living rooms and private open spaces receive a minimum of 2 hours direct sunlight between 9 am and 3 pm at mid winter. A detailed tabulation is provided in drawing DA51.
2. In all other areas, living rooms and private open spaces of at least 70% of apartments in a building receive a minimum of 3 hours direct sunlight between 9 am and 3 pm at mid winter	The site is located within the Newcastle local government area and details are provided in the section above.
3. A maximum of 15% of apartments in a building receive no direct sunlight between 9 am and 3 pm at mid winter	20 apartments (14%) receive no direct sunlight between 9 am and 3 pm at mid winter
Design guidance	
The design maximises north aspect and the number of single aspect south facing apartments is minimised	The design maximises north aspect apartments. Only 9 units representing 7% of the apartments are single aspect south facing apartments

Single aspect, single storey apartments should have a northerly or easterly aspect	As discussed above, Only 9 units representing 7% of the apartments are single aspect south facing apartments
Living areas are best located to the north and service areas to the south and west of apartments	Where possible all apartments with a north aspect are designed with their living areas are best located to the north
To optimise the direct sunlight to habitable rooms and balconies a number of the following design features are used: • dual aspect apartments • shallow apartment layouts • two storey and mezzanine level apartments • bay windows	The design incorporates the following features: • The majority of apartments are dual aspect apartments with 69% being provided with cross ventilation • All apartments are shallow apartments with depths of habitable rooms from an openable window being a maximum of 8m • No two storey and mezzanine level apartments are provided A detailed tabulation is provided in drawing DA51.
To maximise the benefit to residents of direct sunlight within living rooms and private open spaces, a minimum of $1m^2$ of direct sunlight, measured at 1m above floor level, is achieved for at least 15 minutes	As discussed above, 71% of the apartment living rooms and private open spaces receive a minimum of 2 hours direct sunlight between 9 am and 3 pm at mid winter. A detailed tabulation is provided in drawing DA51.
Achieving the design criteria may not be possible on some sites. This includes: • where greater residential amenity can be achieved along a busy road or rail line by orientating the living rooms away from the noise source • on south facing sloping sites • where significant views are oriented away from the desired aspect for direct sunlight Design drawings need to demonstrate how site constraints and orientation preclude meeting the design criteria and how the development meets the objective	The site provides magnificent views over the lake to the south west. These views are orientated away from the desired aspect for direct sunlight. The buildings have been designed to take into consideration the significant views from the apartments facing the lake across Brooks Parade whilst still meeting the overall requirements of this section.

Objective 4A-2 Daylight access is maximised where sunlight is limited	
Design guidance	
Courtyards, skylights and high level windows (with sills of 1,500mm or greater) are used only as a secondary light source in habitable rooms	No apartments utilise courtyards, skylights and high level windows (with sills of 1,500mm or greater) as a primary light source in habitable rooms
Where courtyards are used : • use is restricted to kitchens, bathrooms and service areas • building services are concealed with appropriate detailing and materials to visible walls • courtyards are fully open to the sky • access is provided to the light well from a communal area for cleaning and maintenance • acoustic privacy, fire safety and minimum privacy separation distances (see section 3F Visual privacy) are achieved	No apartments utilise courtyards
Opportunities for reflected light into apartments are optimised through: • Reflective Exterior Surfaces On Buildings Opposite South Facing Windows • positioning windows to face other buildings or surfaces (on neighbouring sites or within the site) that will reflect light • integrating light shelves into the design • light coloured internal finishes	Opportunities for reflected light into apartments have been optimised in the design through • the external surfaces of the buildings facing south facing windows are light in colour • the balcony balustrades facing south facing windows are glass balustrades which face north • all internal finishes will be light coloured

Objective 4A-3 Design incorporates shading and glare control, particularly for warmer months	
Design guidance	
A number of the following design features are used: • balconies or sun shading that extend far enough to shade summer sun, but allow winter sun to penetrate living areas • shading devices such as eaves, awnings, balconies, pergolas, external louvres and planting • horizontal shading to north facing windows • vertical shading to east and particularly west facing windows • operable shading to allow adjustment and choice • high performance glass that minimises external glare off windows, with consideration given to reduced tint glass or glass with a reflectance level below 20% (reflective films are avoided)	The design incorporates the following design features: • The balconies on most apartments have been designed to provide shade from summer sun, but allow winter sun to penetrate living areas • shading devices incorporate eaves, balconies, and external louvers • Adjustable horizontal sliding louvers are provided on the balconies of a number of apartments • All glazing will be installed in accordance with the requirements of the BASIX assessment prepared for the project that forms part of this submission

4B Natural ventilation	
Objective 4B-1 All habitable rooms are naturally ventilated	
Design guidance	
The building's orientation maximises capture and use of prevailing breezes for natural ventilation in habitable rooms	The building's orientation maximises capture and use of prevailing breezes for natural ventilation in habitable rooms. A detailed tabulation is provided in drawing DA51.
Depths of habitable rooms support natural ventilation	The depths of habitable rooms support natural ventilation
The area of unobstructed window openings should be equal to at least 5% of the floor area served	The area of unobstructed window openings is equal to at least 5% of the floor area served
Light wells are not the primary air source for habitable rooms	The design does not incorporate any light wells
Doors and openable windows maximise natural ventilation opportunities by using the following design solutions: • adjustable windows with large effective openable areas • a variety of window types that provide safety and flexibility such as awnings and louvres • windows which the occupants can reconfigure to funnel breezes into the apartment such as vertical louvres, casement windows and externally opening doors	Doors and openable windows have been designed to maximise natural ventilation whilst still complying with the Building Code of Australia.

Objective 4B-2 The layout and design of single aspect apartments maximises natural ventilation	
Design guidance	
Apartment depths are limited to maximise ventilation and airflow (see also figure 4D.3)	Apartment depths meet the criteria set out in figure 4D.3 and no habitable areas are greater than 8m deep from an openable window or door. In some apartments, non-habitable areas such as studies, bathrooms and laundries are located beyond this zone.
Natural ventilation to single aspect apartments is achieved with the following design solutions: • primary windows are augmented with plenums and light wells (generally not suitable for cross ventilation) • stack effect ventilation / solar chimneys or similar to naturally ventilate internal building areas or rooms such as bathrooms and laundries • courtyards or building indentations have a width to depth ratio of 2:1 or 3:1 to ensure effective air circulation and avoid trapped smells	As discussed above, 97 apartments representing 69% of all apartments are provided with cross ventilation. A detailed tabulation is provided in drawing DA51. The design does not utilise light wells, solar chimneys, courtyards or the like to achieve these figures.

Objective 4B-3 The number of apartments with natural cross ventilation is maximised to create a comfortable indoor environment for residents	
Design criteria	
1. At least 60% of apartments are naturally cross ventilated in the first nine storeys of the building. Apartments at ten storeys or greater are deemed to be cross ventilated only if any enclosure of the balconies at these levels allows adequate natural ventilation and cannot be fully enclosed	1. As discussed above, 97 apartments representing 69% of all apartments are provided with cross ventilation. None of the buildings are ten storeys or greater.
2. Overall depth of a cross-over or cross-through apartment does not exceed 18m, measured glass line to glass line	2. No cross-over apartments are included in the proposal. No cross-through apartments exceed 18m, measured glass line to glass line.
Design guidance	
The building should include dual aspect apartments, cross through apartments and corner apartments and limit apartment depths	The buildings include dual aspect apartments, cross through apartments and corner apartments which limit apartment depths
In cross-through apartments external window and door opening sizes/areas on one side of an apartment (inlet side) are approximately equal to the external window and door opening sizes/areas on the other side of the apartment (outlet side) (see figure 4B.4)	The corner and cross through apartments are provided with opening areas well in excess of the requirements of Objective 4B-1.

Apartments are designed to minimise the number of corners, doors and rooms that might obstruct airflow	In general, the majority of corner apartments are designed to provide cross ventilation through the main living areas
Apartment depths, combined with appropriate ceiling heights, maximise cross ventilation and airflow	As discussed above, apartment depths meet the criteria set out in figure 4D.3 and no habitable areas are greater than 8m deep from an openable window or door. Ceiling heights in habitable rooms have been designed to be 2.7m

<table>
<tr><td>4C Ceiling heights</td><td></td></tr>
<tr><td>Objective 4C-1
Ceiling height achieves sufficient natural ventilation and daylight access</td><td></td></tr>
<tr><td>Design criteria</td><td></td></tr>
<tr><td>1. Measured from finished floor level to finished ceiling level, minimum ceiling heights are:

<table>
<tr><th colspan="2">Minimum ceiling height
for apartment and mixed use buildings</th></tr>
<tr><td>Habitable rooms</td><td>2.7m</td></tr>
<tr><td>Non-habitable</td><td>2.4m</td></tr>
<tr><td>For 2 storey apartments</td><td>2.7m for main living area floor
2.4m for second floor, where its area does not exceed 50% of the apartment area</td></tr>
<tr><td>Attic spaces</td><td>1.8m at edge of room with a 30 degree minimum ceiling slope</td></tr>
<tr><td>If located in mixed used areas</td><td>3.3m for ground and first floor to promote future flexibility of use</td></tr>
</table>
</td><td>As discussed above, ceiling heights in habitable rooms have been designed to be 2.7m.
Non-habitable rooms have been designed to be 2.4m.
No 2 storey apartments or attic spaces are included in the design.</td></tr>
</table>

These minimums do not preclude higher ceilings if desired	
Design guidance	
Ceiling height can accommodate use of ceiling fans for cooling and heat distribution	As discussed above, ceiling heights in habitable rooms have been designed as 2.7m. This height will allow the installation of ceiling fans.
Objective 4C-2 Ceiling height increases the sense of space in apartments and provides for well proportioned rooms	
Design guidance	
A number of the following design solutions can be used: • the hierarchy of rooms in an apartment is defined using changes in ceiling heights and alternatives such as raked or curved ceilings, or double height spaces • well proportioned rooms are provided, for example, smaller rooms feel larger and more spacious with higher ceilings • ceiling heights are maximised in habitable rooms by ensuring that bulkheads do not intrude. The stacking of service rooms from floor to floor and coordination of bulkhead location above non-habitable areas, such as robes or storage, can assist	The design incorporates the following design solutions: • Ceiling heights in habitable areas are 2.7m • Habitable rooms are well proportioned and the width to height ratio is greater than 1 • Service areas such as bathrooms and laundries are generally stacked on each other and located to the rear of the apartments and against the core sections of the buildings

Objective 4C-3 Ceiling heights contribute to the flexibility of building use over the life of the building	
Design guidance	
Ceiling heights of lower level apartments in centres should be greater than the minimum required by the design criteria allowing flexibility and conversion to non-residential uses (see figure 4C.1)	The sections of the buildings facing Sharp Street and Brooks Parade have been provided with commercial areas. given that significant retail and commercial premises are provided on adjoining properties, there is no demand for future conversion of residential sections into non-residential uses.

<table>
<tr><td>4D Apartment size and layout</td><td></td></tr>
<tr><td>Objective 4D-1
The layout of rooms within an apartment is functional, well organised and provides a high standard of amenity</td><td></td></tr>
<tr><td>Design criteria</td><td></td></tr>
<tr><td>1. Apartments are required to have the following minimum internal areas:

<table><tr><th>Apartment type</th><th>Minimum internal area</th></tr><tr><td>Studio</td><td>35m^2</td></tr><tr><td>1 bedroom</td><td>50m^2</td></tr><tr><td>2 bedroom</td><td>70m^2</td></tr><tr><td>3 bedroom</td><td>90m^2</td></tr></table>
The minimum internal areas include only one bathroom. Additional bathrooms increase the minimum internal area by 5m^2 each</td><td>The apartment areas generally comply and mainly exceed the minimum internal areas described in Objective 4D-1</td></tr>
<tr><td>A fourth bedroom and further additional bedrooms increase the minimum internal area by 12m^2 each</td><td>No apartments are provided with a fourth bedroom</td></tr>
</table>

2. Every habitable room must have a window in an external wall with a total minimum glass area of not less than 10% of the floor area of the room. Daylight and air may not be borrowed from other rooms	All habitable room have a window in an external wall with a total minimum glass area of not less than 10% of the floor area of the room. No habitable rooms rely on borrowed light from other rooms
Design guidance	
Kitchens should not be located as part of the main circulation space in larger apartments (such as hallway or entry space)	All kitchens are located in their own defined areas and are not located as part of the main circulation space such as hallway or entry space
A window should be visible from any point in a habitable room	A window or door is visible from any point in a habitable room. In a limited number of kitchens minor blind spots exist but the rear wall of a kitchen is generally less than 8m from an openable window or door
Where minimum areas or room dimensions are not met apartments need to demonstrate that they are well designed and demonstrate the usability and functionality of the space with realistically scaled furniture layouts and circulation areas. These circumstances would be assessed on their merits	As discussed above, the habitable rooms meet the criteria of Objective 4D-1

Objective 4D-2 Environmental performance of the apartment is maximised	
Design criteria	
1. Habitable room depths are limited to a maximum of 2.5 x the ceiling height	As discussed above, apartment depths meet the criteria set out in figure 4D.3 and no habitable areas are greater than 8m deep from an openable window or door. In some apartments, non-habitable areas such as studies, bathrooms and laundries are located beyond this zone.
2. In open plan layouts (where the living, dining and kitchen are combined) the maximum habitable room depth is 8m from a window	As discussed above, apartment depths meet the criteria set out in figure 4D.3 and no habitable areas are greater than 8m deep from an openable window or door. In some apartments, non-habitable areas such as studies, bathrooms and laundries are located beyond this zone.
Design guidance	
Greater than minimum ceiling heights can allow for proportional increases in room depth up to the permitted maximum depths	As discussed above ceiling heights are maintained at 2.7m in habitable rooms.
All living areas and bedrooms should be located on the external face of the building	All living areas and bedrooms are located on the external face of the building.

4D Apartment size and layout	
Where possible: • bathrooms and laundries should have an external openable window • main living spaces should be oriented toward the primary outlook and aspect and away from noise sources	As discussed above, the site is bounded by Edgar Street to the east, Sharp Street to the south, Brooks Parade to the west and a canal to the north. The design incorporates 4 buildings on the site. The service zones are located to the rear of the units against the central cores of the buildings. A limited number of bathrooms have been located on the external perimeter of the buildings. The main living spaces have been located on the external perimeter of the buildings. Given that the site is bounded on 3 sides by public streets, and the primary outlook to the north and the west, some apartments may be susceptible to street noise. An acoustic report has been prepared and the recommendations will be incorporated into the design. The acoustic report forms part of this submission.
Objective 4D-3 Apartment layouts are designed to accommodate a variety of household activities and needs	
Design criteria	
1. Master bedrooms have a minimum area of $10m^2$ and other bedrooms $9m^2$ (excluding wardrobe space)	In general the Master Bedrooms and other bedrooms exceed the minimum dimensions in this design criteria.
2. Bedrooms have a minimum dimension of 3m (excluding wardrobe space)	The majority of second bedrooms have minimum dimensions of 2.9m x 3.3m which provides a minimum overall area of greater than $9m^2$. Master bedrooms generally have minimum dimensions of 3m x 3.9m which provides a minimum overall area of greater than $10m^2$.

3. Living rooms or combined living/dining rooms have a minimum width of: • 3.6m for studio and 1 bedroom apartments • 4m for 2 and 3 bedroom apartments	Widths of living rooms in some of the apartments are marginally below this standard, but this is offset by larger than required areas of the apartments and the general amenity of the apartments.
4. The width of cross-over or cross-through apartments are at least 4m internally to avoid deep narrow apartment layouts	As discussed above, there are no cross over apartments proposed.
Design guidance	
Access to bedrooms, bathrooms and laundries is separated from living areas minimising direct openings between living and service areas	In some of the apartments and in particular in the 1-bedroom apartments, some of the bedrooms, kitchens, etc are accessed directly off one side of the living and dining area. A full wall along the length of the apartment is provided to allow for the placement of wall cabinets and other similar furniture
All bedrooms allow a minimum length of 1.5m for robes	All bedrooms are provided with robe space in excess of 1.5m and in most apartments the robe space is considerably greater
The main bedroom of an apartment or a studio apartment should be provided with a wardrobe of a minimum 1.8m long, 0.6m deep and 2.1m high	The main bedrooms in all apartments are provided with a robe space in excess of 1.8m long x 0.6m wide. The robes have been designed with a minimum height of 2.4m with the walk in robes being considerably greater. In the majority of apartments the robe space is considerably greater.

Apartment layouts allow flexibility over time, design solutions may include: • dimensions that facilitate a variety of furniture arrangements and removal • spaces for a range of activities and privacy levels between different spaces within the apartment • dual master apartments • dual key apartments *Note: dual key apartments which are separate but on the same title are regarded as two sole occupancy units for the purposes of the Building Code of Australia and for calculating the mix of apartments* • room sizes and proportions or open plans (rectangular spaces (2:3) are more easily furnished than square spaces (1:1)) • efficient planning of circulation by stairs, corridors and through rooms to maximise the amount of usable floor space in rooms	Apartment layouts have been designed to allow for a flexible furniture layout. In general, the living and dining areas of apartments have been combined with a rectangular ratio approximately 1:1.5 to 1.8. 116 of the apartments representing 85% have been provided with a study nook or space to allow for separate dedicated usage. No dual key apartments are proposed. In general internal corridors have been minimised and the bulk of the apartment areas are usable spaces.

<table>
<tr><td>4E Private open space and balconies</td><td></td></tr>
<tr><td>Objective 4E-1
Apartments provide appropriately sized private open space and balconies to enhance residential amenity</td><td></td></tr>
<tr><td>Design criteria</td><td></td></tr>
<tr><td>1. All apartments are required to have primary balconies as follows:

<table><tr><th>Dwelling type</th><th>Minimum area</th><th>Minimum depth</th></tr><tr><td>Studio apartments</td><td>4m^2</td><td>-</td></tr><tr><td>1 bedroom apartments</td><td>8m^2</td><td>2m</td></tr><tr><td>2 bedroom apartments</td><td>10m^2</td><td>2m</td></tr><tr><td>3+ bedroom apartments</td><td>12m^2</td><td>2.4m</td></tr></table>
The minimum balcony depth to be counted as contributing to the balcony area is 1m</td><td>All apartments are provided with primary balconies in excess of the minimum requirements set out in this Objective and in a number of apartments the areas are more than double the minimum recommended. A detailed tabulation of balcony areas is provided in drawing DA51.

The minimum balcony depth counted as contributing to the balcony area is generally greater than 1m</td></tr>
<tr><td>2. For apartments at ground level or on a podium or similar structure, a private open space is provided instead of a balcony. It must have a minimum area of 15m^2 and a minimum depth of 3m</td><td>2 apartments in building D are provided with street access and have been provided with private open spaces well in excess of the recommended areas and dimensions. The other apartments on the Ground Floor are elevated a minimum of 0.5m above the podium level to meet the level set by Council's Sea Level Rise policy and are therefore considered balconies</td></tr>
</table>

Design guidance	
Increased communal open space should be provided where the number or size of balconies are reduced	As discussed above, the balcony number and sizes are well in excess of the requirements of Objective E3-1. The communal open space provided is also well in excess of that recommended in Objective 3D-1
Storage areas on balconies is additional to the minimum balcony size	As discussed above, although the balcony number and sizes are well in excess of the requirements of Objective E3-1 it is not recommended that storage be provided o balconies.
Balcony use may be limited in some proposals by: • consistently high wind speeds at 10 storeys and above • close proximity to road, rail or other noise sources exposure to significant levels of aircraft noise • heritage and adaptive reuse of existing buildings In these situations, juliet balconies, operable walls, enclosed winter gardens or bay windows may be appropriate, and other amenity benefits for occupants should also be provided in the apartments or in the development or both. Natural ventilation also needs to be demonstrated	As discussed above, the proposed buildings are not in excess of 10 storeys and the buildings are not in a heritage conservation area or as part of an adaptive reuse of existing buildings.

Objective 4E-2 Primary private open space and balconies are appropriately located to enhance liveability for residents	
Design guidance	
Primary open space and balconies should be located adjacent to the living room, dining room or kitchen to extend the living space	The balconies are located adjacent to and with direct access from the living / dining areas of the apartments and within close proximity to the majority of kitchens.
Private open spaces and balconies predominantly face north, east or west	The private open spaces and balconies predominantly face north, east or west. As discussed above, only 9 apartments representing 7% of the apartments are provided with balconies that face south
Primary open space and balconies should be orientated with the longer side facing outwards or be open to the sky to optimise daylight access into adjacent rooms	The primary open space and balconies are orientated with the longer side facing outwards. In the corner apartments, the balconies generally wrap around the external corner providing 2 faces facing outwards.

Objective 4E-3 Private open space and balcony design is integrated into and contributes to the overall architectural form and detail of the building	
Design guidance	
Solid, partially solid or transparent fences and balustrades are selected to respond to the location. They are designed to allow views and passive surveillance of the street while maintaining visual privacy and allowing for a range of uses on the balcony. Solid and partially solid balustrades are preferred	As discussed above, the site is bounded by Edgar Street to the east, Sharp Street to the south, Brooks Parade to the west and a canal to the north. The predominant views are to the south west to Lake Macquarie and to a lesser extent to the north west over the adjoining Hunter Water land. The balconies of the residential apartments that overlook the streets are located at First Floor level thus providing passive surveillance of the streets while maintaining visual privacy due to their location at approximately 4.6m above street level. The balconies are well in excess of the minimum standards. Generally, the balustrades are glass and have been provided with partitions and louvered screens where appropriate to provide visual privacy from other apartments where required.
Full width full height glass balustrades alone are generally not desirable	There are no full height glass balustrades as the sole balustrade for any apartment as shown on the elevations shown on drawings A11, A12, A13 and A14. A number of balconies particularly in Buildings A, B and C include continuous glass balconies 1.om high to maximise the view
Projecting balconies should be integrated into the building design and the design of soffits considered	The balconies have been integrated into the design. the following options have been adopted: • framing of the balconies to provide defined projections and articulation • breaking up of balconies into individual runs • long runs have been avoided or broken up where appropriate • Provision of glass louvered winter gardens in specific apartments

Operable screens, shutters, hoods and pergolas are used to control sunlight and wind	Screening and solar control is provided by a combination of the following elements: • horizontal sliding screens • overhanging hoods and balconies • fixed louvers
Balustrades are set back from the building or balcony edge where overlooking or safety is an issue	As discussed above, overlooking has been adequately addressed in response to Objective 3F2 above. All balconies have been designed to comply with the Building Code of Australia to ensure no safety issues or non-compliance arise
Downpipes and balcony drainage are integrated with the overall facade and building design	Downpipes and balcony drainage will be integrated into the overall facade and building design
Air-conditioning units should be located on roofs, in basements, or fully integrated into the building design	Dedicated screened plant areas are provided on the roof of all 4 buildings and adequate risers have been provided to allow access for piping to any mechanical plant located on the roof.
Where clothes drying, storage or air conditioning units are located on balconies, they should be screened and integrated in the building design	It is not proposed that any clothes drying, storage or air conditioning units are located on balconies.
Ceilings of apartments below terraces should be insulated to avoid heat loss	Any ceilings below terraces and in particular where the building tier back will be insulated in accordance with the BASIX Assessment that forms part of this submission.
Water and gas outlets should be provided for primary balconies and private open space	The owners will provide purchasers with the option to install water and gas outlets should be provided for primary balconies and private open space.

Objective 4E-4 Private open space and balcony design maximises safety	
Design guidance	
Changes in ground levels or landscaping are minimised	As discussed above, the site is subject to Council's Sea Level Rise policy which has set the level of the commercial areas at AHD 2.36m ie approximately 1.0m higher than natural ground. This has resulted in an elevated podium being created at the commercial flood level. The podium has also been set back from the street boundaries to meet Council's requirements and more importantly, Council's Strategic Development Department report entitled Review of the Town Centres DCP and Belmont Area Plan for 32 Brooks Parade Belmont. This setback has been heavily landscaped and tiered as shown in the Landscaping plans that form part of this submission.
Design and detailing of balconies avoids opportunities for climbing and falls	As discussed above, the balconies have been designed to meet the requirements of the Building Code of Australia and do not provide the opportunity for climbing and resultant falls
4F Common circulation and spaces	
Objective 4F-1 Common circulation spaces achieve good amenity and properly service the number of apartments	
Design criteria	
1. The maximum number of apartments off a circulation core on a single level is eight	The maximum number of apartments in any of the four buildings off a circulation core on a single level is not greater than eight.

2. For buildings of 10 storeys and over, the maximum number of apartments sharing a single lift is 40	as discussed above, none of the buildings are 10 storeys and over. In any case, the maximum number of apartments in any one building (Building C) is 38 apartments
Design guidance	
Greater than minimum requirements for corridor widths and/ or ceiling heights allow comfortable movement and access particularly in entry lobbies, outside lifts and at apartment entry doors	The entries to the buildings are considerably wider than the minimum standards required. The width of corridors meet the requirements of AS1428.1. A Disability Access Report has been prepared and form part of this submission.
Daylight and natural ventilation should be provided to all common circulation spaces that are above ground	Daylight and natural ventilation is not provided to the common circulation spaces that are above the Ground Floor. The building cores have been designed to minimise their length. Given the above and that the maximum number of apartments is 8 and usually significantly less, we maintain that this deviation is acceptable.
Windows should be provided in common circulation spaces and should be adjacent to the stair or lift core or at the ends of corridors	Windows are provided to the common circulation spaces of Buildings C and D only on the lower levels of these buildings. Skylights have been provided to the top residential floors of each building. The building cores have been designed to minimise their length. Given the above, and that the number of apartments is 7 and usually less where windows have not been provided, we maintain that this deviation is acceptable.
Longer corridors greater than 12m in length from the lift core should be articulated. Design solutions may include: • a series of foyer areas with windows & spaces for seating • wider areas at apartment entry doors and varied ceiling heights	None of the corridors are greater than 12m from the lift core except in Building D where the corridor has been extended to 13.4m to provide access to full height windows at one end.
Design common circulation spaces to maximise opportunities for dual aspect apartments, including multiple core apartment buildings and cross over apartments	As discussed above, the development comprises 4 buildings. The buildings vary between 8 apartments per floor to 4 apartments per floor. 97 apartments representing 69% are provided with cross ventilation which has been achieved by adopting dual aspect and cross flow apartments.

Achieving the design criteria for the number of apartments off a circulation core may not be possible. Where a development is unable to achieve the design criteria, a high level of amenity for common lobbies, corridors and apartments should be demonstrated, including: • sunlight and natural cross ventilation in apartments • access to ample daylight and natural ventilation in common circulation spaces • common areas for seating and gathering • generous corridors with greater than minimum ceiling heights • other innovative design solutions that provide high levels of amenity	As discussed above, the design criteria has been more than achieved with the exception of the provision of windows to the corridors on some floors. This has been compensated for by larger than required entry lobbies and the limited number of apartments serviced by a core on each floor.
Where design criteria 1 is not achieved, no more than 12 apartments should be provided off a circulation core on a single level	As discussed above design criteria 1 has been achieved. The maximum number of apartments in any of the four buildings off a circulation core on a single level is not greater than eight.
Primary living room or bedroom windows should not open directly onto common circulation spaces, whether open or enclosed. Visual and acoustic privacy from common circulation spaces to any other rooms should be carefully controlled	No primary living room or bedroom windows open directly onto common circulation spaces.

Objective 4F-2 Common circulation spaces promote safety and provide for social interaction between residents	
Design guidance	
Direct and legible access should be provided between vertical circulation points and apartment entries by minimising corridor or gallery length to give short, straight, clear sight lines	As discussed above, none of the corridors are greater than 12m from the lift core except in Building D where the corridor has been extended to 13.4m to provide access to full height windows at one end. The corridors are generally straight runs with clear sight lines from the lifts to the apartment entries.
Tight corners and spaces are avoided	Tight spaces and corners are minimised and circulation complies with AS AS1428.1. A Disability Access Report has been prepared and form part of this submission.
Circulation spaces should be well lit at night	Circulation spaces will be well lit.
Legible signage should be provided for apartment numbers, common areas and general wayfinding	Legible signage will be provided for apartment numbers, floor levels and building identification. Wayfinding signage will be provided at Ground Floor level in the communal open space and in the Basement carpark.
Incidental spaces, for example space for seating in a corridor, at a stair landing, or near a window are provided	As discussed above, none of the corridors are greater than 12m from the lift core and most are considerably shorter except in Building D where the corridor has been extended to 13.4m to provide access to full height windows at one end. As such the use of seating in the corridors is not applicable.
In larger developments, community rooms for activities such as owners corporation meetings or resident use should be provided and are ideally co-located with communal open space	Whist the development could be considered a largish development in the Newcastle region, it is not a large development by any standards. As such, it is not proposed that any community rooms will be provided.

<table>
<tr><td>Where external galleries are provided, they are more open than closed above the balustrade along their length</td><td>No external galleries are provided as a means of access in the residential levels.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>4G Storage</td><td></td></tr>
<tr><td>Objective 4G-1
Adequate, well designed storage is provided in each apartment</td><td></td></tr>
<tr><td>Design criteria</td><td></td></tr>
<tr><td>1. In addition to storage in kitchens, bathrooms and bedrooms, the following storage is provided:

<table><tr><th>Dwelling type</th><th>Storage size volume</th></tr><tr><td>Studio apartments</td><td>4m^3</td></tr><tr><td>1 bedroom apartments</td><td>6m^3</td></tr><tr><td>2 bedroom apartments</td><td>8m^3</td></tr><tr><td>3+ bedroom apartments</td><td>10m^3</td></tr></table>
At least 50% of the required storage is to be located within the apartment</td><td>Significant storage has been provided within the apartments, as dedicated storage areas on the Ground Floor, and within the Basement residential carpark. A limited number of storage units are provided on the lower floors of Building A.</td></tr>
</table>

Design guidance	
Storage is accessible from either circulation or living areas	Storage is accessible from either circulation or living areas. Some of the storage in the Basement carpark is accessible from, and will be dedicated to the car park associated with the apartment.
Storage provided on balconies (in addition to the minimum balcony size) is integrated into the balcony design, weather proof and screened from view from the street	Although the balconies exceed the minimum standards, it is not proposed that any storage will be provided on the balconies.
Left over space such as under stairs is used for storage	All left over spaces have been integrated into the storage provided.
Objective 4G-2 Additional storage is conveniently located, accessible and nominated for individual apartments	
Design guidance	
Storage not located in apartments is secure and clearly allocated to specific apartments	Storage on the residential floors and in the Basement carpark will be clearly identified and allocated to specific apartments.
Storage is provided for larger and less frequently accessed items	With the exception of a limited number of storage units attached to individual carparks, all storage units have a minimum dimension of 1.0m thus providing adequate storage for larger and less frequently accessed items.
Storage space in internal or basement car parks is provided at the rear or side of car spaces or in cages so that allocated car parking remains accessible	In a number of cases, storage spaces in the Basement carpark are provided at the rear or side of car spaces so that allocated car parking remains accessible. All other storage is provided in separate cages with their own individual access

If communal storage rooms are provided they should be accessible from common circulation areas of the building	All storage spaces are individual units. Where these are located in dedicated areas, they are accessible from common circulation areas of the buildings.
Storage not located in an apartment is integrated into the overall building design and is not visible from the public domain	None of the storage spaces are visible from the public domain.
4H Acoustic privacy	
Objective 4H-1 Noise transfer is minimised through the siting of buildings and building layout	
Design guidance	
Adequate building separation is provided within the development and from neighbouring buildings/adjacent uses (see also section 2F Building separation and section 3F Visual privacy)	Building separation has been addressed in response to the various objectives above.
Window and door openings are generally orientated away from noise sources	As discussed above, the site is bounded by Edgar Street to the east, Sharp Street to the south, Brooks Parade to the west and a canal to the north. The design incorporates 4 buildings on the site. The main living spaces have been located on the external perimeter of the buildings. Given that the site is bounded on 3 sides by public streets, and the primary outlook to the north and the west, some apartments may be susceptible to street noise. An acoustic report has been prepared and the recommendations will be incorporated into the design. The acoustic report forms part of this submission.

Noisy areas within buildings including building entries and corridors should be located next to or above each other and quieter areas next to or above quieter areas	Building corridors are located above one another. The 4 entries are located below apartments. These areas will be acoustically treated to buffer noise in accordance with the recommendations of the acoustic report that forms part of this submission.
Storage, circulation areas and non-habitable rooms should be located to buffer noise from external sources	As discussed above, the apartments have been designed so that the main living spaces and bedrooms are located on the external perimeter of the buildings and the wet areas and studies against the core this providing a buffer between the circulation areas and the habitable rooms.
The number of party walls (walls shared with other apartments) are limited and are appropriately insulated	As discussed above, the number of apartments on any one floor is no greater than 8 and in most cases significantly less. Party walls will be constructed to meet the requirements of the Building Code of Australia and the recommendations of the acoustic report that forms part of this submission.
Noise sources such as garage doors, driveways, service areas, plant rooms, building services, mechanical equipment, active communal open spaces and circulation areas should be located at least 3m away from bedrooms	The garage door and driveway is located some distance away from bedrooms and well in excess of 3m. As discussed above, the residential Ground Floor is set 0.5m above the communal open areas. These areas have been heavily landscaped to provide both visual and acoustic privacy.

Objective 4H-2 Noise impacts are mitigated within apartments through layout and acoustic treatments	
Design guidance	
Internal apartment layout separates noisy spaces from quiet spaces, using a number of the following design solutions: • rooms with similar noise requirements are grouped together • doors separate different use zones • wardrobes in bedrooms are co-located to act as sound buffers	Internal apartment layouts have been designed to generally separate noisy spaces from quiet spaces, using some of the following design solutions: • doors separate different use zones • wardrobes in bedrooms are co-located to act as sound buffers Where possible wardrobes have been utilised to provide a buffer from bathrooms and kitchens. Where possible (although not in all cases) adjoining apartment layouts have been designed on a "Bedroom to Bedroom" and “Living to Living" basis.
Where physical separation cannot be achieved noise conflicts are resolved using the following design solutions: • double or acoustic glazing • acoustic seals • use of materials with low noise penetration properties • continuous walls to ground level courtyards where they do not conflict with streetscape or other amenity requirements	As discussed above, party walls will be constructed to meet the requirements of the Building Code of Australia. An acoustic report has been prepared and forms part of this submission. The recommendations of the acoustic report will be incorporated into the construction of the buildings.

4J Noise and pollution	
Objective 4J-1 In noisy or hostile environments the impacts of external noise and pollution are minimised through the careful siting and layout of buildings	
Design guidance	
To minimise impacts the following design solutions may be used: • physical separation between buildings and the noise or pollution source • residential uses are located perpendicular to the noise source and where possible buffered by other uses • non-residential buildings are sited to be parallel with the noise source to provide a continuous building that shields residential uses and communal open spaces • non-residential uses are located at lower levels vertically separating the residential component from the noise or pollution source. Setbacks to the underside of residential floor levels should increase relative to traffic volumes and other noise sources • buildings should respond to both solar access and noise. Where solar access is away from the noise source, non-habitable rooms can provide a buffer • where solar access is in the same direction as the noise source, dual aspect apartments with shallow building depths are preferable (see figure 4J.4)	The development is not located in a noisy or hostile environment. Notwithstanding the above, an acoustic report has been prepared and forms part of this submission. The recommendations of the acoustic report will be incorporated into the construction of the buildings.

• landscape design reduces the perception of noise and acts as a filter for air pollution generated by traffic and industry	
Achieving the design criteria in this Apartment Design Guide may not be possible in some situations due to noise and pollution. Where developments are unable to achieve the design criteria, alternatives may be considered in the following areas: • solar and daylight access • private open space and balconies • natural cross ventilation	As discussed above, the development is not located in a noisy or hostile environment.
Objective 4J-2 Appropriate noise shielding or attenuation techniques for the building design, construction and choice of materials are used to mitigate noise transmission	
Design guidance	
Design solutions to mitigate noise include: • limiting the number and size of openings facing noise sources • providing seals to prevent noise transfer through gaps • using double or acoustic glazing, acoustic louvres or enclosed balconies (wintergardens) • using materials with mass and/or sound insulation or absorption properties e.g. solid balcony balustrades, external screens and soffits	As discussed above, the site is bounded by Edgar Street to the east, Sharp Street to the south, Brooks Parade to the west and a canal to the north. The design incorporates 4 buildings on the site. The main living spaces have been located on the external perimeter of the buildings. Given that the site is bounded on 3 sides by public streets, and the primary outlook to the north and the west, some apartments may be susceptible to street noise. An acoustic report has been prepared and the recommendations will be incorporated into the design. The acoustic report forms part of this submission.

4K Apartment mix	
Objective 4K-1 A range of apartment types and sizes is provided to cater for different household types now and into the future	
Design guidance	
A variety of apartment types is provided	A variety of apartment types are provided. A detailed tabulation is provided in drawing DA51.
The apartment mix is appropriate, taking into consideration: • the distance to public transport, employment and education centres • the current market demands and projected future demographic trends • the demand for social and affordable housing • different cultural and socioeconomic groups	The apartment mix takes into account the socio-economic demographics of the area. A Social Impact Assessment has been prepared and forms part of this submission
Flexible apartment configurations are provided to support diverse household types and stages of life including single person households, families, multi-generational families and group households	As discussed above, a variety of apartment types are provided to cater for owners and occupiers ranging from the rental market to the more mature owner occupier.

Objective 4K-2 The apartment mix is distributed to suitable locations within the building	
Design guidance	
Different apartment types are located to achieve successful facade composition and to optimise solar access (see figure 4K.3)	Different apartment types have been located to achieve successful facade composition and to optimise solar access. In general, main living areas have been orientated to the north and east, the exceptions being the apartments that face onto Brooks Parade which have been orientated to the south west to maximise the views over the lake.
Larger apartment types are located on the ground or roof level where there is potential for more open space and on corners where more building frontage is available	As discussed above with the exception of the 2 apartments facing Edgar Street which are provided with their own entries and private open spaces, all apartments are elevated from the podium and the balconies are identical in size to those above.
4L Ground floor apartments	
Objective 4L-1 Street frontage activity is maximised where ground floor apartments are located	
Design guidance	
Direct street access should be provided to ground floor apartments	As discussed above, the building is a mixed use development with commercial areas fronting Sharp Street and Brooks Parade. The other street frontage is Edgar Street and 2 apartments have been located along this street frontage.

Activity is achieved through front gardens, terraces and the facade of the building. Design solutions may include: • both street, foyer and other common internal circulation entrances to ground floor apartments • private open space is next to the street • doors and windows face the street	As discussed above, the building is a mixed use development with commercial areas fronting Sharp Street and Brooks Parade. The other street frontage is Edgar Street and 2 apartments have been located along this street frontage.
Retail or home office spaces should be located along street frontages	As discussed above, the building is a mixed use development and the commercial areas front Sharp Street and Brooks Parade. No dedicated home offices are provided
Ground floor apartment layouts support small office home office (SOHO) use to provide future opportunities for conversion into commercial or retail areas. In these cases provide higher floor to ceiling heights and ground floor amenities for easy conversion	As discussed above, no dedicated home offices are provided.

Objective 4L-2 Design of ground floor apartments delivers amenity and safety for residents	
Design guidance	
Privacy and safety should be provided without obstructing casual surveillance. Design solutions may include: • elevation of private gardens and terraces above the street level by 1-1.5m (see figure 4L.4) • landscaping and private courtyards • window sill heights that minimise sight lines into apartments • integrating balustrades, safety bars or screens with the exterior design	As discussed above, the site is subject to Council's Sea Level Rise policy which has set the level of the commercial areas at AHD 2.36m and the residential areas 0.5m higher at AHD 2.86m, ie approximately 1.0m and 1.5m higher than natural ground respectively. This has resulted in an elevated podium being created at the commercial flood level. The residential apartments on the podium has also been set back from the street boundaries to meet Council's requirements and more importantly, Council's Strategic Development Department report entitled Review of the Town Centres DCP and Belmont Area Plan for 32 Brooks Parade Belmont. Window cill heights of the Ground Floor apartments are therefore set at approximately 2.4m above street level which provides passive surveillance without affecting the privacy of the apartments. The balustrades, fenestration and commercial shopfronts have been integrated into the overall design.
Solar access should be maximised through: • high ceilings and tall windows • trees and shrubs that allow solar access in winter and shade in summer	As discussed above, solar access has been addressed in response to the relevant objectives.

4M Facades	
Objective 4M-1 Building facades provide visual interest along the street while respecting the character of the local area	
Design guidance	
Design solutions for front building facades may include: • a composition of varied building elements • a defined base, middle and top of buildings • revealing and concealing certain elements • changes in texture, material, detail and colour to modify the prominence of elements	As discussed above, the project consists of 4 individual buildings on a raised podium. The buildings are set back from the street and tiered back at the upper levels. A range of textures and materials are proposed as indicated on the drawings and finishes board that form part of this submission. Articulation and shading is achieved by the intrinsic forms of the buildings and by projecting balconies, fins, a combination of fixed and sliding louvers and a limited amount of glass louvered winter gardens.
Building services should be integrated within the overall facade	It is not proposed that any services be attached to the facade of the building and all downpipes will be recessed from the main facades
Building facades should be well resolved with an appropriate scale and proportion to the streetscape and human scale. Design solutions may include: • well composed horizontal and vertical elements • variation in floor heights to enhance the human scale • elements that are proportional and arranged in patterns • public artwork or treatments to exterior blank walls • grouping of floors or elements such as balconies and windows on taller buildings	As discussed above, the project consists of 4 individual buildings on a raised podium. The buildings are set back from the street and tiered back at the upper levels. The buildings are not necessarily square to one another and follow in the main the street alignments. A range of textures and materials are proposed as indicated on the drawings and finishes board that form part of this submission. Articulation and shading is achieved by the intrinsic forms of the buildings and by projecting balconies, fins and a combination of fixed and sliding louvers.

Building facades relate to key datum lines of adjacent buildings through upper level setbacks, parapets, cornices, awnings or colonnade heights	The building facades do not necessarily relate to the adjoining buildings. The building to the east is the rear section and loading dock of Belmont Citi Shopping Centre which consists of a blank pre-cast wall. The building to the south west is Belmont Towers which is an 8 storey tower block constructed in the seventies with minimal articulation. The building relates to the more recent Belmont Central to the south in that it is similar in tiering and the horizontal treatment of balconies.
Shadow is created on the facade throughout the day with building articulation, balconies and deeper window reveals	As discussed above, the buildings are heavily articulated through the intrinsic forms of the buildings and by projecting balconies, fins and a combination of fixed and sliding louvers. Moreover, a number of windows have been provided with projecting surrounds to further provide the impression of deeper reveals. These elements combine to cast a myriad of shadows.
Objective 4M-2 Building functions are expressed by the facade	
Design guidance	
Building entries should be clearly defined	As discussed above, the building entries are clearly defined, project from the face of the buildings, and are treated with different finishes from the surrounding areas.
Important corners are given visual prominence through a change in articulation, materials or colour, roof expression or changes in height	Various corners and in particular on the upper floors have been treated differently from the remainder of the buildings
The apartment layout should be expressed externally through facade features such as party walls and floor slabs	The buildings have been designed as individual buildings with significant articulation, as such it has not been necessary to express the apartment layouts on the facades.

4N Roof design	
Objective 4N-1 Roof treatments are integrated into the building design and positively respond to the street	
Design guidance	
Roof design relates to the street. Design solutions may include: • special roof features and strong corners • use of skillion or very low pitch hipped roofs • breaking down the massing of the roof by using smaller elements to avoid bulk • using materials or a pitched form complementary to adjacent buildings	As discussed above, 3 of the buildings are tiered back on the Fourth Floor. The roof design of these buildings has been integrated into the overall design and is an extension in part of the wall treatment. The fourth building, Building A, has been stepped back once on the north and east facades to allow the building to act as a "book end" to the eight storey Belmont Towers to the south across Sharp Street. The roofs for this building have been designed as a series of skillion roofs to emphasise and better articulate this corner.
Roof treatments should be integrated with the building design. Design solutions may include: • roof design proportionate to the overall building size, scale and form • roof materials compliment the building • service elements are integrated	As discussed above, the buildings are tiered back on the fourth floor. The roof design has been integrated into the overall design and is an extension in part of the wall treatment. All service areas, lift over runs and access are well set back from the building perimeter and are screened.

Objective 4N-2 Opportunities to use roof space for residential accommodation and open space are maximised	
Design guidance	
Habitable roof space should be provided with good levels of amenity. Design solutions may include: • penthouse apartments • dormer or clerestory windows • openable skylights	The buildings have not been designed to provide roof top communal open spaces to maximise the views over Lake Macquarie. The balustrade line is well set back from the building line and will not be discernible from street level.
Open space is provided on roof tops subject to acceptable visual and acoustic privacy, comfort levels, safety and security considerations	As discussed above the roof top communal open spaces are designed to maximise the views over Lake Macquarie. The balustrade line is well set back from the building line and will not be discernible from street level. Access will be via the lifts servicing the buildings.
Objective 4N-3 Roof design incorporates sustainability features	
Design guidance	
Roof design maximises solar access to apartments during winter and provides shade during summer. Design solutions may include: • the roof lifts to the north • eaves and overhangs shade walls and windows from summer sun	The roofs of the 3 lower buildings have been designed as projecting battered eaves which provide a degree of shading to the windows from summer sun. The roofs of the fourth building, Building A, have been designed as a series of skillion roofs to emphasise and better articulate this corner.

Skylights and ventilation systems should be integrated into the roof design	Skylights over the corridors below have been incorporated into the roof design.
4O Landscape design	
Objective 4O-1 Landscape design is viable and sustainable	
Design guidance	
Landscape design should be environmentally sustainable and can enhance environmental performance by incorporating: • diverse and appropriate planting • bio-filtration gardens • appropriately planted shading trees • areas for residents to plant vegetables and herbs • composting • green roofs or walls	A detailed landscape design has been prepared and forms part of this submission. The design incorporates planting and shading trees that conform to Council's guidelines.
Ongoing maintenance plans should be prepared	An on-going maintenance plan for the building in general and the landscaping in particular will be prepared as part of the construction phase of the project.
Microclimate is enhanced by: • appropriately scaled trees near the eastern and western elevations for shade • a balance of evergreen and deciduous trees to provide shading in summer and sunlight access in winter • shade structures such as pergolas for balconies and courtyards	As discussed above, a detailed landscape design has been prepared and forms part of this submission. The design incorporates appropriately scaled trees and a balance of evergreen and deciduous trees that conform to Council's guidelines.

Tree and shrub selection considers size at maturity and the potential for roots to compete (see Table 4)	As discussed above, a detailed landscape design has been prepared and forms part of this submission. The design conforms to Council's guidelines and the tree and shrub selection takes into account the size at maturity and the potential for roots to compete.
Objective 4O-2 Landscape design contributes to the streetscape and amenity	
Design guidance	
Landscape design responds to the existing site conditions including: • changes of levels • views • significant landscape features including trees and rock outcrops	As discussed above, a detailed landscape design has been prepared and forms part of this submission. The design conforms to Council's guidelines. The design takes into account the changes in level in the design with tiered landscaping and similar elements along the perimeter of the podium. There are no significant landscape features including trees and rock outcrops
Significant landscape features should be protected by: • tree protection zones (see figure 4 O.5) • appropriate signage and fencing during construction	A number of existing trees external to the site will be retained as indicated on the landscape plans that form part of this submission. The trees will be protected by tree protection zones and appropriate signage and fencing during the construction phase of the project.
Plants selected should be endemic to the region and reflect the local ecology	As discussed above, a detailed landscape design has been prepared and forms part of this submission. The design conforms to Council's guidelines.

4P Planting on structures	
Objective 4P-1 Appropriate soil profiles are provided	
Design guidance	
Structures are reinforced for additional saturated soil weight	The planter boxes on the podium are located on a suspended slab. The slab will be designed to take into account the saturated soil weight. It is proposed that the planter boxes at the roof top level will be free standing planter boxes sitting on top of the floor finish.
Soil volume is appropriate for plant growth, considerations include: • modifying depths and widths according to the planting mix and irrigation frequency • free draining and long soil life span • tree anchorage	As discussed above, a detailed landscape design has been prepared and is included in this submission. The planter beds were designed by the landscape architect to ensure that the depths and widths are suitable for the planting mix and irrigation frequency and are free draining to ensure long soil life span. Tree anchorage details are provided on the landscaping plans.
Minimum soil standards for plant sizes should be provided in accordance with Table 5	As discussed above, a detailed landscape design has been prepared and is included in this submission. The minimum soil standards will be met where applicable or modified in accordance with industry standards.

Objective 4P-2 Plant growth is optimised with appropriate selection and maintenance	
Design guidance	
Plants are suited to site conditions, considerations include: • drought and wind tolerance • seasonal changes in solar access • modified substrate depths for a diverse range of plants • plant longevity	As discussed above, a detailed landscape design has been prepared and is included in this submission. The design has been prepared to conform with Council's guidelines and incorporate the intent of this objective.
A landscape maintenance plan is prepared	As discussed above, an on-going maintenance plan for the building in general and the landscaping in particular will be prepared as part of the construction phase of the project.
Irrigation and drainage systems respond to: • changing site conditions • soil profile and the planting regime • whether rainwater, stormwater or recycled grey water is used	The detailed design of the drainage system for the planter beds and other landscaped areas will be carried out as part of the construction phase of the project and will incorporate the intent of this objective.

Objective 4P-3 Planting on structures contributes to the quality and amenity of communal and public open spaces	
Design guidance	
Building design incorporates opportunities for planting on structures. Design solutions may include: • green walls with specialised lighting for indoor green walls • wall design that incorporates planting • green roofs, particularly where roofs are visible from the public domain • planter boxes Note: structures designed to accommodate green walls should be integrated into the building facade and consider the ability of the facade to change over time	As discussed above, the majority of the communal open space is located over the basement carpark at podium level. The layout of this area has been designed by a landscape architect and incorporates a shaded BBQ area, a water feature, seating and planter boxes of varying shapes and depths.
4Q Universal design	
Objective 4Q-1 Universal design features are included in apartment design to promote flexible housing for all community members	
Design guidance	
Developments achieve a benchmark of 20% of the total apartments incorporating the Livable Housing Guideline's silver level universal design features	The development achieves a benchmark of 20% of the total apartments incorporating the Livable Housing Guideline's silver level universal design features as confirmed in the Disability Access Report that forms part of this submission

Objective 4Q-2 A variety of apartments with adaptable designs are provided	
Design guidance	
Adaptable housing should be provided in accordance with the relevant council policy	As discussed above, a Traffic Report and a Disability Access Report have been prepared and form part of this submission. Both reports confirm that adaptable housing and parking is provided in accordance with Council's policy.
Design solutions for adaptable apartments include: • convenient access to communal and public areas • high level of solar access • minimal structural change and residential amenity loss when adapted • larger car parking spaces for accessibility • parking titled separately from apartments or shared car parking arrangements	The design and proposed conversion of the adaptable units are shown on drawings DA 21 and 22. The modification modifications are acceptable for the proposed conversions are acceptable and do not affect the structural integrity of the buildings. Carparks that confirm with the standards described in the Disability Access Report are shown on drawing DA02. The majority of adaptable apartments face north and east with only one apartment facing south.

Objective 4Q-3 Apartment layouts are flexible and accommodate a range of lifestyle needs	
Design guidance	
Apartment design incorporates flexible design solutions which may include: • rooms with multiple functions • dual master bedroom apartments with separate bathrooms • larger apartments with various living space options • openplan 'loft' style apartments with only a fixed kitchen, laundry and bathroom	The individual apartments have been designed to cater for a variety of age groups and users. In general, all living and dining areas have been combined as an open plan to provide flexibility with furniture layouts. Whist no dual master bedrooms have been provided, all 2-bedroom and 3-bedroom apartments are provided with ensuites in addition to a separate bathroom. 116 of the apartments representing 85% have been provided with dedicated separate study areas.

4R Adaptive reuse	
Objective 4R-1 New additions to existing buildings are contemporary and complementary and enhance an area's identity and sense of place	
Design guidance	
Design solutions may include: • new elements to align with the existing building • additions that complement the existing character, siting, scale, proportion, pattern, form and detailing • use of contemporary and complementary materials, finishes, textures and colours	The project is not an adaptive re-use of an existing building and does not integrate any existing buildings into the design, and as such this objective is not applicable.
Additions to heritage items should be clearly identifiable from the original building	The project is not an adaptive re-use of an existing building and does not integrate any existing buildings into the design, and as such this objective is not applicable.
New additions allow for the interpretation and future evolution of the building	The project is not an adaptive re-use of an existing building and does not integrate any existing buildings into the design, and as such this objective is not applicable.

Objective 4R-2 Adapted buildings provide residential amenity while not precluding future adaptive reuse	
Design guidance	
Design features should be incorporated sensitively into adapted buildings to make up for any physical limitations, to ensure residential amenity is achieved. Design solutions may include: • generously sized voids in deeper buildings • alternative apartment types when orientation is poor • using additions to expand the existing building envelope	The project is not an adaptive re-use of an existing building and does not integrate any existing buildings into the design, and as such this objective is not applicable.

Some proposals that adapt existing buildings may not be able to achieve all of the design criteria in this Apartment Design Guide. Where developments are unable to achieve the design criteria, alternatives could be considered in the following areas: • where there are existing higher ceilings, depths of habitable rooms could increase subject to demonstrating access to natural ventilation, cross ventilation (when applicable) and solar and daylight access (see also sections 4A Solar and daylight access and 4B Natural ventilation) • alternatives to providing deep soil where less than the minimum requirement is currently available on the site • building and visual separation–subject to demonstrating alternative design approaches to achieving privacy • common circulation • car parking • alternative approaches to private open space and balconies	The project is not an adaptive re-use of an existing building and does not integrate any existing buildings into the design, and as such this objective is not applicable.

4S Mixed use	
Objective 4S-1 Mixed use developments are provided in appropriate locations and provide active street frontages that encourage pedestrian movement	
Design guidance	
Mixed use development should be concentrated around public transport and centres	The site is located in Council's Town Centres DCP as a designated mixed use development. It is located on a bus route and adjacent to an existing shopping centre.
Mixed use developments positively contribute to the public domain. Design solutions may include: • development addresses the street • active frontages are provided • diverse activities and uses • avoiding blank walls at the ground level • live/work apartments on the ground floor level, rather than commercial	As discussed above, the site is a corner site bounded by streets on 3 sides and a canal on the fourth side. Commercial areas face Sharp Street and Brooks Parade providing an active street frontages. The owners have negotiated the purchase of a strip of land from the adjoining residential property to provide a pedestrian link at grade to the north of the canal linking Edgar Street to Brooks Parade and the fore shore beyond. This will be a dedicated public open space provided in the development. It will link Edgar Street to Brooks Parade and the foreshore beyond. No blank walls are provided on any of the street frontages 2 apartments are provided with individual street access off Edgar Street

Objective 4S-2 Residential levels of the building are integrated within the development, and safety and amenity is maximised for residents	
Design guidance	
Residential circulation areas should be clearly defined. Design solutions may include: • residential entries are separated from commercial entries and directly accessible from the street • commercial service areas are separated from residential components • residential car parking and communal facilities are separated or secured • security at entries and safe pedestrian routes are provided • concealment opportunities are avoided	As discussed above, the development comprises 4 separate residential buildings. The residential entries are well defined and are separate from the commercial areas. The visitors carpark is totally separate from the residential carpark with its own separate lift access to the podium. The entries are well defined and secure and safe pedestrian routes are provided.
Landscaped communal open space should be provided at podium or roof levels	As discussed above, landscaped communal open space is provided at both podium level and on the roof top areas of each building.

4T Awnings and signage	
Objective 4T-1 Awnings are well located and complement and integrate with the building design	
Design guidance	
Awnings should be located along streets with high pedestrian activity and active frontages	As discussed above, the buildings have been set back from the street boundaries in accordance with Council's DCP and more importantly with the recommendations proposed in Council's Strategic Development Department report entitled Review of the Town Centres DCP and Belmont Area Plan for 32 Brooks Parade Belmont.
A number of the following design solutions are used: • continuous awnings are maintained and provided in areas with an existing pattern • height, depth, material and form complements the existing street character • protection from the sun and rain is provided • awnings are wrapped around the secondary frontages of corner sites • awnings are retractable in areas without an established pattern	The buildings have been set back from the street boundaries in accordance with Council's DCP and more importantly with the discussions held with Council officers, and the recommendations proposed in Council's Strategic Development Department report entitled Review of the Town Centres DCP and Belmont Area Plan for 32 Brooks Parade Belmont. Balconies are provided over the commercial areas facing Brooks Parade to provide the same functionality as awnings.
Awnings should be located over building entries for building address and public domain amenity	As discussed above, the residential entries project forward from the facades of the buildings and are roofed over.

Awnings relate to residential windows, balconies, street tree planting, power poles and street infrastructure	As discussed above, the buildings have been set back from the street boundaries in accordance with Council's DCP and more importantly with the discussions held with Council officers, and with the recommendations proposed in Council's Strategic Development Department report entitled Review of the Town Centres DCP and Belmont Area Plan for 32 Brooks Parade Belmont. As such there are no projecting awnings over the streets.
Gutters and down pipes should be integrated and concealed	Gutters and downpipes will be integrated into the design at Construction Certificate stage.
Lighting under awnings should be provided for pedestrian safety	Whilst no specific awnings will be provided over the street alignment, lighting will be provided to both the communal open spaces and all other open areas.
Objective 4T-2 Signage responds to the context and desired streetscape character	
Design guidance	
Signage should be integrated into the building design and respond to the scale, proportion and detailing of the development	All signage relating to the commercial areas will be integrated into the tenancy fitouts and will be subject to separate Applications.
Legible and discrete way finding should be provided for larger developments	As discussed above, wayfinding signage will be provided at Ground Floor level in the communal open space and in the Basement carpark
Signage is limited to being on and below awnings and a single facade sign on the primary street frontage	As discussed above, all signage relating to the commercial areas will be integrated into the tenancy fitouts and will be subject to separate Applications.

4U Energy efficiency	
Objective 4U-1 Development incorporates passive environmental design	
Design guidance	
Adequate natural light is provided to habitable rooms (see 4A Solar and daylight access)	All habitable rooms are provided with external windows.
Well located, screened outdoor areas should be provided for clothes drying	It is not proposed that any outdoor areas will be provided for clothes drying.
Objective 4U-2 Development incorporates passive solar design to optimise heat storage in winter and reduce heat transfer in summer	
Design guidance	
A number of the following design solutions are used: • the use of smart glass or other technologies on north and west elevations • thermal mass in the floors and walls of north facing rooms is maximised • polished concrete floors, tiles or timber rather than carpet • insulated roofs, walls and floors and seals on window and door openings • overhangs and shading devices such as awnings, blinds	As discussed above, a BASIX certificate has been prepared and forms part of this submission. The building has been designed to minimise reliance on mechanical heating and cooling. Walls, floors and roofs will be insulated in accordance with the BASIX certificate. The majority of doors and windows have been provided with a combination of overhanging canopies vertical fins, horizontal louvers and sliding horizontal screens

and screens	
Provision of consolidated heating and cooling infrastructure should be located in a centralised location (e.g. the basement)	A centralised HWS is proposed for the buildings and individual HWS on balconies are not proposed.
Objective 4U-3 Adequate natural ventilation minimises the need for mechanical ventilation	
Design guidance	
A number of the following design solutions are used: • rooms with similar usage are grouped together • natural cross ventilation for apartments is optimised • natural ventilation is provided to all habitable rooms and as many non-habitable rooms, common areas and circulation spaces as possible	As discussed above, 97 apartments representing 69% are provided with cross ventilation. All habitable rooms are provided with openable windows or doors on the exterior facades of the buildings. In addition, 46 of the apartments representing 33% of the kitchens are provided with openable windows.
4V Water management and conservation	
Objective 4V-1 Potable water use is minimised	
Design guidance	
Water efficient fittings, appliances and wastewater reuse should be incorporated	As discussed above, a BASIX certificate has been prepared and forms part of this submission. The certificate nominates a number of energy saving devices including water efficient fittings and storm water reuse.

Apartments should be individually metered	At this stage, Hunter Water do not require individual metering for the apartments. Provision will be made at detailed design stage for the installation of individual meters in the future.
Rainwater should be collected, stored and reused on site	As discussed above, a BASIX certificate has been prepared and forms part of this submission. The certificate nominates storm water reuse.
Drought tolerant, low water use plants should be used within landscaped areas	As discussed above, a landscape design has been prepared and forms part of this submission. The planting complies with Council's requirements in relation to the species of drought tolerant, low water use plants
Objective 4V-2 Urban stormwater is treated on site before being discharged to receiving waters	
Design guidance	
Water sensitive urban design systems are designed by a suitably qualified professional	A storm water management plan has been prepared by a qualified and experienced engineer and forms part of this submission.
A number of the following design solutions are used: • runoff is collected from roofs and balconies in water tanks and plumbed into toilets, laundry and irrigation • porous and open paving materials is maximised • on site stormwater and infiltration, including bio-retention systems such as rain gardens or street tree pits	As discussed above, a BASIX certificate has been prepared and forms part of this submission. The certificate nominates storm water reuse.

Objective 4V-3 Flood management systems are integrated into site design	
Design guidance	
Detention tanks should be located under paved areas, driveways or in basement car parks	As discussed above, a storm water management plan has been prepared by a qualified and experienced engineer and forms part of this submission. It nominates the storm water detention proposed to comply with Council's requirements.
On large sites parks or open spaces are designed to provide temporary on site detention basins	The development is not a large site that incorporates large parks or open spaces.
4W Waste management	
Objective 4W-1 Waste storage facilities are designed to minimise impacts on the streetscape, building entry and amenity of residents	
Design guidance	
Adequately sized storage areas for rubbish bins should be located discreetly away from the front of the development or in the basement car park	A Waste Management Plan has been prepared and forms part of the submission. The individual buildings are provided with rubbish chutes servicing all floors which terminate in Garbage Rooms in the Basement
Waste and recycling storage areas should be well ventilated	The Garbage Rooms will be mechanically exhausted to the roof level and duct space allocation has been provided.
Circulation design allows bins to be easily manoeuvred between storage and collection points	The Garbage Rooms have been designed to allow for the bins to be easily manoeuvred.

Temporary storage should be provided for large bulk items such as mattresses	Sufficient space is provided in the Garbage Rooms for the temporary storage of large bulk items.
A waste management plan should be prepared	A Waste Management Plan has been prepared and forms part of the submission.
Objective 4W-2 Domestic waste is minimised by providing safe and convenient source separation and recycling	
Design guidance	
All dwellings should have a waste and recycling cupboard or temporary storage area of sufficient size to hold two days worth of waste and recycling	The kitchens of the individual apartments are generously sized and sufficient space is available to provide temporary storage area of sufficient size to hold two days' worth of waste and recycling.
Communal waste and recycling rooms are in convenient and accessible locations related to each vertical core	The Garbage Rooms are located in the Basement adjacent to the lifts servicing the apartments.
For mixed use developments, residential waste and recycling storage areas and access should be separate and secure from other uses	The residential and commercial Garbage Rooms will be separate
Alternative waste disposal methods such as composting should be provided	It is not proposed that any composting will be provided on site.

4X Building maintenance	
Objective 4X-1 Building design detail provides protection from weathering	
Design guidance	
A number of the following design solutions are used: • roof overhangs to protect walls • hoods over windows and doors to protect openings • detailing horizontal edges with drip lines to avoid staining of surfaces • methods to eliminate or reduce planter box leaching • appropriate design and material selection for hostile locations	The buildings have been designed to minimise maintenance where possible. • The topmost roofs overhang the walls. • The majority of windows are either protected by projecting surrounds or by overhead balconies or canopies. • All horizontal edges will be provided with drip lines in accordance with good building practice. • The planter boxes will be fully tanked to prevent leaching. • The buildings, whilst adjacent to the lake are not in an overly hostile location. Nevertheless it is not proposed that any mild steel handrails or the like will be installed
Objective 4X-2 Systems and access enable ease of maintenance	
Design guidance	
Window design enables cleaning from the inside of the building	The windows that are not accessible off balconies will be double action awning windows to facilitate cleaning from the inside. The limited areas of curtain walling will be provided with abseiling and water points at roof level to facilitate cleaning
Building maintenance systems should be incorporated and integrated into the design of the building form, roof and facade	It is not proposed to provide any building maintenance units. As discussed above, the limited areas of curtain walling will be provided with abseiling and water points at roof level to facilitate cleaning.

Design solutions do not require external scaffolding for maintenance access	The design does not require the installation of scaffolding for on-going maintenance access.
Manually operated systems such as blinds, sunshades and curtains are used in preference to mechanical systems	The screens proposed are either fixed screens or horizontal manually sliding screens accessible off balconies.
Centralised maintenance, services and storage should be provided for communal open space areas within the building	Centralised maintenance, services and storage has been provided at both the Ground Floor and the Basement levels.
Objective 4X-3 Material selection reduces ongoing maintenance costs	
Design guidance	
A number of the following design solutions are used: • sensors to control artificial lighting in common circulation and spaces • natural materials that weather well and improve with time such as face brickwork • easily cleaned surfaces that are graffiti resistant • robust and durable materials and finishes are used in locations which receive heavy wear and tear, such as common circulation areas and lift interiors	It is proposed that the following items will be incorporated into the final design at detailed design stage: • sensors to control artificial lighting in common circulation and spaces • a limited amount of face brickwork as shown on the drawings • a limited amount of zinc cladding as shown on the drawings • a graffiti resistant finish to the podium level and planter boxes between the natural ground level and the Ground Floor • robust and durable materials and finishes will be used in locations which receive heavy wear and tear, including common circulation areas and lift interiors

Monteath & Powys Pty Ltd

SURVEYING, PLANNING, ENGINEERING DESIGN, PROJECT MANAGEMENT







STRATEGIC PLANNING AND URBAN DESIGN ANALYSIS

32-44 BROOKS PARADE, BELMONT

Strategic Planning and Urban Design Analysis

This Report was prepared by:-

Monteath & Powys Pty Ltd
125 Bull Street
NEWCASTLE WEST NSW 2302

PO Box 2270
DANGAR NSW 2302

Telephone: (02) 4926 1388
Facsimile: (02) 4929 3475
Web: www.monteathpowys.com.au

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AUTHOR:	Mark Cini B.Comm, MPlan Planner	Darren Holloway BSc (Hons) MBEnv Manager Registered Planner (No. 8653)

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1 INTRODUCTION

This report has been prepared on behalf of Coeve Design and KML Joint Venture in relation to a potential development of several adjoining lots at Brookes Parade, Belmont (the subject site). Earlier iterations of this report has also been previously reviewed by Lake Macquarie City Council (LMCC) officers. Peter Annand of Annand and Associates also peer reviewed this report and other urban design reports prepared in the area. This report provides a strategic overview and design analysis of a site at Brookes Parade in Belmont.

The aim of the report is:

1. To examine the strategic planning context of the site and the proposal for multi-storey residential development of the site in regards to current and proposed planning controls.
2. To consider any proposed development on the site in relation to potential environmental constraints (and opportunities).
3. Provide an urban design analysis for the subject site. It is noted that an assessment against State Environmental Planning Policy Number 65 (SEPP 65) has been prepared by and architect in accordance with the SEPP.

Lake Macquarie City Council's development controls identify the subject site as a significant site in the Belmont Town Centre. Part of the strategic planning assessment undertaken in this report will consider the site and the surrounding area. To justify any variation to the existing standards and controls, or amendment of proposed standard and controls, a comprehensive examination of the site and future potential development in the context of Belmont town centre and wider Lake Macquarie LGA is necessary.

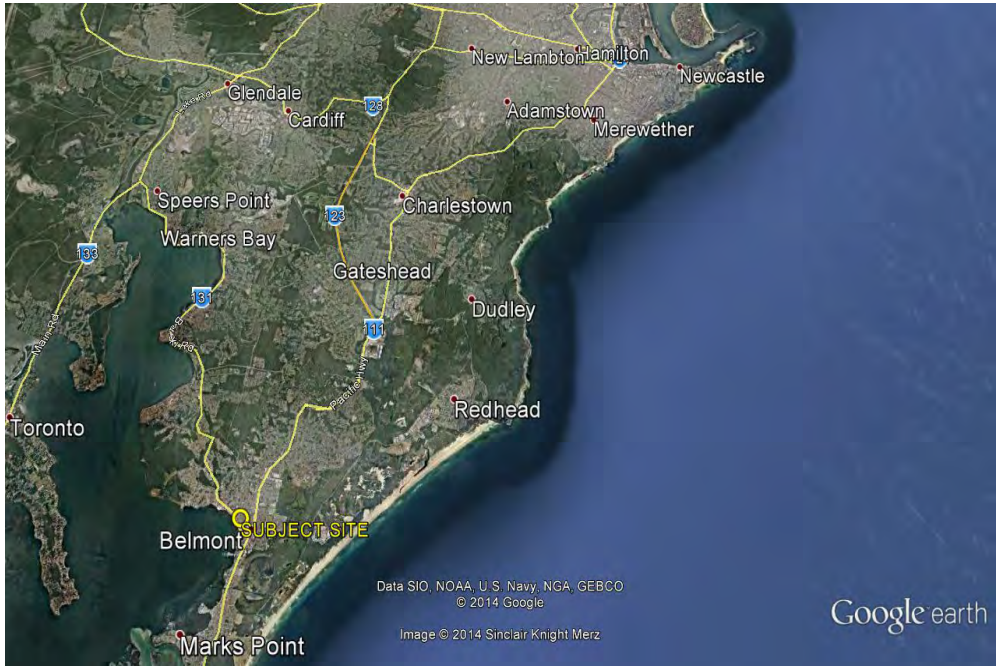


Figure 1-1: Locality Map (Google Earth, 2014)

2 SUBJECT SITE

The subject site is located in the town of Belmont in the local government area of Lake Macquarie (Figure 1-1) approximately two hours drive north of Sydney, and 17 kilometres from Newcastle CBD. The subject site is comprised of fifteen lots in the Belmont Town Centre, bounded by Brooks Parade, Sharp Street and Edgar Street (Figure 2-1).The particulars for each lot are shown below in Table 2-1. The total site area is approximately 7,178m². A site analysis plan is presented in Figure 2-2.

The site is a prominent location on the Belmont foreshore. The site frontage to Brooks Parade is approximately 95 metres, which is currently the largest combined street frontage of any development site along Brooks Parade.

An open stormwater channel runs through the north part of the site, across two lots, which connects the stormwater network in Edgar Street to the outfall into Lake Macquarie.

There is slight fall from Edgar Street toward Brookes Parade across the site. The site is lower in topography than the Pacific Highway to the east. Stormwater from the existing dwellings drains directly to the street.

Access to the site is available from Brooks Parade, Sharp Street and Edgar Street.

Current uses on the site and in the area are predominantly for residential purposes. The dwellings comprise a mix of one and two storey buildings, and redevelopment of some sites for dwellings up to six storeys.

Reticulated water and service, electricity, and telecommunications are available to the site.

Table 2-1: Lot Particulars

Lot	Section	DP
11	B	585
A	-	400644
B	-	400644
2	-	353066
1	-	353066
4	-	12898
5	-	12898
6	-	12898
7	-	12898
10	B	585
8	-	12898
B	-	339105
A	-	339105
4	B	585
3	B	585



Figure 2-1: Subject Site, Brooks Parade, Belmont



Figure 2-2: Site Analysis Plan

3 URBAN AREA ANALYSIS

The subject site is located in the town centre of Belmont. Belmont town centre is a busy centre divided down the middle by the Pacific Highway. The Pacific Highway is the main road and public transport route linking Belmont to Newcastle CBD and the regional centre of Charlestown to the north, and Swansea to the south.

3.1 LAND USE

Land use in Belmont Town centre is prescribed by the Lake Macquarie Local Environmental Plan (LEP) 2014. The Plan identifies a Land Use Zone that applies to each parcel of land, as well as the land uses permissible in each zone. Figure 3.1 identifies the current B4 Mixed Use zoning. The zoning map reveals that the site has been identified for mixed use, higher density residential development.

The land use pattern in Belmont consists of a commercial core on both sides of the Pacific Highway, supported by mixed uses around the core, and then medium and higher density development beyond that. Some residential buildings near the Highway have been converted to business uses.

The objectives of the relevant zone under LEP 2014 are presented in Table adjacent.

The subject site is zoned as B4 Mixed Use Development. Potential development on the subject site can include mixed use development to provide retail and commercial uses, typically on the ground floor and lowers floors of buildings, and residential dwellings above those floors. However, it may be appropriate for residential uses to be provided on the ground floor in appropriate locations within the development site.

As is discussed later in this report the Hunter Regional Plan prepared by the NSW Department of Planning and Environment applies to the subject site. There are no sub-regional strategies that apply to the Lower Hunter. More detail on the Lower Hunter area in the broader Hunter Region is outlined in the Greater Newcastle Metropolitan Plan and Council's local planning strategies. Nonetheless, within Lake Macquarie local government area, Belmont is a sub-regional centre providing a number of services and facilities of a typical sub-regional centre including court house and other civic functions. The current LEP identifies the Belmont town centre for future higher density development reflecting the strategic direction of the town centre identified by Council.

Table 3-1: Objectives of relevant zones under LEP 2014

Zoning LEP 2014	Zone objectives (LEP 2014)
B4 Mixed uses	• To provide a mixture of compatible land uses. • To integrate suitable business, office, residential, retail and other development in accessible locations so as to maximise public transport patronage and encourage walking and cycling. • To enable development that complements and enhances the core retail function and trading performance of the B2 Local Centre and B3 Commercial Core zones.

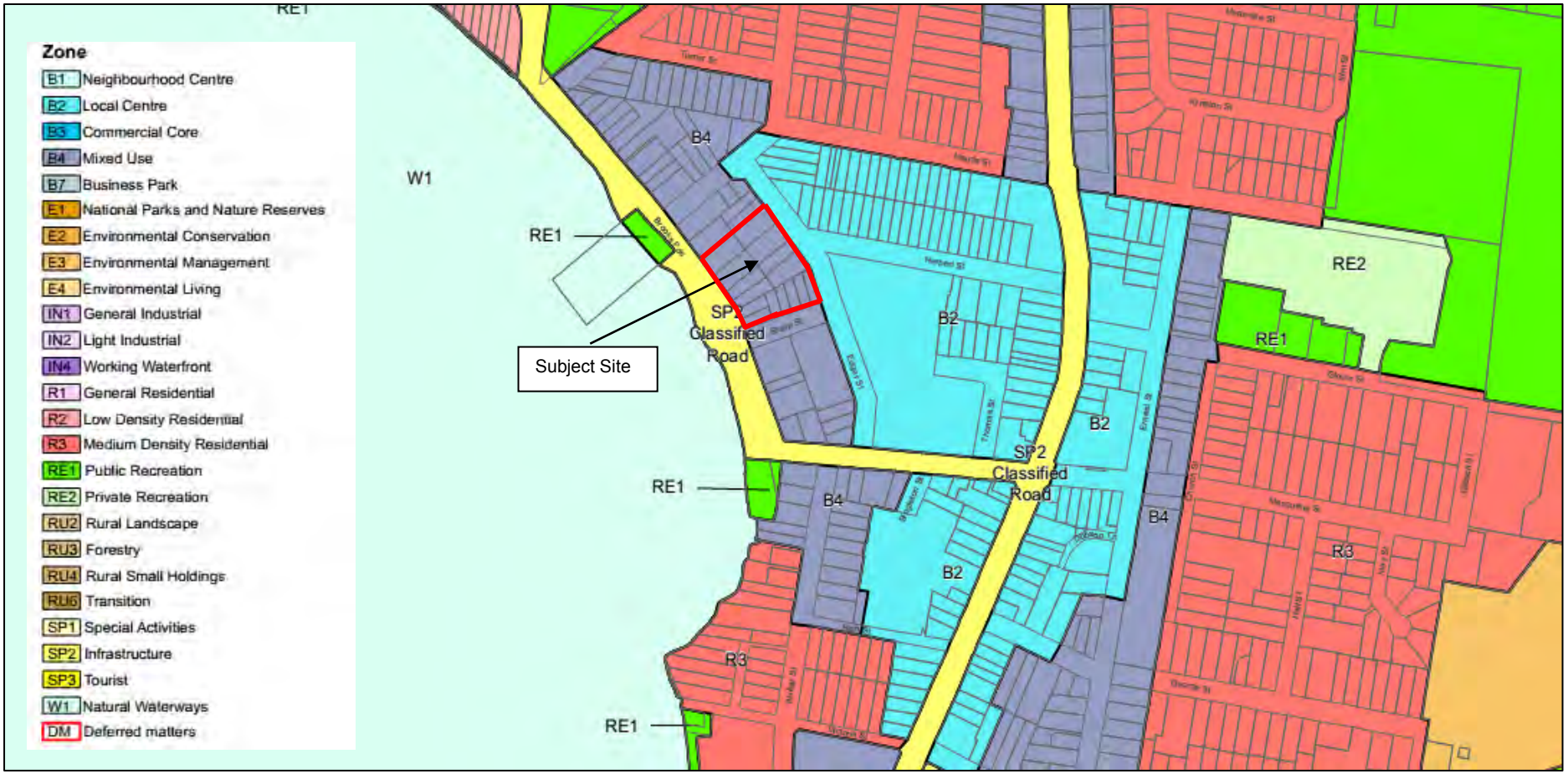


Figure 3-1: Land Use Zoning (LEP 2014)

3.2 COMMUNITY FACILITIES

Belmont town centre has a variety of community facilities that are located in close proximity and easy to access (Figure 3-2).

Two shopping centres are located within close proximity to each other: Belmont Citi Centre and Belmont Central Shopping Centre. Major supermarkets (Coles, Woolworths and Aldi) are present in Belmont. All the major banks are represented, as well as local building societies, such as the Newcastle Permanent Building Society and the Greater Building Society.

Newsagencies, butchers, bakeries, the post office and various specialty shops are located in the major shopping centres and the connecting streets, such as Macquarie Street and the Pacific Highway. Major food outlets, such as McDonalds and Subway, and cafes are scattered around the town centre to cater for weekday and weekend trade.

Medical services available in the town include several general practitioners and dentists, while Belmont Public Hospital is located within 5 minutes drive. Other personal services include pharmacies, hairdressers and beauty salons.

Belmont has retained various civic services. The local Court House operates daily, and is supported by Belmont Police Station in the adjacent Herbert Street. Belmont Ambulance Station is also located Herbert Street.

Education facilities in Belmont include two primary schools, a high school and the Hunter Institute of Technology Belmont Campus.

A variety of community facilities operate in Belmont, such as neighbourhood centre, Public Library, various sporting fields and courts, as well as commercial clubs including Belmont 16ft Sailing Club and Belmont Yacht Club.

Overall, the social and civic facilities at Belmont are reflective of its status as a major sub-regional centre in Lake Macquarie.

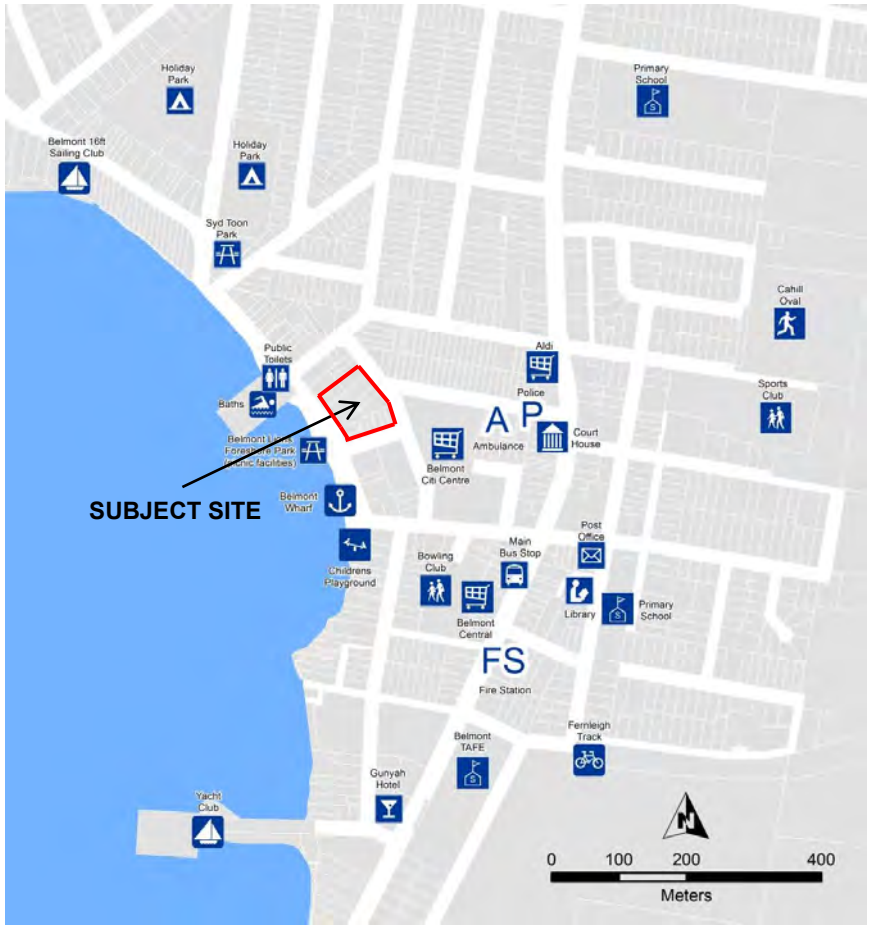


Figure 3-2: Community Facilities

3.3 OPEN SPACE

Open space in the vicinity of the subject site is considerable. Lake Macquarie is a vast water space at the western side of the town centre that is adjoined by Belmont Lions Park (Figure 3-3). This foreshore park has public facilities such as picnic tables, benches, and public toilets. Further south is a children's playground. Other facilities include the Belmont Rotary Park, Belmont Baths and Belmont Wharf.

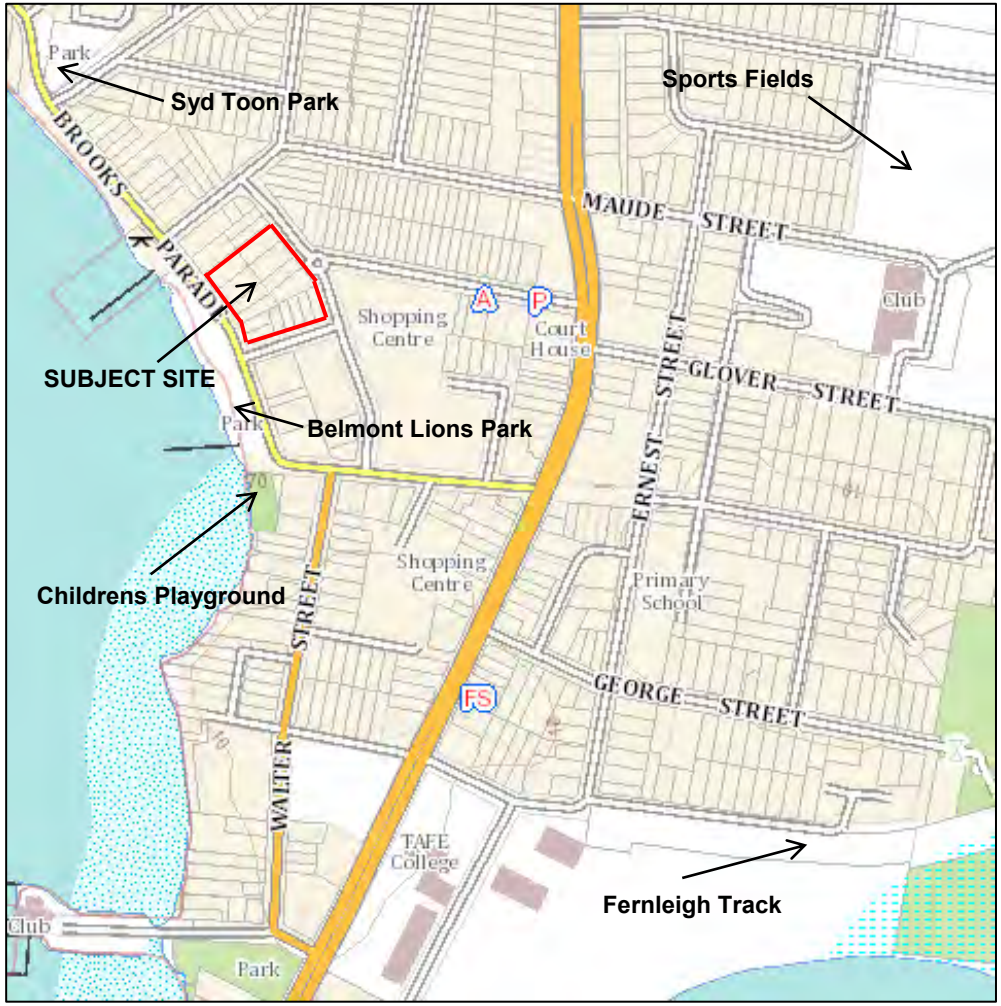


Figure 3-3: Open Space Network

3.4 PUBLIC TRANSPORT

The subject site is within 400 metres walk of bus stops for major routes (Figure 3-4).

Public transport is provided by government and private bus companies. Newcastle Buses provides several routes to various local centres, town centres, north to Newcastle City Centre and south to Swansea. Private bus companies also service Belmont town centre and access beyond Swansea to Catherine Hill Bay, Nords Wharf and Lake Haven. Bus routes to Belmont are shown in Figure 3-5.

Bus Routes:

14 – Belmont to Newcastle
Daily service via Belmont via Redhead, Gateshead, Charlestown, and to Newcastle;

29 – Belmont to Glendale
Swansea via Belmont, Belmont Hospital, Valentine, Croudace Bay, Warners Bay, Cardiff and on to Glendale;

41 – Belmont to Mount Hutton
Belmont via Valentine, Tingara Heights to Mount Hutton;

43 – Belmont to Mount Hutton
Belmont via Floraville, Windale and Mount Hutton;

45 – Belmont – Swansea
Swansea to Belmont, via Pelican, Marks Point and Blacksmiths;

48 – Belmont
Belmont via Redhead, Whitebridge, Charlestown and Warners Bay;



Figure 3-4: Major Transport Routes and Bus Stops



Figure 3-5: Bus Routes

3.5 ROAD HIERARCHY

Belmont Town centre is serviced by the Pacific Highway, which is an arterial road that runs north from Charlestown town centre (major employment area), and to the south toward Swansea, connecting with the M1 motorway (Figure 3-6).

The distributor roads in the town centre that connect with the subject site are Macquarie Street, Brooks Parade, Ross Street and Evens Street. Ross Street continues north to Valentine and Warners Bay.

Collector roads include Mark Street, Maude Street and Edgar Street.

Local roads include Sharp Street and Herbert Street. These streets carry less traffic than all the surrounding streets.

Access from the road network is available from Brooks Parade, Sharp Street and Edgar Street. The final access point will be subject to traffic engineering requirements, however, several access points are available.



Figure 3-6: Road Hierarchy

3.6 PEDESTRIAN MOVEMENT

Overall, Belmont Town Centre is walkable and well connected.

The pedestrian network in Belmont Town Centre is complete on one side of most streets. The footpaths are standard width, with the exception of the area along the Pacific Highway and the foreshore, which are wider.

The main pedestrian movement network around the subject site is shown in Figure 3-7 below.



Figure 3-7: Pedestrian Movements around the Subject Site

3.7 URBAN PATTERN AND DEVELOPMENT

The urban pattern is formed by the series of urban blocks and lots within each of the blocks. The street network in Belmont is a classic grid (Figure 3-6). The Pacific Highway is a spine that runs from Belmont South to Belmont North, and splits Belmont almost down the middle into east and west. This corridor is 26 metres wide, and supports pedestrian walkways on both sides. The highway is connected to collector streets, normally at right angles. Local streets connect to collector roads at right angles as well. The street widths are uniform, approximately 20 metres, and generally with a pedestrian footpath on one side of the road.

The lot layout within each urban block is also uniform for most blocks. The rear boundary of any lot is generally shared within only one neighbour. The lot layout in Belmont facilitates consolidation of existing lots into larger lots for development capable of accommodating larger built forms, and therefore higher density of dwellings.

The urban pattern in Belmont Town Centre provides several sites for significant future development of a single lot, or through lot consolidation of several lots into a single lot. Opportunities exist for substantial future development adjoining the subject site. The key single lot for significant development is the Belmont Citi Centre site. Belmont Central Shopping Centre could consolidate with adjoining lots for substantial development. Other lots on the Pacific Highway have potential through consolidation.

The subject site is a significant development lot in the development of Belmont Town Centre, particularly as the site fronts the foreshore of Lake Macquarie. The site is currently the consolidation of fourteen lots, and represents a particular opportunity to achieve a high quality development on the site consistent with the development pattern on surrounding lots.

3.8 BUILT FORMS

The subject site is adjoined in each major direction by different forms of development within 300 metres (refer to Figure 2-2). The key built forms for new development are tower blocks and rectangle blocks (Figure 3-8). Each urban block and built form use is discussed in detail below, and images in Table 3-1.

North
The urban block that accommodates the subject site, also accommodates:

- Rectangle-block, five storey mixed use development at the intersection of Brooks Parade and Maude Street (24-26 Brooks Parade), known as Santorini Apartments, and;
- Single storey residential development;
- An open stormwater channel that provides connection for the stormwater network to Lake Macquarie;
- A sewer pump station that is part of Hunter Water Corporation's infrastructure, which is immediately north of the channel and faces Brooks Parade.

Urban blocks beyond Maude Street are mostly characterised by detached single storey residential dwellings, and a limited number of two-storey unit blocks.

South
Sharp Street adjoins the site at the south.

The urban block immediately south is characterised mostly by recent mixed use development, including:

- 46 Brooks Parade, tower block, eight storeys, directly opposite the subject site at the intersection of Brooks Parade and Sharp Street. Belmont Towers is a residential apartment building with large setbacks to the street and ground floor single garages that face the street;
- 13-17 Edgar Street, rectangle block, six storeys, at the intersection of Edgar Street and Sharp Street is a mixed use development, with ground floor commercial space and upper floors for residential use. The development was completed in 2010;
- 54-56 Brooks Parade, tower block, six storeys, is a mixed use development with ground floor cafe and single driveway access from Brooks Parade, and was completed in 2007;
- 58 Brooks Parade, tower block seven storeys, is currently under construction and will comprise mixed use development for a residential flat building.

East
Herbert Street runs perpendicular from the site to the Pacific Highway, and creates two distinct urban blocks. The block on the north side of Herbert Street is predominantly detached single storey dwellings. The block on the south side of Herbert Street is mostly retail and commercial uses. The dominant development is Belmont Citi Centre shopping centre and open air car park. The loading dock entrance at Herbert Street faces the subject site. Shop top development along the Pacific Highway edge of the urban block is further to the east.

West
Directly across the street is Belmont Lions Park, an open space area that separates the road (Brookes Parade) from the foreshore of Lake Macquarie. A pedestrian footpath runs through the park that connects to a small children's playground some 200 metres to the south, and public facilities at the end of Maude Street. The only built form on this site is a toilet block. Built forms exceeding one storey on this site are unlikely to be erected in the future. Several mature fig trees are located along the street edge of the park.

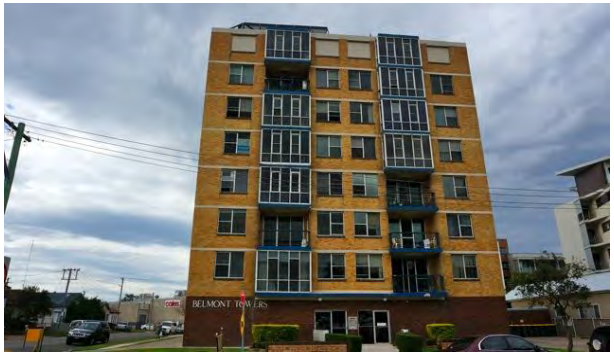


Figure 3-8: Adjacent Multi Storey Development

Table 3-1: Adjacent Built Forms



24-26 Brooks Parade (Santorini Apartments)



46 Brooks Parade (Belmont Towers)



56 Brooks Parade (Deck Apartments)



58 Brooks Parade (Belmont Wharf)



13-17 Edgar Street (Belmont Central)



13-17 Edgar Street (Belmont Central)

3.9 TOPOGRAPHY

The land form of Belmont Town Centre and the surrounding area is a consistent grade, approx 1° (Figure 3-9), rising from Lake Macquarie in the west, and reaching 16 metres in elevation at the eastern-most edge of development in the town centre.

The importance of the topography of the Belmont town centre cannot be underestimated in the visual setting of the town centre and foreshore. From the foreshore the town centre slopes upwards in an easterly direction to the Pacific Highway and further upwards to the south east. The highest point in the area is near the TAFE to the south of the subject site. This high point to the south east is approximately 14 m high than the subject site (Figure 3-10). Proposed height limits and controls in the Belmont area will mean that higher buildings on the foreshore area will actually blend with other developments along the foreshore and on the hilltop in Belmont centre.

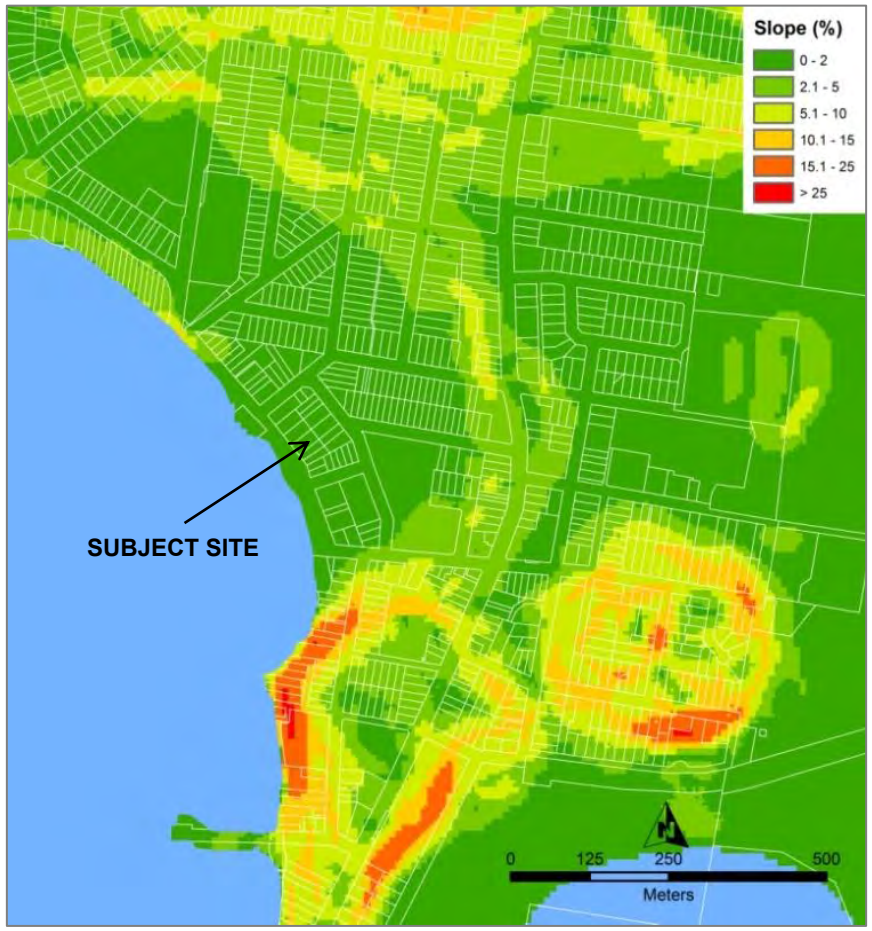


Figure 3-9: Slope Analysis

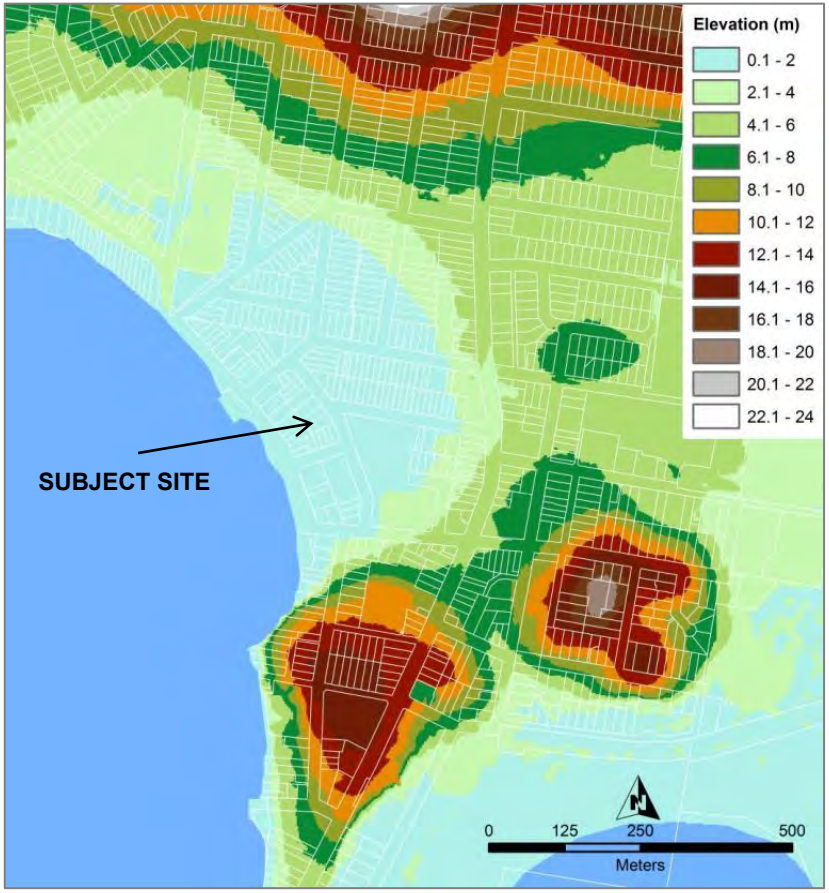


Figure 3-10: Elevation of Belmont Town Centre

3.10 VISTAS AND VIEWS

The topography and built form combine to provide vistas and view corridors (Figure 3-11).

Vistas from outside the town centre toward the centre exist from other hilltops. Several streets north of Evans Street have views south to the town centre; the top of Wommora Avenue with views to the south west; Belmont North looking south, and; the vicinity of Green Point looking south east. Finally, marine craft users on Lake Macquarie have uninterrupted vistas of the Belmont foreshore.

Several view corridors in the town centre are available to the Lake. The key view corridor to the Lake is provided between buildings from the Pacific Highway down Macquarie Street (Figure 3-12), which terminates at the Lions Club Park. Mark Street, Maude Street (Figure 3-13) and Sharp Street (Figure 3-14) provide short view corridors as a result of the change in direction of the streets. Mark Street provides a corridor 300 metres long, however it is not a significant street. Maude Street changes direction 140 metres before the foreshore, while Sharp Street does not align with Herbert to continue the corridor. There are no view corridors to the lake from Herbert St.

View corridors through urban blocks in the town centre have not been achieved, and are challenged by environmental constraints to deal with solar access, flooding and inundation.



Figure 3-11: Vistas and Views



Figure 3-12: View Corridor Macquarie Street



Figure 3-13: View Corridor Maude Street



Figure 3-14: View Corridor Sharp Street



Figure 3-15: Fig Trees on Brooks Parade Obscure Subject Site

3.10.1 View Corridors – Subject Site

As identified above there are view corridors into the subject site. However, as previously noted there are some viewpoints from which the site is barely visible, even with potential heights of 8-10 storeys, given the topography of the Belmont area. The most prominent views are from the Lake.

Figure 3-16 views the site from Macquarie Street looking north. Apartments on Edgar Street block the views into the site such that Belmont Towers is barely visible even from this short distance away.

Figure 3-17 views the subject site from the Pacific Highway. Even with current one and two storey buildings the site is barely visible and is unlikely to be seen if redevelopment occurs in accordance with the current controls under LEP 2014.

The main view corridors into the street will be from Sharp Street, Brookes Parade, Edgar Street, Maude Street and from Lake Macquarie. Even from nearby Herbert Street looking west (Figure 3-19) current views into the site are obscured.

As noted topography is an important aspect of the view corridors in the area. South of Macquarie Street the site is barely visible and when looking north and north west. The site is also barely visible from the Pacific Highway to the west. In this sense the potential view corridors are very localised. Consideration was afforded to views from the hillslopes to the north of the site. Clearly most of Belmont town centre is visible from areas to the north (e.g. Tingira Heights, Floraville), however, if future development is consistent with current controls the subject site will not be prominent given the potential surrounding development.



Figure 3-16: Macquarie St looking north to the subject site



Figure 3-17: Pacific Hwy looking west to the subject site



Figure 3-18: Eastern End of Coles Car Park Looking West



Figure 3-19: Hebert Street and Pacific Highway Looking West (current Belmont Towers is obscured in the background)

3.11 FLOODING AND INUNDATION

The subject site has a ground level of RL 1 metre AHD - to RL 1.2 metres AHD across the site. Development below 3.0 metres is subject to Council's sea level rise policy. Consequently, development will need to be elevated.

A podium level for future development is a potential solution, potentially at a height of 1.5 metres. Accurate flood information is available from Council, but for the purpose of the analysis, it is assumed that the podium level will be 1.5m, with an overall RL of 2.5-2.7 metres AHD for the site. The impact of flooding is considered manageable.

A stormwater channel also runs through and to the north of the site. The channel services the stormwater water network further north from Mark Street, and connects to Lake Macquarie at the north-west corner of the site and Belmont foreshore park.

3.12 SOLAR ACCESS AND OVERSHADOWING

The subject site is likely to enjoy good solar access within the site, while future development of the site is likely to have minimal solar impact on adjoining sites (Figure 3-20). The site is largely oriented to the north. The stormwater channel provides approximately 5 metres separation from blocks to the north. Hunter Water's sewer pump station is unlikely to be built out, providing uninterrupted solar access. The site enjoys winds from the north-east in summer.

Overshadowing existing development is considered limited. Existing development to the east and south of the subject site are separated by Edgar Street and Sharp Street respectively, which are both 20 metre road reserves. Adverse solar impact to Edgar Street development is highly unlikely. This site enjoys uninterrupted access to the north via Herbert Street. Solar access impacts to Sharp Street development are likely to be minimal from future development of the subject site, or could occur at the ground floor (commercial level), depending on building mass and heights.



Figure 3-20: Solar and Wind Access (JBA 2012)
(Note: Previous application over more lots than proposal)

3.13 SUMMARY

This section has examined the site in its broader context in relation to a number of issues including existing land uses, topography, visual corridors, flooding, open space, pedestrian movement, built form and the existing built form. The site presents a number of potential constraints which are presented in Figure 3-21. Conversely, the site also presents a number of opportunities for redevelopment which are outlined in Figure 3-22.

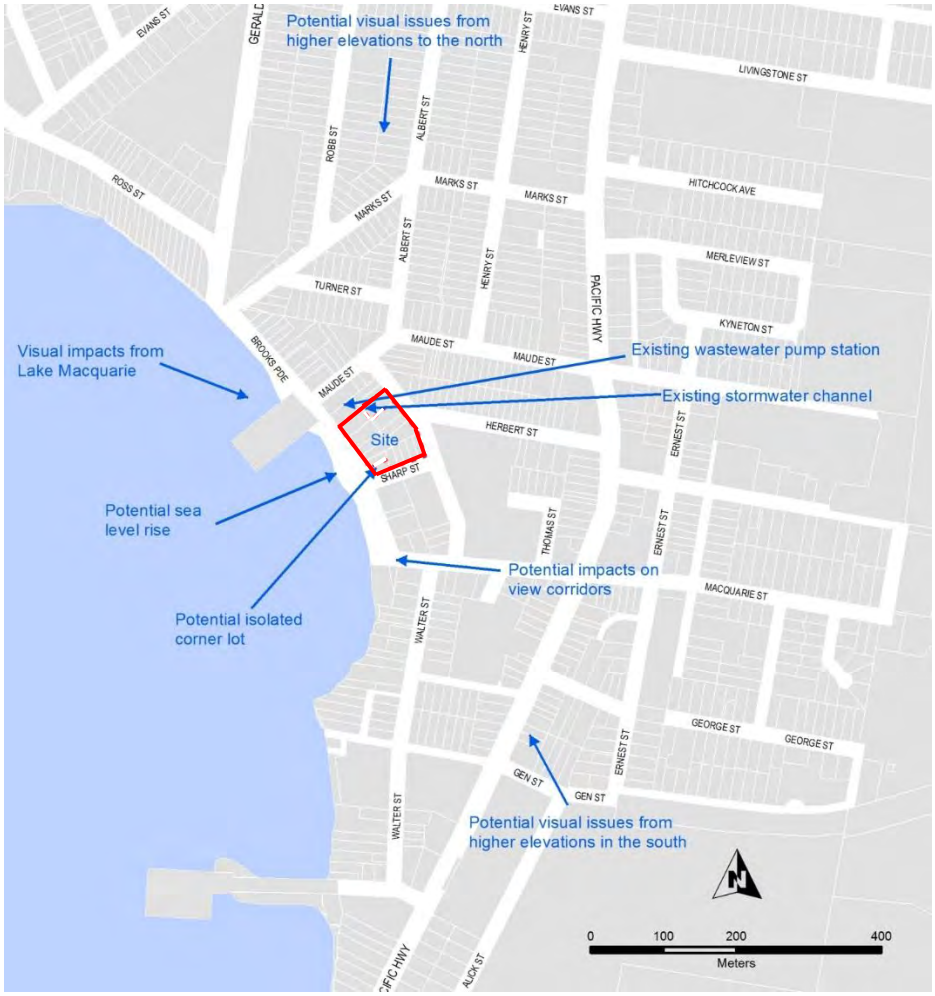


Figure 3-21: Potential Site Constraints

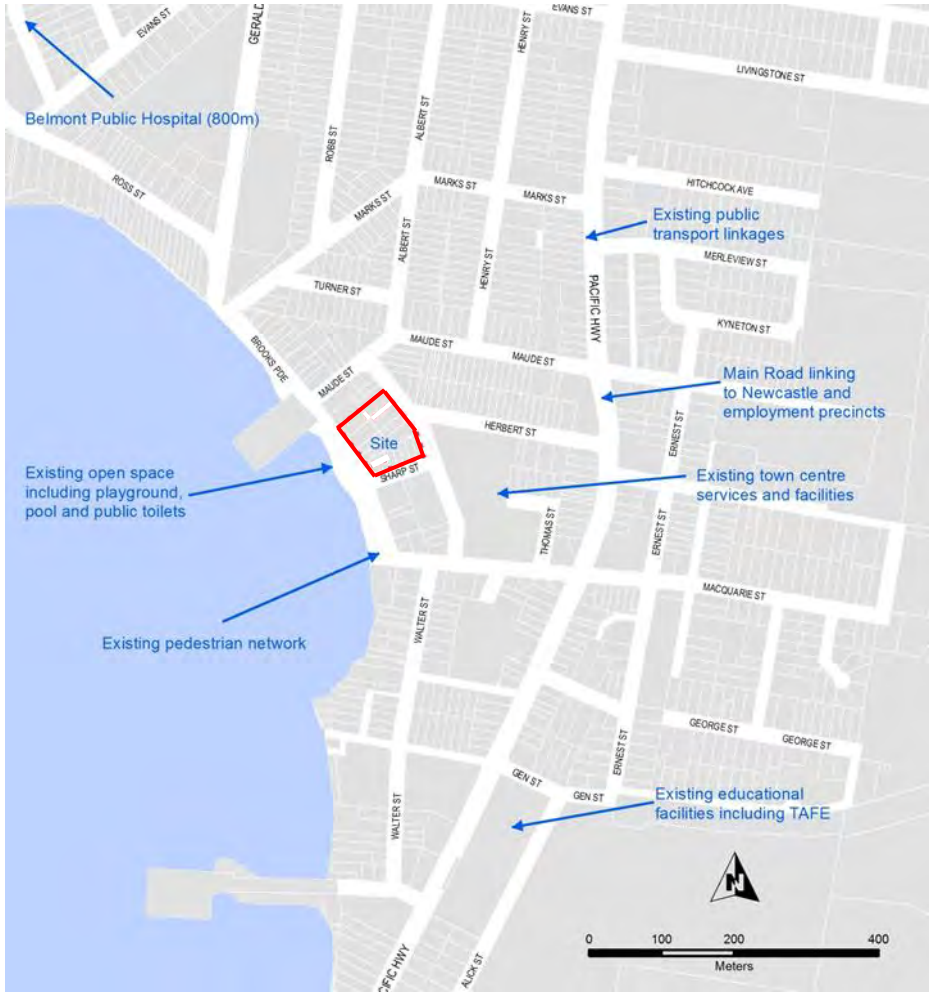


Figure 3-22: Opportunities Plan

4 PRINCIPLES FOR DEVELOPMENT

To develop the design principles for the proposed development a number of guides and charters were considered. These publications included:

- Our Cities, Our Future (Australian Government, 2011);
- Creating Places For People: an urban design protocol for Australian cities (Department of Infrastructure and Transport, 2012);
- Coastal Design Code (Coastal Council of NSW, 2003).

A discussion of the design principles in each publication are provided below. A summary of the findings and list of site specific principles are included in Section 4.4 of the report.

4.1 OUR CITIES, OUR FUTURE

The Federal Government prepared Our Cities, Our Future (also known as the National Urban Policy) in 2009 to inform the development of Australian cities into the future. The policy provides a framework to assist with further policy development by setting of goals, objectives and principles. These goals, objectives and principles are summarised by the following:

- Efficiency - Our cities and the social and economic infrastructure and services that support them should be planned and managed to maximise their efficient use

- Value for money - Investments in our cities should be cost-effective to return maximum benefits to communities and investors

- Innovation - The planning, design, construction and management of our cities requires creative ideas and solutions to meet the current and future challenges

- Adaptability - Our cities need to be adaptable to changes in the economy, population, demographics, technology and the environment

- Resilience - Our cities need to be resilient to events such as natural disasters, the effects of climate change and global socio-economic processes

- Equity - Our cities should support the equitable distribution of access to resources and opportunities, including education, jobs, housing, services and facilities

- Affordability - Households should have affordable options for where they live and work, how they travel and access services and facilities, and for leisure opportunities
- Subsidiarity - Planning and services should be delivered by the most local level of government that has sufficient scale and capability to reasonably deliver them
- Integration - Policies and programs need to be integrated across the different levels of government, across portfolios and with industry and communities
- Engagement - Planning, policies and programs need to be informed by the views of all sectors of the community

The policy also recommends that a National Urban Design Protocol be developed to provide a more detailed set of guidelines for the future development of Australian Cities.

4.2 CREATING PLACES FOR PEOPLE: AN URBAN DESIGN PROTOCOL FOR AUSTRALIAN CITIES

Creating Places for People was prepared as a direct response to the National Urban Policy to direct urban design on a national level. The policy was prepared to include the following broader urban design principles:

Productivity and Sustainability

Enhance local economy and environment, connect physically and socially, provide diversity and ensure sustainability.

Liveability

Comfort, vibrant, safe and walkable.

Leadership and Governance

Work within the planning environment, engage with stakeholders and consider custodianship.

The broadly reflect the principles of Our Cities, Our Future discussed above.

4.3 NSW COASTAL DESIGN GUIDELINE

The NSW Coastal Design Guideline was prepared by the NSW Coastal Council to "provide a framework for discussion and decision making involving coastal planning, design and development proposals between all stakeholders in the context of caring for the natural beauty and amenity of coastal beaches, headlands, waterways and ecologies upstream."

The guidelines provide a hierarchy of coastal settlement that includes:

- Coastal Cities
- Coastal Towns
- Coastal Villages
- Coastal Hamlets

Belmont is characterised as a Coastal Town as it has a population of approximately 6,500 residents and provides the facilities and services that include commercial development, a main street, retail town centre, parks, playing fields, churches, education institutions and medical facilities.

The NSW Coastal Design Guideline identifies the main urban design principles applicable to Coastal Towns as:

1. Relationship to the environment
2. Visual sensitivity
3. Edges to the water and natural areas
4. Streets
5. Buildings
6. Height

4.4 DESIGN PRINCIPLES

Belmont is a rapidly developing sub-regional centre and is coming under increasing pressure for redevelopment, particularly for mixed use development and residential apartments. The following design principles have been developed to specifically address these issues.

The following design principles have been developed from the review of the relevant guidelines and charters above. The principles have also been informed by the urban form analysis presented above, including environmental and topographical constraints and potential connectivity with existing networks

In the current situation the application of these principles will be locally specific. For example, the site is not within a heritage conservation area. The local area also contains a mix of uses with a large span of time between different developments within the Belmont Town Centre.

- Interaction with Natural & Urban Context

  The three main considerations in relation to the site context are the visual sensitivity of the surrounding urban development, view corridors from the surrounding area and interaction with the Lake.

  The prominence of Brookes Parade is one of the main considerations of this report. The road contains the older Belmont Towers and a number of recently constructed residential developments. The reduction in the visual prominence of Belmont Towers was identified in several previous studies. The interaction with the existing urban fabric is therefore vitally important.

  The topography of the Belmont town centre provides an important component to the view corridors into the site, as does the Lake. The topography of the Belmont town centre provides view corridors from the Pacific Highway to the Lake along Macquarie Street and Sharp Street. Other views into the subject site are limited by the specific topography of the area. The Pacific Highway and the two supermarkets near the Highway provide central activity points in the area.

  Interaction with the foreshore area is also an important issue that was considered during the concept design. The foreshore area of the Lake provides a sensitive landscape, with various recreational and social functions.

- Physical Connections

  The Lake and its foreshore area are important destinations and are considered to be a community asset. The retail/commercial area on the Pacific Highway and the public transport linkages along the Highway are also considered to be important destinations.

  The physical connections to these areas will be an important consideration to the design of any future development.

- Sustainability

  It is noted that the foreshore area in Belmont may be subject to future sea level rise and this should be considered in any future proposal.

  Intertwined in this is ensuring the final design on the site considers the impact of sea level rise including on adjacent sites.
- Vibrancy & Diversity

The creation of and activated street frontage along Brookes Parade is an important consideration. Attracting people to the foreshore should be encouraged to ensure a safe and vibrant area for the community.

The inclusion of a range of residential development and ground level commercial development should be considered to provide a diverse range of services.

- Planning Environment

  The provisions of the current NSW planning framework should be used to guide the design process.

- Community

  This report did consider the community particularly in relation to the foreshore area of the Lake opposite the subject site as well as ensuring connections to local public infrastructure and services were enhanced.

  Intertwined within this principle as well as others noted above is the principle of amenity. This will be to ensure the amenity of the Belmont town centre is not significantly impacted by any development on the subject site.

Other guiding principles were also considered as part of this study including convenience and character. There is significant overlap between these principles and the ones identified above.

For example, Belmont is a town centre and the subject site is conveniently located to the services and facilities in Belmont town centre. The final design of the building at the DA stage will be an important contributor to the character of Belmont and the existing streetscape.

The character of the town centre is a mix of old and new buildings, some of better design than others. The final detailed design should address this issue.

5 SWOT ANALYSIS

5.1 STRENGTHS

The subject site has several strengths, which are also derived from its location in the Belmont town centre:

Site

- Water front location.
- Lot orientation providing wind and solar access.
- Wide street frontage to Brooks Parade and foreshore.
- Separation from adjacent development.
- Three street frontages for greater access.

Belmont Town Centre

- Close proximity to, and good supply of, public and privately operated local amenities and community facilities.
- Good public transport connection.
- Walkable neighbourhood.
- Existing retail and commercial activities.
- Topography is generally at low grades around the lake and shopping precinct, while ground elevation increases south of Macquarie Street.
- Open space provided by Lake Macquarie and foreshore areas.

5.2 WEAKNESSES

Few weakness or constraints were identified for the site.

- Stormwater channel – the location of the channel results in fragmentation of the subject site. The cost to relocate the channel is likely to be prohibitive for the future developer of the site. Therefore, the analysis assumes that the location of the channel is not changed.

- Sewer pump station – the sewer pump station is assumed to be fixed, and consequently that this lot is unlikely to be developed. The costs to relocate the station are likely to be prohibitive, unless an upgraded station in an alternative location is required. As such, this site is assumed to continue to be used for sewer infrastructure.

5.3 OPPORTUNITIES

The potential development of the site presents several significant opportunities that deliver on the desired strategic outcomes for Belmont town centre:

- Efficient land use - development within the existing urban footprint is an efficient use of the land, infrastructure and other resources;
- Increase activity within the town centre – stimulate economic development through spending in local businesses and uplift community spirit through greater number and diversity of persons to participate in community life;
- Diversify housing types – provide range of apartment sizes and types to supplement the supply of detached single storey dwellings in the area;
- High-quality streetscape and public domain – provide high-quality design to new buildings that face three streets in Belmont town centre, as well as enhance the frontage to the foreshore area;
- Greater building height and mass –the topography of Belmont town centre and open space provided by the lake allow the area to accommodate greater building scale across the site, and stepped development to connect development north of the site with development to the south.

5.4 THREATS

The key threat to the potential development of the site is:

- Site dislocation – the potential dislocation of the development site as a whole into smaller development lots could diminish the potential to realise the opportunities identified above. This site has significant development potential when all the identified adjacent lots can be developed at the one time under a single plan. For example, if the site became two or three smaller development sites, or one of the central lots fronting Brooks Parade withdrew from the potential development, the full potential development for the site will not be achieved.

The development potential is discussed in greater in the following sections of this report.

6 STRATEGIC CONSIDERATIONS AND PREVIOUS STUDIES

6.1 HUNTER REGIONAL PLAN

The Hunter Regional Plan identifies Belmont as a 'centre'. The Hunter City Plan identifies growth opportunities along the Pacific Highway corridor between Charlestown and Belmont to support the viability if existing centres. The proposal would be consistent with the vision for Belmont as identified in the Regional Strategy.

The subject site is located in Belmont. Belmont is identified as a town centre in the strategy. Towns such as Belmont are characterised by shopping and business activities, such as health and professional service for the district, as well as supplying medium and higher density development. Belmont is also central to other employment lands within one kilometre of the town centre and to industrial lands five kilometres away at Redhead.

The subject site can deliver higher levels of housing within a major centre, close to employment lands, making efficient use of existing infrastructure and providing good amenity. Potential development could provide up to 138 units – a mix of 1, 2 and 3 bedrooms – in the town centre and adjacent to Lake Macquarie, in addition to retail and commercial units. Several other sites in the immediate vicinity have been similarly developed.

Development of the site is considered consistent with the objectives of the Hunter Regional Plan, and will make a positive contribution to realise the strategy through the provision of higher density development in a major sub-regional centre.

6.2 LIFE STYLE 2030 STRATEGY

Lifestyle 2030 Strategy is the eminent Strategic plan prepared by Lake Macquarie City Council to inform the development of the local government area. The current strategy was adopted by Council in March 2013.

The local government area surrounds the shores of Lake Macquarie, extending north to the border with Newcastle Local Government area, south to Wyong Shire Council, east the Pacific Ocean, and west to the Watagan State forest before adjoining Cessnock local government area. The extent of Lake Macquarie local government area and its urban structure are illustrated in Figure 6-1 below.

6.2.1 Belmont Town Centre

Belmont is identified in the Strategy as a Town Centre within the East Lake Intensification Corridor. The strategy expects urban zoned land in the corridor to be developed for multi-unit housing close to centres and well serviced by public transport routes, as well as employment, community services and facilities. The intensification for housing assists to maintain the supply of industrial land for manufacturing activities in the corridor, such as Redhead and Bennetts Green, which plays an important role in the local and regional economy. Intensification limits the growth of the urban footprint, protecting ecological lands along the along the east and west sides of the corridor from Belmont to Charlestown.

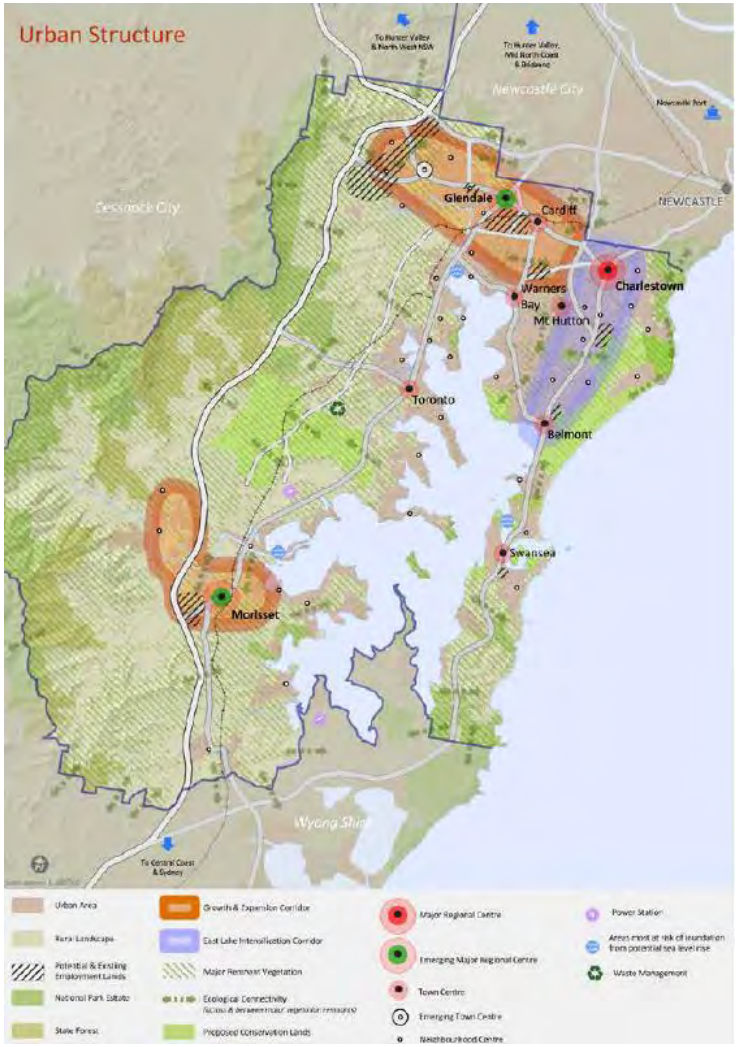


Figure 6-1: Urban Structure (Lifestyle 2030)

6.2.2 Strategic Directions

Lifestyle 2030 has seven strategic directions, each illustrated by numerous statements of the desired outcomes. The key desired outcomes for each strategic direction are supported by the potential development of the site, and presented below in Table 6-1.

Table 6-1: Lifestyle 2030 Strategic Directions Development Response

	City Strategic Direction	Potential development response
1.	A city responsive to the environment	The development is located within the existing urban footprint of Belmont. Habitable areas within the site will be elevated to protect against the effects of flooding and/or sea-level rise. The scenic quality of the area is preserved by high quality urban design and maintaining view corridors to the lake from the Belmont town centre.
2.	A city that make an equitable contribution to global sustainability	Though the construction of the new dwellings will require some materials will higher levels of embodied energy, the development will provide long term water and energy efficiency measures in accordance with BASIX requirements, as well as reduced dependence on fossil fuels for transportation by locating development closer to complimentary activities and high frequency public transport routes (e.g. Pacific Highway).
3.	A well designed adaptable and liveable city	Stronger function and urban design relationships between the Lake and Belmont town centre is facilitated by the development. A break between the unit blocks provides a view and pedestrian corridor through the development site to the Lake. Building setbacks above the forth storey can be incorporated into the development to reduce scale and mass of development, and allow wind and solar access to the street and surrounding development. Frontage to the Lake will be landscaped with gardens and provide pedestrian access through the development to the Lake, as well as around the perimeter of the development site.

		Finally, the potential development will offer different bedroom/study combinations for the dwellings for different household sizes.
4.	A well serviced and equitable city	Belmont is identified by Council as suitable for further urban infill development, and adopted a Town Centre Development Control Plan. Potential development can be consistent with the controls, with the exception of the current controls that prescribed the number of storeys. Despite the non-conformances, potential development can provide outcomes that are consistent with the objectives of the strategy. Car parking can be provided within the development site, however public transport is accessible within 400 metres, with services to other town in Lake Macquarie, such as Warners Bay and Charlestown, and onwards to Newcastle. Pedestrian and cycle networks are available long the Lake Macquarie foreshore in front of the development on Brooks Street.
6.	A city responsive to the wellbeing of its residents	Different bedroom/study combinations for the dwellings for different household sizes will be offered. Potential development will provide quality housing, landscaping, and diverse retail opportunities. Commercial services will also be available to locate within the development. The subject site is also located centrally to shopping centres, health services and various community centres that are vital for community wellbeing.
7.	A city that practices participatory democracy and is well governed	State and local government strategic planning policies (e.g. climate change considerations) have been incorporated into the development. The ground floor level is elevated to mitigate the impacts associated with climate change that may affect the foreshore of Lake Macquarie. Council is responsive to the need for higher residential development and to create and apply appropriate development controls.

Overall, the potential development is consistent with the objectives of the Lake Macquarie Lifestyle 2030 Strategy.

6.3 LAKE MACQUARIE TOWN CENTRES DCP – TOWN CENTRE AREA PLANS – BELMONT

The Lake Macquarie Development Control Plan (DCP) provides general controls for development in Lake Macquarie. The subject site falls within the provisions of the Lake Macquarie Town Centres DCP.

The Belmont Town Centre Area Plan (Area Plan) describes the future desired character, environmental constraints and development controls that will apply. The plan will inform development in the town centre, between Maude Street in and Victoria Street in the south, as well as development on both sides of the Pacific Highway from Evans Street to the Gunyah Hotel. The application area of the plan, and future structure plan, are illustrated in Figure 6-2.

The Area Plan describes the existing and desired future character of the area, environmental constraints, development controls, and certain urban blocks and their specific controls in the area.

The desired structure of Belmont Town Centre as presented in the Plan, is shown below in Figure 6-2 and the Block Control Plan in Figure 6-3 below.



Figure 6-2: Belmont Town Centre Area Structure Plan



Figure 6-3: Extent of Area Plan and Blocks

The DCP provides Block Controls for each urban block affected by the Area Plan. The subject site is located within Block C (Figure 6-3). The DCP Block Controls provides general building envelops including heights/storeys and indicative building footprints. The objectives of the block controls are:

- To improve the amenity and connectivity of the public domain;
- To improve vehicle circulation and access to public transport;
- To ensure that building scale, height and setback contribute to the desired future character of the town centre.

The Area Plan requires the preparation of a Concept Plan due to the significance of the subject site to the Belmont Town Centre (Figure 6.4). The aim of this requirement is to ensure that future development provides benefits to residents and the community based on a sound concept plan, informed by strategic, environmental and comprehensive urban analysis. Comprehensive environmental analysis would be undertaken when a development application is prepared and lodged with Council.

Specific building types, heights and massing specified in the Plan apply to the site. Extracts from the Plan are shown in Figure 6.4 and 6.5. The Plan shows that buildings are proposed to have a maximum height of six storeys, stepped down to 4 storeys. Additionally, development may encroach the setback for up to 50% of the building frontage on level one along Brooks Parade, Sharp Street and Edgar Street. Separation between the buildings should be 12 metres based on the C Section in Figure 6.4 and Figure 6.5. The distance of the east-west break between buildings is not specified.

The potential development on the subject site will be a balance of the requirements of this Plan, the Local Environmental Plan, the Apartment Design Code, and a feasible development outcome for the site. Compliance with the DCP is addressed in the Statement of Environmental Effects.

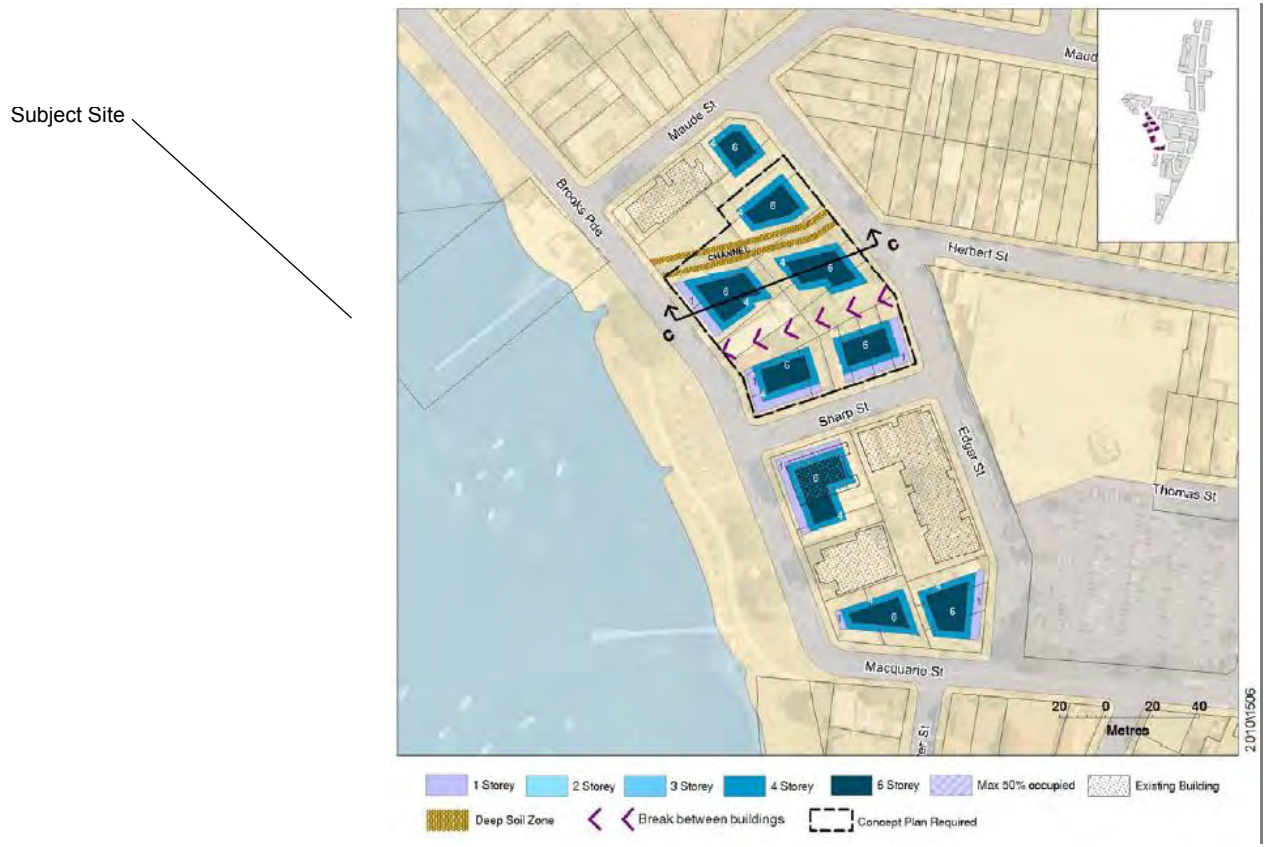


Figure 6-4: DCP Block Control Plan Applicable to Subject Site

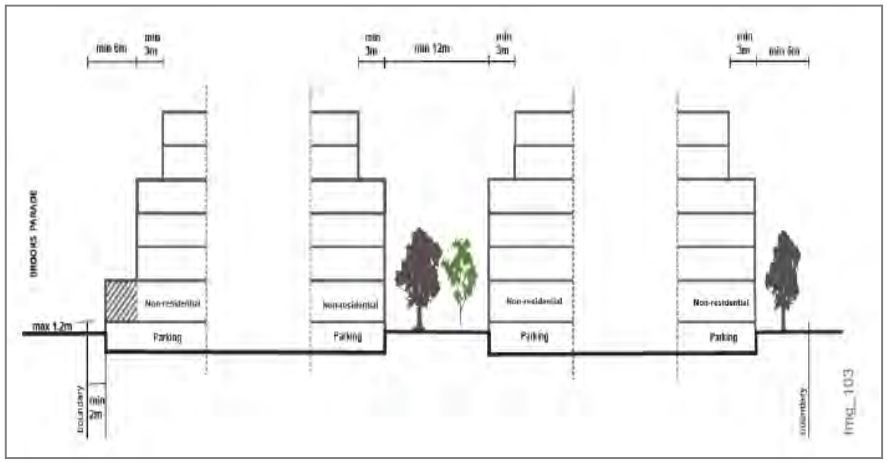


Figure 6-5: DCP Block Control - Building Section

The potential development should be able to achieve the majority of development controls in the Plan, in particular:

- Separation between the building blocks on the east-west axis through the site;
- Setbacks in accordance with the Plan on most sides – the minor exception being Brooks Parade where the corners of balconies of the lower floors will encroach the 6-metres building setback.

The non-conformances with the DCP may be considered a satisfactory strategic outcome for the site, following consideration of the urban design and environmental factors discussed in the Statement of Environmental Effects.

6.4 LOCAL ENVIRONMENTAL PLAN 2014 AND DEVELOPMENT CONTROL PLAN 2014

The current LEP and DCP were enacted in 2014. The LEP identifies a mixed use development zoning for the site. Higher densities are encouraged on the site and within the town centre more generally. This is consistent with Council's current strategic planning framework.

The Belmont Area Plan as presented above forms part of the DCP. There is also a residential flat DCP that would need to be considered for the proposed development. The Area Plan though provides more specific local provisions.

6.5 COUNCIL REVIEW OF TOWN CENTRES DCP AND BELMONT AREA PLAN

Lake Macquarie City Council strategic planning section undertook a review in November 2013 of the Town Centre DCP and Belmont Area Plan with respect to the subject site.

This planning and design report has considered findings of this review.

6.6 SUMMARY

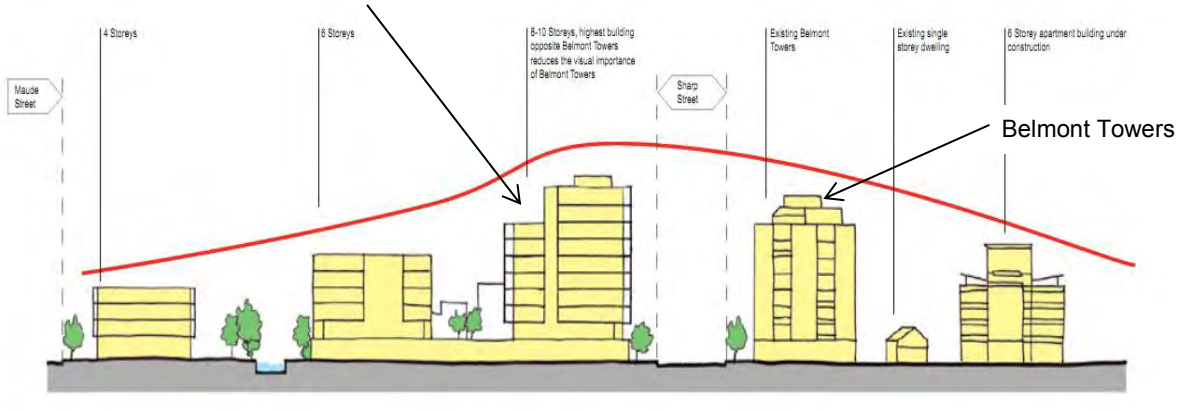
Overall, the potential development for mixed use development at Brooks Parade, Belmont is consistent with the strategic objectives of the planning instruments that apply. The Lower Hunter Regional Strategy identifies Belmont as a town centre in the Hunter that is capable of accommodating greater levels of urban activity, such as increased dwellings, employment and community activities. Lake Macquarie's Lifestyle 2030 also supports further development of Belmont. The town is identified as a centre in the urban structure of Lake Macquarie, connected to other centres by a local and regional bus network, and in proximity of industrial and other employment lands. The potential development supports the strategic directions for the development of Belmont, locating dwellings in the heart of the town, close to local shops and various other facilities, while providing a high quality urban design in a prominent location on the foreshore. Finally, the potential development achieves the objectives of the desired future character albeit with some non-conformances to controls. In sum, mixed use development on the site is strategically supported.

6.7 BACKGROUND STUDIES

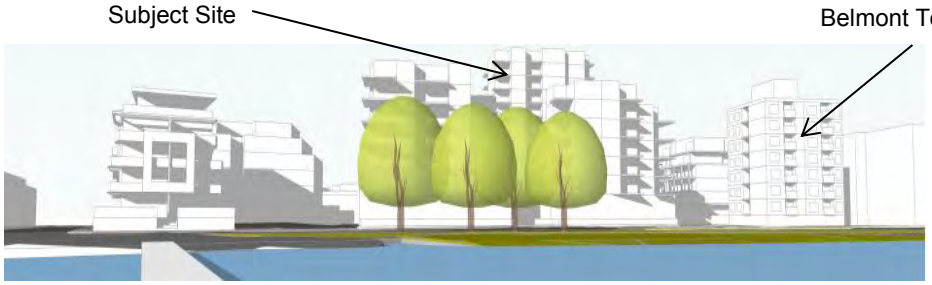
There have been a number of studies prepared for the site and the immediate area including Deicke Richards, Killen and Doran, Cardno, Lake Macquarie City Council, Monteath and Powys, and JBA. All studies promoted higher density forms of housing on the subject site. The Belmont Design Guidelines prepared by Council in 2001 identified development of similar height to Belmont Towers. However, more recent work, particularly by Deicke Richards identified development of between 8-10 storeys adjacent to Belmont Towers falling away to 6 storeys (on the subject site moving further north). These latter two studies particularly identified that the 1960s-70s development known as Belmont Towers should not be the focal point for Belmont along Brookes Parade and more appropriate architecturally designed buildings on the subject site should be encouraged to reduce the prominence of Belmont Towers. JBA identified seven storeys adjacent to Belmont Towers but up to 12 storeys at the Edgar Street frontage (to the east). Similarly, they proposed reducing the prominence of Belmont Towers.

Figure 6-6: Concepts from Previous Studies

Subject Site



(Deicke Richards 2007)



JBA (2012)

7 MARKET DEMAND AND ANALYSIS

7.1 DEMOGRAPHIC ANALYSIS

An analysis was conducted of Australia Bureau of Statistics (ABS) Census surveys in 2001, 2006 and 2011 ('the period') for Belmont and the local government area of Lake Macquarie. Where possible, Belmont was analysed at the lowest possible statistical area.

Flats, unit and apartments accounted for 15.5% of the stock of dwellings in Belmont, second only to separate houses, which accounted for 71.2% of dwellings, at the 2011 Census.

Growth in the market for flats, units or apartments in the period was reasonable. In Lake Macquarie, this market grew by 1.5%, which significantly outstripped growth in separate houses (0.1%) and semi-detached, row, terrace house and town house development (0.0%). Furthermore, Belmont achieved 3.6% growth in this market compared against all dwelling types.

Across Lake Macquarie, the number of persons residing in flats, units in apartments for the period is generally constant, typically one person (60%), followed by two persons (30%), while three or more persons accounts for the remainder (10%). An examination of household types shows reveals that lone person households is consistently accounted for 57% of all household types residing in flats, units or apartments. Significantly, couples with no children living in this dwelling type increased from 15% to 20% over the period. One parent families accounted for fewer than 10%.

Flats, units or apartments were examined by tenure and household type across Lake Macquarie. Owner occupiers and renters are generally 25% and 75%, respectively. However, owner occupation grew by 5% over the period (2001-2011), which suggests a trend may be developing for apartments in the area. An examination of household types reveals that "couple families without children" increased in flats, units or apartments - as a proportion of total dwelling types, it rose from 2.2% in 2001 to 3.9% in 2011. Lone person households' rose by 2.7% over the same period.

The increase diversity of dwellings in the Belmont town centre will allow elder residents to age in place, with persons aged over the age of 55 years accounting for 32% of the population of Belmont.

Figures 7-1 and 7-2 show that the number of persons over 50 in surrounding suburbs (by Statistical Area Level 1), accounts for more than 50% of the population. Over 50s may have higher demand for units and apartments as they look to down size – i.e. to sell a detached dwelling and purchase an apartment for less money and using the residual for future income.

Table 7-1: Persons aged over 50 years of age (2011)

Area	Persons Over 50	Percentage of Person over 50 (%)
Statistical Area Level 1 which includes the Subject Site	216	46%
East Lake Macquarie	95,423	39%
Lake Macquarie LGA	73,194	39%

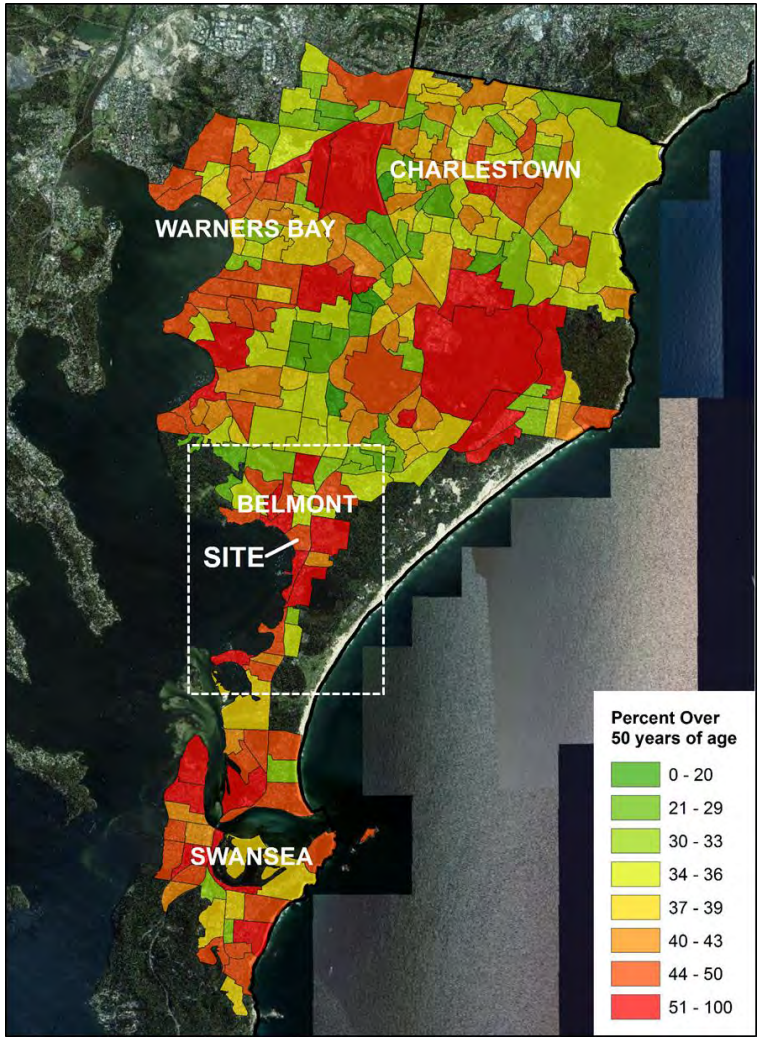


Figure 7-1: Percentage of Persons Aged Over 50 Years – Eastern Lake Macquarie

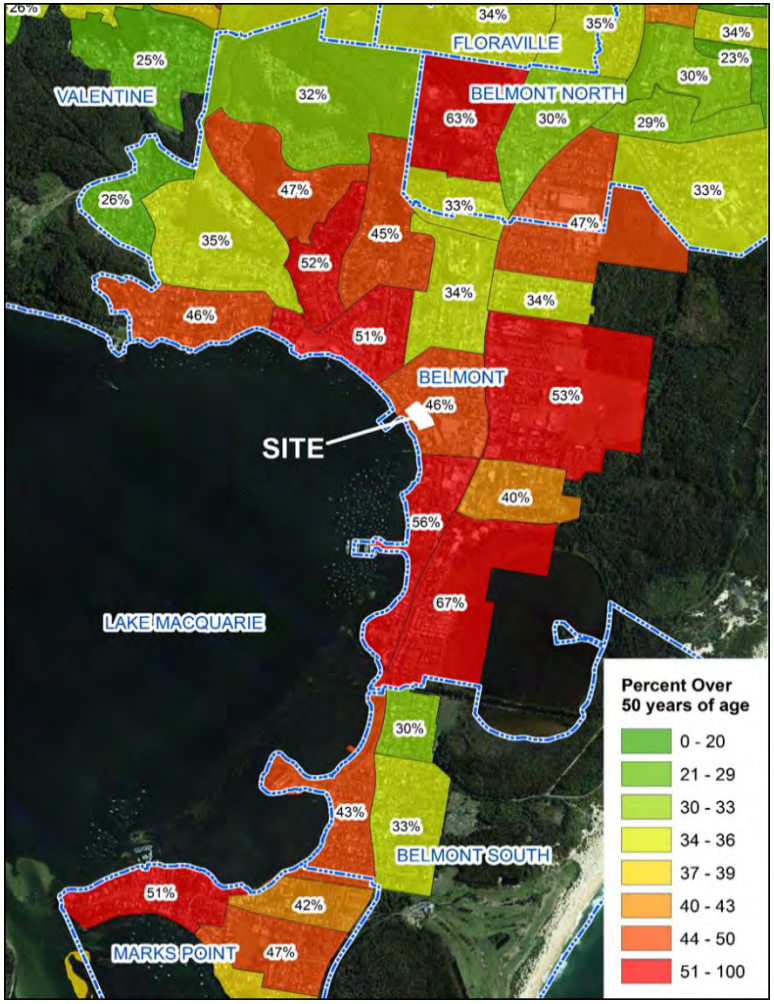


Figure 7-2: Percentage of Persons Aged Over 50 Years - Belmont

The results above show that there is a high proportion of older persons in the Belmont area. Higher density development in Belmont will allow these residents to age in place.

7.2 BUILDING APPROVALS AND SUPPLY

Within the Belmont Town centre, several mixed use developments incorporating several storeys of residential flats have been approved, constructed and occupied in the past several years as identified in Table 7.2.

The built form for each development is comprised of a single block building, with generally commercial / retail on the ground storey, and the remaining storeys for residential use. Car parking and utilities are provided in basement levels or at ground level.

Table 7-2 also reveals that there is variation in the median sales price of dwellings in approved multi-unit development in the area. There is obviously a high end market, which may be related to waterfront location and amenity. Some penthouses on the foreshore area have sold for upwards of over $1 million. There is also a lower end market providing more affordable housing in the area. Higher density housing in Belmont is providing housing diversity.

There will be different markets also within buildings, between dwellings on lower storeys and penthouse apartments at the top. There is also a mix of unit sizes. Importantly, as discussed previously there has been an increase in owner-occupation of flats and units in Belmont between the Censuses in 2001 and 2011. There is an increasing tendency for owner occupiers in this market in Belmont.

There are many nearby existing suburbs from Swansea, Marks Point in the south through to Valentine and Eleebana in the north, which have an older demographic. Higher densities in Belmont will allow these people to age in place. Belmont is obviously an attractor for residents in the eastern Lake Macquarie area. It has many civic functions as it is a sub-regional centre, and there are existing public transport services linking other centres, as well as recreation facilities in the area, particularly along the foreshore. The higher density housing in Belmont is servicing a number of markets from the older retiree who is asset rich but income poor, but also those who can afford lakeside living. The TAFE and public transport links also provide opportunities for young persons to live in a sub-regional centre providing linkages to other employment opportunities in Charlestown and Newcastle. There are obviously affordable housing options for these individuals as well.

Table 7-2: Approved Developments in the Vicinity of the Subject Site

	Development Application (DA)	Occupation Certificate (OC)	Units	Median Sales Price
13-17 Edgar Street	28/06/2006	Not Available	48	$510,000
54-56 Brooks Parade	01/11/2005	12/01/2007	13	$825,000
24-26 Brooks Parade	10/10/2008	Not Available	17	$735,000
635 Pacific Highway	07/07/2005	23/11/2007	17	$375,000
11 Ernest Street/ Pacific Highway	10/08/2012	Not Available	109	$357,250

Note: Not Available means OC was not publicly available online or has not been issued.

8 URBAN DESIGN AND BUILT FORM

The following sections discuss the key elements of the urban fabric of Belmont Town Centre, and the impact of development on the site, adjoining development, and the wider urban area in Belmont.

8.1 CONSULTATIONS

The Urban Design Review Panel (SEPP 65 Panel) established by Council (consisting of external consultants) considered Council's Review of Town Centres DCP and Belmont Area Plan in December 2013. The Panel noted this work needs to be taken to a more strategic level before it focuses on specific site outcomes. This means that the site needs to be considered in the context of the broader urban locality i.e. Belmont Town Centre. The Belmont Area Plan is now incorporated into Council's DCP. Previous urban design reports have also been presented to the SEPP 65 Panel. Due to the lack of feedback from the previous Panel meetings (December 2013 and June 2014) the landowners had all previous urban design reports (refer to Section 6.7) peer reviewed by Annand Associates Urban Design (AAUD). AAUDs comments included: significant urban design already undertaken for the site; future planning should consider future landscaping including deep soil planting, podium planting; consider any public domain plans; consider pedestrian linkages along the canal; consider CPTED as part of the detailed design and showing how the isolated lot may be incorporated. Comments from AAUD were incorporated into the design.

8.2 BUILT FORM OPTIONS

Previous design schemes for the subject site have identified a mix of of densities and heights, with buildings up to 12 storeys in height (JBA 2012). Some schemes had lower height limits along Brooks Parade with higher heights along Edgar St (Cardno 2012) while others had higher height limits along Brooks Parade (e.g. Deicke Richards 2007, Monteath and Powys 2014) such that Belmont Towers was not the predominant building along the foreshore.

8.3 SUITABLE LAND FORM AND URBAN PATTERN

The existing landform, street grid and lot layout are suitable for potential development. The subject site is largely flat, with approximately 1° fall from east to west. As discussed earlier in the report, the town centre has a slight slope, making pedestrian connection in the area relatively easy.

To mitigate flood and inundation issues, this analysis assumes a podium of 1.5 metres would be required, which raises the RL to the top of the podium to approximately 2.5 metres AHD.

The subject site comprises almost entirely of a single urban block. This provides for the redevelopment of the block consistent with the Area Plan and efficient use of the land.

As noted in Section 3.9, the Pacific Highway to the east and the southern end of Belmont town centre are at higher elevations. Given current building heights and even proposed, future height limits under current controls views into the subject site are limited.

8.4 BUILDING TYPES AND CONFIGURATION

8.4.1 Building Types

Similar adjacent developments generally incorporate two built forms:

- Square-base tower types, such as Belmont Towers at 46 Brooks Parade, Deck Apartments at 56 Brooks Parade, and apartments under construction at 58 Brooks Parade, which are typically narrow and tall (six storeys and over) and;

- Rectangle block types, such as Belmont Central at 13-17 Edgar Street and Santorini Apartments at 26 Brooks Parade, which are typically long and low (up to six storeys).

8.4.2 Building Configuration

The Belmont Area Plan identifies four individual square-shaped building forms for the site, with desired setback and building separations shown in Figure 6-4 and Figure 6-5. These are typically tower blocks, with a large separation through the site.

The use of rectangle block form does not appear to be encouraged by the Area Plan. The form appears to conflict with the objectives of the Area Plan and one of the controls. Firstly, this type of built form appears to conflict with the objective that *"development provides large breaks between buildings located between Edgar Street to Lake Macquarie"*. The intent appears to be to provide views, or glimpses, through buildings to the Lake. However, the subject site would be the only site burdened with this requirement. The block between Sharp Street and Macquarie Street cannot accommodate this requirement, which arguably is the most important urban block in the Area Plan. No other urban block or site has achieved this requirement, and is unlikely to achieve it. Furthermore, views to lake are available through Macquarie Street (to the south of

the site) and Maude Street (to the north of the site) as previously identified. Views to the lake from the Highway/town centre are physically not possible through the subject site.

Secondly, the controls for Brooks and Edgar Street require that built forms should not exceed 30 metres length. This effectively prevents rectangle buildings like the development at 13-17 Edgar Street (Belmont Central) and 26 Brooks Parade (Santorini apartments). If this control is enforced in the area, Belmont Central will be more conspicuous by the lack of similar buildings type diverse building shapes.

8.5 BUILDING HEIGHT

In general, the height of buildings excludes building plant rooms and equipment located above the roof line. The height of buildings is measured to the part of the building that extends from the building base and to the rooftop of habitable rooms in the building. It is not measured to the top of small structures used to service the building, such as lift facilities and air conditioning units, or architectural features of the roof structure. These structures are not major obstructions to views or vistas because, typically, they have a small footprint compared to the overall roof size, and generally located in the centre of the building. These structures are generally not visible from the street or neighbouring buildings.

8.5.1 Existing Development Approved Before LEP 2004

This built form analysis has not considered the heights of buildings approved and constructed prior to the LEP 2004 in Belmont. The height of much existing development in Belmont, generally does not exceed 8 metres in height. Rather, the building heights contained in the LEP 2014 provide for significant increases in height across the town centre. Consequently, it is not considered appropriate to compare to existing low-rise development to potential development as the increase in the building height limit will encourage redevelopment in the area to the new building heights. This is an important point, as future development on the site, including current controls promote higher density development. It is important that any future development on the site consider the potential scale of current controls and approvals in the area as is demonstrated in the images below.

Table 8-1: Relevant Building Height, Relevant Level (RL) for Similar Developments

Location	Height (No. of Storeys)	Building Height (m)	Building height Max RL[1] (m)
46 Brooks Parade (Belmont Towers)	8	-	24.66[2] 27.05[3]
13-17 Edgar Street (Belmont Central)	6	19.8	20.98
58 Brooks Parade	7	22.76	23.78
54-56 Brooks Parade (Deck Apartments)	6	20.28	21.3
24-26 Brooks Parade (Santorini Apartments)	5	16.05	17.39
29 Macquarie Street	3	<13	19.0
635 Pacific Highway	4	15.7	28.2
571 Pacific Highway	4	15.92	22.5
600 Pacific Highway	4	16.1	26.2
11 Ernest Street (Belle Apartments)	6	20.2	25.6

[1] Relative level from sea level (0m) to the roof line of the building, excluding building plant such as lift rooms and air conditioning units
[2] Top of main parapet
[3] Top of splayed setback parapet

8.5.2 Maximum Building Heights - LEP 2014

The building heights in the LEP 2014 are illustrated in Figure 8-1 below, as is the extent of the area analysed. Under the LEP, the subject site will be permitted to have a maximum building height of 22 metres, as will much of the foreshore along Brooks Parade.

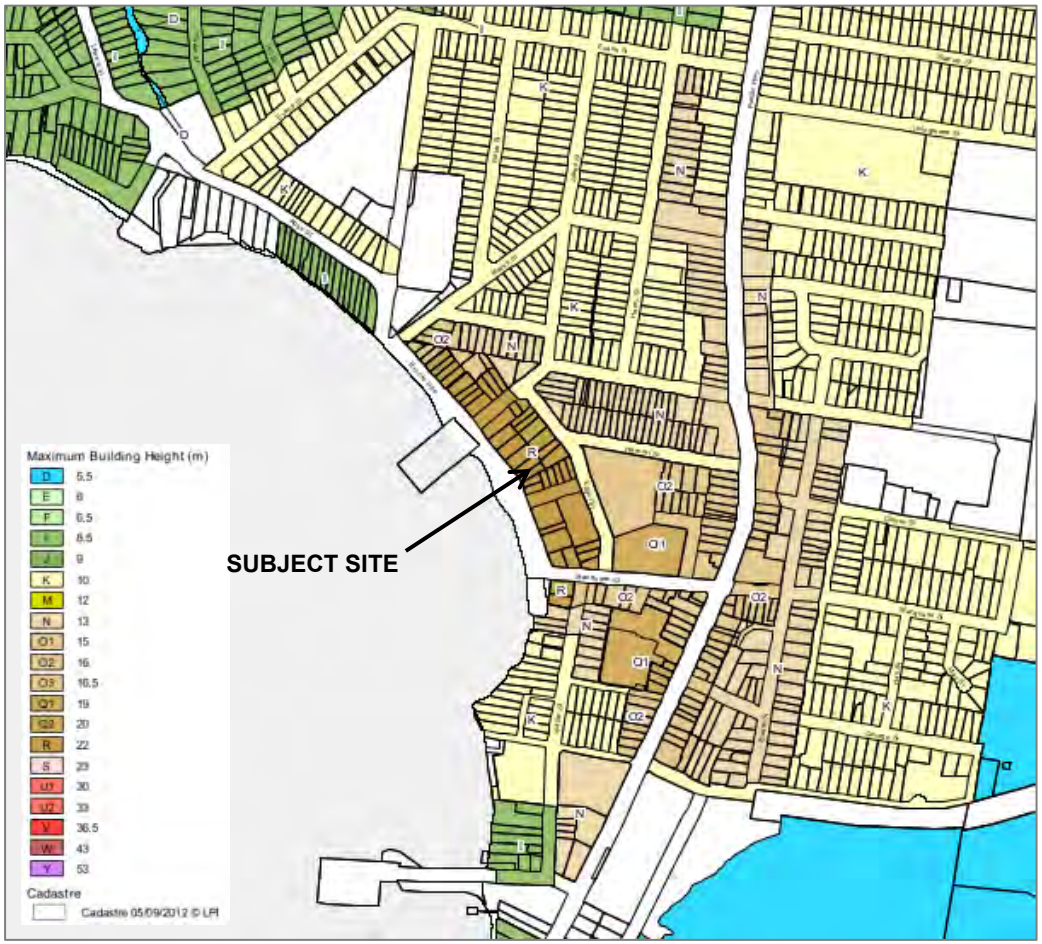


Figure 8-1: Height of Buildings, LEP 2014

8.5.3 Maximum Relative Level in Belmont Town Centre

The probable maximum relative level (Elevation + Height of Building (HOB)) attainable in Belmont town centre is approximately RL 32.00 (Elevation 13m + HOB 19m). This is in the vicinity of Victoria Street, Gen Street and the Pacific Highway, and the Belmont Central Shopping Centre site.

Based on consideration of the topography, and consistently noted in this report, and LEP 2014, the tallest building in a potential development on the subject site could reasonably be expected to extend to RL 32 – RL 33. This is consistent with the potential maximum RL for the other key sites in the Belmont town centre, such as Belmont Central shopping centre.

8.5.4 Building Height Considerations

The height of buildings in the subject site is a key opportunity to establish a visual connection between existing and future development. This is particularly important at the intersection of Brooks Parade and Maude Street. The building height of the Santorini Apartments is 16 metres. Under the permissible building heights in the LEP 2014, this building could be 6 metres lower than its nearest neighbours to the north, south and east. Therefore, potential development within the subject site could step up the height of buildings along Brooks Parade (north to south) to create a visual connection to height of existing and future buildings. Additionally, buildings within the site could step up from east to west to connect the site with future development on the Belmont Citi Centre site on the opposite side of Edgar Street.

8.6 BUILDING MASSING

In addition to building height, building mass is determined by several factors. To determine appropriate building massing and form for the site and within the context of the Belmont town centre, several factors have been considered:

- Building types;
- Setbacks and maximum occupied area;
- Separation between buildings;
- Site coverage.

Building types appropriate for the site include square towers and rectangle blocks, which were discussed in Section 8.4. The mass for each of these forms is modified by setbacks to the street, separation from surrounding development, and site coverage.

8.6.1 Setbacks

Setbacks determine the distance of the potential development from the site boundary to the street and adjoining development lots. The most significant street in the site context is Brooks Parade, which faces the Belmont Foreshore. Sharp and Edgar Streets are less significant. Sharp Street is a connector street to the foreshore for vehicles and pedestrians. Edgar Street is a circulation street for vehicles around the shopping centre.

Sharp Street is a continuous line to each connecting street. The boundary changes direction along Brooks Parade, and at the intersection of Herbert Street and Edgar Street, which is reflected in the different building alignments and overshadowing within the site.

8.6.2 Separation Between Buildings

Separation between the buildings within the subject site is considered in the SEPP 65 assessment (in association with the Apartment Design Guide) and in this case the Area Plan. Building separation controls work together with building height controls to affect the bulk and scale of buildings. Bulk and scale can affect not only the streetscape character and appearance of an area, but also the environmental performance of building within the site and surrounding areas, such as reduced visual and acoustic privacy, overshadowing, and loss of open space.

The Apartment Design Guide (ADG) links in with the design quality principles of the State Environmental Planning Policy No. 65 – Design Quality of Residential Flat Development. As a State policy, it overrides the requirements of local development controls.

In general, the level of separation increases as building height increases. These matters are addressed in the SEPP 65 statement included with the DA.

Consideration was also afforded to the existing separation distances between recent apartment buildings constructed in the area

8.6.3 Site Coverage

Site coverage is generally accepted as the amount of site land covered by impervious surface, such as buildings and driveways. The subject site is currently within a mixed use zone. At the first level it is necessary to raise the site ground level with a podium due to flooding issues. Above the podium level, the site coverage is reduced by requirements for setbacks and building separation, and potentially landscaping requirements. Effectively, the site cover is the footprint of buildings erected on the podium, and excludes balconies.

8.7 VISUAL IMPACT

As noted earlier in this report, the topography of Belmont town centre affects the height of development and, therefore, visual impact of development in the town centre. The visual impact on Brooks Parade arising from potential development of the subject site appears to be minimal. The potential development can sit comfortably within the scale of existing and future development along the foreshore. The reason for this is that the height and scale of development in Belmont increases gradually from the periphery of the suburb to the peak at Belmont Central Shopping Centre. The building scale increases from the north of the town centre at Evans Street, starting at 10 metres, rising to 13 metres from Maude Street, 16 metres at Herbert Street, and peaking at 19 metres at Macquarie Street. However, the peak continues south beyond Macquarie Street as a result of the sloping land form, until it plateaus near Victoria Street. The height of potential development in the subject site is unlikely to overwhelm the foreshore or the town centre, and is considered strategically acceptable.

When viewed from Lake Macquarie, approximately 500 metres from the foreshore in Belmont, development along the foreshore from Mark Street to Macquarie rises gently. Sharp Street provides separation so that height on the subject site will not appear to overwhelm Belmont Towers. South of Macquarie Street, the elevated landscape and building heights (including the Pacific Highway) block views into the site. Consequently, the building heights and mass of all the site (including in the future) are unlikely to have unacceptable impacts on the vistas from the lake.

9 PREFERRED OPTION

The preferred option for the site is presented in Figures 9-1, 9-2 and 9-3 below. There have been a number of options considered on the site in the past as identified earlier. The current configuration has been based on all information presented above including planning, environment and the existing development within Belmont.

9.1 BUILDING TYPE AND CONFIGURATION

The preferred building type and configuration provides an even distribution of mass across the site. This facilitates good building separation and coverage within the site, which is clear from the illustrations.

The preferred option varies the appearance of the development along Sharp Street and is consistent with development along Brooks Parade.

All balconies are in excess of eight square metres and greater than two metres in width.

9.2 BUILDING HEIGHTS

The preferred option consists of four tower blocks with retail/commercial premises also included in the proposal. The building locations identify visible pedestrian connections through the site.

The two tower blocks on the northern boundary of the site are at approximately 21.6 RL. The tower block at the juncture of Edgar Street and Sharp Street is also approximately 21.6 RL. The tower block at the juncture of Brooks and Sharp Street is the tallest building at approximately 27.66 RL.

The preferred option has the tallest building adjacent to Belmont Towers on Brooks Parade, and will be of similar height to the top of the splayed setback parapet at Belmont Towers (27.1 RL).

The other three buildings on the site are similar in height to the Deck Apartments to the south but lower than other buildings in the area (e.g. 58 Brooks Parade, Belmont Towers). Some other images of the proposed development in relation to the current situation and potential future redevelopment of the area under LEP 2014 are presented in Appendix A.



Figure 9-1: Brookes Parade and Sharp Street Elevations



Figure 9-2: Edgar Street Elevation and Elevation from Northern Boundary of the Site



Figure 9-3: Site Overview

9.3 SETBACKS

The proposed development has setbacks of at least six metres for all living spaces. Buildings on Brooks Parade will be set back six metres, while setbacks from the canal (northern end are at least six metres). Setbacks from the isolated lot (corner of Brooks and Sharp) are three metres. The residential tower blocks on Edgar and Sharp are at least six metres from the boundary. There is some overhang of non-habitable areas on the corner of Edgar and Sharp which are setback three metres from the boundary.

9.4 SEPARATION BETWEEN BUILDINGS

The preferred option can achieve separation between room types. The buildings are separate by 12 metres. At higher levels the separations are increased.

9.5 SITE COVERAGE

Site cover of existing development in the vicinity of the subject site ranges from 42% to 51% of the site (Table 9-1).

Site coverage is estimated to be 36% of the site area excluding podiums. There is some conjecture around podiums in current controls and thus with podiums (including landscaping podiums) the site coverage is approximately 65%.

Table 9-1: Site Coverage and Floor Space Ratios for Existing Development

Existing development	Site coverage (%)	'Estimated FSR' from Approved Plans
46 Brooks Parade(Belmont Towers)	N/A	NA
13-17 Edgar Street(Belmont Central)	45%	2.30
58 Brooks Parade (Belmont Wharf Apartments)	46%	2.03
54-56 Brooks Parade (Deck Apartments)	42%	NA
24-26 Brooks Parade (Santorini Apartments)	51%	2.16
29 Macquarie Street	N/A	NA
635 Pacific Highway	N/A	2.71
571 Pacific Highway	N/A	1.81
600 Pacific Highway	N/A	2.61

The subject site proposes an FSR of approximately 2.0 to 1. Once 'common areas' (e.g. lift wells) etc are considered the FSR would be lower than 2:1, which is well within the range of other developments in the area.

Floor space ratio (FSR) is also an indicator of building mass that expresses the buildings total area as a ratio of the land area where the building will be located. Generally, car parking and balconies are excluded from the calculation. Lake Macquarie City Council does not use FSR as a development standard to control development, however, it does provide an indicator of mass to compare existing development. Therefore, FSR is a guide to compare the scale and bulk of surrounding development, and should not be seen as a hard and fast limit on the development potential of the site.

Existing surrounding development in Belmont in since 2006 has been able to achieved floor space ratios between 1.8 and 2.6 (Table). In order to produce built outcomes with consistent scale and massing on the site, potential development on the site could achieve an FSR in a similar range, though not less than 2.0. It should also be borne in mind that the potential development of the site could be limited by other factors that are not related to built form, such as car parking, which is discussed later.

9.6 VISUAL IMPACT

Overall, the preferred option sits comfortably into the subject site and with the surrounding development, which can be seen from the massing diagrams in Appendix A.

The selected vistas are unlikely to be affected by future development of Belmont town centre. Future development in the car park of Belmont Citi Centre will obstruct views to the subject site from Macquarie Street and Thomas, and so these view points are not been represented in the analysis.

9.7 LANDSCAPING

Landscaping along each boundary will vary with the character and function to the street or boundary, as well as the desire and availability for deep soil planting. Approximately 14% of the site will be landscaped.

Landscaping within the setback to Brooks Parade is desirable to soften the development edge between the foreshore and the built form, particular the podium wall.

The interface with Edgar and Sharp Streets would also be enhanced with landscaping. However, plantings should avoid obscuring vision between the street and ground floor commercial uses. Landscaping in the setback should balance the requirement for visibility of the street from the development with the appearance of landscaping on each setback.

9.8 PEDESTRIAN CONNECTION

The preferred option supports pedestrian connection in the town centre. It can provide pedestrian access at each street frontage, disabled lift facilities or a ramp entrance. These accesses will not be obscured by landscaping. The pedestrian network at street level will be preserved. A proposed walkway is also proposed along the northern boundary of the site providing additional pedestrian access.

9.9 CAR PARKING

The car parking rates applicable to potential development on the site are set out in the architectural plans which provides an excess

of parking. The subject site is within is within 400 metres walk major bus routes that operate on the Pacific Highway.

The preferred option provides car parking for the residential dwellings within the subject site, spaces for visitor parking, and commercial tenants.

9.10 SOLAR ACCESS AND OVERSHADOWING

Solar access and overshadowing has been presented as part of the architectural drawings. The subject site has limited impact on neighbouring properties due to its topography and physical location. Over 70% of balconies and living areas are subject to relevant solar access provisions.

9.11 PLANNING IMPLICATIONS

The proposed development complies with the LEP except for an overrun on one of the buildings in relation to height (Sharp/Brooks corner). Other buildings comply with the LEP. It is understood a Clause 4.6 variation is being sought. It is noted that there are several urban design reports previously prepared including the peer review undertaken by AAUD that supports a slightly higher height in this corner.

The proposal is supported by strategic planning documents identifying Belmont as a sub-regional centre with capacity to deliver higher density housing.

The preferred option generally complies with the Lake Macquarie DCP. There are some minor variations regarding street awnings in trying to balance landscaping and access to retail premises, and front fencing. There are some minor technical discrepancies relating to the flood level on the site which translates into other matters (e.g. podiums). There is some inconsistency with setbacks relating to Council having both commercial and residential flat building DCPs in the context of a mixed use development.

9.12 ADDRESSING DESIGN PRINCIPLES

At the beginning of this report a number of principles were considered in designing the preferred option for the site. These are considered below:

- Interaction with the Natural and Urban Context – the visual sensitivity of the lake and foreshore areas have been considered in the proposed development. No view corridors from the west to the lake will be impeded by the development. The site has linkages through the site to the lake.

- Physical Connections – pedestrian linkages through the site and around the site including the canal have been proposed. Internal security as well as public linkages were also considered in the final design.

- Sustainability – the site meets the requirements of BASIX.

- Vibrancy and Diversity – the development proposes mixed uses with some retail components providing active street frontages. Linkages to the Belmont town centre and main shopping centre have been considered. The units provide a diversity of sizes (1-3 bedroom) as well as universally designed units and disability legislative requirements.

- Planning and Environment – the environmental constraints have been considered in detail for the site. The accompanying statement of environmental effects provides

more detail on these matters. The planning controls and guidelines have been considered in the design process (see also section 9.12 above).

- Community – the foreshore and public areas in Belmont will not be impacted by the proposal. Public linkages to these areas for internal and external residents has been considered. The amenity of the foreshore area has been maintained. The future re-development of the town centre has also been considered in the proposal.

10 CONCLUDING REMARKS

The strategic planning and urban design analysis has demonstrated that the preferred option represents an appropriate and efficient use of a significant site in the Belmont town centre, and provide high quality development in a prominent location on Lake Macquarie's foreshore.

It is identified that the site can accommodate mixed use development within the strategic planning framework prepared for the site. Consideration of the urban design, environment, and supply and demand factors for residential dwellings in Belmont indicates that the potential development is consistent with the desired strategic outcomes for Belmont, Lake Macquarie and the Lower Hunter. This report also finds that potential development would be largely consistent with Town Centre Area Plan. A review by Council accepts that variations other controls, could yield an acceptable outcome, based on merit provided any adverse effects are adequately addressed.

APPENDIX A

Images



Western Viewpoint – Current Imagery

D08936405



South West Viewpoint – Current Imagery

D08936405



Southern Viewpoint – Current Imagery

D08936405



North Western Viewpoint – Current Imagery

D08936405



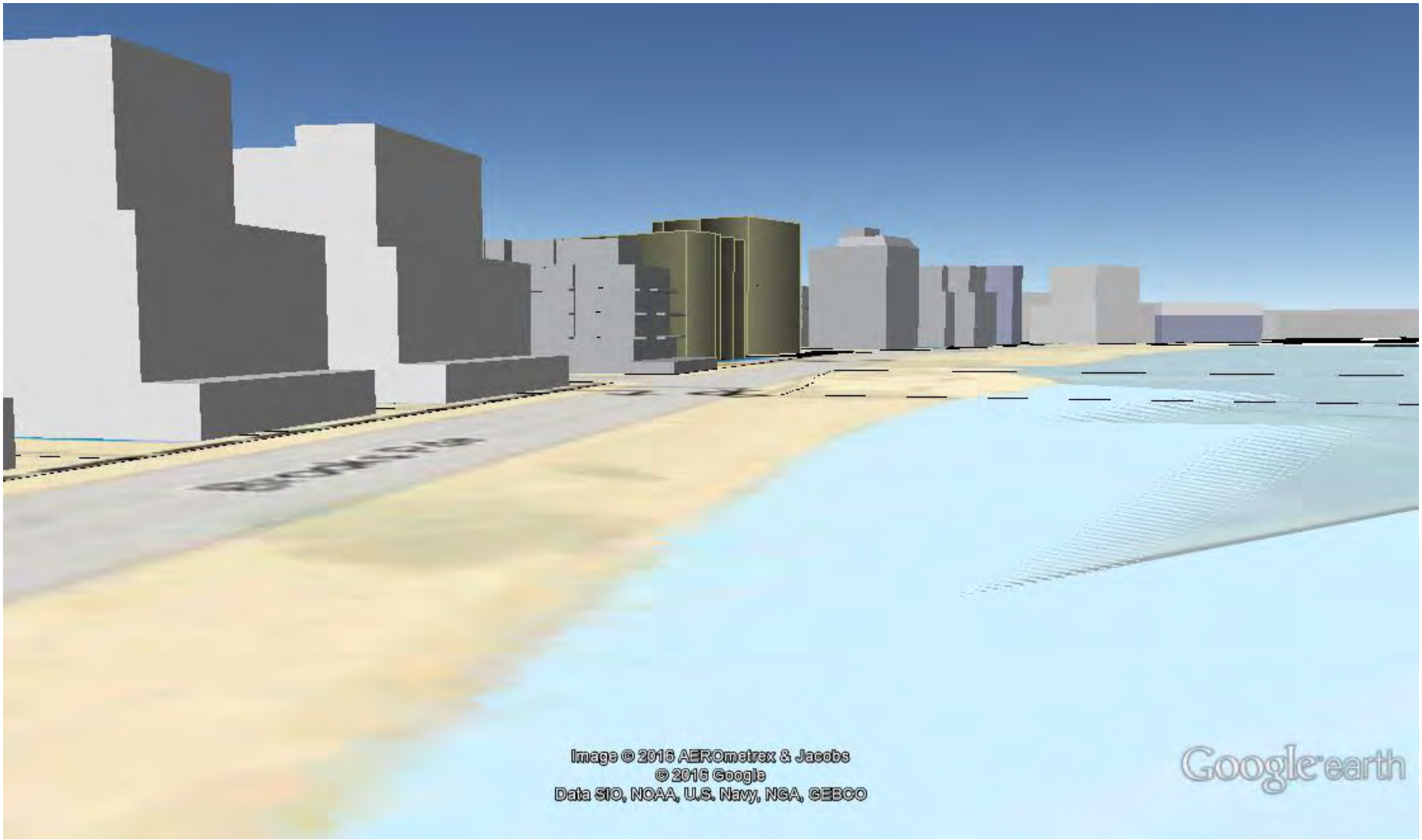
North Eastern Viewpoint – Current Imagery

D08936405



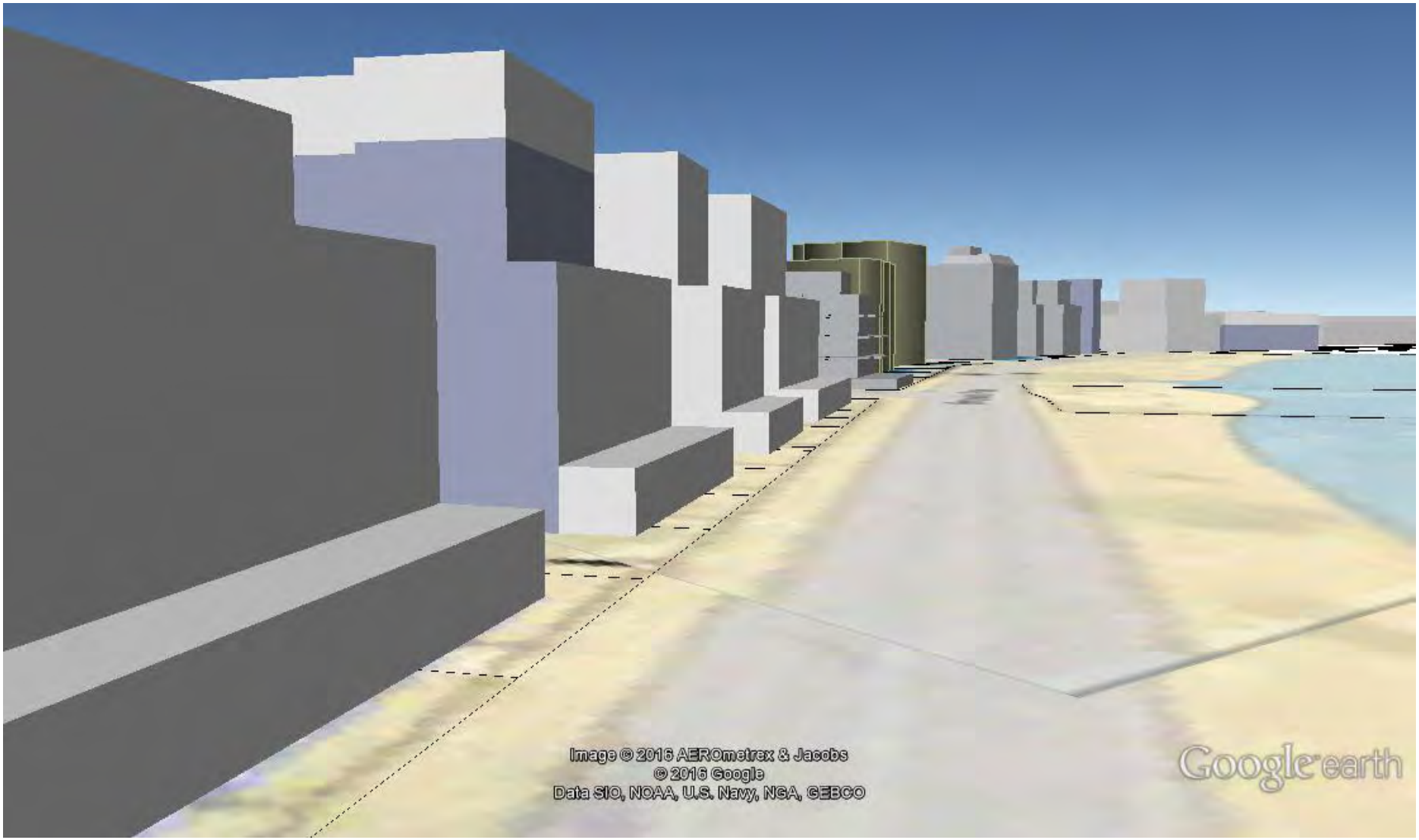
Looking North from TAFE – Current Imagery

D08936405



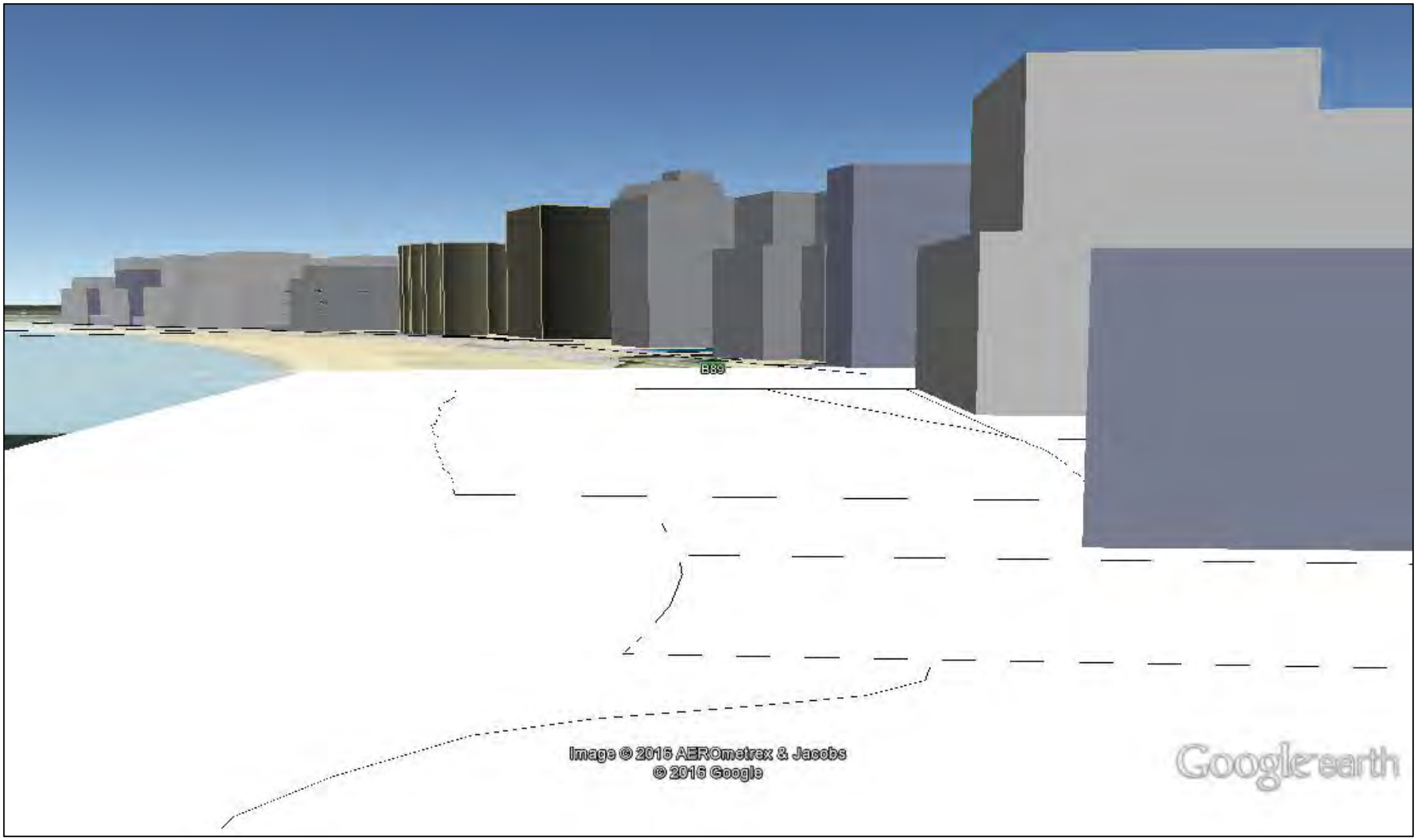
Northern Viewpoint at Future Development Potential

D08936405



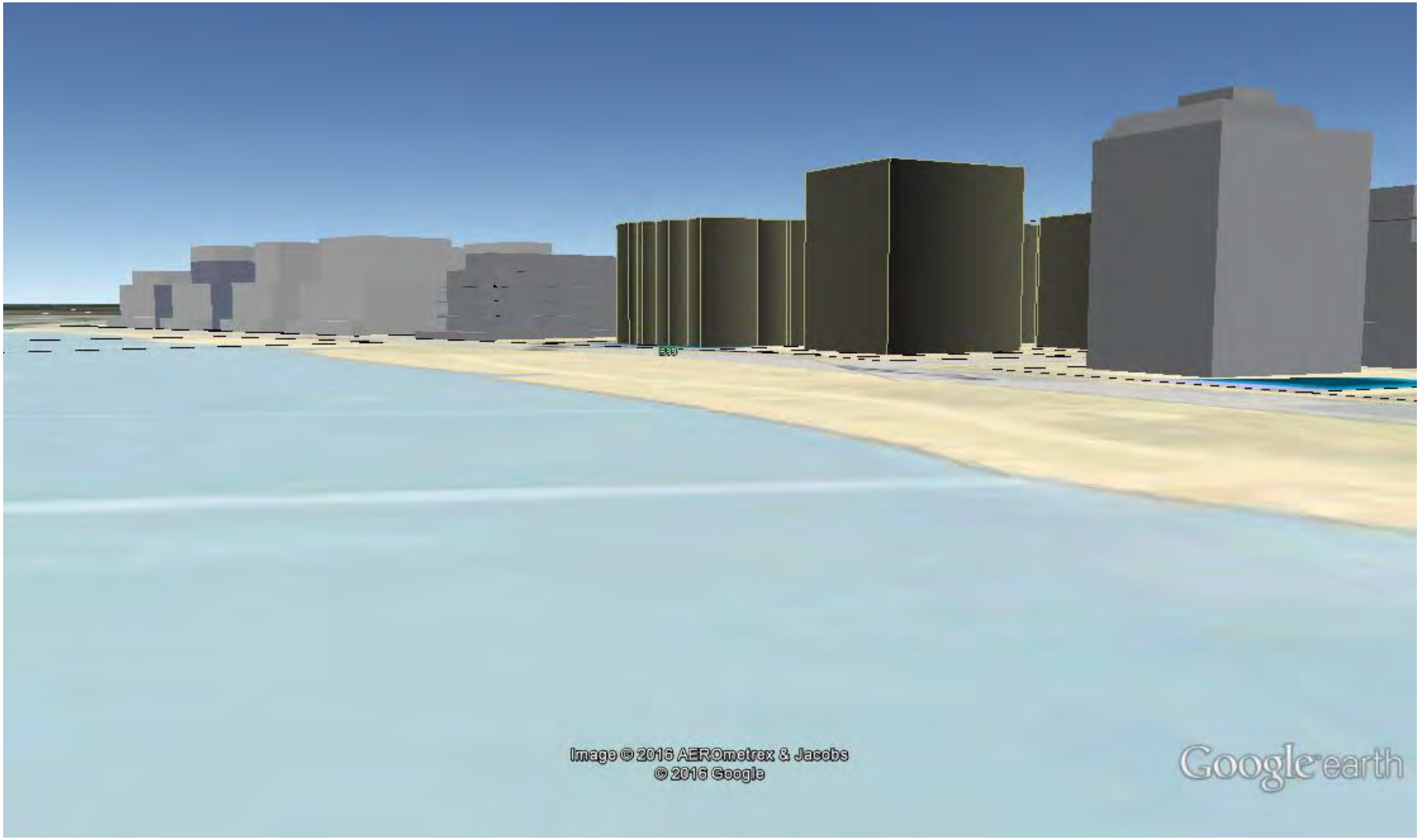
Brooks Parade Looking South at Full Development Potential

D08936405



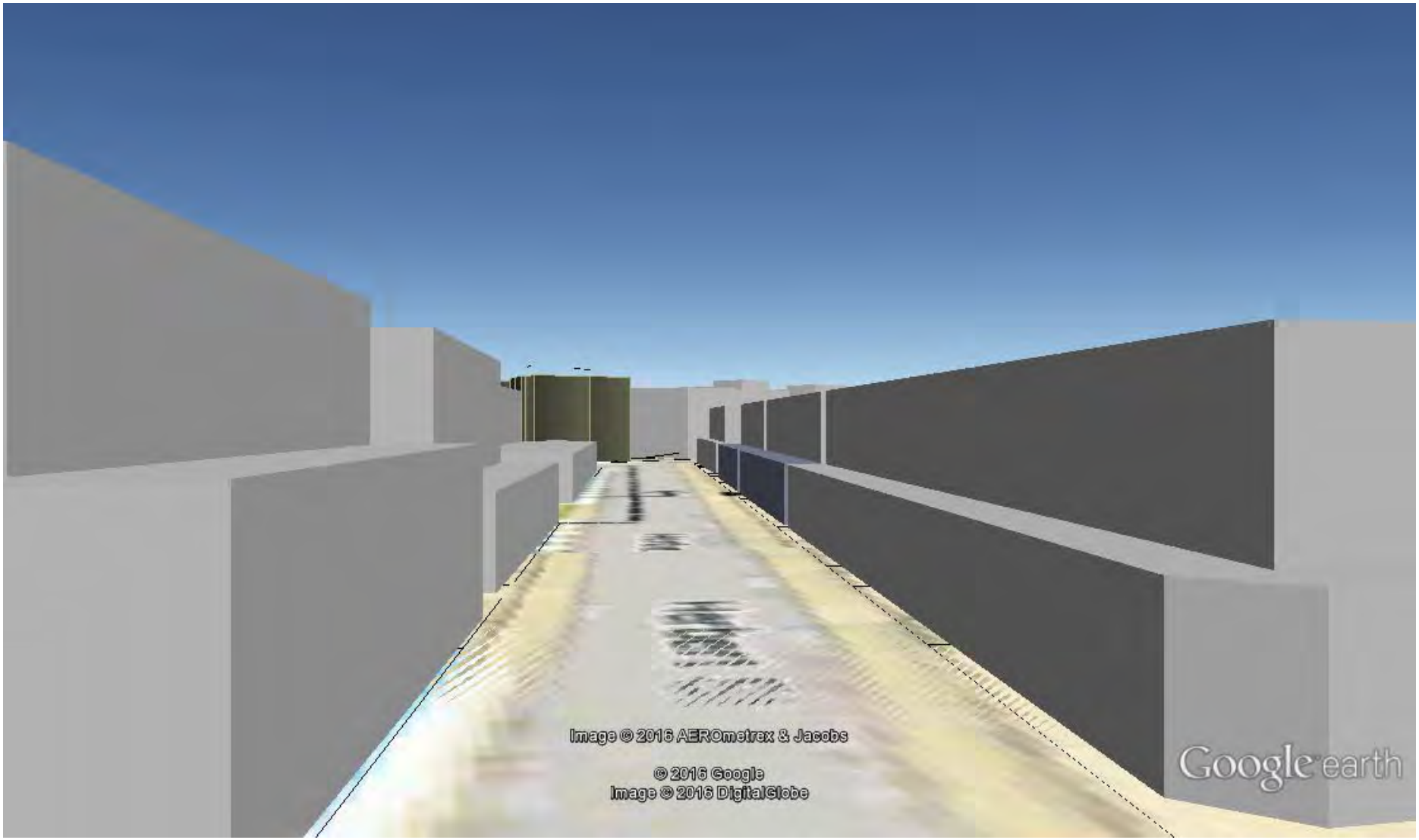
Brooks Parade Looking North at Full Development Potential

D08936405



Brooks Parade Looking North at Full Development Potential

D08936405



Herbert Street Looking West Towards the Lake at Full Development Potential

D08936405

Monteath & Powys Pty Ltd

SURVEYING, PLANNING, ENGINEERING DESIGN, PROJECT MANAGEMENT



CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN

Mixed Use Development

32-44 BROOKS PARADE, 2-10 SHARP STREET & 5-11 EDGAR STREET, BELMONT

Crime Prevention Through Environmental Design

Liability limited by a scheme approved under Professional Standards Legislation

Quality ISO 9001 Certified System

This Report was prepared by:-

Monteath & Powys Pty Ltd
Suite 13 Tonella Commercial Centre
125 Bull Street
NEWCASTLE WEST NSW 2302

PO Box 2270
DANGAR NSW 2309

Telephone: (02) 4926 1388
Facsimile: (02) 4929 3475
Web: www.monteathpowys.com.au

PROJECT:	Mixed use, multi storey development comprising 140 residential units, 4 retail/commercial areas, 1 communal multi-purpose room, basement car parking and associated landscaping – 32-44 Brooks Parade, 2-10 Sharp Street and 5-11 Edgar Street, Belmont.
CLIENT:	KML Joint Venture
OUR REFERENCE:	13/0524
VERSION:	**Amended – 25 June 2018**
AUTHOR:	Konrad Grinlaubs Senior Planner M.P.I.A.
CERTIFICATION:	I hereby certify that this Crime Prevention Through Environmental Design Report has been prepared in accordance with the requirement of the NSW Police Safer by Design Guidelines. I certify that to the best of my knowledge the information contained within this Report is neither false nor misleading.
SIGNATURE	
CHECKED BY:	Darren Holloway B.Sci. (Hons), MBEnv Principal Planner Certified Practising Planner
SIGNATURE:	

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1. INTRODUCTION

This Crime Prevention Through Environmental Design (CPTED) Assessment has been prepared for KML Joint Venture and Coeve Design (Vic) Pty Ltd by Monteath Powys Pty Ltd.

The purpose of this report is to consider the potential crime risk caused by the proposed mixed use, multi storey development comprising 140 residential units, 4 retail/commercial areas, 1 communal multi-purpose room, basement car parking and associated landscaping at 32-44 Brooks Parade, 2-10 Sharp Street and 5-11 Edgar Street, Belmont, and to identify proactive and preventative building design measures to minimise opportunities for criminal behaviour.

There are a number of publications which promote the use of CPTED. These include the NSW Police Safer by Design Guidelines, as well as the NSW Department of Urban Affairs and Planning's *Crime Prevention and the Assessment of Development Applications*.

There are four components in CPTED:

1. Natural access control;
2. Natural surveillance; and
3. Territorial reinforcement
4. Space Management

This proposal has considered the principles of CPTED in developing the design of the proposed residential development. The objectives of each component have been discussed below, and a response has been included in relation to the proposed development.

2. SITE AND LOCATION

2.1 SITE AND LOCATION

The site is located centrally within Belmont, approximately 50m from the Belmont Citi shopping centre in the Lake Macquarie Local Government Area. The subject site known as 32-44 Brooks Parade, 2-10 Sharp Street and 5-11 Edgar Street, Belmont, subject site lot details below;

Lot	Section	DP
11	B	585
A	-	400644
B	-	400644
2	-	353066
1	-	353066
4	-	12898
5	-	12898
6	-	12898
8	-	12898
B	-	339105
A	-	339105
4	B	585
3	B	585
10 (part)	-	585
7	-	12898

The subject site is identified in **Figure 1** below, is approximately two hours' drive north of Sydney, and 17 kilometres from Newcastle CBD. The site comprises of fifteen lots in the Belmont Town Centre, bounded by Brooks Parade, Sharp Street and Edgar Street (see **Figure 2**).

The site is located in a prominent location on the Belmont foreshore. The site frontage to Brooks Parade is approximately 80 metres. The site has frontage to two other roads, Edgar Street the north-east and Sharp Street to the south-east.

Current uses on the site are predominantly for residential purposes being single storey dwellings and a two storey dwelling. Three premises along Brooks Parade are small scale commercial uses.



Figure1: Locality Map (Google Maps, 2015)



Figure 2: Subject Site (SixMaps, 2015)

The subject site is approximately 7,083m^2 in size. Refer to Figure 1 Locality Map.

Surrounding Development

The subject site is adjoined in each major direction by different forms of development within 300 metres. The key built forms for new development are tower blocks and rectangle blocks. Each urban block and built form use is discussed in detail below;

North

The urban block that accommodates the subject site, also accommodates:

- Rectangle-block, five storey mixed use development at the intersection of Brooks Parade and Maude Street (24-26 Brooks Parade), known as Santorini Apartments, and;
- Single storey residential development;
- An open stormwater channel that provides connection for the stormwater network to Lake Macquarie;
- A sewer pump station that is part of Hunter Water Corporation's infrastructure, which is immediately north of the channel and faces Brooks Parade.

Urban blocks beyond Maude Street are mostly characterised by detached single storey residential dwellings, and a limited number of two-storey unit blocks.

South

Sharp Street adjoins the site at the south. The urban block immediately south is characterised mostly by recent mixed use development, including:

- 46 Brooks Parade, tower block, eight storeys, directly opposite the subject site at the intersection of Brooks Parade and Sharp Street. Belmont Towers is a residential apartment building with large setbacks to the street and ground floor single garages that face the street;
- 13-17 Edgar Street, rectangle block, six storeys, at the intersection of Edgar Street and Sharp Street is a mixed use development, with ground floor commercial space and upper floors for residential use. The development was completed in 2010;
- 54-56 Brooks Parade, tower block, six storeys, is a mixed use development with ground floor cafe and single driveway access from Brooks Parade, and was completed in 2007;
- 58 Brooks Parade, tower block seven storeys, is currently under construction and will comprise mixed use development for a residential flat building.

East

Herbert Street runs perpendicular from the site to the Pacific Highway, and creates two distinct urban blocks. The block on the north side of Herbert Street is predominantly detached single storey dwellings. The block on the south side of Herbert Street is mostly retail and commercial uses. The dominant development is Belmont Citi Centre shopping centre and open air car park. The loading dock entrance at Herbert Street faces the subject site. Shop top development along the Pacific Highway edge of the urban block is further to the east.

West

Directly across the street is Belmont Lions Park, an open space area that separates the road (Brookes Parade) from the foreshore of Lake Macquarie. A pedestrian footpath runs through the park that connects to a small children's playground some 200 metres to the south, and public facilities at the end of Maude Street. The only built form on this site is a toilet block. Built forms exceeding one storey on this site are unlikely to be erected in the future. Several mature fig trees are located along the street edge of the park.

2.2 BUREAU OF CRIME STATISTICS AND RESEARCH

A review of the NSW Crime Statistics data for 2011 to 2015 reveals that crime in the Belmont area is relatively low when compared with the wider NSW averages.

However, the Belmont statistical area is relatively small and isolated. To provide a more detailed analysis of the crime in the area, the suburbs of Wallsend (north) and Rankin Park (south) were included in the research.

The crime activity of significance identified by the review local crime statistics (NSW Bureau of Crime Statistics and Research, criminal activity in vicinity of suburb of Belmont for the period Oct 2015 – Sept 2016) identifies the following crime that may impact on the proposed facility:

- Malicious damage to property
- Steal from motor vehicle / motor vehicle theft
- Harassment, threatening behaviour or nuisance / assault (non-domestic violence)
- Break and enter offences / steal from dwelling

The findings are shown in Table 1 below (Elermore Vale in brackets):

Table 1: **Crime Statistics**

	Jan-Dec 2011	*Jan-Dec 2012*	*Jan-Dec 2013*	*Jan-Dec 2014*	*Jan-Dec 2015*		
Offence type	*Number of incidents*	*Number of incidents*	*Number of incidents*	*Number of incidents*	*Number of incidents*	*24-month trend^^*	*60-month trend^^*
Murder	0	0	0	3	0	nc**	nc**
Assault - domestic violence related	274	318	322	292	268	Stable	Stable
Assault - non-domestic violence related	461	427	389	356	324	Stable	-8.4%
Sexual assault	50	53	78	49	54	Stable	Stable
Indecent assault, act of indecency and other sexual offences	60	52	64	73	79	Stable	Stable
Robbery without a weapon	17	17	8	12	2	nc**	nc**
Robbery with a firearm	0	0	3	1	1	nc**	nc**
Robbery with a weapon not a firearm	9	12	13	4	2	nc**	nc**
Break and enter dwelling	316	360	229	215	258	Stable	-4.9%
Break and enter non-dwelling	252	194	145	105	100	Stable	-20.6%
Motor vehicle theft	143	96	107	100	104	Stable	-7.7%
Steal from motor vehicle	487	470	292	275	272	Stable	-13.6%
Steal from retail store	156	156	161	124	109	Stable	Stable
Steal from dwelling	303	317	293	319	220	-31.0%	-7.7%
Steal from person	47	37	38	39	19	nc**	nc**
Fraud	218	173	274	263	293	Stable	**7.7%**
Malicious damage to property	889	799	695	623	594	Stable	-9.6%

Crime	2010	2011	2012	2013	Trend
Assault	158 (41)	182 (33)	198 (48)	151 (28)	Stable
Homicide	0 (0)	0 (0)	0 (0)	0 (0)	Stable
Robbery	5 (0)	9 (2)	9 (0)	9 (0)	n.c
Sexual Offences	34 (2)	39 (2)	39 (3)	45 (9)	n.c
Theft	744 (134)	805 (157)	677 (125)	683 (135)	Stable
Malicious damage	376 (93)	307 (48)	298 (47)	262 (63)	Stable
Other offences – arson	29 (5)	18 (1)	13 (1)	20 (4)	n.c
Other offences – harassements, threatening behaviour	41 (10)	73 (14)	83 (16)	70 (17)	n.c
Other offences – prohibited and related weapons offences	16 (6)	13 (5)	15 (3)	24 (12)	n.c

The data above shows that the identified crimes are relatively stable.

The main instances of crime in the local area includes malicious damage and theft.

Other offences lower level offences include assault, harassment, threatening behaviour and prohibited weapons offences.

3. DESCRIPTION OF PROPOSAL

3.1 SUMMARY

The proposed development involves a mixed use, multi storey development comprising 140 residential units, 4 retail/commercial areas, 1 communal multi-purpose room, basement car parking and associated landscaping – 32-44 Brooks Parade, 2-10 Sharp Street and 5-11 Edgar Street, Belmont.

Refer to architectural design and layout plans for the proposed development at **Appendix A** of the Development Application for which this report is also appended.

3.2 DESIGN LAYOUT AND ACCESS

The proposed development will be accessed via Brooks Parade, Sharp Street and Edgar Street. Parking will be provided as part of the development including provisions for residents, residential visitors and general visitors. A new public footpath has been proposed along the back of the north western site of the existing drain. Acess is available through the central areasa of the site via gated entry and contains pathways, landscaping, managed lawns and is a communal domain.

3.3 DEVELOPMENT DESIGN

The building is designed in a northerly, southerly and westerly orientation with all apartments provided with expansive balconies. The development contain four (4) towers, three are six storey buildings, with the fourth tower an eight (8) storey building, located on the southern part of the site adjacent to the corner of Brooks Parade and Sharp Street. All four towers contain the fourth storey and above being setback and contained to the centre of the building.

Pedestrian entry into the development is provided from Edgar Street, Sharp Street and Brooks Parade, via the existing footpath. The residential entry and lobby is accessed via the new pedestrian central courtyard through the centre of the site. The lobbies are all accessible from the basement. The lobbies are clearly marked and with the use of landscaping and articulation provides a sense of entry and arrival. A pedestrian pathway is provided along the northern boundary of the site connecting Edgar Street and Brooks Parade.

Each apartment is designed with an open plan layout and includes a balcony off living areas. Additionally, each apartment has access to the common open space at the ground floor deep soil zone and buildings A and D to a smaller first floor communal recreation area.

The ground floor landscaped area includes paving and seating and given its orientation the landscaped area will form an accessible area, as opposed to an enclosed private open space. This way, the landscape areas performs as both a communal area for all residents as well as being accessible to all members of the public.

3.4 LANDSCAPING

The landscaping plan, prepared by Forum Landscape Design, was specifically designed to provide a high standard of living throughout the development with treatment and plant selection taken predominantly from Lake Macquarie City Council Coastal Planting Guide.

The landscaping plan includes a large portion of managed gardens surrounding the development. A mix of tall canopy trees have been proposed along the east, south and west boundaries. This will provide privacy and a sense of territory for those living within the development.

Fencing generally limted to the ground level units at the north east corner. This includes a 1.8m render fence with auminum picket gate. Central courtyard planting and paving is also proposed refer attached landscape plans at **Appendix E** of the Development Applicaiton.

4. ASSESSMENT OF PROPOSAL IN ACCORDANCE WITH CPTED PRINCIPLES

4.1 NATURAL ACCESS CONTROL

Natural access control limits the opportunity for crime by taking steps to:

- Control access to decrease opportunities for criminal activity by denying criminals access to potential targets. This will also assist in creating a perception of risk for potential offenders. This could include gates, fences, walls, footpaths, landscaping and lighting.
- Clearly differentiate between public space and private space. This includes the provision of special guides to users to and from specific entrances and exits.
- Clear boundaries should be defined between public and private areas. These are particularly helpful at entrances to commercial buildings, residential buildings, shops and parking areas.
- Prevent or discourage public access to or from enclosed and un-monitored areas.

The proposed development has been assessed against this principle, and the following recommendations have been made:

Unmonitored areas

The proposed public pathway along the northern boundary of the site provides a potential area for anti-social behaviour and the area to be relatively unmonitored at times. This area is considered to be a potential risk. It is recommended that lighting be installed to enhance surveillance of the area and appropriate landscaping to comprise of low level planting only. The balconies facing north towards the public pathway are approximetly 1.5m to 1.8m above ground level. This together with a balustrade of 1.0m act as a physical barrier to restrict acess to private balconies and minimise the opportunity for crimes such as theft to occur.

Access stairs from podium to basement are considered a potential security risk and could create an opportunity for unwarranted access to the basement. It is proposed that access will be via an intercom system connected to the individual apartments. Access to the secure lobbies in the basement carpark will be via a second intercom link. These measures will minimise the opportunity for the public to access to private spaces and increase the effort for people to gain unauthorised access.

Enclosed areas

Balconies facing the internal communal spaces are considered a possible area of risk. To reduce risk of public access to these areas the balconies facing the internal communal spaces are 0.5m above the FFL. Together with a balustrade of 1.2m (only for these balconies) provide a barrier that is 1.7m high. These measures act as a physical barrier to restrict acess to private balconies and minimise the opportunity for crimes such as theft to occur.

Units with external access gates from rear yards to the communal domain and perimter boundries are also considered an area of risk. To minimise the risk, lockable gates are to be installed.

General Matters

To further minimise risk of crime in the communal domain of the development, gates will be installed on the Brooks Parade and Edgar Street pedestrian access points. These gates will act to restrict pedestrian traffic especially at night.

The basement visitor carpark is considered an area of possible risk. To minimise this risk a self closing door is to be installed and operated by swips cards. This will create a physical barrier to restrict vehicle movements to those with a valid reason for utilising the basement carpark. As such, reducing opportunities for crime or malicious damage to vehicles or property.

4.2 NATURAL SURVEILLANCE

Natural surveillance can be achieved by creating an environment where there is opportunity for people engaged in their normal behaviour to observe the space around them. This can be achieved by maximising visibility and creating sightlines within development and to/from adjacent development.

Criminals are less likely to attempt a crime in areas where they can be easily observed. Conversely, people are likely to feel safer when they can see and be seen. The incorporation of natural surveillance into the design will increases the threat of apprehension by increasing the perception that people can be seen.

The proposed development has been assessed against this principle, and the following recommendations have been made:

Structures at Entrance

The mailboxes and refuse storage areas are located at the entrance to the site. These structures are removed from the residential development by a riparian corridor. This limits the amount of casual surveillance available to the area. With malicious damage relatively high in the surrounding area, it is recommended that the area is well lit to discourage antisocial behaviour. Signage identifying the site as private property can also be erected to delineate the private areas from the public land.

Landscaping

Landscaping for the proposed development has been designed to ensure sightlines into the public domain are maximised. This is important in areas that are located away from the main thoroughfares, such as those around the drainage line. The landscaping in the public areas should be minimal, and be managed to ensure sightlines are available through the landscaping to avoid creating an isolated area away from potential sources of casual surveillance. Fences around the open space areas should be made of a semi transparent material, such as timber slats or palasades, to allow surveillance. This will also increase the perception that people can be seen, which will act as a deterant to would-be criminals.
To increase and maintain sightlines large trees will be trunked at the bottom to eliminate blind spots and compliment the low level gardens.

Create clear sightlines

The access road to the entrance of the proposed development should be activated to ensure constant casual surveillance is available. All public domain areas should be managed to a degree which allows for clear sightlines.

General Matters

The internal design of residential units and balconies aid in the developments natural surveillance due to an open plan layout that includes balconies off living areas. Windows facing towards internal courtyards and outside footpaths also provide natural surveillance.

External lighting will be provided within and ouside the development. It will also be illuminated at night to ensure pedestrians have sufficient light to compliment the clear sight lines created through the low level landscaping. External lighting will also aid the natural surveillance from balconies at night. All street lighting should be vandal resistant and lighting should satisfy the relevant Australian Standard. Sufficient lighting is also to be installed in basement carparks to ensure that there is no dark areas especially near access stairs and lifts.

The BBQ area located in the communal domain is to be constructed as an open pergola design to ensure that there are clear sightlines through the entire area. This will help to maintain the natural surveillance created in the domain through landscaping.

To increase surveillance security cameras will be installed throughout the development ensuring that unmonitored areas are suffiently covered. Signs stating security cameras in use will also be erected to further help compliment controls in place for access delineation.

4.3 TERRITORIAL REINFORCEMENT

Territorial reinforcement involves the use of physical attributes that express ownership such as fences, signage, landscaping and lighting. Clearly defining property lines and distinguishing between private and public spaces are examples of this principle.

Territorial reinforcement is a social control that creates a sense of ownership in which the perception is that residents are more likely to challenge intruders or report them to the police. It also provides an environment where strangers stand out and are more easily identified.

By using buildings, fences, pavement, signs, lighting and landscape to express ownership and define public, semi-public and private space, natural territorial reinforcement occurs.

The proposed development has been assessed against this principle, and the following recommendations have been made.

Landscaping

Landscaping has been designed in accordance with territorial reinforcement objectives to ensure a feeling of ownership and communal living within and on the perimeter of the development. As shown on the landscape plans, landscaping has been proposed around the development, which clearly delinates the public from the private along the local road network.

Differentiating between public and private areas

The entrances to the new development will be clearly identifiable, this will delineate the public and private areas and create a feeling of community that will differentiate the area from the surrounding residential areas that may discourage criminal activity.

It is recommended that the landscaping particularly along the road frontages is well maintained, trees have clear trunks and any litter and graffiti is removed as soon as practical. Entrances to the development be surfaced with a different surface materials to clearly identify the private from the public areas.

4.4 SPACE MANAGEMENT

A fourth component of CPTED is referred to as space management. It is based around the theory that a well maintained development creates a sense of ownership and will tend to make someone feel like they will be observed by neighbours or business owners as it is obvious people care about the area.

Some common environmental design issues that can lead to criminal activity include:

- Solid or excessively high fences that obstruct view lines
- Vacant lots full of weeds or debris
- Inappropriate or poorly maintained vegetation, including low tree canopies
- Lack of natural surveillance points created by blank exterior walls or bricked-in windows
- Any graffiti should be removed as quickly as possible to minimise potential for cumulative graffiti and vandalism actions
- Maintain well-built adequately secured boundary fences and gates

The main issue for the development is the ongoing maintenance of the private/public spaces. It is essential to ensure fencing and landscaping is maintained within strata management. It is important to provide a high quality development where future residents feel a sense of communal living and ownership.

Semi transparent fencing material, such as timber slats or palasades, will allow surveillance from within each dwellings boundary, while creating a sense of communal living. Any graffiti or vandalism must be removed as quickly as possible to minimise cumulative graffiti and to deter future vandalism.

It is considered that the proposed development sufficiently addresses the space management issues discussed above.

5. CONCLUSION

Our assessment of the proposal in accordance with the CPTED principles confirms that the development can be managed to minimise the potential risk of crime subject to some minor amendments in accordance with the recommendations of this report.

A summary of the recommended strategies are as follows:

- Provide well-appointed entry statements and changing road and footpath surfaces to create a sense of delineation between public and private.
- The car parking area should include mechanisms such as a security surveillance system that is of a quality to enable clear identification of motor vehicle registration plates, application of sensor lighting for external parking spaces, clear signage, establishment of clear line of sight.
- Directional signage shall be provided throughout the development, inclusive of car parking areas and vehicle access entrances/exits. The signage is to be clear, legible and useful, to aid way finding throughout the area reducing opportunity for excuse making behaviour and loitering.
- Access to basement stairs and secure lobbies will be controlled by an intercom system and a security surveillance system.
- The main lower level entry/exit doors should also be fitted with single cylinder locksets (Australia and New Zealand Standard – Lock Sets) to restrict unauthorized access to the premise. The windows to individual dwellings should also be fitted with key operated locksets (Australia and New Zealand Standard – Lock Sets) to restrict unauthorized access to lower level units. Install lockable (Australia and New Zealand Standard – Lock Sets)gates to the yards at podium level.
- Street lighting should be vandal resistant and lighting should satisfy the relevant Australian Standard1158.1 to provide appropriate lamps and lighting levels to mitigate pedestrian crime risk and fear. Where damaged or broken, lighting shall be repaired within 48 hours.
- Mail delivery area and boxes is to be in a secure locations as part of building design (e.g. internal foyer areas). The application of technical surveillance, signage and lighting shall be installed.
- Minimise and preferably avoid landscaping that prevents a clear sightlines to/from isolated areas i.e. The use of trees with elongated trunks with canopy clearance of 2 metres, and shrubs should be less than 1 metre high.. Pathways for pedestrian travel

should be lit with low lighting to mark the path of travel. Where damaged or broken, lighting shall be repaired within 48 hours.

- Incorporate semi-transparent fencing into the overall development design to increase internal surveillance Provide safety/warning signage along the adjacent footpath and internal footpath if required.
- Fencing and landscaping should limit opportunity for 'ladders' that might assist gaining entry to buildings. This can be achieved by minimising horizontal slats or climbable building elements and locating climbable vegetation an appropriate distance from buildings to avoid people using it to access upper level balconies and windows. Alternatively, plant varities that discourage entry i.e. cactus.
- Maintain public domain reserves and landscaping area regularly. Graffiti and vandal resistance building materials and fixtures shall be used in the construction of the development. Where there are existing surfaces exposed to potential for graffiti damage, graffiti resistant coatings should be applied. Graffiti shall be removed within 24 hours of its appearance.

It is considered that the proposal will provide a relatively safe environment for future residents and should be supported by Council.

DA Access Report

Date of Report:	11 July 2016
Amendment A:	9 August 2016
Amendment B:	26 February 2018
Amendment C:	13 July 2018
Re:	Residential Apartment Complex with 4 Retail/Commercial Spaces at Brooks Parade, Belmont NSW
For:	KML Joint Venture
Assessment:	Plans by Coeve Design (18/06/18, plot date 19/06/18) Drawing Numbers DA02-L, DA03-R, DA04-K, DA05-L, DA06-J, DA07-J, DA08-G, DA09-G, DA10-F Adaptable unit plans by Coeve Design (4/08/16, plot date 5/08/16) Drawing Numbers DA21-A, DA22-A Architectural summary_June 2018_V2 received from Clint Forrester via email 12/07/18

This Access Report is an assessment of the proposed building work to demonstrate consideration of accessibility requirements for the revised development application submission.

The following comments are based on access and adaptable housing requirements of the Building Code of Australia 2016 (BCA), Disability (Access to Premises – Buildings) Standards 2010 (including Amendment No. 1) (Premises Standards), Lake Macquarie City Council Development Control Plan (DCP), Australian Standards (AS), Disability Discrimination Act (DDA) and the Livable Housing Design Guidelines as referenced by State Environmental Planning Policy No 65-Design Quality of Residential Apartment Development (SEPP 65).

This report contains comments regarding issues of non-compliance, or identifying where insufficient information has been provided for an assessment to be made. Recommendations may also be made to enhance accessibility and minimise the risk of action under the Disability Discrimination Act (DDA).

Unless otherwise specified, all Australian Standards references are from the following:

AS 1428.1-2009 (including Amendment No. 1)
AS/NZS 1428.4.1-2009 (including Amendment No. 1)
AS 1735.12-1999
AS/NZS 2890.6-2009
AS 4299-1995

	Access elements	*Reference*	Assessment
1.	**Access requirements**		
1.1	Access for people with a disability is required:		
	a) From the main points of a pedestrian entry at the allotment boundary.	*BCA D3.2 a i*	
	b) From required accessible car parking spaces.	*BCA D3.2 a iii*	
	c) Through the principal pedestrian entrance of each residential lobby and each retail/commercial space.	*BCA D3.2 b*	
	d) Where a passenger lift is installed, access is to be provided to the entrance doorway of each sole-occupancy unit located on the levels served by the lift.	*BCA Table D3.1*	
	e) To and within all spaces for use in common by the residents. This includes garbage chutes, the communal multi-purpose room, and common paved/landscaped areas on the ground floor and rooftops.	*BCA Table D3.1*	
	f) To and within all areas of the retail/commercial spaces normally used by the occupants.	*BCA Table D3.1*	
1.2	It is not necessary to provide access for people with a disability to or within an area where access would be inappropriate because of the particular purpose for which the area is used and/or an area that would pose a health or safety risk for people with a disability. Therefore, it is typically not considered necessary to provide access to and within areas such as plant rooms and services/maintenance areas as it is anticipated that the duties of staff in these areas will require physical capabilities.	*BCA D3.4*	
1.3	The Lake Macquarie City Council Development Control Plan requires that one adaptable dwelling be provided for every 10 dwellings. 14 of the 140 units are therefore required to be adaptable and the Architectural Summary nominates 26 adaptable units within Blocks B, C and D to address this requirement. The DCP requires that these have a car park linked to the dwelling by an unobstructed path of travel at a suitable gradient for wheelchair access and passenger lifts are shown to provide this link to each Block. It also requires that adaptable dwellings have entries, doors and passageways that are of suitable dimensions to facilitate wheelchair access and reference is made to AS 4299 in the assessment of these elements.	*DCP 9.11.10*	Compliance achievable

	Access elements	*Reference*	Assessment
	The Class C requirements of AS 4299 have been utilised for the assessment of the adaptable unit designs within this report.		Refer to section 7 of this report
1.4	State Environmental Planning Policy No 65-Design Quality of Residential Apartment Development (SEPP 65) requires that the Apartment Design Guide be considered in the determination for development consent. Clause 4Q of the Apartment Design Guide requires that universal design features be included in apartment design and suggests that 20% of the dwellings be designed to meet the silver level of the Livable Housing Design Guidelines. 28 of the 140 units are therefore required to incorporate silver level features on initial construction and the Architectural Summary nominates 53 livable units within Blocks A, B, C and D to address this requirement.	*SEPP 65 28*	Compliance achievable
	Livable unit designs have been assessed against silver level requirements of the Livable Housing Design Guidelines within this report.		Refer to section 8 of this report
2.	**Continuous accessible path of travel**		
2.1	The continuous accessible path of travel to and within areas required to be accessible is to comply with AS 1428.1. This is generally achievable subject to assessment of specific dimensions and features which are not fully detailed on the plans at this early stage of design such as flush transitions between floor surfaces. Compliance is to be confirmed at CC stage, including the following features:		
	a) An unobstructed width of at least 1000mm (with additional space at doorways and changes in direction) and an unobstructed vertical clearance of at least 2000mm (or 1980mm at doorways).	*AS 1428.1 6.3 6.2*	Compliance achievable/ confirm for CC
	b) A continuous accessible path of travel is not to include a step, stairway or other impediment.	*AS 1428.1 6.1*	Ensure compliance
	c) Turning spaces of at least 1540mm x 2070mm are to be provided within 2m of the end of accessways where it is not possible to continue travelling along the accessway.	*AS 1428.1 6.5*	As scaled from plans/ confirm for CC

Access elements	*Reference*	Assessment
d) Walkways are required to have firm and level ground of a different material to the walkway abutting the sides of the walkway, extending horizontally for at least 600mm and following the same grade unless a kerb; a kerb rail and handrail; or a wall at least 450mm high is provided.	*AS 1428.1 10.2 a*	Confirm for CC
e) The transition between floor surfaces is to be flush. A construction tolerance is allowed between surfaces of less than 5mm with rounded edges or less than 3mm tolerance for vertical edges. (Refer to AS 1428.1 7.2 and Fig. 6b for details regarding pavers.)	*AS 1428.1 7.2 Fig. 6, 7*	Confirm for CC

3. Approaches and entrances

3.1 Ramps are shown for the approaches from the Brooks Parade, Sharp Street and Edgar Street boundaries.

Plans show 1:20 gradient walkways within the Block B, C and D residential lobbies, and outside the Block B lobby entrance.

Comments:

a) We note that while stairs are provided at the western corner of the site from the canal walkway, there is no accessible approach to the retail/commercial level at this point and the closest ramp is over 50m away on Brooks Parade. We recommend, as best practice, that a ramp be provided to enable equitable access for all users.	Consider DDA risk
b) Plans do not show details of the entrances to all retail/commercial spaces at this early stage of the design process. It is anticipated that accessible paths of travel will be provided from street level to entrances via the ramps shown. Where stairs are provided without an adjacent ramp, there may be some risk of DDA complaint if people are required to travel further to use an accessible approach to the site. This risk may be reduced through the use of appropriate signage to direct people to the closest ramp and this is to be confirmed at CC stage.	Consider DDA risk
c) The 1:20 walkway outside the Block B lobby entrance is to be reconfigured so that the 1:20 gradient runs in the direction of travel and a maximum crossfall of 1:40 is provided. Otherwise, a 1:40 gradient landing will be required at the base of this walkway with dimensions appropriate to the required change in direction.	Amend for CC

	Access elements	*Reference*	Assessment
3.2	Ramps are to comply with AS 1428.1 and plans showing more details and dimensions are to be provided at CC stage. Required features include: a gradient not steeper than 1:14, handrails and kerbs/kerbrails on both sides, tactile ground surface indicators at the top and bottom and landings with dimensions appropriate to changes in direction. The BCA also requires that the slip-resistance of this ramp be tested in accordance with AS 4586 and comply with BCA Table D2.14. **Comment:** 1:20 walkways are not required to have tactile ground surface indicators at the top and bottom and are permitted to have no handrails and kerbs or kerb rails where a different ground surface extends at least 600mm on each side of the walkway at the same level, or there is a wall over 450mm in height on each side such as within the residential lobbies.	*BCA D3.3 a Table D2.14 D2.10 c AS 1428.1 10*	Confirm for CC
3.3	Stairs are shown at various points as alternative approaches to the building and for egress from the basement level and within each block. The BCA requires all stairs (except fire-isolated stairs) to have accessible features complying with AS 1428.1 including opaque risers, sharp nosing profile, non-slip contrasting edge strips, handrails on both sides and tactile ground surface indicators at the top and bottom. All other fire-isolated stairs are to have contrasting non-slip edge strips in accordance with AS 1428.1. The BCA requires slip-resistance of all stair treads and landings or their nosing strips to be tested in accordance with AS 4586 and comply with BCA Table D2.14. Plans do not show full details at this early stage of design and plans are to demonstrate compliance at CC stage. **Comment:** Where stairs are located at the property boundary, they are to be set back at least 900mm to allow for the required handrail extensions and tactile ground surface indicators	*BCA D3.3 a AS 1428.1 11*	Confirm for CC
3.4	The path of travel from the accessible visitor/retail/commercial car parking has been considered via the dedicated lift to the retail/commercial level. However, this appears to provide a direct connection only to the 79.51m² and 84.66m² retail/commercial spaces and relies upon people accessing the remaining retail/commercial spaces and the communal multi-purpose room via the ramp to street level and using public footpaths to return to the retail/commercial level via a second ramp.		Consider DDA risk/ confirm for CC

	Access elements	*Reference*	Assessment

The accessibility of the public footpath has not been assessed and will be a factor in determining the provision of an accessible path of travel between accessible car parking and retail/commercial areas as required by the BCA unless a direct, accessible connection is provided at the retail/commercial level.

4. Doorways

4.1	Doorways for the entrances to the retail/commercial spaces, residential lobbies and adaptable units, and doorways in common areas are to comply with AS 1428.1. It is recommended that the entrance door to each residential unit comply with AS 1428.1 for the purpose of visitability. Doorways are not fully detailed on the plans at this early stage of planning. Further details and dimensions are to be assessed at CC stage, including a minimum clear opening width of 850mm to the active leaf and circulation spaces with a maximum gradient and cross fall of 1:40. Features such as luminance contrast to the doors or frames, opening force of the doors, level or ramped thresholds, glazing identification and door hardware are also to comply with AS 1428.1. Where doorways are shown, a scaled assessment indicates that compliance with circulation space requirements will generally be in accordance with AS 1428.1, except for:	*BCA D3.2 e* *AS 1428.1* *13.2*	Confirm for CC
	a) At the Block B Unit 1.02, 2.02, 3.02 and 4.02 entrance doorways, 530mm latch side circulation space will be required where the door swings towards the user in the initial construction.		Amend for CC
	b) At the Block C Unit 2.01 and 3.01 entrance doorways, 530mm latch side circulation space will be required where the door swings towards the user in the initial construction.		Amend for CC
	c) At the Block D Unit 2.03, 3.03 and 4.03 entrance doorways, 530mm latch side circulation space will be required where the door swings towards the user in the initial construction.		Amend for CC

	Access elements	*Reference*	Assessment
	d) While AS 1428.1 does not address door circulation at lift doors, it is recommended that a space of at least 1500mm x 1500mm is provided outside each lift door to enable wheelchair users to manoeuvre through 90 degrees. A scaled assessment indicates that this space has been provided in all locations except for on the basement level at the Block C lift. It is recommended, that where possible, an increased space of 1800 x 2000mm is provided to enable two wheelchair users or people with prams to pass.		Consider best practice
4.2	While internal doors within adaptable units are permitted to have a reduced clear opening width of 820mm. It is recommended that a minimum 920mm door leaf is utilised as best practice.		Confirm for CC
	AS 1428.1 circulation spaces are to be achieved upon adaptation at internal doorways in the adaptable units. A scaled assessment indicates that this will be achievable in the Block B Unit 1.02, Block B Unit 2.06, Block C Unit 2.01, and Block C Unit 1.05 unit types. For the remaining unit types (Block C Unit 2.02, Block C Unit 2.04, Block C Unit 1.03, and Block D Unit 2.03), post-adaptation plans are to be provided at CC stage to verify compliance.		As scaled from plans/ provide post-adaptation plans for assessment
5.	**Lifts**		
5.1	Four passenger lifts are proposed to provide vertical circulation from basement car parking to each block of residential units. An additional passenger lift is also shown to provide an accessible path of travel from accessible visitor/retail/commercial car parking to the retail/commercial level. **Comment:** The 2400 x 2400mm elevating platform adjacent to the loading dock and turning platform has been considered exempt from the provision of access under BCA D3.4 as it is not associated with accessible car parking and is not considered for general use. It is anticipated that people using this platform will have specific training to ensure their safety.		
5.2	All passenger lifts are to comply with BCA E3.6 including minimum floor dimensions of 1400mm x 1600mm for a lift travelling more than 12m and minimum floor dimensions of 1100mm x 1400mm for a lift travelling less than 12m. (Note that the BCA may prescribe requirements in relation to accommodating a stretcher in addition to elements required for access for people with a disability).	*BCA E3.6*	Confirm for CC

	Access elements	*Reference*	Assessment
	Plans are to show further details for assessment at CC stage and certification is to be obtained from the lift supplier regarding compliance with BCA E3.6.		
6.	**Common sanitary facilities**		
6.1	A toilet facility is shown in the eastern corner of the site adjacent to the visitor/retail/commercial lift. A scaled assessment indicates that there will be sufficient space to achieve the required AS 1428.1 circulation spaces for an accessible toilet facility. Fixtures and fittings, including the WC pan, WC seat, backrest, toilet paper dispenser, sink, shelf, soap dispenser, mirror, clothes hook, grabrails and door hardware, are to comply with AS 1428.1 and CC plans are to demonstrate compliance. Where sanitary facilities are provided for males and females in addition to the accessible sanitary facility, BCA F2.4 requires toilets suitable for people with an ambulant disability. Details are to be provided for assessment at CC stage.	*BCA Table F2.4 a*	As scaled from plans/ provide details for assessment
7.	**Adaptable units**		
7.1	For adaptable unit types Block B Unit 1.02, Block B Unit 2.06, Block C Unit 2.01, and Block C Unit 1.05, pre- and post-adaptation unit designs have been assessed against AS 4299 Class C requirements and the results summarised in this section of this report. It is noted that Adaptable Unit Plans (4/08/16, plot date 5/08/16) have been superseded for the remaining unit types (Block C Unit 2.02, Block C Unit 2.04, Block C Unit 1.03, and Block D Unit 2.03). In these instances, the unit designs shown on floor plans have been assessed for features required in the initial construction. Post-adaptation plans are to be provided for assessment at CC stage to verify compliance for AS 4299 features that will be incorporated on adaptation.		Provide post-adaptation plans for assessment
7.2	The adaptable units are to have a minimum bedroom width to provide 1m clearance on each side of a queen bed and at least 1540mm x 2070mm for turning space at the foot of the bed (or at one side). A scaled assessment indicates that this will be achievable in the main bedroom of each adaptable unit.	*AS 4299 4.6.1*	As scaled from plans/ provide post-adaptation plans

	Access elements	*Reference*	Assessment
7.3	The living/dining area in each adaptable unit is to have at least 2250mm clear of furniture in accordance. The open plan designs are conducive to this, however, will be impacted by an occupant's furniture layout.	*AS 4299 4.7.1*	As scaled from plans/ provide post-adaptation plans
7.4	The kitchen in each adaptable unit is to have at least 1550mm clearance in front of the kitchen bench. A scaled assessment indicates this will be achievable upon adaptation with some kitchen reconfiguration.	*AS 4299 4.5.2 4.5.4*	As scaled from plans
	Other Class C features of AS 4299 are to be incorporated during reconfiguration and adaptation work and will be intended to meet the needs of the occupants. Floor finishes are to be slip-resistant continuous beneath kitchen joinery to enable removal of cabinets or replacement/relocation of joinery for adaptation.		Confirm for CC
7.5	The laundry in each adaptable unit is to have at least 1550mm clearance in front of or beside appliances and a scaled assessment indicates this will be achievable upon adaptation. There is to be provision an automatic washing machine and a slip resistant floor surface.	*AS 4299 4.8 4.9.1*	As scaled from plans/ provide post-adaptation plans
7.6	Letterboxes are to be located on a hard standing area which is to be connected to an accessible pathway. These are not indicated on the plans and CC plans are to confirm compliance.	*AS 4299 3.8*	Confirm for CC
7.7	While storage lockers are not addressed by AS 4299, it is recommended that the lockers allocated to adaptable units are connected to an accessible pathway. The lockers on the basement level are therefore preferable over the lockers in Blocks A and B, which are reached via a narrow corridor.		Consider DDA risk
7.8	The bathroom in each adaptable unit is to be capable of complying with AS 1428.1 in the future. They are to incorporate the following features:		
	a) Minimum room size conducive to AS 1428.1 circulation space requirements.	*AS 4299 4.4.1*	As scaled from plans/ provide post-adaptation plans
	b) A hobless shower recess with the shower screen able to be easily removed.	*AS 4299 4.4.4 f*	Confirm for CC
	c) A recessed soap holder.	*AS 4299 4.4.4 f*	Confirm for CC

	Access elements	*Reference*	Assessment
	d) A slip-resistant floor surface.	*AS 4299 4.4.2*	Confirm for CC
	e) Shower taps able to be positioned in accordance with AS 1428.1.	*AS 4299 4.4.4 f*	Confirm for CC
	f) Provision for an adjustable, detachable hand held shower rose.	*AS 4299 4.4.4 h*	Confirm for CC
	g) Provision for a grabrail in the shower to comply with AS 1428.1 through reinforced walls.	*AS 4299 4.4.4 h*	Confirm for CC
	h) Tap sets to be capstan or lever handles with a single outlet.	*AS 4299 4.4.4 c*	Confirm for CC
	i) Provision for a washbasin with clearances to comply with AS 1428.1.	*AS 4299 4.4.4 g*	Confirm for CC
7.9	The toilet for each adaptable unit is to be capable of complying with AS 1428.1 in the future. They are to incorporate the following features:	*AS 4299 4.4.1*	
	a) The WC pan located at correct distances from fixed walls.	*AS 4299 4.4.3*	Confirm for CC
	b) Provision for a grab rail through reinforced walls.	*AS 4299 4.4.4 h*	Confirm for CC
	c) Slip resistant floor surface.	*AS 4299 4.4.2*	Confirm for CC
	d) Minimum circulation space of 900mm x 1250mm in front of the WC pan clear of any door swing or obstruction in the initial construction. **Comment:** This is achieved in most unit types with sliding doors and partial shower screens which are required to be incorporated in the initial construction to ensure compliance, except for in the Block C Unit 1.03 unit type where the door swing is not permitted to overlap with this circulation space.	*AS 4299 4.4.3 Fig. 1.1*	Amend for CC

	Access elements	*Reference*	Assessment
8.	**Universal design**		
8.1	Livable unit plans have been assessed against the silver level requirements of the Livable Housing Design Guidelines (LHDG) as prescribed by SEPP 65 and the results summarised in this section of this report.		
	Block A Unit 1.01 is considered unsuitable as a livable unit in its current configuration due to the present of stairs inside the entrance door, which will not satisfy the requirement for a toilet on the entry level.		Amend for CC
8.2	**Dwelling entrance**		
	a) A level landing area of at least 1200mm x 1200mm is required on the arrival side of the entrance door (i.e. the external side).	*LHG 2.b*	As scaled from plans
	b) An entrance door is to have a minimum clear opening width of 820mm (note that the adaptable housing requirement supercedes this).	*LHG 2.a.i Fig. 2(a)*	Confirm for CC
	c) A level (step-free) transition and threshold is required. A maximum vertical tolerance of 5mm between abutting surfaces is allowable provided the lip is rounded or bevelled.	*LHG 2.a.ii*	Confirm for CC
	d) A ramped threshold may be provided at the entrance where the threshold is between 5mm and 56mm.	*LHG 2.c*	Confirm for CC
8.3	**Internal doors and corridors**		
	a) Doorways to rooms on the entry level used for living, dining, bedroom, bathroom, kitchen, laundry and sanitary compartment purposes are to have a minimum clear opening width of 820mm and level transitions and thresholds (a 5mm rounded or bevelled lip is permitted).	*LHG 3.a.i, ii*	Confirm for CC
	b) Internal corridors to the doorways referred to above are to have a minimum clear width of 1000mm. **Comments:** i. The clearance between the end of the kitchen bench and the bedroom wall/door scales at less than 1000mm in Block B Units 2.06, 3.05 and 4.05.	*LHG 3.b*	Confirm/ amend for CC

Access elements	*Reference*	Assessment

ii. Confirmation will be required as to the clear width of corridors in Block C units 2.01 and 3.01 as a scaled assessment indicates that a 1000mm width may not be achieved.

iii. Where Block A Unit 1.01 is retained as a livable unit, corridors do not offer any construction tolerance to achieve a 1000mm width between finished surfaces.

iv. Note that corridors which scale close to 1000mm will not have any construction tolerance. On completion, 1000mm clearance is required between skirtings or the narrowest point.

8.4 **Shower**

a)	One bathroom is to feature a slip resistant, hobless shower recess. Shower screens are permitted provided they can be easily removed at a later date.	*LHG 5.a*	Confirm for CC
b)	This shower recess is to be located in a corner of the room to enable the installation of grabrails at a future date in accordance with Figures 8(a) or 8(b) of the LHDG as outlined in section 8.6 of this report.	*LHG 5.b*	Confirm for CC

8.5 **Toilet**

a)	A toilet is to be provided on ground or entry level with a minimum 900mm x 1200mmm circulation space in front of the WC pan clear of the door swing (note that the adaptable housing requirement supercedes this).	*LHG 4.a.i, ii Figs. 3(a), 3(b)*	
	Comment: This is achievable for most livable units with the installation of sliding doors and partial shower screens in the initial construction, except for Block C Unit 1.03 where the door swing overlaps with this circulation space. We note that minimal construction tolerance will be available between fixtures and walls in many unit types. Construction plans are to nominate minimum dimensions to ensure compliance.		Amend for CC

Access elements	*Reference*	Assessment
b) This toilet pan is to be located in a corner of the room adjacent to a wall that extends 600-1000mm in front of the toilet pan, to allow for wall reinforcing in accordance with Figures 6a or 6b of the LHDG as outlined in section 8.6 of this report, for the future installation of grab rails.	*LHG 4.a.iii*	
Comment: For unit types such as Block B Unit 1.02 and Block C Unit 1.05, compliance is not achievable in the current configuration where the wall alongside the toilet does not extend at least 600mm in front of the pan for the provision of LHDG compliant wall reinforcing. This comment applies to many of the nominated livable units and will necessitate some redesign if these are to be retained as livable units. Where cavity sliding doors are installed on the wall alongside the toilet, consideration should also be given to ensure that wall reinforcement can be provided in the required locations.		Amend for CC
8.6 **Reinforcement of bathroom & toilet walls**		
a) Except for walls constructed of solid masonry or concrete, the walls around the shower and toilet should be reinforced to provide a fixing surface for the safe installation of grabrails.	*LHG 6.a*	Confirm for CC
b) The walls around the toilet and shower recess are to be reinforced by installing:		
i. Noggings with a thickness of at least 25mm in accordance with Fig. 6a or 8a of LHDG; or	*LHG 6.b.i, 6.d.i*	Confirm for CC
ii. Sheeting with a thickness of at least 12mm in accordance with Fig. 6b or 8b of LHDG.	*LHG 6.b.ii, 6.d.ii*	Confirm for CC

	Access elements	*Reference*	Assessment
9.	**Car parking**		
9.1	With 140 units in the development, 14 adaptable units are required and therefore 14 car parking spaces are required within the residential basement car parking area for allocation to the adaptable units.	*AS 4299 3.7.2 BCA D3.5 c*	
	AS 4299 requires that these spaces have a minimum width of 3.8m. Plans show 4 spaces (R38, R58, R87, R106) which address this requirement; shown as a 2400mm space with an adjacent shared area at least 1400mm wide. 3 spaces (R3, R7 and R20) will require further consideration as one has a reduced width to the shared area and the remaining two have a column located between the space and shared area, which is not permitted. CC plans are to demonstrate compliance for at least two of these spaces.		Amend/ confirm for CC
	The remaining 8 car parking spaces for allocation to the adaptable units are instead shown in a configuration generally consistent with AS 2890.6 and this is acceptable as current best practice.		As shown on plans
	Plans showing further details and dimensions are to be assessed at CC stage.		Confirm for CC
9.2	Two accessible car parking spaces are shown in the basement residential visitors parking area. Where this area is open to the general public during business hours, these spaces may be used by customers of the retail/commercial spaces to satisfy BCA Table D3.5.	*BCA D3.5 c Table D3.5*	Confirm for CC
	The car parking spaces are to comply with AS 2890.6 and the configuration shown is generally consistent with this standard. Plans showing further details are to be assessed at CC stage to confirm compliance.		
9.3	Where entry to the car park is restricted with a security system, the style of controls is to be considered in relation to potential use by people with a disability (eg swipe card or keypad access may be difficult for people with limited arm use who may not be able to reach out the car window or who have weak grip). Plans note remote control operation and this is preferred from an accessibility perspective.	*AS 2890.6 A4*	Consider DDA risk

Conclusion

Generally, the plans assessed show that compliance with requirements for access for people with a disability and adaptable/livable housing is achievable subject to further details and some amendments. At this early stage of design, full details are not shown on plans. As further planning occurs, consideration is to be given to specific elements including switches, controls, lighting levels, hearing augmentation, and signage, and plans showing more detailed dimensions and features should be assessed prior to the issue of a construction certificate.

Report prepared by:



Aja Goddard
Access Consultant
ACAA Accredited Member 243

Report amended by:



Wendy Gould
Access Consultant
ACAA Associate Member 556

Reasonable care and skill have been exercised in the assessment of the building and the preparation of this report. However, this report shall not be construed as relieving any other party of their responsibilities or obligations.

The advice given is based on the assessment of the plans and other relevant documentation supplied regarding access requirements in the BCA, Australian Standards, Premises Standards and Disability Discrimination Act current at the time. The advice relates specifically to this project and may not apply to any other building or to this building at any other point in time.

BASIX® Certificate

Building Sustainability Index www.basix.nsw.gov.au

Multi Dwelling

Certificate number: 747948M_02

This certificate confirms that the proposed development will meet the NSW government's requirements for sustainability, if it is built in accordance with the commitments set out below. Terms used in this certificate, or in the commitments, have the meaning given by the document entitled "BASIX Definitions" dated 06/10/2017 published by the Department. This document is available at www.basix.nsw.gov.au

This certificate is a revision of certificate number 747948M lodged with the consent authority or certifier on 23 December 2016 with application DA/11/2017.

It is the responsibility of the applicant to verify with the consent authority that the original, or any revised certificate, complies with the requirements of Schedule 1 Clause 2A, 4A or 6A of the Environmental Planning and Assessment Regulation 2000

Secretary
Date of issue: Thursday, 13 September 2018
To be valid, this certificate must be lodged within 3 months of the date of issue.

NSW GOVERNMENT Planning & Environment

Project summary	
Project name	9447_02
Street address	36 Brooks Parade Belmont 2280
Local Government Area	Lake Macquarie City Council
Plan type and plan number	deposited 585
Lot no.	4
Section no.	-
No. of residential flat buildings	4
No. of units in residential flat buildings	140
No. of multi-dwelling houses	0
No. of single dwelling houses	0

Project score		
Water	✔ 40	Target 40
Thermal Comfort	✔ Pass	Target Pass
Energy	✔ 21	Target 20

Certificate Prepared by

Building SustainabilityAssessments

(ABN: 27 131 950 064)

Ph: 02 4962 3439 Email: enquiries@buildingsustainability.net.au

Revision of Certificates not lodged within 3 months of the date of issue will incur further BASIX issuing fees.

Description of project

Project address	
Project name	9447_02
Street address	36 Brooks Parade Belmont 2280
Local Government Area	Lake Macquarie City Council
Plan type and plan number	deposited 585
Lot no.	4
Section no.	-

Project type	
No. of residential flat buildings	4
No. of units in residential flat buildings	140
No. of multi-dwelling houses	0
No. of single dwelling houses	0

Site details	
Site area (m²)	7083
Roof area (m²)	2005
Non-residential floor area (m²)	699.0
Residential car spaces	165
Non-residential car spaces	0

Common area landscape	
Common area lawn (m²)	0.0
Common area garden (m²)	1621.0
Area of indigenous or low water use species (m²)	-

Assessor details	
Assessor number	BDAV/13/1491
Certificate number	0003174930
Climate zone	15

Project score		
Water	✔ 40	Target 40
Thermal Comfort	✔ Pass	Target Pass
Energy	✔ 21	Target 20

Description of project

The tables below describe the dwellings and common areas within the project

Residential flat buildings - Building A, 37 dwellings, 9 storeys above ground

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
A101	3	108.0	0.0	0.0	0.0
A204	2	97.0	0.0	0.0	0.0
A302	3	110.0	0.0	0.0	0.0
A306	2	97.0	0.0	0.0	0.0
A404	2	97.0	0.0	0.0	0.0
A502	3	110.0	0.0	0.0	0.0
A506	2	97.0	0.0	0.0	0.0
A701	3	110.0	0.0	0.0	0.0
A801	3	110.0	0.0	0.0	0.0
A604	3	106.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
A201	3	111.0	0.0	0.0	0.0
A205	2	100.0	0.0	0.0	0.0
A303	2	91.0	0.0	0.0	0.0
A401	3	111.0	0.0	0.0	0.0
A405	2	100.0	0.0	0.0	0.0
A503	2	91.0	0.0	0.0	0.0
A601	3	110.0	0.0	0.0	0.0
A702	3	110.0	0.0	0.0	0.0
A802	3	110.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
A202	3	110.0	0.0	0.0	0.0
A206	2	97.0	0.0	0.0	0.0
A304	2	97.0	0.0	0.0	0.0
A402	3	110.0	0.0	0.0	0.0
A406	2	97.0	0.0	0.0	0.0
A504	2	97.0	0.0	0.0	0.0
A602	3	110.0	0.0	0.0	0.0
A703	3	106.0	0.0	0.0	0.0
A803	3	106.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
A203	2	91.0	0.0	0.0	0.0
A301	3	111.0	0.0	0.0	0.0
A305	2	100.0	0.0	0.0	0.0
A403	2	91.0	0.0	0.0	0.0
A501	3	111.0	0.0	0.0	0.0
A505	2	100.0	0.0	0.0	0.0
A603	3	106.0	0.0	0.0	0.0
A704	3	106.0	0.0	0.0	0.0
A804	3	106.0	0.0	0.0	0.0

Residential flat buildings - Building B, 31 dwellings, 7 storeys above ground

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
B101	2	72.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
B102	2	87.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
B103	1	54.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
B104	2	90.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
B201	2	92.0	0.0	0.0	0.0
B205	2	86.0	0.0	0.0	0.0
B302	2	89.0	0.0	0.0	0.0
B306	3	110.0	0.0	0.0	0.0
B404	2	86.0	0.0	0.0	0.0
B502	2	77.0	0.0	0.0	0.0
B602	2	77.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
B202	2	89.0	0.0	0.0	0.0
B206	2	76.0	0.0	0.0	0.0
B303	3	109.0	0.0	0.0	0.0
B401	2	92.0	0.0	0.0	0.0
B405	2	76.0	0.0	0.0	0.0
B503	3	98.0	0.0	0.0	0.0
B603	3	98.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
B203	1	54.0	0.0	0.0	0.0
B207	3	110.0	0.0	0.0	0.0
B304	2	86.0	0.0	0.0	0.0
B402	2	89.0	0.0	0.0	0.0
B406	3	110.0	0.0	0.0	0.0
B504	2	85.0	0.0	0.0	0.0
B604	2	85.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
B204	1	54.0	0.0	0.0	0.0
B301	2	92.0	0.0	0.0	0.0
B305	2	76.0	0.0	0.0	0.0
B403	3	109.0	0.0	0.0	0.0
B501	2	82.0	0.0	0.0	0.0
B601	2	82.0	0.0	0.0	0.0

Residential flat buildings - Building C, 38 dwellings, 7 storeys above ground

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
C101	3	120.0	0.0	0.0	0.0
C105	2	85.0	0.0	0.0	0.0
C203	2	85.0	0.0	0.0	0.0
C207	2	77.0	0.0	0.0	0.0
C303	2	85.0	0.0	0.0	0.0
C307	2	77.0	0.0	0.0	0.0
C403	2	85.0	0.0	0.0	0.0
C407	2	77.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
C102	2	83.0	0.0	0.0	0.0
C106	3	103.0	0.0	0.0	0.0
C204	1	68.0	0.0	0.0	0.0
C208	2	83.0	0.0	0.0	0.0
C304	1	68.0	0.0	0.0	0.0
C308	2	83.0	0.0	0.0	0.0
C404	1	68.0	0.0	0.0	0.0
C408	2	83.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
C103	1	68.0	0.0	0.0	0.0
C201	2	90.0	0.0	0.0	0.0
C205	1	61.0	0.0	0.0	0.0
C301	2	90.0	0.0	0.0	0.0
C305	1	61.0	0.0	0.0	0.0
C401	2	87.0	0.0	0.0	0.0
C405	1	61.0	0.0	0.0	0.0
C501	3	108.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
C104	1	61.0	0.0	0.0	0.0
C202	1	61.0	0.0	0.0	0.0
C206	2	78.0	0.0	0.0	0.0
c302	1	61.0	0.0	0.0	0.0
C306	2	78.0	0.0	0.0	0.0
C402	1	61.0	0.0	0.0	0.0
C406	2	78.0	0.0	0.0	0.0
C502	2	74.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
C503	2	79.0	0.0	0.0	0.0
C603	2	79.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
C504	2	92.0	0.0	0.0	0.0
C604	2	92.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
C601	3	108.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
C602	2	74.0	0.0	0.0	0.0

Residential flat buildings - Building D, 34 dwellings, 7 storeys above ground

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
D101	2	88.0	0.0	0.0	0.0
D202	2	85.0	0.0	0.0	0.0
D206	3	96.0	0.0	0.0	0.0
D303	2	79.0	0.0	0.0	0.0
D307	2	93.0	0.0	0.0	0.0
D404	1	53.0	0.0	0.0	0.0
D501	3	97.0	0.0	0.0	0.0
D505	2	80.0	0.0	0.0	0.0
D604	2	91.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
D102	2	78.0	0.0	0.0	0.0
D203	2	79.0	0.0	0.0	0.0
D207	2	93.0	0.0	0.0	0.0
D304	1	53.0	0.0	0.0	0.0
D401	3	101.0	0.0	0.0	0.0
D405	1	54.0	0.0	0.0	0.0
D502	1	55.0	0.0	0.0	0.0
D601	3	97.0	0.0	0.0	0.0
D605	2	80.0	0.0	0.0	-

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
D103	2	91.0	0.0	0.0	0.0
D204	1	53.0	0.0	0.0	0.0
D301	3	101.0	0.0	0.0	0.0
D305	1	54.0	0.0	0.0	0.0
D402	2	85.0	0.0	0.0	0.0
D406	3	96.0	0.0	0.0	0.0
D503	1	53.0	0.0	0.0	0.0
D602	1	55.0	0.0	0.0	0.0

Dwelling no.	No. of bedrooms	Conditioned floor area (m²)	Unconditioned floor area (m²)	Area of garden & lawn (m²)	Indigenous species (min area m²)
D201	3	101.0	0.0	0.0	0.0
D205	1	54.0	0.0	0.0	0.0
D302	2	85.0	0.0	0.0	0.0
D306	3	96.0	0.0	0.0	0.0
D403	2	79.0	0.0	0.0	0.0
D407	2	93.0	0.0	0.0	0.0
D504	2	91.0	0.0	0.0	0.0
D603	1	53.0	0.0	0.0	0.0

Description of project

The tables below describe the dwellings and common areas within the project

Common areas of unit building - Building A

Common area	Floor area (m²)
Car park area (A)(LB)	1218.0
Service Area (A)(LB)	12.0
Ground floor lobby type (A)(LG)	47.0
Hallway/lobby type (A)(L3)	20.0
Hallway/lobby type (A)(L6)	13.0

Common area	Floor area (m²)
Lift car (No.1)	-
Plant Area (A)(L8)	23.0
Hallway/lobby type (A)(L1)	20.0
Hallway/lobby type (A)(L4)	20.0
Hallway/lobby type (A)(L7)	13.0

Common area	Floor area (m²)
Garbage room (A)(LB)	14.0
Storage area (A)(LG)	69.0
Hallway/lobby type (A)(L2)	20.0
Hallway/lobby type (A)(L5)	13.0

Common areas of unit building - Building B

Common area	Floor area (m²)
Car park area (B)(LB)	1218.0
Service Area (B)(LB)	12.0
Ground floor lobby type (B)(LG)	45.0
Hallway/lobby type (B)(L3)	20.0

Common area	Floor area (m²)
Lift car (No.2)	-
Plant Area (B)(L6)	23.0
Hallway/lobby type (B)(L1)	20.0
Hallway/lobby type (B)(L4)	13.0

Common area	Floor area (m²)
Garbage room (B)(LB)	21.0
Storage area (B)(LG)	19.0
Hallway/lobby type (B)(L2)	20.0
Hallway/lobby type (B)(L5)	13.0

Common areas of unit building - Building C

Common area	Floor area (m²)
Car park area (C)(LB)	1218.0
Service Area (C)(LB)	12.0
Ground floor lobby type (C)(LG)	58.0
Hallway/lobby type (C)(L3)	23.0

Common area	Floor area (m²)
Lift car (No.3)	-
Service Area (C)(LG)	54.0
Hallway/lobby type (C)(L1)	23.0
Hallway/lobby type (C)(L4)	13.0

Common area	Floor area (m²)
Garbage room (C)(LB)	24.0
Plant Area (C)(L6)	23.0
Hallway/lobby type (C)(L2)	23.0
Hallway/lobby type (C)(L5)	13.0

Common areas of unit building - Building D

Common area	Floor area (m²)
Car park area (D)(LB)	1218.0
Service Area (D)(LB)	12.0
Hallway/lobby type (D)(L1)	36.0
Hallway/lobby type (D)(L4)	15.0

Common area	Floor area (m²)
Lift car (No.4)	-
Plant Area (D)(L6)	23.0
Hallway/lobby type (D)(L2)	28.0
Hallway/lobby type (D)(L5)	15.0

Common area	Floor area (m²)
Garbage room (D)(LB)	29.0
Ground floor lobby type (D)(LG)	33.0
Hallway/lobby type (D)(L3)	28.0

Schedule of BASIX commitments

1. Commitments for Residential flat buildings - Building A
    - (a) Dwellings
        - (i) Water
        - (ii) Energy
        - (iii) Thermal Comfort
    - (b) Common areas and central systems/facilities
        - (i) Water
        - (ii) Energy

2. Commitments for Residential flat buildings - Building B
    - (a) Dwellings
        - (i) Water
        - (ii) Energy
        - (iii) Thermal Comfort
    - (b) Common areas and central systems/facilities
        - (i) Water
        - (ii) Energy

3. Commitments for Residential flat buildings - Building C
    - (a) Dwellings
        - (i) Water
        - (ii) Energy
        - (iii) Thermal Comfort
    - (b) Common areas and central systems/facilities
        - (i) Water
        - (ii) Energy

4. Commitments for Residential flat buildings - Building D
    - (a) Dwellings

(i) Water
(ii) Energy
(iii) Thermal Comfort

(b) Common areas and central systems/facilities
(i) Water
(ii) Energy

5. Commitments for multi-dwelling houses

6. Commitments for single dwelling houses

7. Commitments for common areas and central systems/facilities for the development (non-building specific)
(i) Water
(ii) Energy

Schedule of BASIX commitments

The commitments set out below regulate how the proposed development is to be carried out. It is a condition of any development consent granted, or complying development certificate issued, for the proposed development, that BASIX commitments be complied with.

1. Commitments for Residential flat buildings - Building A

(a) Dwellings

(i) Water	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) The applicant must comply with the commitments listed below in carrying out the development of a dwelling listed in a table below.			
(b) The applicant must plant indigenous or low water use species of vegetation throughout the area of land specified for the dwelling in the "Indigenous species" column of the table below, as private landscaping for that dwelling. (This area of indigenous vegetation is to be contained within the "Area of garden and lawn" for the dwelling specified in the "Description of Project" table).	✔	✔	
(c) If a rating is specified in the table below for a fixture or appliance to be installed in the dwelling, the applicant must ensure that each such fixture and appliance meets the rating specified for it.		✔	✔
(d) The applicant must install an on demand hot water recirculation system which regulates all hot water use throughout the dwelling, where indicated for a dwelling in the "HW recirculation or diversion" column of the table below.		✔	✔
(e) The applicant must install: (aa) a hot water diversion system to all showers, kitchen sinks and all basins in the dwelling, where indicated for a dwelling in the "HW recirculation or diversion" column of the table below; and (bb) a separate diversion tank (or tanks) connected to the hot water diversion systems of at least 100 litres. The applicant must connect the hot water diversion tank to all toilets in the dwelling.		✔ ✔	✔ ✔
(e) The applicant must not install a private swimming pool or spa for the dwelling, with a volume exceeding that specified for it in the table below.	✔	✔	
(f) If specified in the table, that pool or spa (or both) must have a pool cover or shading (or both).		✔	
(g) The pool or spa must be located as specified in the table.	✔	✔	
(h) The applicant must install, for the dwelling, each alternative water supply system, with the specified size, listed for that dwelling in the table below. Each system must be configured to collect run-off from the areas specified (excluding any area which supplies any other alternative water supply system), and to divert overflow as specified. Each system must be connected as specified.	✔	✔	✔

	Fixtures					Appliances		Individual pool				Individual spa		
Dwelling no.	All shower-heads	All toilet flushing systems	All kitchen taps	All bathroom taps	HW recirculation or diversion	All clothes washers	All dish-washers	Volume (max volume)	Pool cover	Pool location	Pool shaded	Volume (max volume)	Spa cover	Spa shaded
All dwellings	3 star (> 4.5 but <= 6 L/min)	3 star	5 star	5 star	no	-	-	-	-	-	-	-	-	-

	Alternative water source							
Dwelling no.	Alternative water supply systems	Size	Configuration	Landscape connection	Toilet connection (s)	Laundry connection	Pool top-up	Spa top-up
None	-	-	-	-	-	-	-	-

(ii) Energy	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) The applicant must comply with the commitments listed below in carrying out the development of a dwelling listed in a table below.			
(b) The applicant must install each hot water system specified for the dwelling in the table below, so that the dwelling's hot water is supplied by that system. If the table specifies a central hot water system for the dwelling, then the applicant must connect that central system to the dwelling, so that the dwelling's hot water is supplied by that central system.	✔	✔	✔
(c) The applicant must install, in each bathroom, kitchen and laundry of the dwelling, the ventilation system specified for that room in the table below. Each such ventilation system must have the operation control specified for it in the table.		✔	✔
(d) The applicant must install the cooling and heating system/s specified for the dwelling under the "Living areas" and "Bedroom areas" headings of the "Cooling" and "Heating" columns in the table below, in/for at least 1 living/bedroom area of the dwelling. If no cooling or heating system is specified in the table for "Living areas" or "Bedroom areas", then no systems may be installed in any such areas. If the term "zoned" is specified beside an air conditioning system, then the system must provide for day/night zoning between living areas and bedrooms.		✔	✔
(e) This commitment applies to each room or area of the dwelling which is referred to in a heading to the "Artificial lighting" column of the table below (but only to the extent specified for that room or area). The applicant must ensure that the "primary type of artificial lighting" for each such room in the dwelling is fluorescent lighting or light emitting diode (LED) lighting. If the term "dedicated" is specified for a particular room or area, then the light fittings in that room or area must only be capable of being used for fluorescent lighting or light emitting diode (LED) lighting.		✔	✔

(ii) Energy	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(f) This commitment applies to each room or area of the dwelling which is referred to in a heading to the "Natural lighting" column of the table below (but only to the extent specified for that room or area). The applicant must ensure that each such room or area is fitted with a window and/or skylight.	✔	✔	✔
(g) This commitment applies if the applicant installs a water heating system for the dwelling's pool or spa. The applicant must:			
(aa) install the system specified for the pool in the "Individual Pool" column of the table below (or alternatively must not install any system for the pool). If specified, the applicant must install a timer, to control the pool's pump; and		✔	
(bb) install the system specified for the spa in the "Individual Spa" column of the table below (or alternatively must not install any system for the spa). If specified, the applicant must install a timer to control the spa's pump.		✔	
(h) The applicant must install in the dwelling:			
(aa) the kitchen cook-top and oven specified for that dwelling in the "Appliances & other efficiency measures" column of the table below;		✔	
(bb) each appliance for which a rating is specified for that dwelling in the "Appliances & other efficiency measures" column of the table, and ensure that the appliance has that minimum rating; and		✔	✔
(cc) any clothes drying line specified for the dwelling in the "Appliances & other efficiency measures" column of the table.		✔	
(i) If specified in the table, the applicant must carry out the development so that each refrigerator space in the dwelling is "well ventilated".		✔	

	Hot water	Bathroom ventilation system		Kitchen ventilation system		Laundry ventilation system	
Dwelling no.	Hot water system	Each bathroom	Operation control	Each kitchen	Operation control	Each laundry	Operation control
All dwellings	central hot water system 1	individual fan, ducted to façade or roof	interlocked to light	individual fan, ducted to façade or roof	manual switch on/off	individual fan, ducted to façade or roof	manual switch on/off

	Cooling		Heating		Artificial lighting						Natural lighting	
Dwelling no.	living areas	bedroom areas	living areas	bedroom areas	No. of bedrooms &/or study	No. of living &/or dining rooms	Each kitchen	All bathrooms/ toilets	Each laundry	All hallways	No. of bathrooms &/or toilets	Main kitchen
A203, A204, A205, A206, A303, A304, A305, A306, A403, A404, A405, A406, A503, A504, A505, A506	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	2	1	yes	yes	yes	yes	0	no
All other dwellings	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	3	1	yes	yes	yes	yes	0	no

	Individual pool		Individual spa		Appliances & other efficiency measures							
Dwelling no.	Pool heating system	Timer	Spa heating system	Timer	Kitchen cooktop/oven	Refrigerator	Well ventilated fridge space	Dishwasher	Clothes washer	Clothes dryer	Indoor or sheltered clothes drying line	Private outdoor or unsheltered clothes drying line
All dwellings	-	-	-	-	gas cooktop & electric oven	-	yes	-	-	-	no	no

(iii) Thermal Comfort	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) The applicant must attach the certificate referred to under "Assessor details" on the front page of this BASIX certificate (the "Assessor Certificate") to the development application and construction certificate application for the proposed development (or, if the applicant is applying for a complying development certificate for the proposed development, to that application). The applicant must also attach the Assessor Certificate to the application for a final occupation certificate for the proposed development.			
(b) The Assessor Certificate must have been issued by an Accredited Assessor in accordance with the Thermal Comfort Protocol.			
(c) The details of the proposed development on the Assessor Certificate must be consistent with the details shown in this BASIX Certificate, including the details shown in the "Thermal Loads" table below.			
(d) The applicant must show on the plans accompanying the development application for the proposed development, all matters which the Thermal Comfort Protocol requires to be shown on those plans. Those plans must bear a stamp of endorsement from the Accredited Assessor, to certify that this is the case.	✔		
(e) The applicant must show on the plans accompanying the application for a construction certificate (or complying development certificate, if applicable), all thermal performance specifications set out in the Assessor Certificate, and all aspects of the proposed development which were used to calculate those specifications.		✔	
(f) The applicant must construct the development in accordance with all thermal performance specifications set out in the Assessor Certificate, and in accordance with those aspects of the development application or application for a complying development certificate which were used to calculate those specifications.		✔	✔
(g) Where there is an in-slab heating or cooling system, the applicant must: (aa) Install insulation with an R-value of not less than 1.0 around the vertical edges of the perimeter of the slab; or (bb) On a suspended floor, install insulation with an R-value of not less than 1.0 underneath the slab and around the vertical edges of the perimeter of the slab.	✔	✔	✔
(h) The applicant must construct the floors and walls of the development in accordance with the specifications listed in the table below.	✔	✔	✔

	Thermal loads	
Dwelling no.	**Area adjusted heating load (in mJ/m²/yr)**	**Area adjusted cooling load (in mJ/m²/yr)**
A101	15.0	23.0
A201	30.0	23.0
A202	47.0	23.0
A203	36.0	24.0
A204	19.0	27.0

	Thermal loads	
Dwelling no.	**Area adjusted heating load (in mJ/m²/yr)**	**Area adjusted cooling load (in mJ/m²/yr)**
A205	10.0	17.0
A206	15.0	16.0
A301	25.0	25.0
A302	48.0	23.0
A303	35.0	24.0
A304	18.0	26.0
A305	10.0	23.0
A306	9.0	17.0
A401	30.0	24.0
A402	54.0	21.0
A403	41.0	21.0
A404	22.0	24.0
A405	13.0	22.0
A406	12.0	15.0
A501	31.0	24.0
A502	55.0	21.0
A503	42.0	20.0
A504	24.0	22.0
A505	15.0	19.0
A506	13.0	15.0
A601	33.0	21.0
A602	57.0	21.0
A603	37.0	23.0
A701	35.0	25.0
A702	58.0	21.0
A703	38.0	23.0
A704	21.0	24.0

	Thermal loads	
Dwelling no.	**Area adjusted heating load (in mJ/m²/yr)**	**Area adjusted cooling load (in mJ/m²/yr)**
A801	37.0	28.0
A802	71.0	24.0
A803	45.0	26.0
A804	30.0	31.0
All other dwellings	17.0	14.0

(b) Common areas and central systems/facilities

(i) Water	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) If, in carrying out the development, the applicant installs a showerhead, toilet, tap or clothes washer into a common area, then that item must meet the specifications listed for it in the table.		✔	✔
(b) The applicant must install (or ensure that the development is serviced by) the alternative water supply system(s) specified in the "Central systems" column of the table below. In each case, the system must be sized, be configured, and be connected, as specified in the table.	✔	✔	✔
(c) A swimming pool or spa listed in the table must not have a volume (in kLs) greater than that specified for the pool or spa in the table.	✔	✔	
(d) A pool or spa listed in the table must have a cover or shading if specified for the pool or spa in the table.		✔	
(e) The applicant must install each fire sprinkler system listed in the table so that the system is configured as specified in the table.		✔	✔
(f) The applicant must ensure that the central cooling system for a cooling tower is configured as specified in the table.		✔	✔

Common area	Showerheads rating	Toilets rating	Taps rating	Clothes washers rating
All common areas	no common facility	no common facility	3 star	no common laundry facility

(ii) Energy	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) If, in carrying out the development, the applicant installs a ventilation system to service a common area specified in the table below, then that ventilation system must be of the type specified for that common area, and must meet the efficiency measure specified.		✔	✔
(b) In carrying out the development, the applicant must install, as the "primary type of artificial lighting" for each common area specified in the table below, the lighting specified for that common area. This lighting must meet the efficiency measure specified. The applicant must also install a centralised lighting control system or Building Management System (BMS) for the common area, where specified.		✔	✔
(c) The applicant must install the systems and fixtures specified in the "Central energy systems" column of the table below. In each case, the system or fixture must be of the type, and meet the specifications, listed for it in the table.	✔	✔	✔

	Common area ventilation system		Common area lighting		
Common area	**Ventilation system type**	**Ventilation efficiency measure**	**Primary type of artificial lighting**	**Lighting efficiency measure**	**Lighting control system/BMS**
Car park area (A)(LB)	ventilation (supply + exhaust)	carbon monoxide monitor + VSD fan	fluorescent	zoned switching with motion sensor	No
Lift car (No.1)	-	-	fluorescent	connected to lift call button	No
Garbage room (A)(LB)	ventilation exhaust only	-	fluorescent	motion sensors	No
Service Area (A)(LB)	ventilation exhaust only	thermostatically controlled	fluorescent	manual on / manual off	No
Plant Area (A)(L8)	no mechanical ventilation	-	fluorescent	manual on / manual off	No
Storage area (A)(LG)	ventilation exhaust only	time clock or BMS controlled	fluorescent	motion sensors	No
Ground floor lobby type (A)(LG)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (A)(L1)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (A)(L2)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (A)(L3)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (A)(L4)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (A)(L5)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (A)(L6)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (A)(L7)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No

Central energy systems	Type	Specification
Central hot water system (No. 1)	gas-fired storage (manifolded)	Piping insulation (ringmain & supply risers): (b) Piping internal to building: R1.0 (~38 mm)
Lift (No. 1)	gearless traction with V V V F motor	Number of levels (including basement): 10

2. Commitments for Residential flat buildings - Building B

(a) Dwellings

(i) Water	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) The applicant must comply with the commitments listed below in carrying out the development of a dwelling listed in a table below.			
(b) The applicant must plant indigenous or low water use species of vegetation throughout the area of land specified for the dwelling in the "Indigenous species" column of the table below, as private landscaping for that dwelling. (This area of indigenous vegetation is to be contained within the "Area of garden and lawn" for the dwelling specified in the "Description of Project" table).	✔	✔	
(c) If a rating is specified in the table below for a fixture or appliance to be installed in the dwelling, the applicant must ensure that each such fixture and appliance meets the rating specified for it.		✔	✔
(d) The applicant must install an on demand hot water recirculation system which regulates all hot water use throughout the dwelling, where indicated for a dwelling in the "HW recirculation or diversion" column of the table below.		✔	✔
(e) The applicant must install: (aa) a hot water diversion system to all showers, kitchen sinks and all basins in the dwelling, where indicated for a dwelling in the "HW recirculation or diversion" column of the table below; and (bb) a separate diversion tank (or tanks) connected to the hot water diversion systems of at least 100 litres. The applicant must connect the hot water diversion tank to all toilets in the dwelling.		✔ ✔	✔ ✔
(e) The applicant must not install a private swimming pool or spa for the dwelling, with a volume exceeding that specified for it in the table below.	✔	✔	
(f) If specified in the table, that pool or spa (or both) must have a pool cover or shading (or both).		✔	
(g) The pool or spa must be located as specified in the table.	✔	✔	
(h) The applicant must install, for the dwelling, each alternative water supply system, with the specified size, listed for that dwelling in the table below. Each system must be configured to collect run-off from the areas specified (excluding any area which supplies any other alternative water supply system), and to divert overflow as specified. Each system must be connected as specified.	✔	✔	✔

	Fixtures					Appliances		Individual pool				Individual spa		
Dwelling no.	All shower-heads	All toilet flushing systems	All kitchen taps	All bathroom taps	HW recirculation or diversion	All clothes washers	All dish-washers	Volume (max volume)	Pool cover	Pool location	Pool shaded	Volume (max volume)	Spa cover	Spa shaded
All dwellings	3 star (> 4.5 but <= 6 L/min)	3 star	5 star	5 star	no	-	-	-	-	-	-	-	-	-

	Alternative water source							
Dwelling no.	Alternative water supply systems	Size	Configuration	Landscape connection	Toilet connection (s)	Laundry connection	Pool top-up	Spa top-up
None	-	-	-	-	-	-	-	-

(ii) Energy	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) The applicant must comply with the commitments listed below in carrying out the development of a dwelling listed in a table below.			
(b) The applicant must install each hot water system specified for the dwelling in the table below, so that the dwelling's hot water is supplied by that system. If the table specifies a central hot water system for the dwelling, then the applicant must connect that central system to the dwelling, so that the dwelling's hot water is supplied by that central system.	✔	✔	✔
(c) The applicant must install, in each bathroom, kitchen and laundry of the dwelling, the ventilation system specified for that room in the table below. Each such ventilation system must have the operation control specified for it in the table.		✔	✔
(d) The applicant must install the cooling and heating system/s specified for the dwelling under the "Living areas" and "Bedroom areas" headings of the "Cooling" and "Heating" columns in the table below, in/for at least 1 living/bedroom area of the dwelling. If no cooling or heating system is specified in the table for "Living areas" or "Bedroom areas", then no systems may be installed in any such areas. If the term "zoned" is specified beside an air conditioning system, then the system must provide for day/night zoning between living areas and bedrooms.		✔	✔
(e) This commitment applies to each room or area of the dwelling which is referred to in a heading to the "Artificial lighting" column of the table below (but only to the extent specified for that room or area). The applicant must ensure that the "primary type of artificial lighting" for each such room in the dwelling is fluorescent lighting or light emitting diode (LED) lighting. If the term "dedicated" is specified for a particular room or area, then the light fittings in that room or area must only be capable of being used for fluorescent lighting or light emitting diode (LED) lighting.		✔	✔

(ii) Energy	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(f) This commitment applies to each room or area of the dwelling which is referred to in a heading to the "Natural lighting" column of the table below (but only to the extent specified for that room or area). The applicant must ensure that each such room or area is fitted with a window and/or skylight.	✔	✔	✔
(g) This commitment applies if the applicant installs a water heating system for the dwelling's pool or spa. The applicant must:			
(aa) install the system specified for the pool in the "Individual Pool" column of the table below (or alternatively must not install any system for the pool). If specified, the applicant must install a timer, to control the pool's pump; and		✔	
(bb) install the system specified for the spa in the "Individual Spa" column of the table below (or alternatively must not install any system for the spa). If specified, the applicant must install a timer to control the spa's pump.		✔	
(h) The applicant must install in the dwelling:			
(aa) the kitchen cook-top and oven specified for that dwelling in the "Appliances & other efficiency measures" column of the table below;		✔	
(bb) each appliance for which a rating is specified for that dwelling in the "Appliances & other efficiency measures" column of the table, and ensure that the appliance has that minimum rating; and		✔	✔
(cc) any clothes drying line specified for the dwelling in the "Appliances & other efficiency measures" column of the table.		✔	
(i) If specified in the table, the applicant must carry out the development so that each refrigerator space in the dwelling is "well ventilated".		✔	

	Hot water	Bathroom ventilation system		Kitchen ventilation system		Laundry ventilation system	
Dwelling no.	Hot water system	Each bathroom	Operation control	Each kitchen	Operation control	Each laundry	Operation control
All dwellings	central hot water system 2	individual fan, ducted to façade or roof	interlocked to light	individual fan, ducted to façade or roof	manual switch on/off	individual fan, ducted to façade or roof	manual switch on/off

	Cooling		Heating		Artificial lighting						Natural lighting	
Dwelling no.	living areas	bedroom areas	living areas	bedroom areas	No. of bedrooms &/or study	No. of living &/or dining rooms	Each kitchen	All bathrooms/ toilets	Each laundry	All hallways	No. of bathrooms &/or toilets	Main kitchen
B303, B403	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	3	1	yes	yes	yes	yes	0	no
B103, B203, B204	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1	1	yes	yes	yes	yes	0	no
B207, B306, B406, B503, B603	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	3	1	yes	yes	yes	yes	0	yes
B201, B205, B301, B304, B401, B404, B501, B502, B601, B602	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	2	1	yes	yes	yes	yes	0	yes
All other dwellings	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	2	1	yes	yes	yes	yes	0	no

	Individual pool		Individual spa		Appliances & other efficiency measures							
Dwelling no.	Pool heating system	Timer	Spa heating system	Timer	Kitchen cooktop/oven	Refrigerator	Well ventilated fridge space	Dishwasher	Clothes washer	Clothes dryer	Indoor or sheltered clothes drying line	Private outdoor or unsheltered clothes drying line
All dwellings	-	-	-	-	gas cooktop & electric oven	-	yes	-	-	-	no	no

(iii) Thermal Comfort	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) The applicant must attach the certificate referred to under "Assessor details" on the front page of this BASIX certificate (the "Assessor Certificate") to the development application and construction certificate application for the proposed development (or, if the applicant is applying for a complying development certificate for the proposed development, to that application). The applicant must also attach the Assessor Certificate to the application for a final occupation certificate for the proposed development.			
(b) The Assessor Certificate must have been issued by an Accredited Assessor in accordance with the Thermal Comfort Protocol.			
(c) The details of the proposed development on the Assessor Certificate must be consistent with the details shown in this BASIX Certificate, including the details shown in the "Thermal Loads" table below.			
(d) The applicant must show on the plans accompanying the development application for the proposed development, all matters which the Thermal Comfort Protocol requires to be shown on those plans. Those plans must bear a stamp of endorsement from the Accredited Assessor, to certify that this is the case.	✔		
(e) The applicant must show on the plans accompanying the application for a construction certificate (or complying development certificate, if applicable), all thermal performance specifications set out in the Assessor Certificate, and all aspects of the proposed development which were used to calculate those specifications.		✔	
(f) The applicant must construct the development in accordance with all thermal performance specifications set out in the Assessor Certificate, and in accordance with those aspects of the development application or application for a complying development certificate which were used to calculate those specifications.		✔	✔
(g) Where there is an in-slab heating or cooling system, the applicant must: (aa) Install insulation with an R-value of not less than 1.0 around the vertical edges of the perimeter of the slab; or (bb) On a suspended floor, install insulation with an R-value of not less than 1.0 underneath the slab and around the vertical edges of the perimeter of the slab.	✔	✔	✔
(h) The applicant must construct the floors and walls of the development in accordance with the specifications listed in the table below.	✔	✔	✔

	Thermal loads	
Dwelling no.	**Area adjusted heating load (in mJ/m²/yr)**	**Area adjusted cooling load (in mJ/m²/yr)**
B101	38.0	24.0
B102	17.0	28.0
B103	21.0	19.0
B104	13.0	13.0
B203	15.0	18.0
B204	16.0	18.0
B205	24.0	30.0
B206	29.0	25.0
B303	15.0	14.0
B304	25.0	30.0
B305	30.0	24.0
B401	32.0	24.0
B402	14.0	26.0
B403	18.0	14.0
B404	30.0	25.0
B405	39.0	18.0
B406	51.0	16.0
B501	26.0	20.0
B502	26.0	26.0
B503	44.0	30.0
B504	64.0	24.0
B601	33.0	18.0
B602	28.0	23.0
B603	47.0	28.0
B604	66.0	23.0
B201, B301	33.0	24.0
B202, B302	10.0	30.0

	Thermal loads	
Dwelling no.	**Area adjusted heating load (in mJ/m²/yr)**	**Area adjusted cooling load (in mJ/m²/yr)**
All other dwellings	44.0	19.0

(b) Common areas and central systems/facilities

(i) Water	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) If, in carrying out the development, the applicant installs a showerhead, toilet, tap or clothes washer into a common area, then that item must meet the specifications listed for it in the table.		✔	✔
(b) The applicant must install (or ensure that the development is serviced by) the alternative water supply system(s) specified in the "Central systems" column of the table below. In each case, the system must be sized, be configured, and be connected, as specified in the table.	✔	✔	✔
(c) A swimming pool or spa listed in the table must not have a volume (in kLs) greater than that specified for the pool or spa in the table.	✔	✔	
(d) A pool or spa listed in the table must have a cover or shading if specified for the pool or spa in the table.		✔	
(e) The applicant must install each fire sprinkler system listed in the table so that the system is configured as specified in the table.		✔	✔
(f) The applicant must ensure that the central cooling system for a cooling tower is configured as specified in the table.		✔	✔

Common area	Showerheads rating	Toilets rating	Taps rating	Clothes washers rating
All common areas	no common facility	no common facility	3 star	no common laundry facility

(ii) Energy	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) If, in carrying out the development, the applicant installs a ventilation system to service a common area specified in the table below, then that ventilation system must be of the type specified for that common area, and must meet the efficiency measure specified.		✔	✔
(b) In carrying out the development, the applicant must install, as the "primary type of artificial lighting" for each common area specified in the table below, the lighting specified for that common area. This lighting must meet the efficiency measure specified. The applicant must also install a centralised lighting control system or Building Management System (BMS) for the common area, where specified.		✔	✔
(c) The applicant must install the systems and fixtures specified in the "Central energy systems" column of the table below. In each case, the system or fixture must be of the type, and meet the specifications, listed for it in the table.	✔	✔	✔

	Common area ventilation system		Common area lighting		
Common area	**Ventilation system type**	**Ventilation efficiency measure**	**Primary type of artificial lighting**	**Lighting efficiency measure**	**Lighting control system/BMS**
Car park area (B)(LB)	ventilation (supply + exhaust)	carbon monoxide monitor + VSD fan	fluorescent	zoned switching with motion sensor	No
Lift car (No.2)	-	-	fluorescent	connected to lift call button	No
Garbage room (B)(LB)	ventilation exhaust only	-	fluorescent	motion sensors	No
Service Area (B)(LB)	ventilation exhaust only	thermostatically controlled	fluorescent	manual on / manual off	No
Plant Area (B)(L6)	no mechanical ventilation	-	fluorescent	manual on / manual off	No
Storage area (B)(LG)	ventilation exhaust only	time clock or BMS controlled	fluorescent	motion sensors	No
Ground floor lobby type (B)(LG)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (B)(L1)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (B)(L2)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (B)(L3)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (B)(L4)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (B)(L5)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No

Central energy systems	Type	Specification
Central hot water system (No. 2)	gas-fired storage (manifolded)	Piping insulation (ringmain & supply risers): (b) Piping internal to building: R1.0 (~38 mm)
Lift (No. 2)	gearless traction with V V V F motor	Number of levels (including basement): 8

3. Commitments for Residential flat buildings - Building C

(a) Dwellings

(i) Water	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) The applicant must comply with the commitments listed below in carrying out the development of a dwelling listed in a table below.			
(b) The applicant must plant indigenous or low water use species of vegetation throughout the area of land specified for the dwelling in the "Indigenous species" column of the table below, as private landscaping for that dwelling. (This area of indigenous vegetation is to be contained within the "Area of garden and lawn" for the dwelling specified in the "Description of Project" table).	✔	✔	
(c) If a rating is specified in the table below for a fixture or appliance to be installed in the dwelling, the applicant must ensure that each such fixture and appliance meets the rating specified for it.		✔	✔
(d) The applicant must install an on demand hot water recirculation system which regulates all hot water use throughout the dwelling, where indicated for a dwelling in the "HW recirculation or diversion" column of the table below.		✔	✔
(e) The applicant must install: (aa) a hot water diversion system to all showers, kitchen sinks and all basins in the dwelling, where indicated for a dwelling in the "HW recirculation or diversion" column of the table below; and (bb) a separate diversion tank (or tanks) connected to the hot water diversion systems of at least 100 litres. The applicant must connect the hot water diversion tank to all toilets in the dwelling.		✔ ✔	✔ ✔
(e) The applicant must not install a private swimming pool or spa for the dwelling, with a volume exceeding that specified for it in the table below.	✔	✔	
(f) If specified in the table, that pool or spa (or both) must have a pool cover or shading (or both).		✔	
(g) The pool or spa must be located as specified in the table.	✔	✔	
(h) The applicant must install, for the dwelling, each alternative water supply system, with the specified size, listed for that dwelling in the table below. Each system must be configured to collect run-off from the areas specified (excluding any area which supplies any other alternative water supply system), and to divert overflow as specified. Each system must be connected as specified.	✔	✔	✔

	Fixtures					Appliances		Individual pool				Individual spa		
Dwelling no.	All shower-heads	All toilet flushing systems	All kitchen taps	All bathroom taps	HW recirculation or diversion	All clothes washers	All dish-washers	Volume (max volume)	Pool cover	Pool location	Pool shaded	Volume (max volume)	Spa cover	Spa shaded
All dwellings	3 star (> 4.5 but <= 6 L/min)	3 star	5 star	5 star	no	-	-	-	-	-	-	-	-	-

	Alternative water source							
Dwelling no.	Alternative water supply systems	Size	Configuration	Landscape connection	Toilet connection (s)	Laundry connection	Pool top-up	Spa top-up
None	-	-	-	-	-	-	-	-

(ii) Energy	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) The applicant must comply with the commitments listed below in carrying out the development of a dwelling listed in a table below.			
(b) The applicant must install each hot water system specified for the dwelling in the table below, so that the dwelling's hot water is supplied by that system. If the table specifies a central hot water system for the dwelling, then the applicant must connect that central system to the dwelling, so that the dwelling's hot water is supplied by that central system.	✔	✔	✔
(c) The applicant must install, in each bathroom, kitchen and laundry of the dwelling, the ventilation system specified for that room in the table below. Each such ventilation system must have the operation control specified for it in the table.		✔	✔
(d) The applicant must install the cooling and heating system/s specified for the dwelling under the "Living areas" and "Bedroom areas" headings of the "Cooling" and "Heating" columns in the table below, in/for at least 1 living/bedroom area of the dwelling. If no cooling or heating system is specified in the table for "Living areas" or "Bedroom areas", then no systems may be installed in any such areas. If the term "zoned" is specified beside an air conditioning system, then the system must provide for day/night zoning between living areas and bedrooms.		✔	✔
(e) This commitment applies to each room or area of the dwelling which is referred to in a heading to the "Artificial lighting" column of the table below (but only to the extent specified for that room or area). The applicant must ensure that the "primary type of artificial lighting" for each such room in the dwelling is fluorescent lighting or light emitting diode (LED) lighting. If the term "dedicated" is specified for a particular room or area, then the light fittings in that room or area must only be capable of being used for fluorescent lighting or light emitting diode (LED) lighting.		✔	✔

(ii) Energy	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(f) This commitment applies to each room or area of the dwelling which is referred to in a heading to the "Natural lighting" column of the table below (but only to the extent specified for that room or area). The applicant must ensure that each such room or area is fitted with a window and/or skylight.	✔	✔	✔
(g) This commitment applies if the applicant installs a water heating system for the dwelling's pool or spa. The applicant must:			
(aa) install the system specified for the pool in the "Individual Pool" column of the table below (or alternatively must not install any system for the pool). If specified, the applicant must install a timer, to control the pool's pump; and		✔	
(bb) install the system specified for the spa in the "Individual Spa" column of the table below (or alternatively must not install any system for the spa). If specified, the applicant must install a timer to control the spa's pump.		✔	
(h) The applicant must install in the dwelling:			
(aa) the kitchen cook-top and oven specified for that dwelling in the "Appliances & other efficiency measures" column of the table below;		✔	
(bb) each appliance for which a rating is specified for that dwelling in the "Appliances & other efficiency measures" column of the table, and ensure that the appliance has that minimum rating; and		✔	✔
(cc) any clothes drying line specified for the dwelling in the "Appliances & other efficiency measures" column of the table.		✔	
(i) If specified in the table, the applicant must carry out the development so that each refrigerator space in the dwelling is "well ventilated".		✔	

	Hot water	Bathroom ventilation system		Kitchen ventilation system		Laundry ventilation system	
Dwelling no.	Hot water system	Each bathroom	Operation control	Each kitchen	Operation control	Each laundry	Operation control
All dwellings	central hot water system 3	individual fan, ducted to façade or roof	interlocked to light	individual fan, ducted to façade or roof	manual switch on/off	individual fan, ducted to façade or roof	manual switch on/off

	Cooling		Heating		Artificial lighting						Natural lighting	
Dwelling no.	living areas	bedroom areas	living areas	bedroom areas	No. of bedrooms &/or study	No. of living &/or dining rooms	Each kitchen	All bathrooms/ toilets	Each laundry	All hallways	No. of bathrooms &/or toilets	Main kitchen
C101, C501, C601	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	3	1	yes	yes	yes	yes	0	no
C102, C104, C106, C208, C301, C308, C401, C408, C503, C603	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	2	1	yes	yes	yes	yes	0	no
C103, C202, C204, C205, c302, C304, C305, C402, C404, C405	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1	1	yes	yes	yes	yes	0	no
All other dwellings	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	2	1	yes	yes	yes	yes	0	yes

	Individual pool		Individual spa		Appliances & other efficiency measures							
Dwelling no.	Pool heating system	Timer	Spa heating system	Timer	Kitchen cooktop/oven	Refrigerator	Well ventilated fridge space	Dishwasher	Clothes washer	Clothes dryer	Indoor or sheltered clothes drying line	Private outdoor or unsheltered clothes drying line
All dwellings	-	-	-	-	gas cooktop & electric oven	-	yes	-	-	-	no	no

(iii) Thermal Comfort	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) The applicant must attach the certificate referred to under "Assessor details" on the front page of this BASIX certificate (the "Assessor Certificate") to the development application and construction certificate application for the proposed development (or, if the applicant is applying for a complying development certificate for the proposed development, to that application). The applicant must also attach the Assessor Certificate to the application for a final occupation certificate for the proposed development.			
(b) The Assessor Certificate must have been issued by an Accredited Assessor in accordance with the Thermal Comfort Protocol.			
(c) The details of the proposed development on the Assessor Certificate must be consistent with the details shown in this BASIX Certificate, including the details shown in the "Thermal Loads" table below.			
(d) The applicant must show on the plans accompanying the development application for the proposed development, all matters which the Thermal Comfort Protocol requires to be shown on those plans. Those plans must bear a stamp of endorsement from the Accredited Assessor, to certify that this is the case.	✔		
(e) The applicant must show on the plans accompanying the application for a construction certificate (or complying development certificate, if applicable), all thermal performance specifications set out in the Assessor Certificate, and all aspects of the proposed development which were used to calculate those specifications.		✔	
(f) The applicant must construct the development in accordance with all thermal performance specifications set out in the Assessor Certificate, and in accordance with those aspects of the development application or application for a complying development certificate which were used to calculate those specifications.		✔	✔
(g) Where there is an in-slab heating or cooling system, the applicant must: (aa) Install insulation with an R-value of not less than 1.0 around the vertical edges of the perimeter of the slab; or (bb) On a suspended floor, install insulation with an R-value of not less than 1.0 underneath the slab and around the vertical edges of the perimeter of the slab.	✔	✔	✔
(h) The applicant must construct the floors and walls of the development in accordance with the specifications listed in the table below.	✔	✔	✔

	Thermal loads	
Dwelling no.	**Area adjusted heating load (in mJ/m²/yr)**	**Area adjusted cooling load (in mJ/m²/yr)**
C101	27.0	13.0
C102	18.0	25.0
C103	18.0	9.0
C104	21.0	11.0
C105	28.0	25.0
C106	38.0	19.0
C202	6.0	22.0
C203	15.0	32.0
C204	11.0	12.0
C206	26.0	25.0
C207	49.0	26.0
C208	49.0	13.0
C303	16.0	32.0
C304	12.0	12.0
C306	27.0	24.0
C307	50.0	26.0
C308	50.0	13.0
C401	44.0	14.0
C402	12.0	21.0
C403	19.0	27.0
C404	15.0	10.0
C405	18.0	11.0
C406	33.0	20.0
C407	57.0	22.0
C408	56.0	11.0
C501	35.0	15.0
C502	23.0	26.0

	Thermal loads	
Dwelling no.	**Area adjusted heating load (in mJ/m²/yr)**	**Area adjusted cooling load (in mJ/m²/yr)**
C503	19.0	19.0
C504	41.0	29.0
C601	38.0	13.0
C602	26.0	23.0
C603	16.0	17.0
C604	42.0	26.0
c302	8.0	23.0
C201, C301	27.0	18.0
All other dwellings	13.0	13.0

(b) Common areas and central systems/facilities

(i) Water	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) If, in carrying out the development, the applicant installs a showerhead, toilet, tap or clothes washer into a common area, then that item must meet the specifications listed for it in the table.		✔	✔
(b) The applicant must install (or ensure that the development is serviced by) the alternative water supply system(s) specified in the "Central systems" column of the table below. In each case, the system must be sized, be configured, and be connected, as specified in the table.	✔	✔	✔
(c) A swimming pool or spa listed in the table must not have a volume (in kLs) greater than that specified for the pool or spa in the table.	✔	✔	
(d) A pool or spa listed in the table must have a cover or shading if specified for the pool or spa in the table.		✔	
(e) The applicant must install each fire sprinkler system listed in the table so that the system is configured as specified in the table.		✔	✔
(f) The applicant must ensure that the central cooling system for a cooling tower is configured as specified in the table.		✔	✔

Common area	Showerheads rating	Toilets rating	Taps rating	Clothes washers rating
All common areas	no common facility	no common facility	3 star	no common laundry facility

(ii) Energy	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) If, in carrying out the development, the applicant installs a ventilation system to service a common area specified in the table below, then that ventilation system must be of the type specified for that common area, and must meet the efficiency measure specified.		✔	✔
(b) In carrying out the development, the applicant must install, as the "primary type of artificial lighting" for each common area specified in the table below, the lighting specified for that common area. This lighting must meet the efficiency measure specified. The applicant must also install a centralised lighting control system or Building Management System (BMS) for the common area, where specified.		✔	✔
(c) The applicant must install the systems and fixtures specified in the "Central energy systems" column of the table below. In each case, the system or fixture must be of the type, and meet the specifications, listed for it in the table.	✔	✔	✔

	Common area ventilation system		Common area lighting		
Common area	**Ventilation system type**	**Ventilation efficiency measure**	**Primary type of artificial lighting**	**Lighting efficiency measure**	**Lighting control system/BMS**
Car park area (C)(LB)	ventilation (supply + exhaust)	carbon monoxide monitor + VSD fan	fluorescent	zoned switching with motion sensor	No
Lift car (No.3)	-	-	fluorescent	connected to lift call button	No
Garbage room (C)(LB)	ventilation exhaust only	-	fluorescent	motion sensors	No
Service Area (C)(LB)	ventilation exhaust only	thermostatically controlled	fluorescent	manual on / manual off	No
Service Area (C)(LG)	ventilation exhaust only	thermostatically controlled	fluorescent	manual on / manual off	No
Plant Area (C)(L6)	no mechanical ventilation	-	fluorescent	manual on / manual off	No
Ground floor lobby type (C)(LG)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (C)(L1)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (C)(L2)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (C)(L3)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (C)(L4)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (C)(L5)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No

Central energy systems	Type	Specification
Central hot water system (No. 3)	gas-fired storage (manifolded)	Piping insulation (ringmain & supply risers): (b) Piping internal to building: R1.0 (~38 mm)
Lift (No. 3)	gearless traction with V V V F motor	Number of levels (including basement): 8

4. Commitments for Residential flat buildings - Building D

(a) Dwellings

(i) Water	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) The applicant must comply with the commitments listed below in carrying out the development of a dwelling listed in a table below.			
(b) The applicant must plant indigenous or low water use species of vegetation throughout the area of land specified for the dwelling in the "Indigenous species" column of the table below, as private landscaping for that dwelling. (This area of indigenous vegetation is to be contained within the "Area of garden and lawn" for the dwelling specified in the "Description of Project" table).	✔	✔	
(c) If a rating is specified in the table below for a fixture or appliance to be installed in the dwelling, the applicant must ensure that each such fixture and appliance meets the rating specified for it.		✔	✔
(d) The applicant must install an on demand hot water recirculation system which regulates all hot water use throughout the dwelling, where indicated for a dwelling in the "HW recirculation or diversion" column of the table below.		✔	✔
(e) The applicant must install: (aa) a hot water diversion system to all showers, kitchen sinks and all basins in the dwelling, where indicated for a dwelling in the "HW recirculation or diversion" column of the table below; and (bb) a separate diversion tank (or tanks) connected to the hot water diversion systems of at least 100 litres. The applicant must connect the hot water diversion tank to all toilets in the dwelling.		✔ ✔	✔ ✔
(e) The applicant must not install a private swimming pool or spa for the dwelling, with a volume exceeding that specified for it in the table below.	✔	✔	
(f) If specified in the table, that pool or spa (or both) must have a pool cover or shading (or both).		✔	
(g) The pool or spa must be located as specified in the table.	✔	✔	
(h) The applicant must install, for the dwelling, each alternative water supply system, with the specified size, listed for that dwelling in the table below. Each system must be configured to collect run-off from the areas specified (excluding any area which supplies any other alternative water supply system), and to divert overflow as specified. Each system must be connected as specified.	✔	✔	✔

	Fixtures					Appliances		Individual pool				Individual spa		
Dwelling no.	All shower-heads	All toilet flushing systems	All kitchen taps	All bathroom taps	HW recirculation or diversion	All clothes washers	All dish-washers	Volume (max volume)	Pool cover	Pool location	Pool shaded	Volume (max volume)	Spa cover	Spa shaded
All dwellings	3 star (> 4.5 but <= 6 L/min)	3 star	5 star	5 star	no	-	-	-	-	-	-	-	-	-

	Alternative water source							
Dwelling no.	Alternative water supply systems	Size	Configuration	Landscape connection	Toilet connection (s)	Laundry connection	Pool top-up	Spa top-up
None	-	-	-	-	-	-	-	-

(ii) Energy	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) The applicant must comply with the commitments listed below in carrying out the development of a dwelling listed in a table below.			
(b) The applicant must install each hot water system specified for the dwelling in the table below, so that the dwelling's hot water is supplied by that system. If the table specifies a central hot water system for the dwelling, then the applicant must connect that central system to the dwelling, so that the dwelling's hot water is supplied by that central system.	✔	✔	✔
(c) The applicant must install, in each bathroom, kitchen and laundry of the dwelling, the ventilation system specified for that room in the table below. Each such ventilation system must have the operation control specified for it in the table.		✔	✔
(d) The applicant must install the cooling and heating system/s specified for the dwelling under the "Living areas" and "Bedroom areas" headings of the "Cooling" and "Heating" columns in the table below, in/for at least 1 living/bedroom area of the dwelling. If no cooling or heating system is specified in the table for "Living areas" or "Bedroom areas", then no systems may be installed in any such areas. If the term "zoned" is specified beside an air conditioning system, then the system must provide for day/night zoning between living areas and bedrooms.		✔	✔
(e) This commitment applies to each room or area of the dwelling which is referred to in a heading to the "Artificial lighting" column of the table below (but only to the extent specified for that room or area). The applicant must ensure that the "primary type of artificial lighting" for each such room in the dwelling is fluorescent lighting or light emitting diode (LED) lighting. If the term "dedicated" is specified for a particular room or area, then the light fittings in that room or area must only be capable of being used for fluorescent lighting or light emitting diode (LED) lighting.		✔	✔

(ii) Energy	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(f) This commitment applies to each room or area of the dwelling which is referred to in a heading to the "Natural lighting" column of the table below (but only to the extent specified for that room or area). The applicant must ensure that each such room or area is fitted with a window and/or skylight.	✔	✔	✔
(g) This commitment applies if the applicant installs a water heating system for the dwelling's pool or spa. The applicant must:			
(aa) install the system specified for the pool in the "Individual Pool" column of the table below (or alternatively must not install any system for the pool). If specified, the applicant must install a timer, to control the pool's pump; and		✔	
(bb) install the system specified for the spa in the "Individual Spa" column of the table below (or alternatively must not install any system for the spa). If specified, the applicant must install a timer to control the spa's pump.		✔	
(h) The applicant must install in the dwelling:			
(aa) the kitchen cook-top and oven specified for that dwelling in the "Appliances & other efficiency measures" column of the table below;		✔	
(bb) each appliance for which a rating is specified for that dwelling in the "Appliances & other efficiency measures" column of the table, and ensure that the appliance has that minimum rating; and		✔	✔
(cc) any clothes drying line specified for the dwelling in the "Appliances & other efficiency measures" column of the table.		✔	
(i) If specified in the table, the applicant must carry out the development so that each refrigerator space in the dwelling is "well ventilated".		✔	

	Hot water	Bathroom ventilation system		Kitchen ventilation system		Laundry ventilation system	
Dwelling no.	Hot water system	Each bathroom	Operation control	Each kitchen	Operation control	Each laundry	Operation control
All dwellings	central hot water system 4	individual fan, ducted to façade or roof	interlocked to light	individual fan, ducted to façade or roof	manual switch on/off	individual fan, ducted to façade or roof	manual switch on/off

	Cooling		Heating		Artificial lighting						Natural lighting	
Dwelling no.	living areas	bedroom areas	living areas	bedroom areas	No. of bedrooms &/or study	No. of living &/or dining rooms	Each kitchen	All bathrooms/ toilets	Each laundry	All hallways	No. of bathrooms &/or toilets	Main kitchen
D103	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	3	1	yes	yes	yes	yes	0	yes
D501, D601	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1	1	yes	yes	yes	yes	0	yes
D207, D307, D407, D505	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	3	1	yes	yes	yes	yes	0	no
D203, D303, D403, D502, D602	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1	1	yes	yes	yes	yes	0	no
D101, D202, D205, D302, D305, D402, D405, D504, D604	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	2	1	yes	yes	yes	yes	0	yes
All other dwellings	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	1-phase airconditioning 2 Star (new rating)	2	1	yes	yes	yes	yes	0	no

	Individual pool		Individual spa		Appliances & other efficiency measures							
Dwelling no.	Pool heating system	Timer	Spa heating system	Timer	Kitchen cooktop/oven	Refrigerator	Well ventilated fridge space	Dishwasher	Clothes washer	Clothes dryer	Indoor or sheltered clothes drying line	Private outdoor or unsheltered clothes drying line
All dwellings	-	-	-	-	gas cooktop & electric oven	-	yes	-	-	-	no	no

(iii) Thermal Comfort	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) The applicant must attach the certificate referred to under "Assessor details" on the front page of this BASIX certificate (the "Assessor Certificate") to the development application and construction certificate application for the proposed development (or, if the applicant is applying for a complying development certificate for the proposed development, to that application). The applicant must also attach the Assessor Certificate to the application for a final occupation certificate for the proposed development.			
(b) The Assessor Certificate must have been issued by an Accredited Assessor in accordance with the Thermal Comfort Protocol.			
(c) The details of the proposed development on the Assessor Certificate must be consistent with the details shown in this BASIX Certificate, including the details shown in the "Thermal Loads" table below.			
(d) The applicant must show on the plans accompanying the development application for the proposed development, all matters which the Thermal Comfort Protocol requires to be shown on those plans. Those plans must bear a stamp of endorsement from the Accredited Assessor, to certify that this is the case.	✔		
(e) The applicant must show on the plans accompanying the application for a construction certificate (or complying development certificate, if applicable), all thermal performance specifications set out in the Assessor Certificate, and all aspects of the proposed development which were used to calculate those specifications.		✔	
(f) The applicant must construct the development in accordance with all thermal performance specifications set out in the Assessor Certificate, and in accordance with those aspects of the development application or application for a complying development certificate which were used to calculate those specifications.		✔	✔
(g) Where there is an in-slab heating or cooling system, the applicant must: (aa) Install insulation with an R-value of not less than 1.0 around the vertical edges of the perimeter of the slab; or (bb) On a suspended floor, install insulation with an R-value of not less than 1.0 underneath the slab and around the vertical edges of the perimeter of the slab.	✔	✔	✔
(h) The applicant must construct the floors and walls of the development in accordance with the specifications listed in the table below.	✔	✔	✔

	Thermal loads	
Dwelling no.	**Area adjusted heating load (in mJ/m²/yr)**	**Area adjusted cooling load (in mJ/m²/yr)**
D101	38.0	31.0
D102	7.0	31.0
D103	28.0	20.0
D201	29.0	22.0
D202	13.0	33.0
D203	20.0	15.0
D204	21.0	18.0
D205	56.0	34.0
D206	47.0	28.0
D207	28.0	13.0
D301	33.0	23.0
D302	14.0	33.0
D303	21.0	15.0
D304	22.0	17.0
D305	57.0	33.0
D306	48.0	28.0
D307	29.0	13.0
D401	41.0	21.0
D402	20.0	26.0
D403	26.0	14.0
D404	27.0	16.0
D405	51.0	29.0
D406	55.0	24.0
D407	35.0	11.0
D501	33.0	35.0
D502	38.0	14.0
D503	35.0	15.0

	Thermal loads	
Dwelling no.	**Area adjusted heating load (in mJ/m²/yr)**	**Area adjusted cooling load (in mJ/m²/yr)**
D504	50.0	36.0
D505	48.0	15.0
D601	46.0	25.0
D602	40.0	12.0
D603	37.0	13.0
D604	62.0	27.0
All other dwellings	49.0	14.0

(b) Common areas and central systems/facilities

(i) Water	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) If, in carrying out the development, the applicant installs a showerhead, toilet, tap or clothes washer into a common area, then that item must meet the specifications listed for it in the table.		✔	✔
(b) The applicant must install (or ensure that the development is serviced by) the alternative water supply system(s) specified in the "Central systems" column of the table below. In each case, the system must be sized, be configured, and be connected, as specified in the table.	✔	✔	✔
(c) A swimming pool or spa listed in the table must not have a volume (in kLs) greater than that specified for the pool or spa in the table.	✔	✔	
(d) A pool or spa listed in the table must have a cover or shading if specified for the pool or spa in the table.		✔	
(e) The applicant must install each fire sprinkler system listed in the table so that the system is configured as specified in the table.		✔	✔
(f) The applicant must ensure that the central cooling system for a cooling tower is configured as specified in the table.		✔	✔

Common area	Showerheads rating	Toilets rating	Taps rating	Clothes washers rating
All common areas	no common facility	no common facility	3 star	no common laundry facility

(ii) Energy	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) If, in carrying out the development, the applicant installs a ventilation system to service a common area specified in the table below, then that ventilation system must be of the type specified for that common area, and must meet the efficiency measure specified.		✔	✔
(b) In carrying out the development, the applicant must install, as the "primary type of artificial lighting" for each common area specified in the table below, the lighting specified for that common area. This lighting must meet the efficiency measure specified. The applicant must also install a centralised lighting control system or Building Management System (BMS) for the common area, where specified.		✔	✔
(c) The applicant must install the systems and fixtures specified in the "Central energy systems" column of the table below. In each case, the system or fixture must be of the type, and meet the specifications, listed for it in the table.	✔	✔	✔

	Common area ventilation system		Common area lighting		
Common area	**Ventilation system type**	**Ventilation efficiency measure**	**Primary type of artificial lighting**	**Lighting efficiency measure**	**Lighting control system/BMS**
Car park area (D)(LB)	ventilation (supply + exhaust)	carbon monoxide monitor + VSD fan	fluorescent	zoned switching with motion sensor	No
Lift car (No.4)	-	-	fluorescent	connected to lift call button	No
Garbage room (D)(LB)	ventilation exhaust only	-	fluorescent	motion sensors	No
Service Area (D)(LB)	ventilation exhaust only	thermostatically controlled	fluorescent	manual on / manual off	No
Plant Area (D)(L6)	no mechanical ventilation	-	fluorescent	manual on / manual off	No
Ground floor lobby type (D)(LG)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (D)(L1)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (D)(L2)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (D)(L3)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (D)(L4)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No
Hallway/lobby type (D)(L5)	ventilation (supply + exhaust)	time clock or BMS controlled	fluorescent	motion sensors	No

Central energy systems	Type	Specification
Central hot water system (No. 4)	gas-fired storage (manifolded)	Piping insulation (ringmain & supply risers): (b) Piping internal to building: R1.0 (~38 mm)
Lift (No. 4)	gearless traction with V V V F motor	Number of levels (including basement): 8

7. Commitments for common areas and central systems/facilities for the development (non-building specific)

(b) Common areas and central systems/facilities

(i) Water	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) If, in carrying out the development, the applicant installs a showerhead, toilet, tap or clothes washer into a common area, then that item must meet the specifications listed for it in the table.		✔	✔
(b) The applicant must install (or ensure that the development is serviced by) the alternative water supply system(s) specified in the "Central systems" column of the table below. In each case, the system must be sized, be configured, and be connected, as specified in the table.	✔	✔	✔
(c) A swimming pool or spa listed in the table must not have a volume (in kLs) greater than that specified for the pool or spa in the table.	✔	✔	
(d) A pool or spa listed in the table must have a cover or shading if specified for the pool or spa in the table.		✔	
(e) The applicant must install each fire sprinkler system listed in the table so that the system is configured as specified in the table.		✔	✔
(f) The applicant must ensure that the central cooling system for a cooling tower is configured as specified in the table.		✔	✔

Common area	Showerheads rating	Toilets rating	Taps rating	Clothes washers rating
All common areas	no common facility	no common facility	3 star	no common laundry facility

(ii) Energy	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
(a) If, in carrying out the development, the applicant installs a ventilation system to service a common area specified in the table below, then that ventilation system must be of the type specified for that common area, and must meet the efficiency measure specified.		✔	✔
(b) In carrying out the development, the applicant must install, as the "primary type of artificial lighting" for each common area specified in the table below, the lighting specified for that common area. This lighting must meet the efficiency measure specified. The applicant must also install a centralised lighting control system or Building Management System (BMS) for the common area, where specified.		✔	✔
(c) The applicant must install the systems and fixtures specified in the "Central energy systems" column of the table below. In each case, the system or fixture must be of the type, and meet the specifications, listed for it in the table.	✔	✔	✔

Notes

1. In these commitments, "applicant" means the person carrying out the development.
2. The applicant must identify each dwelling, building and common area listed in this certificate, on the plans accompanying any development application, and on the plans and specifications accompanying the application for a construction certificate / complying development certificate, for the proposed development, using the same identifying letter or reference as is given to that dwelling, building or common area in this certificate.
3. This note applies if the proposed development involves the erection of a building for both residential and non-residential purposes (or the change of use of a building for both residential and non-residential purposes). Commitments in this certificate which are specified to apply to a "common area" of a building or the development, apply only to that part of the building or development to be used for residential purposes.
4. If this certificate lists a central system as a commitment for a dwelling or building, and that system will also service any other dwelling or building within the development, then that system need only be installed once (even if it is separately listed as a commitment for that other dwelling or building).
5. If a star or other rating is specified in a commitment, this is a minimum rating.
6. All alternative water systems to be installed under these commitments (if any), must be installed in accordance with the requirements of all applicable regulatory authorities. NOTE: NSW Health does not recommend that stormwater, recycled water or private dam water be used to irrigate edible plants which are consumed raw, or that rainwater be used for human consumption in areas with potable water supply.

Legend

1. Commitments identified with a "✔" in the "Show on DA plans" column must be shown on the plans accompanying the development application for the proposed development (if a development application is to be lodged for the proposed development).
2. Commitments identified with a "✔" in the "Show on CC/CDC plans and specs" column must be shown in the plans and specifications accompanying the application for a construction certificate / complying development certificate for the proposed development.
3. Commitments identified with a "✔" in the "Certifier check" column must be certified by a certifying authority as having been fulfilled. (Note: a certifying authority must not issue an occupation certificate (either interim or final) for a building listed in this certificate, or for any part of such a building, unless it is satisfied that each of the commitments whose fulfilment it is required to monitor in relation to the building or part, has been fulfilled).

Assessor Certificate

Multiple Dwellings

Assessed and issued in accordance with the BASIX Thermal Comfort Protocol for the Simulation Method

Date:	13 September 2018	**BSA File ref:**	**9447**
Assessor			
Name:	Gavin Chambers **Company:** Building Sustainability Assessments	**Assessor #:**	BDAV/13/1491
Address:	7 William Street, HAMILTON NSW 2303		
Phone:	(02) 4962 3439	**Email:**	enquiries@buildingsustainability.net.au
Declaration of interest in the project design:	None		
Project			
Address:	36 Brooks Parade		
	BELMONT NSW 2280	**Climate Zone:**	15
Assessment			
Software:	BERS Pro 4.3		

Affix assessor stamp

Documentation

All details, upon which this assessment has been based, are included in the project documentation that has been stamped and signed by the Assessor issuing this certificate, as identified below:

Drawings used for this assessment:

(Title, Ref.#, Revision, Issue date, etc)

coeve design Brookes Parade 10/09/2018

Thermal Performance Specification (copy on page 2)

Attached to the drawings and is on page: DA02-N

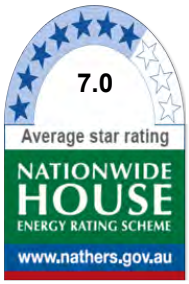
7.0 Average star rating NATIONWIDE HOUSE ENERGY RATING SCHEME www.nathers.gov.au

Certificate no.: 0003174930
Assessor Name: Gavin Chambers
Accreditation no.: VIC/BDAV/13/1491
Certificate date: 13 September 2018
Dwelling Address:
36 Brooks Parade
Belmont, NSW
2280

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Thermal performance specifications **Certificate # 0003174930** **Page 1 of 5**

Unit No.	Floor Areas		Predict. loads (MJ/M²/y)		Star Rating	Basix Floor Type and Area m²
	Cond.	Uncond.	Heat	Cool		
A101	108	0	15	23	7.8	
A201	111	0	30	23	6.9	
A202	110	0	47	23	5.9	
A203	91	0	36	24	6.4	
A204	97	0	19	27	7.3	
A205	100	0	10	17	8.4	
A206	97	0	15	16	8.2	
A301	111	0	25	25	7.0	
A302	110	0	48	23	5.8	
A303	91	0	35	24	6.4	
A304	97	0	18	26	7.4	
A305	100	0	10	23	8.1	
A306	97	0	9	17	8.6	
A401	111	0	30	24	6.8	
A402	110	0	54	21	5.6	

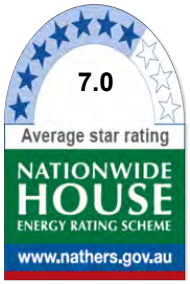


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36 Brooks Parade
Belmont, NSW
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September 2018				BSA Reference: 9447
Building Sustainability Assessments				Ph: (02) 4962 3439
enquiries@buildingsustainability.net.au				www. buildingsustainability.net.au
Important Note				
The following specification was used to achieve the thermal performance values indicated on the Assessor Certificate and takes precedence over any other specification.				
If different construction elements are applied then the Assessor Certificate is no longer valid.				
Thermal Performance Specifications (does not apply to garage)				
External Wall Construction				*Added Insulation*
150 Concrete + Frame + Plasterboard				R2.0
Internal Wall Construction				*Added Insulation*
Plasterboard on studs				none
150 Concrete + Frame + Plasterboard (walls to lobbies, stairwell, liftwell, adjacent unit)				R2.0
Ceiling Construction				*Added Insulation*
Plasterboard				R3.5 to ceilings adjacent to roof and decks above
Roof Construction	*Colour*			*Added Insulation*
Metal	Any			Foil + R1.0 blanket
Concrete	Any			none
Floor Construction	*Covering*			*Added Insulation*
Concrete	As drawn			None
Windows	*Glass and frame type*	*U Value*	*SHGC Range*	*Area sq m*
Performance glazing Type A		*4.60*	*0.32 - 0.40*	Unit D205, D305
Performance glazing Type B		*4.60*	*0.41 - 0.51*	Unit D205, D305
Performance glazing Type A		*4.50*	*0.45 - 0.55*	Unit D405
Performance glazing Type B		*4.50*	*0.55 - 0.67*	Unit D405
ALM-001-01 A	Aluminium Type A Single clear	*6.70*	*0.51 - 0.63*	All other units
ALM-002-01 A	Aluminium Type B Single clear	*6.70*	*0.63 - 0.77*	All other units
Type A windows are awning windows, bifolds, casements, tilt 'n 'turn' windows, entry doors, french doors				
Type B windows are double hung windows, sliding windows & doors, fixed windows, stacker doors, louvres				
Skylights	*Glass and frame type*	*U Value*	*SHGC*	*Area sq m*
U and SHGC values are according to AFRC. Alternate products may be used if the U value is lower and the SHGC is within the range specified				
External Window Shading	*(eaves, verandahs, pergolas, awnings etc)*			
All shade elements modelled as drawn				
Ceiling Penetrations	*(downlights, exhaust fans, flues etc)*			
No adjustment has been made for losses to insulation arising from ceiling penetrations.				

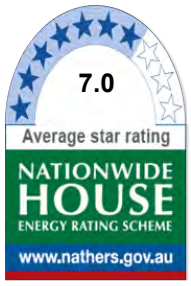
Unit No.	Floor Areas		Predict. loads (MJ/M²/y)		Star Rating	Basix Floor Type and Area m²
	Cond.	Uncond.	Heat	Cool		
A403	91	0	41	21	6.4	
A404	97	0	22	24	7.3	
A405	100	0	13	22	7.9	
A406	97	0	12	15	8.4	
A501	111	0	31	24	6.7	
A502	110	0	55	21	5.4	
A503	91	0	42	20	6.3	
A504	97	0	24	22	7.3	
A505	100	0	15	19	8.0	
A506	97	0	13	15	8.4	
A601	110	0	33	21	6.8	
A602	110	0	57	21	5.4	
A603	106	0	37	23	6.4	
A604	106	0	17	14	8.2	
A701	110	0	35	25	6.4	
A702	110	0	58	21	5.4	
A703	106	0	38	23	6.4	
A704	106	0	21	24	7.4	
A801	110	0	37	28	6.2	
A802	110	0	71	24	4.7	
A803	106	0	45	26	5.8	
A804	106	0	30	31	6.4	
B101	72	0	38	24	6.3	
B102	87	0	17	28	7.3	
B103	54	0	21	19	7.7	
B104	90	0	13	13	8.4	
B201	92	0	33	24	6.6	
B202	89	0	10	30	7.7	
B203	54	0	15	18	8.1	
B204	54	0	16	18	8.0	
B205	86	0	24	30	6.8	
B206	76	0	29	25	6.8	
B207	110	0	44	19	6.3	
B301	92	0	33	24	6.6	
B302	89	0	10	30	7.6	
B303	109	0	15	14	8.4	
B304	86	0	25	30	6.7	
B305	76	0	30	24	6.8	
B306	110	0	44	19	6.3	
B401	92	0	32	24	6.7	
B402	89	0	14	26	7.7	
B403	109	0	18	14	8.2	
B404	86	0	30	25	6.8	
B405	76	0	39	18	6.7	



Certificate no.: 0003174930
Assessor Name: Gavin Chambers
Accreditation no.: VIC/BDAV/13/1491
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Belmont, NSW
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Unit No.	Floor Areas		Predict. loads (MJ/M²/y)		Star Rating	Basix Floor Type and Area m²
	Cond.	Uncond.	Heat	Cool		
B406	110	0	51	16	6.0	
B501	82	0	26	20	7.3	
B502	77	0	26	26	6.9	
B503	98	0	44	30	5.7	
B504	85	0	64	24	4.9	
B601	82	0	33	18	6.9	
B602	77	0	28	23	6.9	
B603	98	0	47	28	5.6	
B604	85	0	66	23	4.9	
C101	120	0	27	13	7.7	
C102	83	0	18	25	7.4	
C103	68	0	18	9	8.4	
C104	61	0	21	11	8.2	
C105	85	0	28	25	6.9	
C106	103	0	38	19	6.6	
C201	90	0	27	18	7.3	
C202	61	0	6	22	8.4	
C203	85	0	15	32	7.2	
C204	68	0	11	12	8.7	
C205	61	0	13	13	8.4	
C206	78	0	26	25	6.9	
C207	77	0	49	26	5.6	
C208	83	0	49	13	6.3	
C301	90	0	27	18	7.3	
C302	61	0	8	23	8.2	
C303	85	0	16	32	7.2	
C304	68	0	12	12	8.7	
C305	61	0	13	13	8.4	
C306	78	0	27	24	6.9	
C307	77	0	50	26	5.6	
C308	83	0	50	13	6.3	
C401	87	0	44	14	6.4	
C402	61	0	12	21	8.1	
C403	85	0	19	27	7.3	
C404	68	0	15	10	8.5	
C405	61	0	18	11	8.4	
C406	78	0	33	20	6.9	
C407	77	0	57	22	5.4	
C408	83	0	56	11	6.1	
C501	108	0	35	15	7.0	
C502	74	0	23	26	7.1	
C503	79	0	19	19	7.8	
C504	92	0	41	29	5.9	
C601	108	0	38	13	6.9	



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Unit No.	Floor Areas		Predict. loads (MJ/M²/y)		Star Rating	Basix Floor Type and Area m²
	Cond.	Uncond.	Heat	Cool		
C602	74	0	26	23	7.1	
C603	79	0	16	17	8.1	
C604	92	0	42	26	5.9	
D101	88	0	38	31	5.9	
D102	78	0	7	31	7.8	
D103	91	0	28	20	7.2	
D201	101	0	29	22	6.9	
D202	85	0	13	33	7.3	
D203	79	0	20	15	7.9	
D204	53	0	21	18	7.7	
D205	54	0	56	34	4.9	
D206	96	0	47	28	5.6	
D207	93	0	28	13	7.6	
D301	101	0	33	23	6.7	
D302	85	0	14	33	7.3	
D303	79	0	21	15	7.9	
D304	53	0	22	17	7.7	
D305	54	0	57	33	4.9	
D306	96	0	48	28	5.6	
D307	93	0	29	13	7.6	
D401	101	0	41	21	6.3	
D402	85	0	20	26	7.3	
D403	79	0	26	14	7.7	
D404	53	0	27	16	7.4	
D405	54	0	51	29	5.4	
D406	96	0	55	24	5.4	
D407	93	0	35	11	7.3	
D501	97	0	33	35	5.9	
D502	55	0	38	14	6.9	
D503	53	0	35	15	7.0	
D504	91	0	50	36	4.9	
D505	80	0	48	15	6.3	
D601	97	0	46	25	5.8	
D602	55	0	40	12	6.9	
D603	53	0	37	13	6.9	
D604	91	0	62	27	4.9	
D605	80	0	49	14	6.3	

7.0
Average star rating
NATIONWIDE HOUSE ENERGY RATING SCHEME
www.nathers.gov.au

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Assessor Name: Gavin Chambers
Accreditation no.: VIC/BDAV/13/1491
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2280

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KML Joint Venture

Proposed Multi-storey Development

Brooks Parade, Sharp Street and Edgar Streets Belmont NSW

Geotechnical Report

Report No. RGS01385.1 - AC

13 February 2018

REGIONAL
GEOTECHNICAL SOLUTIONS

REGIONAL GEOTECHNICAL SOLUTIONS

Manning-Great Lakes

Port Macquarie

Coffs Harbour

RGS01385.1 - AC

13 February 2018

KML Joint Venture
Suite 1
20 Smart Street
CHARLESTOWN NSW 2290

Attention: Tony Brown

Dear Tony

RE: Proposed Multi-storey Development – Belmont NSW

Geotechnical Report

Regional Geotechnical Solutions Pty Ltd (RGS) has completed geotechnical and Phase 1 site contamination assessments at the site of the proposed Belmont Multi-storey Development to be constructed on the block encompassed by Brooks Parade, Sharp Street and Edgar Streets Belmont NSW. This report presents the results of the investigations.

The geotechnical and site contamination assessments are presented in separate reports. This report presents the results of the geotechnical assessment. The site contamination assessment is presented in report number RGS01385.1–AD.

If you have any questions regarding this project, or require any further assistance with this or any other project, please do not hesitate to contact the undersigned.

For and on behalf of

Regional Geotechnical Solutions Pty Ltd

Steven Morton

Principal

Regional Geotechnical Solutions Pty Ltd
ABN 51141848820

44 Bent Street
Wingham 2429
Ph. (02) 6553 5641

Email steve.m@regionalgeotech.com.au
Web: www.regionalgeotech.com.au

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Figure 1 Test Location Plan

Appendices

Appendix A Results of Field Investigations

Appendix B Laboratory Test Results

Appendix C Preliminary Acid Sulfate Soil Management Plan

1 INTRODUCTION

This report presents the results of the geotechnical investigations and assessment undertaken by Regional Geotechnical Solutions Pty Ltd (RGS) for the proposed new Multi-storey Development to be constructed on the block encompassed by Brooks Parade, Sharp Street and Edgar Streets Belmont NSW.

The proposed development is comprised of three, six storey towers and one, eight storey tower with basement parking level parking and landscaped gardens. The towers will be comprised of commercial premises and one, two and three bedroom residential apartments.

The development site is generally level and is situated on the northeastern shore of Lake Macquarie at Belmont, in an area underlain by interbedded sands and estuarine sediments with a high groundwater table.

Taking into account the proposed development details and the likely geotechnical conditions at the site the purpose of the investigation was to obtain an understanding of geotechnical issues at the site and provide comments and recommendations on:

- Site earthworks including site preparation and excavation conditions
- Options for retention and parameters for design of retaining walls
- Foundation conditions including alternative footing types and founding materials, bearing capacities and expected settlements;
- Assessment of "site sub-soil classification" for earthquake design to AS1170.4 - 2007.
- Durability requirements (soil aggressively) for buried structural elements;
- Groundwater conditions including requirements for dewatering
- Pavement thickness design, material requirements and construction recommendations;
- Preliminary acid sulfate soils (ASS) assessment.

2 PROPOSED DEVELOPMENT

The development will cover the majority of the block encompassed by Brooks Parade, Sharp Street, Edgar Street and Maude Street Belmont. The existing developments located at the north-eastern, and north-western corners of the block do not form part of the proposed development. The development will require the demolition of the remaining structures within the site area, which predominantly comprise single storey residential structures with some commercial development fronting Brooks Parade. A concrete lined drainage channel crosses the northern end of the site.

The development will comprise the construction of three, six storey towers and one, eight storey tower. The towers will be comprised of commercial premises and one, two and three bedroom residential apartments. A single level basement car parking level will occupy the majority of the site on the southern side of the drainage channel. A driveway from Edgar and Sharp Streets servicing the basement and loading dock is also proposed.

3 FIELD WORK

Fieldwork for the investigation was undertaken in April 2012 and comprised a site walkover assessment and intrusive investigations. The site walkover included observation and mapping of relevant surface features.

Intrusive investigations included:

- The drilling of eight boreholes using a drill rig;
- The excavation of one hand dug test pit; and
- Dynamic Cone Penetration (DCP) testing at ten locations
- In situ permeability testing at four locations;
- Installation of four standpipe monitoring wells to allow extraction of groundwater samples.

The fieldwork was undertaken in the full time presence of a Senior Geotechnical Engineer from RGS. Engineering logs are presented in Appendix A. The approximate locations, obtained by taped measurements from existing site boundaries, are presented on Figure 1.

4 LABORATORY TESTING

Samples collected during the fieldwork were sent to NATA registered laboratories for testing.

The following geotechnical testing was undertaken:

- One Californian Bearing Ratio (CBR) to assess pavement subgrade design values;
- Sixteen point load strength index tests on recovered rock core;
- Four aggressivity tests to assess durability requirements for buried concrete and steel elements;
- Twenty one acid sulfate soils screening tests; and
- Eight acid sulfate soils CRS test suites.

The results of the testing are presented in Appendix B and discussed in the relevant sections of the report.

5 SITE CONDITIONS

5.1 Surface conditions

The site is located within a coastal environment on the eastern shore of Lake Macquarie approximately 2 km from the coast. The Google earth image below illustrates the site setting and site features.

The site is generally level and located within a low lying Aeolian sand plain at the base of a broad depression within the surrounding gently undulating topography. Beyond the site residual hill-slopes rise gradually to the north and south, and costal dune systems are situated to the east.

Diagram 1: Site Setting and Features



Lake Macquarie is located approximately 50m to the west of the site beyond Brooks Parade and a park reserve. The mean tide level of the lake is approximately 1 to 1.5m below site level.

A concrete lined stormwater drain flows from east to west flowing drain through the northern end of the site.

Existing structures generally comprise single storey houses of timber construction. Three commercial buildings of brick and timber construction occupy the central portion of the Brooks Parade frontage. The existing developments are surrounded by yards comprising grassed lawns, border gardens, with localised concrete pavements and numerous scattered trees and shrubs.

A pump station is located to the north of the stormwater drain at the north –western corner of the site. A recently constructed five storey residential complex with basement car park is located at the corner of Brooks Parade and Maude Street. A similar development is located to the south of the site. The remainder of the site is surrounded by one and two storey residential development. A single level precast panel shopping centre is located to the south east on the opposite side of Edgar Street.

5.2 Subsurface conditions

The 1:250,000 Geology sheet for Sydney indicates the site is underlain by Quaternary alluvial deposits comprising sand, silts clays and gravel. To the north and south of the site the underlying geology comprise the Newcastle Coal Measures comprising shale, sandstone, conglomerate, chert, tuff and coal seams.

In summary the boreholes encountered a subsurface profile generally comprising:

Unit 1 - Topsoil / Fill: Predominantly sand, encountered in all boreholes to depths of between 0.1m to 0.7m; overlying,

Unit 2 - Alluvial / Aeolian Sand: Comprising very loose to loose sand and gravelly sand, encountered below the topsoil and fill in all boreholes.

Unit 3 - Alluvial Clay: Gravelly clay and sandy clay, medium to high plasticity varying from firm to very stiff, encountered below the alluvial sands. A layer of peat approximately 0.6m thick was encountered in in BH3 from a depth of 1.8m.

Unit 4 - Residual Clay: Clay and silty clay of medium to high plasticity, very stiff to hard strength, encountered below the alluvial clays on all boreholes. The residual clays graded into extremely weathered siltstone.

Unit 5 - Weathered Siltstone: The siltstone was extremely weathered (hard residual clay) generally improving with depth to highly to moderately weathered and very low to low strength siltstone. The siltstone was interbedded with sandstone in BH2, BH6, BH7 and BH8 near the siltstone / sandstone interface.

Unit 6 - Weathered Sandstone: The sandstone was generally moderately weathered and low to medium strength improving with depth to slightly weathered to fresh and of medium to high strength.

Further details of the profile encountered are provided in the engineering logs which are presented in Appendix A together with photographs of the rock core.

Sections of up to 0.4m of no core recovery were encountered within some of the cored portions of the boreholes. These sections are likely to represent clay seams in the weathered rock profile. The core contained defects which included predominately partings, joints, clay seams shear zones.

The depth to the base of each of the different materials is summarised in Table 2.

Table 1: Summary of Subsurface Conditions

Unit	Material Description	Depth Encountered (m)							
		BH1	**BH2**	**BH3**	**BH4**	**BH5**	**BH6**	**BH7**	**BH8**
	Surface cover	grass	grass	grass	grass	grass	grass	Concrete 130mm	Concrete 130mm
1	Topsoil / Fill	0 - 0.3	0 - 0.3	0 - 0.1	0 - 0.15	0 - 0.3	0 - 0.2	0 - 0.4	0 - 0.7
2	Aeolian / Alluvial Sand	0.3 - 2.6	0.3 - 2.6	0.1 - 2.4[1]	0.15 - 2.5	0.3 - 2.5	0.2 - 2.8	0.4 - 2.8	0.7 - 2.6
3	Alluvial Clay	2.6 - 4.0	2.6 - 4.0	2.4 - 3.5	2.5 - 3.1	2.5 - 4.0	2.8 - 4.0	2.8 - 4.4	2.6 - 4.5
4	Residual Clay	4.0 - 8.6	4.0 - 6.8	3.5 - 8.2	3.1 - 8.5	4.0 - 8.5	4.0 - 9.0	4.4 - 10	4.5 - 10
5	Extremely weathered Siltstone	8.6 - 11.75	6.8 - 11.5	8.2 - 11.9	8.5 - 12.5	8.5 - 12.5	9.0 - 13.7	10 - 13.58	10 - 12.85
6	Moderately weathered to fresh Sandstone	11.75 - ≥13.2	11.5 - ≥12.9	11.9 - ≥13.4	12.5 - ≥14.5	12.5 - ≥15.85	13.7 - ≥14.45	13.58 - ≥15.25	12.85 - ≥15.0

NOTES:

1. *Peat layer between 1.8m and 2.4m in BH3*

Groundwater was encountered during the drilling of all eight drill rig boreholes. A summary of the groundwater observations is presented in Table 2.

Table 2: Summary of Groundwater Observations

Borehole	Inflow Depth During Drilling (m)	Depth to Water After Completion of Drilling (m)
BH1	Not recorded (1)	Not recorded (2)
BH2	1.5	1.1
BH3	1.5	Not recorded(2)
BH4	1.6	1.1
BH5	1.3	Not recorded(2)
BH6	1.0	0.6
BH7	1.2	Not recorded(2)
BH8	1.0	1.0

NOTES:

1. *Borehole advanced by wash boring methods from 0.6m therefore no meaningful groundwater observations possible.*
2. *No meaningful groundwater observations possible due to water introduced during core drilling.*

It should be noted that groundwater levels may fluctuate seasonally and in response to rainfall and tidal variations.

6 GENERAL SITE CONDITIONS AND CONSTRUCTION PLANNING

The upper soil profile comprises very loose to loose sands which will tend to settle when disturbed by vibration induced movements. Therefore care should be exercised during demolition and construction activities to reduce the potential damage to neighbouring houses and lightly loaded elements of surrounding larger developments which are likely to be founded on shallow footings within the sands. Prior to construction, detailed property condition surveys should be completed for all immediately surrounding properties.

Once demolition of the existing structures is complete, including the removal of footings and services, site works will include the removal of all fill and building debris, any root affected material and any obvious deleterious or otherwise unsuitable material. All such material should be disposed of off-site in accordance with local regulations. Waste classification testing may be required to appropriately assess disposal requirements. Further comments in this regard are provided in the site contamination report (RGS01385.1–AD).

To avoid the risk of damage to adjoining properties during initial site preparation works care should be taken to limit excavations to no more than 1m prior to installing appropriate retention.

Site trafficability was good at the time of the fieldwork which was undertaken over a period of prolonged moderate to heavy rainfall. The near surface soils comprise sands and therefore

working platforms comprising durable crushed rock or recycled crushed concrete would be beneficial in areas of high traffic flows such as site access points.

7 EXCAVATIONS

7.1 Excavation Conditions

The proposed development includes a single basement level and therefore excavations of up to about 3m are anticipated on the southern side of the existing stormwater drainage channel. The excavations will extend up to the property boundaries along all four sides of the excavation. Excavations will generally encounter sand to depths of about 2.5m and clays below 2.5m. Groundwater will be encountered at approximately 1m depth causing collapse of the sand profile into excavations and therefore pre-support and dewatering will be required to support the saturated sands.

Excavation to 3m depth will be achievable using conventional earthmoving equipment such as medium to large sized (20 to 30 tonne) hydraulic excavators.

Other than the bulk excavation required for basement construction temporary, localised excavations such as service trenches that are required to extend into the sands at depths of more than 1.0m will require shoring boxes and/or horizontal dewatering prior to excavation.

7.2 Pre-support and Dewatering

Excavations will extend through the permeable upper sand profile into the underlying low permeability clay below 2.5m depth. The preferred system of pre-support and dewatering would therefore be installation of sheet piles or contiguous reinforced concrete piles around the perimeter of the excavation, socketed into the clay profile below bulk excavation level to a minimum depth of 5m.

Following installation of a system of this nature the excavation could be conducted within the pile walls with inflow restricted to some seepage into the base of the excavation. It is anticipated that inflow through the low permeability clays in the base of the excavation would be restricted to isolated seepage paths such as fissures within the clay. Such inflows could be managed by grading the base of the excavation towards a sump fitted with a pumpout system, and placing a drainage blanket over the floor of the bulk excavation. Taking into account the nature of the materials that will be encountered at bulk excavation level, a working platform over the base of the excavation will be required, and the drainage blanket could be incorporated into this layer.

The basement will be partially constructed below the groundwater table and should be constructed as fully tanked.

7.3 Working Platform

Bulk excavation to basement levels 3m below the existing surface will expose stiff clay below the water table over the floor of the excavation and as such a working platform will be required to render the site trafficable for construction machinery and personnel. The working platform should be underlain by a drainage blanket draining to a sump and pump system to facilitate dewatering of the excavation.

The following procedure is therefore recommended:

- Extend bulk excavation to 700mm below design levels and grade base of excavation towards a sump or series of sumps;
- Place a heavy duty geofabric such as a Bidim A34 over the base of the excavation;
- Place a drainage blanket of 400mm of free draining rockfill, nominally 50 to100mm particle size, over the base of the excavation;
- Place geofabric over the surface of the rock fill;
- Place 300mm select fill working platform over the fabric.

Earthworks should be carried out in accordance with the recommendations outlined in Australian Standard AS3798-1996, *Guidelines on Earthworks for Commercial and Residential Developments*.

8 RETENTION SYSTEMS

8.1 Options and design considerations

Options for pre-support of excavations and permanent support of the basement excavations include sheet piles, contiguous pile walls, and secant pile walls, or a combination of these methods. The use of sheet piles near existing structures is not recommended due to the possibility of damage caused by vibrations during installation.

A contiguous pile wall would be feasible around the majority of the site however secant piles are preferred around the boundary of the property located in the south-western corner of the block. Secant piles will provide a better seal than contiguous piles resulting in lower groundwater inflows into the excavation and reduced chance of loss of material from behind the wall. Any gaps between the piles in a contiguous pile wall will need to be sealed during excavation to reduce loss of material from behind the wall.

8.2 Design Parameters

Retaining walls should be designed on the basis of a triangular lateral earth pressure distribution using the geotechnical parameters presented in Table 3.

Table 3 – Retention Design Parameters

Founding Material	Material Unit Weight (kN/m³)	Effective Friction Angle (°)	At Rest Earth Coefficient Ko	Active Earth Coefficient Ka	Passive Earth Coefficient Kp	Allowable Lateral Capacity (kPa)
Unit 1 Topsoil & Fill	18	25	0.55	0.40	2.5	Nil
Unit 2 Loose Sand	18	28	0.55	0.375	2.8	Nil
Unit 3 Alluvial Clay	17	20	0.5	0.49	2.0	Nil
Unit 4 Residual Clay	18	22	0.7	0.45	2.2	80
Unit 5 EW Siltstone	21	30	0.8	0.3	3.0	450
Unit 6 Sandstone	21	35	0.8	0.27	3.7	800

8.3 Anchored retaining walls

Depending on the amount of lateral movement that can be tolerated and the lateral capacity of the piles, lateral restraint in the form of ground anchors or internal props may be required to support the sheet piles or secant piles. Permission will need to be obtained from adjacent land owners and/or council prior to installing anchors beyond property boundaries. For long term support the retaining walls can be braced by the ground floor slab

The following points are noted in relation to the design of anchored or propped retaining walls:

- Where some adjacent soil movement on the outside of the wall can be tolerated (such as along the eastern and western boundaries adjacent to the footpaths) a rectangular earth pressure distribution of magnitude 6H kPa (where H equals the height of the retained soil in metres) may be adopted.
- Where movement cannot occur (such as along the boundary of the house in the south-western corner) a rectangular earth pressure distribution of magnitude 8H kPa may be adopted.
- Anchors with the bond length within loose sand may be designed using an internal friction angle of 28° and bond stress of 15kPa for the active bond length of the anchor. Anchors

should have a minimum bond length of 3m with the entire bond zone being located behind a line drawn up at 45° from the toe of the excavation. Anchors should be proof loaded to at least 1.3 times their design working capacity before locking off.

- Toe restraint may be designed using the parameters provided in Table 3 (but using a factor of safety of 2) for the materials supporting that portion of the pile founded at least 1m below bulk excavation level.
- For piles founded within the underlying siltstone and sandstone (where retaining wall piles are to be incorporated into the structural footings) lateral resistance can be calculated using the allowable lateral capacities provided in Table 3.
- Any surcharge affecting the walls (e.g. adjacent footings or retaining walls or inclined slopes, traffic loads) should be allowed for in the design.
- Installation of drainage measures will not be possible behind the retaining walls as such they should be designed to withstand full hydrostatic pressures.

8.4 Cantilevered pile walls

Cantilever pile walls can be designed on the basis of a triangular lateral earth pressure distribution using the following parameters outlined in Table 3. The following points are noted:

- For cantilever walls where movement is of little concern, the active earth pressure coefficients (k_a) provided in Table 3 may be adopted for soils assuming a horizontal backfill surface.
- Where the top of the wall is restrained, such as by ground floor slab, or if the walls are retaining areas which are sensitive to movement "at rest" earth pressure coefficients (k_o) should be adopted.
- Any surcharge affecting the walls (e.g. traffic loads, adjacent footings or retaining walls or inclined slopes, traffic loads) should be allowed for in the design.
- Installation of drainage measures will not be possible behind the retaining walls as such they should be designed to withstand full hydrostatic pressures.

9 FOUNDATIONS

9.1 Preferred foundation types

Minor structures that are independent of the main structures may be supported by shallow footings founded with the natural sands. For lightly loaded flexible structures strip footings founded on natural sands with a density index of 50% or better can be proportioned for an allowable base bearing pressure of 50kPa. A peat layer was encountered in borehole BH3 between 1.8 and 2.4m. Therefore where lightly loaded structures on shallow footings are proposed some investigations should be undertaken to assess the presence of localised peat layers or lenses in the building footprint.

On the bases of the investigations undertaken the upper soil profile comprises non-reactive sand soil to beyond the depth of the water table. As such in its current condition the site could be classified as Class 'A' (Non-reactive) in accordance with AS2870 – 2011.

A localised area of fill up to about 0.4m deep was encountered in BH6a and the potential exists for localised deeper fill to be located in other parts of the site. Further to this on completion of earthworks the site classification may change and the resultant classification will be dependent on the nature and reactivity of foundation soils, depth and nature of any fill placed and the degree of compaction, and degree of control testing undertaken on the fill.

All filling required to support structures should be undertaken in accordance with Level 1 construction monitoring and testing as defined in AS3798 – 2007.

9.2 Non-displacement Piles

The main structures on site can be supported by piles founded in the weathered rock below the alluvial and residual soil profile. Options include bored (non-displacement) or driven (displacement) piles.

Non-displacement piles such as bored piles will be required to penetrate low strength soils below the water table and therefore casing will be required in the upper profile to prevent collapse. Alternatively, grout injected continuous flight auger (CFA) piles or steel screw piles could be adopted.

Parameters for the design of non-displacement pile types are outlined in Table 4. Parameters are provided for both limit state design (Ultimate and Serviceability values) or Factor of Safety based design (allowable values based on a FOS = 3). For the purpose of limit state design, serviceability values are based on an assumed tolerable settlement of <1% of pile diameter.

When using the ultimate values outlined in Table 4 for limit state design, a design geotechnical reduction factor should be applied. Selection of appropriate geotechnical reduction factors is discussed in Section 9.4.

Table 4 - Foundation Design Parameters for Non-displacement Piles

Founding Material	Ultimate End Bearing Pressure (MPa)	Serviceability End Bearing Pressure (MPa)	Ultimate Shaft Adhesion (kPa)	Allowable End Bearing Pressure (MPa)	Allowable Lateral Capacity (MPa)	Elastic Modulus (MPa)
Fill and Sand	-	-	-	-	-	-
Alluvial Clay	-	-	-	-	10	-
Residual Clay	-	-	20	-	75	20
EW - HW Siltstone	2.5	0.7	75	0.8	0.45	75
MW Sandstone	4.0	1.0	300	1.5	0.8	200

Notes:

1. *Ultimate values only occur at settlements >5%of minimum footing dimensions.*
2. *Serviceability end bearing values are based on serviceability criteria of estimated settlements <1% of minimum footing dimension*
3. *For pile to carry design loads it is assumed that the pile bases are and walls cleared of debris and for rock socket piles the shaft is roughened to category R2 or better (R2-defined as grooves of depth 1mm to 4mm and width greater than 2mm, at spacing of 50mm to 100mm.*
4. *Minimum socket length of 2 x pile diameter assumed.*

The base of pier holes should be cleaned using a clean out bucket or hand tool as open flight augers often cannot remove sufficient spoil to expose the majority of the base. Pile holes should be dewatered prior to pouring concrete. Alternatively, concrete could be poured using a tremmie line extending to the base of the hole after base cleaning has been completed.

For steel screw piles, shaft adhesion values should be reduced by 50% due to disturbance of material surrounding the shaft. If CFA piles are adopted, effective diameter assumed in shaft adhesion should be reduced by 50mm to allow for the disturbed or smeared zone at the edge of the pile.

Consideration should be given to the uplift loads imposed due to buoyancy forces acting on the tanked basement. The weight of the structure may be sufficient to overcome these forces however if not the piles will need to be designed to accommodate these loads.

9.3 Displacement (driven) Piles

Following bulk excavation, the depth to weathered rock founding material is likely to be of the order of 5m and as such the use of driven timber piles would be feasible. For driven piles taken to a refusal set on the weathered rock, bearing strength will be governed by the structural capacity of the pile. As a guide, 175mm diameter treated timber minipiles driven to refusal will have a structural capacity of the order of 200kN.

9.4 Geotechnical Reduction Factor

For pile design in accordance with AS2159-2009, 'Piling-Design and installation', the ultimate geotechnical strength (Rd,ug) can be calculated using the shaft capacity and ultimate end bearing capacity values provided in Table 4. Calculation of the design geotechnical strength (Rd,g) requires an assessment of the geotechnical strength reduction factor (Φg), which is based on a series of project specific variables. In assessing a suitable geotechnical strength reduction factor for this project, the following assumptions have been made:

- Design of piles and pile groups will be undertaken in accordance with the recommendations presented in this report;
- Limited geotechnical involvement will occur during pile installation;
- No performance monitoring of the supported structure during or after construction; and

- At least one of the piles will be dynamically load tested and analysed with a signal matching system (PDA/CAPWAP or approved equivalent);
- The foundations will be designed by a designer of at least moderate experience in similar geotechnical profiles and pile design;
- Well established pile design methods will be adopted.

Based on the above and in accordance with AS2159-2009, an Individual Risk Rating (IRR) of 3.6 is estimated for the site. Assuming a structure of this type will have low redundancy, a Geotechnical Strength Reduction Factor of Φ_g=0.5 would be appropriate for the site. In the event that any of the assumptions outlined above are not correct, the Geotechnical Strength Reduction Factor may change and in such a case further advice should be sought.

9.5 Earthquake Design Requirements

In accordance with AS1170.4-2007 based on the soil profile present the site would be considered a Class D_e site. A site hazard factor of 0.11 can be adopted for the purposes of earthquake design in the Lake Macquarie area.

9.6 Aggressivity to Buried Structural Elements

The aggressivity test results presented in Table 5 below are compared to the exposure classifications provided in Australian Standard AS2159-2009, *Piling Design and Installation*.

Table 5: Results of Soil Aggressivity Testing

Sample Location	Sample Depth (m)	Sample Type	pH	Soluble Sulfate (%)	Chloride (mg/kg)	Resistivity (ohm.cm)
BH1	4.5 to 4.95	Soil	7.6	<0.1	950	380
BH2	1.6 to 1.95	Soil	6.6	<0.1	65	11200
BH3	7.0 to 7.45	Soil	6.4	<0.1	750	450
BH8	9.0 to 9.45	Soil	6.2	<0.1	1049	370

Comparing the laboratory test results to the exposure classifications provided in Australian Standard AS2159-2009, *Piling Design and Installation* indicates the soil is mildly aggressive to concrete and moderately aggressive to steel elements. As such, it is recommended that concrete elements that come into contact with the ground be designed for a mild exposure classification while steel elements be designed for a moderate exposure classification.

9.7 Bored Pile Excavation Conditions

Due to the presence of ground water within sands well above the level of the founding rock, open bored piles would not be suitable due to likely hole collapse. Construction of bored piles will require casing advanced into the profile using vibratory or screwing methods, embedded into the rock and cleaned out to the rock base. Alternatively, grout injected continuous flight auger (CFA) piles can be adopted.

Soilmec provides a guideline for bored tool selection based on typical RQD and UCS, as shown in Figure 2 below.

For indicative UCS values of 20MPa – 40MPa for HW to SW siltstone and sandstone and RQD of 0% - 70% based on investigations, anticipated sockets into the rock are likely to be achievable using auger and conventional bucket methods.

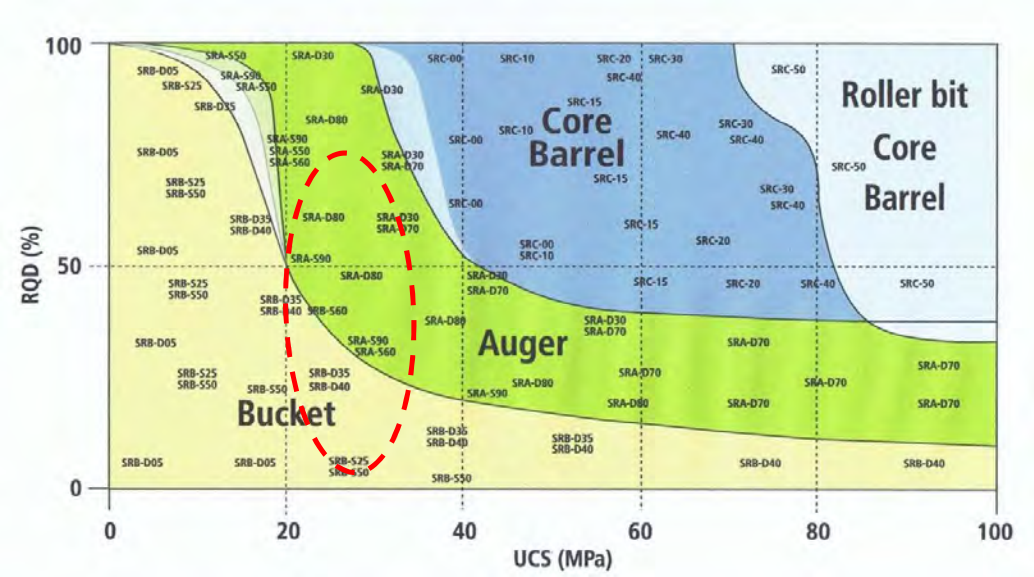


Figure 5.4.1 – Guide to bored pile tool selection, characteristics of HW to SW siltstone and sandstone denoted by red dashed circle. (*Reproduced from Soilmec document 'Rock Drilling Tools' www.soilmec.com*)

10 ACID SULFATE SOILS (ASS)

10.1 ASS Testing

Samples collected during the fieldwork were sent to Biotrack for ASS laboratory testing. The following testing was undertaken:

- Twenty one Screening tests;
- Eight Chromium Reducible Sulfur (CRS) tests.

The results of the screening tests are presented in Appendix B. The following points are noted from the screening tests:

- Soil in water did not produce pH < 4 for the samples tested. Soil in water with a pH < 4 in this test is an indication of actual acid sulfate soil;
- Oxidation with hydrogen peroxide produced pH < 3 for nine of the samples tested. Soil in a peroxide solution with a pH < 3 in this test is an indication of potential acid sulfate soil.

Based on the results of the screening tests eight samples were selected for CRS analysis. Results for $\%S_{KCl}$, S_{Cr} and TAA are compared to action criteria presented in the ASSMAC 1998 *Acid Sulfate Soil Assessment Guidelines* in Table 6 below. The laboratory CRS test results are presented in Appendix B.

Table 6: Summary of ASS CRS Laboratory Testing

Sample Location	Depth (m)	Texture	Percentage Sulphur in the KCL Extract ($\%S_{KCl}$)	Reduced Inorganic Sulfur ($\%S_{cr}$)	Action Criteria For $\%S_{cr}$	Total Actual Acidity (TAA) moleH^+/tonne	Action Criteria for TAA
BH1	3.0 to 3.45	Fine	0.01	**0.13**	0.03	3	18
BH2	1.6 to 1.95	Coarse	< 0.01	0.01	0.03	< 1	18
BH4	1.5 to 1.95	Coarse	< 0.01	< 0.01	0.03	< 1	18
BH5	3.1 to 3.45	Fine	< 0.01	**0.14**	0.03	< 1	18
BH6	1.5 to 1.95	Coarse	0.02	**0.14**	0.03	8	18
BH7	3.0 to 3.45	Fine	0.02	**0.53**	0.03	3	18
BH7	6.0 to 6.45	Fine	<0.01	**0.05**	0.03	< 1	18
BH8	3 to 3.45	Fine	0.03	**0.61**	0.03	< 1	18

NOTE:

1. *Action criteria adopted are based on disturbance of over 1000 tonnes of acid sulfate soils.*

The ASSMAC (1998) action criteria trigger the need to prepare an Acid Sulfate Soil Management Plan and obtain development consent. The action criteria are based on oxidisable sulfur concentrations for three differing soil textures, however, where more than 1000 tonnes of soil is to be disturbed the criteria for coarse textured soils applies. The proposed development will disturb more than 1000 tonnes of soil, therefore action criteria for this site are based on 0.03% oxidisable sulphur, or an acidity of 18 moles per tonne.

10.2 Conclusions

Testing showed concentrations of TAA below the action criteria of 18 moles H^+/tonne. The soils are slightly acidic, and extractable sulfur ($\%S_{KCl}$) levels are low which indicates that the acidity is not sulfuric in nature. However, SCr and SEQ levels are high in two cases (BH7 and BH8) indicating these soils are Potential Acid Sulfate Soils (PASS).

The testing indicates the sands overlying the site are naturally slightly acidic however the acid is not sulfuric in nature. The alluvial clays underlying the sands at depths of between about 2.4m and 4.5m are PASS. An ASS Management Plan will be required for the excavation of the alluvial clays.

A preliminary ASSMP is provided in Appendix C. This plan can form the basis of a detailed ASSMP which can be prepared for the site once final details of excavation location, extent and depth are known.

11 BASEMENT FLOOR SLABS AND PAVEMENTS

The basement floor slab will be cast over the working platform to be constructed on the alluvial clay subgrade exposed at the base of the excavation. A fully tanked basement will be required. As such the floor slab will be integral with the basement perimeter walls and internal columns.

The slab will be required to support vehicular movements associated with the car park. It has been assumed that the basement car park will not be accessible to heavy vehicles. Therefore, taking into account anticipated vehicle loads and likely subgrade conditions, the floor slab should incorporate a minimum 170mm thick slab of 4.0MPa concrete. It is likely that the structural design of the slab will be governed by the requirement to resist uplift pressures on the base of the slab.

12 LIMITATIONS

The findings presented in the report and used as the basis for recommendations presented herein were obtained using normal, industry accepted geotechnical and pavement design practises and standards. To our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, however, can it be considered that these findings represent the actual state of the site at all points. If site conditions encountered during construction vary significantly from those discussed in this report, Regional Geotechnical Solutions Pty Ltd should be contacted for further advice.

This report alone should not be used by contractors as the basis for preparation of tender documents or project estimates. Contractors using this report as a basis for preparation of tender documents should avail themselves of all relevant background information regarding the site before deciding on selection of construction materials and equipment.

If you have any questions regarding this project, or require any additional consultations, please contact the undersigned.

For and on behalf of

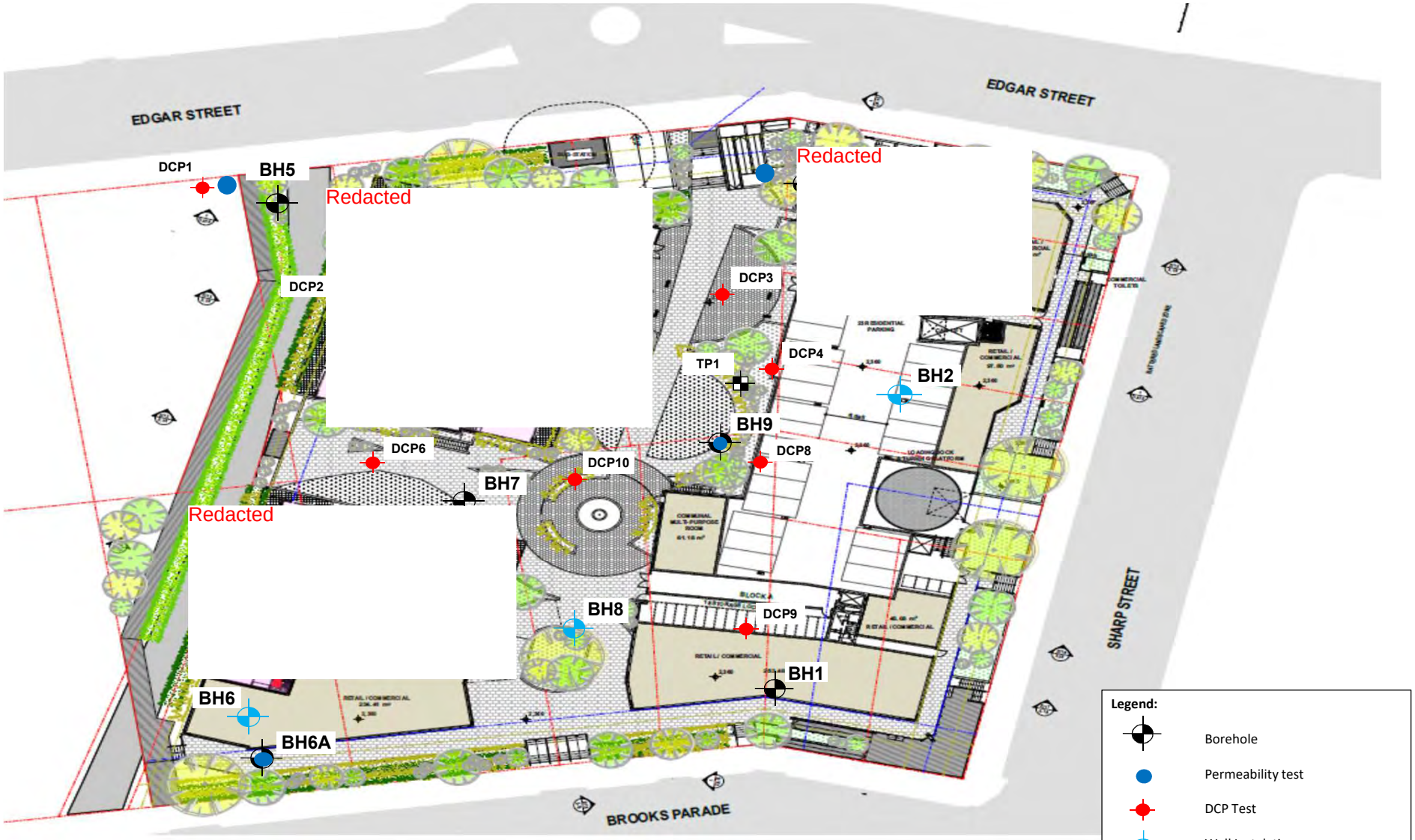
Regional Geotechnical Solutions Pty Ltd



Steve Morton

Principal Geotechnical Engineer

Figures



NOT TO SCALE

REGIONAL GEOTECHNICAL SOLUTIONS	**Client**	KML Joint Venture	Job No.	RGS01385.1
	Project:	Proposed Multi-storey Development Belmont	Drawn By:	AH
			Date:	13-Feb-18
	Title:	Test Location Plan	Drawing No.	**FIGURE 1**

Appendix A

Results of Field Investigations

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH1

CLIENT: KML Joint Venture
PAGE: 1 OF 3

PROJECT NAME: Proposed Multi-Storey Development
JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1
DATE: 11/4/12

DRILL TYPE: XC Track Mounted
SURFACE RL:

BOREHOLE DIAMETER: 100 mm
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
ADTC							Topsoil/Fill: Silty SAND, fine grained, brown, contains fine to medium rounded gravel and rootlets	M				0.00: TOPSOIL: FILL: Grassed
							0.30m					0.30: ALLUVIAL
						SP	SAND, medium to coarse grained, orange, brown, contains medium to coarse subrounded gravel					
				1.0			1.00m					
CB		1.50m SPT 2,2,1 N=3 1.95m				SP	Gravelly SAND, medium to coarse subrounded, grey, gravel is fine to medium grained, subrounded	W	L			
				2.0			2.60m					
		3.00m SPT 2,3,3 N=6 3.45m		3.0		CL	Gravelly CLAY, medium plasticity, grey, gravel is medium to coarse grained, subrounded, claystone, contains medium to coarse grained Sand	M ~ w_P	St - VSt			
				4.0			4.00m					
RR		4.50m SPT 3,5,8 N=13 4.95m				CH	Silty CLAY, high plasticity, pale grey, contains coal bands	M ~ w_P				4.00: RESIDUAL
							4.50m					
				5.0			Clayey SILT, medium to high plasticity, pale grey					
		6.00m SPT 3,4,6 N=10 6.45m		6.0		MH		W	VSt			
				7.0								

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LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH1**

CLIENT: KML Joint Venture

PAGE: 2 OF 3

PROJECT NAME: Proposed Multi-Storey Development

JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1

DATE: 11/4/12

DRILL TYPE: XC Track Mounted

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
RR						MH	Clayey SILT, medium to high plasticity, pale grey *(continued)*	W	VSt			
							8.60m					
				9.0		MH	SILTSTONE, fine to medium grained, grey-brown and orange-brown, very low strength					8.60: Reduction in Drilling Resistence
							9.00m					
							Continued as Cored Drill Hole					
				10.0								
				11.0								
				12.0								
				13.0								
				14.0								
				15.0								

LEGEND:

Water

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes

- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

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REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: **BH1**

CLIENT: KML Joint Venture | **PAGE:** 3 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 11/4/12

DRILL TYPE: XC Track Mounted | **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm | **DATUM:** AHD

Drilling and Sampling					Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	CORE LIFT / TEST	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
				9.0		START CORING AT 9.00m						
NMLC						Start Coring at 9.0m, No Core 0.4m						
				10.0		SILTSTONE, fine grained, grey with orange-brown bands	EW	VL				PT 0° SN PT 0° SN PT 0° SN PT 0° SN PT 0° SN PT 0° SN CS PT 0° SN PT 0° SN PT 0° SN
		10.5					HW	L		0	50	
				11.0			HW - MW	VL - L	A=0.45	13	300 50	PT 0° SN PT 0° SN PT 0° SN CZ 30mm thick
		11.7									100	PT 0°
				12.0		SANDSTONE, fine to medium grained, grey, instinctly bedded	SW	L - M		60	300	PT 5° PT 0° SZ 0° PT 5° SZ 5° PT 0° PT 5° JT 10° CN UN RO PT 5° PT 10°
		13.2		13.0				M	A=1.42			
				14.0		Hole Terminated at 13.20 m						
				15.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Method

AS	Auger Screwing
AD	Auger Drilling
RR	Roller/tricone
CB	Claw or Blade bit
NMLC	NMLC Core

Field Tests

HP	Hand Penetrometer

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength

		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
SS	Sheared Surface
CS	Crushed Seam

Roughness

VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating

CN	Clean
SN	Stained
VN	Veneer
CO	Coating

Planarity

PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

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REGIONAL GEOTECHNICAL SOLUTIONS	**Client**	KML Joint Venture	Job No.	RGS01385.1
	Project:	Proposed Multi-storey Development	Drawn By:	Adam Holzhauser
		Belmont	Date:	28-May-12
	Title:	Core Photograph - BH1	Photo No.	1

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH2

CLIENT: KML Joint Venture
PAGE: 1 OF 3

PROJECT NAME: Proposed Multi-Storey Development
JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1
DATE: 11/4/12

DRILL TYPE: XC Track Mounted
SURFACE RL:

BOREHOLE DIAMETER: 100 mm
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
NMLC							0.20m TOPSOIL, Silty SAND, fine grained, orange-brown, contains rootlets	D				0.00: TOPSOIL: GRASSED
						SM	Silty SAND, fine grained, dark grey	D	VL			0.20: AEOLIAN
				1.0			0.80m					
						SP	Gravelly SAND, medium to coarse grained, grey, gravel is medium to coarse grained, rounded	M				0.80: ALUVIAL
		1.30m SPT 3,1,1 N=2 1.75m					1.50m					
				2.0		SP	SAND, fine to medium grained, grey, contains a trace of fine to medium rounded gravel	W	VL			
							2.60m					
							2.80m Sandy Clay, medium plasticity dark Grey		St			
		2.90m SPT 2,4,6 N=10 3.35m		3.0		CH	Gravely Clay, medium to high plasticity dark grey, Gravel is medium to coarse grained subrounded Siltstone ironstone contains some fine to medium grained Sand		VSt			3.00: ALLUVIAL CLAY
				4.0			4.00m					
		4.20m SPT 2,3,3 N=6 4.65m				CH	Silty Clay, medium to high plasticity, pale grey contains trace of thin coal seams		VSt			4.00: RESIDUAL NO SAMPLE RECOVERY
				5.0								
				6.0								
		7.00m SPT 3,12,7 N=19 7.45m		7.0			6.95m					
						CH	Silty Clay medium to high plasticity, pale grey mottled Orange brown with some highly weathered Siltstone Sands		VSt - H			6.80: EXTREMELY WEATHERED SILTSTONE

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

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REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH2**

CLIENT: KML Joint Venture | **PAGE:** 2 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 11/4/12

DRILL TYPE: XC Track Mounted | **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm | **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
						CH	Silty Clay medium to high plasticity, pale grey mottled Orange brown with some highly weathered Siltstone Sands *(continued)*		VSt - H			
							8.75m					
				9.0			Continued as Cored Drill Hole					
				10.0								
				11.0								
				12.0								
				13.0								
				14.0								
				15.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
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ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: **BH2**

CLIENT: KML Joint Venture | **PAGE:** 3 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 11/4/12

DRILL TYPE: XC Track Mounted | **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm | **DATUM:** AHD

Drilling and Sampling					Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	CORE LIFT / TEST	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
						START CORING AT 8.75m						
NMLC				9.0		Siltstone fine grey with Orange brown bands indistinctly bedded	EW	EL				SM 0°
							HW	VL				JT 5 - 10°
												SZ
												SM 0°
												SZ
												SM 0°
						Siltstone fine dark grey mottled pale grey, distinctly bedded at 5° - 20°	HW - MW	VL - L				SZ 0°
												JT 15°
				10.0								SM 5°
												SM
												PT 0° SN
												PT 0° SN
									A=0.38			PT 0° SN
							MW - SW	L - M				PT 0°
						Interbedded Sandstone and Siltstone, fine Sandstone is pale grey, Siltstone dark grey, distinctly bedded at 0° - 5°						CS 5°
				11.0								SM 0°
						Sandstone, fine to medium grained grey indistinctly bedded						SZ
												PT 5° VN
												PT 5° VN
				12.0			SW - FR	M	A=1.00			
												PT 0° CN
				13.0		Hole Terminated at 12.90 m						
				14.0								
				15.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Method

AS	Auger Screwing
AD	Auger Drilling
RR	Roller/tricone
CB	Claw or Blade bit
NMLC	NMLC Core

Field Tests

HP	Hand Penetrometer

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength

		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
SS	Sheared Surface
CS	Crushed Seam

Roughness

VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating

CN	Clean
SN	Stained
VN	Veneer
CO	Coating

Planarity

PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

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D0893641 5

REGIONAL GEOTECHNICAL SOLUTIONS	**Client**	KML Joint venture	Job No.	RGS01385.1
	Project:	Proposed Multi-storey Development	Drawn By:	Adam Holzhauser
		Belmont	Date:	28-May-12
	Title:	Core Photograph - BH2	Photo No.	2

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH3

CLIENT: KML Joint Venture
PAGE: 1 OF 3

PROJECT NAME: Proposed Multi-Storey Development
JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1
DATE: 11/4/12

DRILL TYPE: XC Track Mounted
SURFACE RL:

BOREHOLE DIAMETER:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
NMLC							0.10m TOPSOIL: Silty Sand, fine dark grey, contains rootlets	M				0.00: TOPSOIL: GRASSED 0.10: AEOLIAN
							0.50m Silty Sand, fine grey	M				
				1.0		SP	SAND, medium to coarse grey contains trace of Fine rounded gravel		VL			0.50: ALLUVIAL
	▶	1.50m SPT 1,1,1 N=2 1.95m					1.60m Peat Brown	W				
				2.0								
							2.50m Gravelly Clay, high plasticity, pale grey - Gravel is fine to medium grained contains fine to medium grained sand	M > w_P	St - VSt			2.50: RESIDUAL
				3.0		CH						
							3.60m Clay, high plasticity, pale grey, contains trace of fine Sand and fine angular Siltstone gravel with some Orange brown mottle					
		4.00m SPT 3,4,6 N=10 4.45m		4.0		CH						
				5.0			5.00m Clay, high plasticity, pale grey, with some Orange brown mottle	W	VSt			
				6.0		CH						
		7.00m SPT 3,4,5 N=9 7.45m		7.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

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REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH3**

CLIENT: KML Joint Venture | **PAGE:** 2 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 11/4/12

DRILL TYPE: XC Track Mounted | **SURFACE RL:**

BOREHOLE DIAMETER: | **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
						CH	8.20m	W	VSt			
							Silty Clay, medium plasticity pale grey mottled orange browny	M < w_P	H			
				9.0			9.20m					
							Continued as Cored Drill Hole					
				10.0								
				11.0								
				12.0								
				13.0								
				14.0								
				15.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

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REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: BH3

CLIENT: KML Joint Venture

PAGE: 3 OF 3

PROJECT NAME: Proposed Multi-Storey Development

JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1

DATE: 11/4/12

DRILL TYPE: XC Track Mounted

SURFACE RL:

BOREHOLE DIAMETER:

DATUM: AHD

Drilling and Sampling					Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	CORE LIFT / TEST	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
				9.0		START CORING AT 9.20m						
NMLC				10.0		Siltstone fine pale grey with occasional orange brown mottle, indistinctly bedded	EW	EL				CS 95° JT 60° SN JT 10° VN CS 30°
				11.0		Siltstone: Fine pale grey mottled orange brown, bedded at 10° to 20°	EW - HW	EL - VL				SM 30° JT 20° VN PT 10° SN JT 45° CN JT 45° VN PT 5° PT 10°
				12.0		Sandstone: Fine pale grey mottled orange brown bedded at 5° to 20° with thin Siltstone bands	MW SW	VL - L M	A=1.02			PT 0°
				13.0		Sandstone: Fine to medium grey, indistinctly bedded	SW - FR	M - H	A=1.36			
				14.0		Hole Terminated at 13.40 m						
				15.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Method

AS	Auger Screwing
AD	Auger Drilling
RR	Roller/tricone
CB	Claw or Blade bit
NMLC	NMLC Core

Field Tests

HP	Hand Penetrometer

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength

		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
SS	Sheared Surface
CS	Crushed Seam

Roughness

VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating

CN	Clean
SN	Stained
VN	Veneer
CO	Coating

Planarity

PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

RG LIB 1.02.GLB Log RG CORED BOREHOLE RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:27 8.30.004 Datgel Lab and In Situ Tool



D0893641 5

REGIONAL GEOTECHNICAL SOLUTIONS	**Client**	KML Joint Venture	Job No.	RGS01385.1
	Project:	Proposed Multi-storey Development	Drawn By:	Adam Holzhauser
		Belmont	Date:	28-May-12
	Title:	Core Photograph - BH3	Photo No.	3

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH5

CLIENT: KML Joint Venture | **PAGE:** 1 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 11/4/12

DRILL TYPE: XC Track Mounted | **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm | **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
NMLC	▶	3.00m SPT 2,4,5 N=9 3.45m		1.0		SM	TOPSOIL: Silty Sand, medium to coarse dark grey with fine to medium grained subrounded Gravel and rootlets	M				0.00: TOPSOIL CROSSED
				2.0			0.30m Silty Sand, medium to coarse grey with medium to coarse subrounded Gravel	M				0.30: ALLUVIAL
				3.0				W	VL			
				4.0			2.50m Sandy Clay, medium to high plasticity, Grey, Sand fine to medium grained	M > w_P	VSt			2.50: ALLUVIAL
		6.00m SPT 5,5,5 N=10 6.45m		5.0		CH	4.00m Clay, medium to high plasticity, pale Grey					4.00: RESIDUAL
				6.0					VSt			
				7.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH5**

CLIENT: KML Joint Venture | **PAGE:** 2 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 11/4/12

DRILL TYPE: XC Track Mounted | **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm | **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
NMLC		9.00m SPT 5,13,14 N=27 9.45m		9.0		CH	Clay, medium to high plasticity, pale Grey *(continued)*		VSt			
							8.50m					
							Clay, medium to high plasticity, pale Grey mottled Orange Brown	$M > w_P$				8.50: EXTREMELY WEATHERED SILTSTONE
				10.0		CH			H			
				11.0			11.00m					
							Siltstone, fine dark grey with pale grey bands, very low strength	M				11.00: EXTREMELY WEATHERED TO HIGHLY WEATHERED SILTSTONE
				12.0			12.50m					
							Continued as Cored Drill Hole					
				13.0								
				14.0								
				15.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

RG LIB 1.02 GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: **BH5**

CLIENT: KML Joint Venture
PAGE: 3 OF 3
PROJECT NAME: Proposed Multi-Storey Development
JOB NO: RGS1385.1
LOGGED BY: AH
LOCATION: Refer to Figure 1
DATE: 11/4/12

DRILL TYPE: XC Track Mounted
SURFACE RL:
BOREHOLE DIAMETER: 100 mm
DATUM: AHD

Drilling and Sampling					Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	CORE LIFT / TEST	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}D/A$	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
				9.0								
				10.0								
				11.0								
				12.0		START CORING AT 12.50m						
NMLC				13.0		Sandstone, fine to medium pale grey with re brown staining, indistinctly bedded	HW	VL				PT 5° SN PT 0° SN PT 0° SN
							SW	M - H				PT 5° CN
				14.0								SM 50° SM 20° SM 20°
						NO CORE 0.25M	EW	VL				
						Sandstone, fine to medium grey, Indistinctly bedded	HW	VL				
							MW	L - M				
				15.0		NO CORE 0.28M						
						Sandstone, fine to medium grey indistinctly bedded	SW	M	A=5.80			SM 0° SM 0° SM 0° 40°
							EW	VL				
						Hole Terminated at 15.85 m						

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Method

AS	Auger Screwing
AD	Auger Drilling
RR	Roller/tricone
CB	Claw or Blade bit
NMLC	NMLC Core

Field Tests

HP	Hand Penetrometer

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength

		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
SS	Sheared Surface
CS	Crushed Seam

Roughness

VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating

CN	Clean
SN	Stained
VN	Veneer
CO	Coating

Planarity

PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

RG LIB 1.02.GLB Log RG CORED BOREHOLE RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:28 8.30.004 Datgel Lab and In Situ Tool



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REGIONAL GEOTECHNICAL SOLUTIONS	**Client**	KML Joint Venture	Job No.	RGS01385.1
	Project:	Proposed Multi-storey Development Belmont	Drawn By:	Adam Holzhauser
			Date:	28-May-12
	Title:	Core Photograph - BH5	Photo No.	5

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH6**

CLIENT: KML Joint Venture | **PAGE:** 1 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 18/4/12

DRILL TYPE: Truck Mounted | **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm | **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
NMLC		1.20m SPT 3,1,2 N=3 1.65m		1.0		SP	0.02m TOPSOIL/FILL: Gravelly SAND, fine to medium grained dark grey, Gravel is fine to medium grained, subangular SAND, medium to coarse grained, grey with fine to medium grained subrounded gravel	W				0.00: TOPSOIL/FILL: GRASSED 0.02: ALLUVIAL
				2.0				W	VL			
				3.0		CL	2.80m Sandy CLAY, medium plasticity, grey, Sand fine to medium grained	M > w_P	St			2.80: ALLUVIAL
		4.50m SPT 5,8,13 N=21 4.95m		4.0			4.00m CLAY, medium-high plasticity, grey mottled orange brown					4.00: RESIDUAL
				5.0								
				6.0		CH		M > w_P	H			
		7.10m SPT 5,10,14 N=24 7.55m		7.0								

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH6**

CLIENT: KML Joint Venture | **PAGE:** 2 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 18/4/12

DRILL TYPE: Truck Mounted | **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm | **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
NMLC		10.70m SPT 10,20,150 N=170 11.15m		9.0		CH	CLAY, medium-high plasticity, grey mottled orange brown *(continued)*	M > w_P				
							9.00m					9.00: EXTREMELY WEATHERED SILTSTONE
				10.0		CH	CLAY, medium plasticity, grey mottled orange, brown	M > w_P	H			
							10.80m					10.80: EXTREMELY WEATHERED TO HIGHLY WEATHERED SILTSTONE
				11.0			SILTSTONE, fine grained, grey mottled orange brown, very low strength with occasional low strength bands					
							11.70m					
				12.0			Continued as Cored Drill Hole					
				13.0								
				14.0								
				15.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: **BH6**

CLIENT: KML Joint Venture | **PAGE:** 3 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 18/4/12

DRILL TYPE: Truck Mounted | **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm | **DATUM:** AHD

Drilling and Sampling					Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	CORE LIFT / TEST	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
				9.0								
				10.0								
				11.0		START CORING AT 11.70m						
NMLC				12.0		Start Coring at 11.70m No Core 0.2m Interbedded SILTSTONE and SANDSTONE, fine grained, Siltstone is dark grey, Sandstone is pale grey, bedded at 5° to 10°	HW	M	A=0.49			SM 0° SM 0° PT 0° CN PT 0° SM 15° PT 0° CN PT 5° SN PT 5 - 10° CN PT 5° CN SM 5 - 10° SN PT 0 - 5° CN PT 15° SN JT 75° VN PT 0° SN PT 0° SN PT 0° CN PT 20° CN PT 20° CN PT 0° CN PT 0° CN PT 5 - 10° CN PT 5 - 20° CN PT 10° CN PT 5° CN PT 5° CN
				13.0			SW	M				
				14.0		SANDSTONE, fine grained, pale grey, indistinctly bedded	SW	M	A=1.09			
						SANDSTONE, fine to medium grained, pale grey, indistinctly bedded		L	A=0.12			
				15.0		Hole Terminated at 14.45 m						

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Method

AS	Auger Screwing
AD	Auger Drilling
RR	Roller/tricone
CB	Claw or Blade bit
NMLC	NMLC Core

Field Tests

HP	Hand Penetrometer

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength

		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
SS	Sheared Surface
CS	Crushed Seam

Roughness

VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating

CN	Clean
SN	Stained
VN	Veneer
CO	Coating

Planarity

PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

RG LIB 1.02.GLB Log RG CORED BOREHOLE RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:28 8.30.004 Datgel Lab and In Situ Tool



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REGIONAL GEOTECHNICAL SOLUTIONS	**Client**	KML Joint Venture	Job No.	RGS01385.1
	Project:	Proposed Multi-storey Development	Drawn By:	Adam Holzhauser
		Belmont	Date:	28-May-12
	Title:	Core Photograph - BH6	Photo No.	6

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH6A

CLIENT: KML Joint Venture
PAGE: 1 OF 1
PROJECT NAME: Proposed Multi-Storey Development
JOB NO: RGS1385.1
LOGGED BY: AH
LOCATION: Refer to Figure 1
DATE: 18/4/12

DRILL TYPE: Hand Excavator
SURFACE RL:
BOREHOLE DIAMETER: 100 mm
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
HA	▶			0.0			0.20m FILL: Sandy Gravel medium to coarse angular orange brown	W				0.00: FILL: GRASSED
							0.35m 0.45m FILL: Gravely Sand, fine to medium grained dark grey mottled pale grey gravel is fine to medium grained subangular contains charcoal					0.45: ALLUVIAL
						SM	FILL SAND: fine to medium grained orange brown		VL			
				1.0			1.00m Silty SAND: medium coarsed dark grey with some fine to medium subrounded gravel					
				2.0								
				3.0								
				4.0			Hole Terminated at 4.00 m					
				5.0								
				6.0								
				7.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH7

CLIENT: KML Joint Venture
PAGE: 1 OF 3
PROJECT NAME: Proposed Multi-Storey Development
JOB NO: RGS1385.1
LOGGED BY: AH
LOCATION: Refer to Figure 1
DATE: 19/4/12

DRILL TYPE: Truck Mounted
SURFACE RL:
BOREHOLE DIAMETER: 100 mm
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
NMLC		3.00m SPT 0,1,2 N=3 3.45m		1.0		SM	0.13m Concrete, 10mm 0.23m Fill: Sandy Gravel medium to coarse angular with some Clay 0.40m Fill: Silty Sand, fine to medium grained dark grey, with some fine to medium grained subrounded Gravel Silty Sand: medium to coarse dark grey	M M $M > w_P$	VL			0.00: CONCRETE 130MM THICK 0.13: FILL 0.40: ALLUVIAL
				2.0								
				3.0			2.95m					
						CH	Sandy Clay, medium to high plasticity, grey with some medium to coarse subrounded gravel	$M > w_P$	F			2.95: ALLUVIAL CLAY
				4.0			4.20m					
		6.00m SPT 4,4,6 N=10 6.45m		5.0		CH	Clay, high plasticity, grey with occasional Orange Brown mottle	$M > w_P$	St			4.20: RESIDUAL
				6.0								
				7.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH7**

CLIENT: KML Joint Venture | **PAGE:** 2 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 19/4/12

DRILL TYPE: Truck Mounted | **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm | **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
NMLC		9.00m SPT 3,8,12 N=20 9.45m		9.0		CH	Clay, high plasticity, grey with occasional Orange Brown mottle *(continued)*	$M > w_P$				
				10.0			10.00m					
						CH	Clay, medium plasticity, grey mottled Orange brown contains bands of highly weathered siltstone		St			10.00: EXTREMELY WEATHERED SILTSTONE
				11.0			11.30m	$M > w_P$				11.20: HIGHLY WEATHERED SILTSTONE
		12.00m SPT 10,0,0 N=R 12.45m		12.0			Siltstone, fine grey banded pale grey, very low strength with low strength bands					
							12.30m 12.35m Interbedded Siltstone and Sandstone, fine Siltstone is dark grey and Sandstone is pale grey bedded @ 0° to 10°					
				13.0			Sandstone fine to medium pale grey bedded @ 10° to 20° Continued as Cored Drill Hole					
				14.0								
				15.0								

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: **BH7**

CLIENT: KML Joint Venture

PAGE: 3 OF 3

PROJECT NAME: Proposed Multi-Storey Development

JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1

DATE: 19/4/12

DRILL TYPE: Truck Mounted

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

DATUM: AHD

Drilling and Sampling					Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	CORE LIFT / TEST	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}D/A$	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
				9.0								
				10.0								
				11.0								
				12.0								
NMLC				13.0			SW	M	A=0.41			PT 0° CN PT 10° CN PT 0° CN JT 30° VN PT 0° CN
				14.0			SW	VL - H M	A=0.90			PT 10° CN PT 10° CN PT 15° CN PT 10° CN
				15.0								JT 30° CN PT 15° CN

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Method

AS	Auger Screwing
AD	Auger Drilling
RR	Roller/tricone
CB	Claw or Blade bit
NMLC	NMLC Core

Field Tests

HP	Hand Penetrometer

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength

		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
SS	Sheared Surface
CS	Crushed Seam

Roughness

VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating

CN	Clean
SN	Stained
VN	Veneer
CO	Coating

Planarity

PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

RG LIB 1.02.GLB Log RG CORED BOREHOLE RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:28 8.30.004 Datgel Lab and In Situ Tool



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REGIONAL GEOTECHNICAL SOLUTIONS	**Client**	KML Joint Venture	Job No.	RGS01385.1
	Project:	Proposed Multi-storey Development	Drawn By:	Adam Holzhauser
		Belmont	Date:	28-May-12
	Title:	Core Photograph - BH7	Photo No.	7

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH8**

CLIENT: KML Joint Venture | **PAGE:** 1 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 19/4/12

DRILL TYPE: | **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm | **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
NMLC	▶	3.00m SPT 0,1,1 N=2 3.45m		1.0		SP	0.13m Concrete 130mm thick Fill: Sandy Gravel medium to coarse sub angular Orange Brown with Clay 0.50m Fill: Gravelly Sand, fine to medium grained, dark grey Gravel is medium to coarse subrounded 0.70m Sand: medium to coarse grey	M D W	VS			0.00: CONCRETE 130MM THICK F72 REO 50MM COVER 0.13: FILL 0.50: ALLUVIAL
				2.0								
				3.0		CH	2.80m Sandy Clay high plasticity, pale grey, Sand fine to medium grained	M > W_P	F			2.80: ALLUVIAL
				4.0			4.25m Clay high plasticity pale grey with some orange brown mottle					4.25: RESIDUAL
		6.00m SPT 3,9,10 N=19 6.45m		5.0								
				6.0		CH		M > W_P	VSt			
				7.0			8.00m					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH8**

CLIENT: KML Joint Venture | **PAGE:** 2 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 19/4/12

DRILL TYPE: | **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm | **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
NMLC		9.00m SPT 10,12,16 N=28 9.45m		9.0		CH	CLAY, high plasticity pale grey with some orange-brown mottle	$M > w_P$				
				10.0			10.00m					10.00: EXTREMELY WEATHERED SILTSTONE
						CL	Clay medium plasticity grey, mottled orange brown					10.35: HIGHLY WEATHERED SILTSTONE
				11.0			10.80m Siltstone fine, dark grey mottled pale grey very low strength with medium strength (sandstone bands)		H			
				12.0			12.00m					
							Continued as Cored Drill Hole					
				13.0								
				14.0								
				15.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: **BH8**

CLIENT: KML Joint Venture | **PAGE:** 3 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 19/4/12

DRILL TYPE: | **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm | **DATUM:** AHD

Drilling and Sampling					Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	CORE LIFT / TEST	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
				9.0								
				10.0								
				11.0								
				12.0		START CORING AT 12.00m						
NMLC				13.0		Interbedded siltstone and sandstone fine Siltstone is dark grey, Sandstone is pale grey, bedded at 0° to 10°	SW	L - M				PT 0° CN SM 5° PT 5° CN PT 0° CN
						Sandstone fine to medium grey indistinctly bedded		VL L M L				SM 0° SM 0° SM 0° PT 5° CN
				14.0		AS ABOVE with thin coal seams then than 1mm			A=0.37			
				15.0		Sandstone fine to medium grey indistinctly bedded		M	A=1.35			
						Hole Terminated at 15.00 m						

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Method

AS	Auger Screwing
AD	Auger Drilling
RR	Roller/tricone
CB	Claw or Blade bit
NMLC	NMLC Core

Field Tests

HP	Hand Penetrometer

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength

		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
SS	Sheared Surface
CS	Crushed Seam

Roughness

VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating

CN	Clean
SN	Stained
VN	Veneer
CO	Coating

Planarity

PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

RG LIB 1.02.GLB Log RG CORED BOREHOLE RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:28 8.30.004 Datgel Lab and In Situ Tool



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REGIONAL GEOTECHNICAL SOLUTIONS	**Client**	KML Joint Venture	Job No.	RGS01385.1
	Project:	Proposed Multi-storey Development Belmont	Drawn By:	Adam Holzhauser
			Date:	28-May-12
	Title:	Core Photograph - BH8	Photo No.	8

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH9

CLIENT: KML Joint Venture

PAGE: 1 OF 1

PROJECT NAME: Proposed Multi-Storey Development

JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1

DATE: 19/4/12

DRILL TYPE: Hand AUGER

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
HA	▶			0.10m			Topsoil: Silty Sand, fine to medium dark grey contains rootlets	M				0.00: TOPSOIL: GRASSED 0.10: ALLUVIAL
						SP	Silty Sand: Fine to medium dark grey	M	VL			
				0.70m		SP	Sand: medium to coarse grey	W	L			
				1.00m								
				1.0								
				2.0								
				3.0								
				4.0								
							Hole Terminated at 4.00 m					
				5.0								
				6.0								
				7.0								

LEGEND:

Water

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes

- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

RG LIB 1.02 GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP1

CLIENT: KML Joint Venture

PAGE: 1 OF 1

PROJECT NAME: Proposed Multi-Storey Development

JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1

DATE: 19/4/12

EQUIPMENT TYPE: Hand Excavator

SURFACE RL:

TEST PIT LENGTH: 0.5 m **WIDTH:** 0.5 m

DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
SHOVEL	(None encountered)						TOPSOIL: Silty Sand, fine to medium grained, dark grey contains rootlets	M				0.00: TOPSOIL: GRASSED
							0.30m Silty Sand: Fine to medium grained dark grey	M	VL - L			0.30: ALLUVIAL
				1.0			0.80m Hole Terminated at 0.80 m					
				2.0								
				3.0								
				4.0								
				5.0								
				6.0								
				7.0								

LEGEND:

Water

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes

- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

Appendix B

Laboratory Test results

REGIONAL GEOTECHNICAL SOLUTIONS

Dynamic Penetrometer

Project Number: RGS01385.1	Date: 17 - 19 April 2012

Client	KML Joint Venture
Project	Proposed Multi-storey Development
Location	Refer to Figure 1

Test Details: Hammer Mass: 9kg Rod Tip: Flat Test as per AS1289 6.3.3
Hammer drop: 600mm Depth to groundwater:

Depth to base of test section (mm)	Test Number and blows recorded per 100mm							Comments (soil type, general information)
	1	**2**	**3**	**4**	**5**	**6**	**7**	
0 - 100	1	2	1	2	1	1	3	
200	0	1	2	2	1	1	6	
300	1	2	2	2	1	1	3	
400	1	2	2	2	1	1	3	
500	1	2	2	2	1	0	3	
600	1	1	1	2	2	1	2	
700	1	2	2	1	2	1	1	
800	1	2	2	2	2	2	3	
900	1	2	2	2	2	3	3	
1000	2	2	3	2	3	3	3	
1100	2	2	4	3	3	4	4	
1200	3	2	4	3	4	3	3	
1300	3	1	4	4	4	3	4	
1400	3	2	4	4	4	3	4	
1500	2	2	4	3	4	3	3	
1600	3	2	3	3	3	3	2	
1700	2	1	2	3	4	3	2	
1800	2	2	2	2	3	3	2	
1900	END	END	END	END	END	END	END	
2000								
2100								
2200								
2300								
2400								
2500								
2600								
2700								
2800								
2900								

REGIONAL GEOTECHNICAL SOLUTIONS

Dynamic Cone Penetrometer

Project Number: RGS01385.1	Date: 17 - 19 April 2012

Client	KML Joint Venture
Project	Proposed Multi-storey Development
Location	Refer to Figure 1

Test Details: Hammer Mass: 9kg Rod Tip: Flat Test as per AS1289 6.3.3
Hammer drop: 600mm Depth to groundwater:

Depth to base of test section (mm)	Test Number and blows recorded per 100mm							Comments (soil type, general information)
	8	**9**	**10**					
0 - 100	1	1	5					
200	1	1	5					
300	2	2	3					
400	1	1	3					
500	1	2	5					
600	2	1	5					
700	2	1	5					
800	1	1	5					
900	2	2	3					
1000	1	2	5					
1100	2	2	4					
1200	1	3	3					
1300	2	2	3					
1400	2	2	4					
1500	5	2	3					
1600	5	2	5					
1700	2	2	5					
1800	2	2	4					
1900	END	END	END					
2000								
2100								
2200								
2300								
2400								
2500								
2600								
2700								
2800								
2900								

FALLING HEAD INFILTRATION TEST - SLOTTED CASED HOLE

CLIENT: KML Joint Venture **Job No.:** RGS01385.1

PROJECT: Proposed Multi-storey Development

LOCATION: Refer to Figure 1

REGIONAL GEOTECHNICAL SOLUTIONS

Date: 29-May-12

Test number:	4		Test Location:	BH3	
Hole radius (m):	0.05		Surface RL:	N/A	
Hole depth(m):	1		Casing stickup(m):	0	
Depth to water table(m):	0.57		Water table RL(m)	N/A	
Slotted section:	0	to 1	Slotted length (m):	0.61	

Reading	Time elapsed (min)	Depth to water (m)	Head loss (m)	Cum. head loss (m)	Volume loss (L)	Cum. Volume loss (L)
1	0	0	0	0	0	0
2	0.5	0.28	0.11	0.11	8.6E-04	8.6E-04
3	1	0.39	0.06	0.17	4.7E-04	1.3E-03
4	1.5	0.45	0.02	0.19	1.6E-04	1.5E-03
5	2	0.47	0.015	0.205	1.2E-04	1.6E-03
6	2.5	0.485	0.01	0.215	7.9E-05	1.7E-03
7	3	0.495	0.01	0.225	7.9E-05	1.8E-03
8	3.5	0.505	0.005	0.23	3.9E-05	1.8E-03
9	4	0.51	0.005	0.235	3.9E-05	1.8E-03
11	5	0.515	0.005	0.24	3.9E-05	1.9E-03
13	6	0.52	0.005	0.245	3.9E-05	1.9E-03
14	7	0.525	0.005	0.25	3.9E-05	2.0E-03
15	8	0.53	0.005	0.255	3.9E-05	2.0E-03
16	9	0.535	0.002	0.257	1.6E-05	2.0E-03
17	10	0.537	0.002	0.259	1.6E-05	2.0E-03
18	11	0.539	0.001	0.26	7.9E-06	2.0E-03
19	12	0.54	0.001	0.261	7.9E-06	2.0E-03
20	13	0.541	0.001	0.262	7.9E-06	2.1E-03
21	14	0.542	0.001	0.263	7.9E-06	2.1E-03
22	15	0.543	0.009	0.272	7.1E-05	2.1E-03
23	20	0.552	0.008	0.28	6.3E-05	2.2E-03
24	30	0.56	0.56	0.84	4.4E-03	6.6E-03

Calculations

Constant loss time period:

Time 1:	1	Depth:	0.39
Time 2:	20	Depth:	0.552
Total time (min):			19
Total head loss (m):			0.162
Volume of water lost (L):			1.2721
Flow rate (L/sec):			0.001115882
Factor:	1.531928	Hc:	0.18

In situ Permeability:

1.31115E-07 m/sec

FALLING HEAD INFILTRATION TEST - SLOTTED CASED HOLE

CLIENT: KML Joint Venture **Job No.:** RGS01385.1

PROJECT: Proposed Multi-storey Development

LOCATION: Refer to Figure 1

REGIONAL GEOTECHNICAL SOLUTIONS

Date: 29-May-12

Test number:	1		Test Location:	BH5	
Hole radius (m):	0.05		Surface RL:	N/A	
Hole depth(m):	1		Casing stickup(m):	0	
Depth to water table(m):	1.3		Water table RL(m)	N/A	
Slotted section:	0	to 1	Slotted length (m):	1	

Reading	Time elapsed (min)	Depth to water (m)	Head loss (m)	Cum. head loss (m)	Volume loss (L)	Cum. Volume loss (L)
1	0	0	0	0	0	0
2	0.5	0.06	0.06	0.06	4.7E-04	4.7E-04
3	1	0.12	0.05	0.11	3.9E-04	8.6E-04
4	1.5	0.17	0.035	0.145	2.7E-04	1.1E-03
5	2	0.205	0.04	0.185	3.1E-04	1.5E-03
6	2.5	0.245	0.035	0.22	2.7E-04	1.7E-03
7	3	0.28	0.03	0.25	2.4E-04	2.0E-03
8	3.5	0.31	0.02	0.27	1.6E-04	2.1E-03
9	4	0.33	0.02	0.29	1.6E-04	2.3E-03
10	4.5	0.35	0.02	0.31	1.6E-04	2.4E-03
11	5	0.37	0.035	0.345	2.7E-04	2.7E-03
12	5.5	0.405	0.035	0.38	2.7E-04	3.0E-03
13	6	0.44	0.03	0.41	2.4E-04	3.2E-03
14	7	0.47	0.01	0.42	7.9E-05	3.3E-03
15	8	0.48	0.01	0.43	7.9E-05	3.4E-03
16	9	0.49	0.02	0.45	1.6E-04	3.5E-03
17	10	0.51	0.04	0.49	3.1E-04	3.8E-03
18	11	0.55	0.02	0.51	1.6E-04	4.0E-03
19	12	0.57	0.01	0.52	7.9E-05	4.1E-03
20	13	0.58	0.04	0.56	3.1E-04	4.4E-03
21	14	0.62	0.14	0.7	1.1E-03	5.5E-03
22	15	0.76	0.03	0.73	2.4E-04	5.7E-03
23	20	0.79	0.06	0.79	4.7E-04	6.2E-03
24	30	0.85	0.85	1.64	6.7E-03	1.3E-02

Calculations

Constant loss time period:

Time 1:	2	Depth:	0.205
Time 2:	15	Depth:	0.76

Total time (min):	13
Total head loss (m):	0.555
Volume of water lost (L):	4.3581
Flow rate (L/sec):	0.005587356
Factor: 2.096983	Hc: -1.095

In situ Permeability:

-2.9176E-06 m/sec

FALLING HEAD INFILTRATION TEST - SLOTTED CASED HOLE

CLIENT: KML Joint Venture **Job No.:** RGS01385.1

PROJECT: Proposed Multi-storey Development

LOCATION: Refer to Figure 1

REGIONAL GEOTECHNICAL SOLUTIONS

Date: 29-May-12

Test number:	2		Test Location:	BH6A	
Hole radius (m):	0.05		Surface RL:	N/A	
Hole depth(m):	1		Casing stickup(m):	0	
Depth to water table(m):	1		Water table RL(m)	N/A	
Slotted section:	0	to 1	Slotted length (m):	1	

Reading	Time elapsed (min)	Depth to water (m)	Head loss (m)	Cum. head loss (m)	Volume loss (L)	Cum. Volume loss (L)
1	0	0	0	0	0	0
2	0.5	0.155	0.1	0.1	7.9E-04	7.9E-04
3	1	0.255	0.06	0.16	4.7E-04	1.3E-03
4	1.5	0.315	0.065	0.225	5.1E-04	1.8E-03
5	2	0.38	0.04	0.265	3.1E-04	2.1E-03
6	2.5	0.42	0.03	0.295	2.4E-04	2.3E-03
7	3	0.45	0.025	0.32	2.0E-04	2.5E-03
8	3.5	0.475	0.025	0.345	2.0E-04	2.7E-03
9	4	0.5	0.02	0.365	1.6E-04	2.9E-03
10	4.5	0.52	0.01	0.375	7.9E-05	2.9E-03
11	5	0.53	0.025	0.4	2.0E-04	3.1E-03
13	6	0.555	0.02	0.42	1.6E-04	3.3E-03
14	7	0.575	0.02	0.44	1.6E-04	3.5E-03
15	8	0.595	0.01	0.45	7.9E-05	3.5E-03
16	9	0.605	0.015	0.465	1.2E-04	3.7E-03
17	10	0.62	0.01	0.475	7.9E-05	3.7E-03
18	11	0.63	0.01	0.485	7.9E-05	3.8E-03
19	12	0.64	0.005	0.49	3.9E-05	3.8E-03
20	13	0.645	0.005	0.495	3.9E-05	3.9E-03
21	14	0.65	0.005	0.5	3.9E-05	3.9E-03
22	15	0.655	0.015	0.515	1.2E-04	4.0E-03
23	20	0.67	0.02	0.535	1.6E-04	4.2E-03
24	30	0.69	0.69	1.225	5.4E-03	9.6E-03

Calculations

Constant loss time period:

Time 1: 2 Depth: 0.38

Time 2: 20 Depth: 0.67

Total time (min): 18

Total head loss (m): 0.29

Volume of water lost (L): 2.2772

Flow rate (L/sec): 0.002108542

Factor: 2.096983 Hc: -0.62

In situ Permeability:

-6.23417E-07 m/sec

FALLING HEAD INFILTRATION TEST - SLOTTED CASED HOLE

CLIENT: KML Joint Venture **Job No.:** RGS01385.1

PROJECT: Proposed Multi-storey Development

LOCATION: Refer to Figure 1

REGIONAL GEOTECHNICAL SOLUTIONS

Date: 29-May-12

Test number:	3		Test Location:	BH9	
Hole radius (m):	0.05		Surface RL:	N/A	
Hole depth(m):	1		Casing stickup(m):	0	
Depth to water table(m):	0.9		Water table RL(m)	N/A	
Slotted section:	0	to 1	Slotted length (m):	1	

Reading	Time elapsed (min)	Depth to water (m)	Head loss (m)	Cum. head loss (m)	Volume loss (L)	Cum. Volume loss (L)
1	0	0	0	0	0	0
2	0.5	0.42	0.125	0.125	9.8E-04	9.8E-04
3	1	0.545	0.06	0.185	4.7E-04	1.5E-03
4	1.5	0.605	0.03	0.215	2.4E-04	1.7E-03
5	2	0.635	0.035	0.25	2.7E-04	2.0E-03
6	2.5	0.67	0.025	0.275	2.0E-04	2.2E-03
7	3	0.695	0.017	0.292	1.3E-04	2.3E-03
8	3.5	0.712	0.013	0.305	1.0E-04	2.4E-03
9	4	0.725	0.01	0.315	7.9E-05	2.5E-03
10	4.5	0.735	0.01	0.325	7.9E-05	2.6E-03
11	5	0.745	0.015	0.34	1.2E-04	2.7E-03
13	6	0.76	0.015	0.355	1.2E-04	2.8E-03
14	7	0.775	0.013	0.368	1.0E-04	2.9E-03
15	8	0.788	0.012	0.38	9.4E-05	3.0E-03
16	9	0.8	0.01	0.39	7.9E-05	3.1E-03
17	10	0.81	0.005	0.395	3.9E-05	3.1E-03
18	11	0.815	0.003	0.398	2.4E-05	3.1E-03
19	12	0.818	0.004	0.402	3.1E-05	3.2E-03
20	13	0.822	0.006	0.408	4.7E-05	3.2E-03
21	14	0.828	0.006	0.414	4.7E-05	3.3E-03
22	15	0.834	0.011	0.425	8.6E-05	3.3E-03
23	20	0.845	0.019	0.444	1.5E-04	3.5E-03
24	30	0.864	0.864	1.308	6.8E-03	1.0E-02

Calculations

Constant loss time period:

Time 1:	2	Depth:	0.635
Time 2:	20	Depth:	0.845
Total time (min):			18
Total head loss (m):			0.21
Volume of water lost (L):			1.6490
Flow rate (L/sec):			0.001526875
Factor:	2.096983	Hc:	-0.265

In situ Permeability:

-1.92954E-07 m/sec

D08936415

Chandler Morrison Geotechnical Pty Ltd

Unit 34, 22 Lawson Crescent, Coffs Harbour NSW 2450 ABN 55 139 985 050

CMG

Client:	Regional Geotechnical Solutions	Project No.	CH11-069	Report No.:	1945
Address:	44 Bent Street				
	Wingham NSW 2429	Sample Date:	7/05/2012	By:	Client
Project:		Test Date:	15/5/2012	By:	AS, DD, DM
Location:		Lot No.		Page	1 of 1

CALIFORNIA BEARING RATIO TEST REPORT
AS1289.6.1.1

Sample No.	A			
Location	TP 1 / 0.5-0.8m			
Decription	Silty SAND			
COMPACTION DETAILS				
Compactive Effort (Standard/modified)	**Standard**			
Maximum Dry Density t/m3	1.67			
Moulded Dry Density t/m3	1.68			
Laboratory Density Ratio %	100.5			
% Retained on 19mm sieve	0.0			
>19mm material substituted (yes/no)	No			
MOISTURE CONTENT DETAILS				
Field Moisture Content %	15.2			
Optimum Moisture Content %	15.4			
Moulded Moisture Content %	15.0			
Laboratory Moisture Ratio %	97			
Top 30mm After Penetration %	18.6			
Remainder of Sample After Penetration %	18.0			
CBR TEST DETAILS				
Duration of Soaking (days)	4			
Surcharge Applied kg	4.5			
Swell %	0.1			
CALIFORNIA BEARING RATIO %	**15**			
Test Methods Used	A,C			

Test Methods

A. AS 1289 5 1.1 Dry Density/Moisture Relationship (Standard Compaction).

B. AS 1289 5.2.1 Dry Density/Moisture Relationship (Modified Compaction).

C. AS 1289 2.1.1 Determination of Moisture Content (Standard Method).

D. Sampled according to AS 1141.3.1

15/05/2011

Approved Signatory: J Morrison Date

NATA Accredited Laboratory No. 17240

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NATA WORLD RECOGNISED ACCREDITATION

CERTIFICATE OF ANALYSIS

Analysis By: Bio-Track Pty Ltd
ABN 91 [illegible] 237 278
Mt Gravatt Road
Upside, Brisbane, Australia, 4520
Ph (07) 3289 7179 Fax (07) 3289 7155

DATE OF REPORT 15 MAY 2012 Page 1 of 1 Report Pages.
CLIENT NAME Adam Holzhauser c/o Regional Geotechnical Solutions Pty Ltd
CLIENT ADDRESS 1/21 Cook Drive Coffs Harbour Coffs Harbour 2450
PROJECT NAME YOUR PROJECT/JOB REFERENCE RGS
SAMPLING DATE NUMBER OF SAMPLES 4 SAMPLE TYPE:Soil
PACKAGING Plastic Bag ** SAMPLES DISPOSED ON 3/05/2013
DATE RECEIVED 3/05/2012 4:01:15 PM LAB REF. LR030512.671

METHODOLOGY: EC Cl as 1:5, pH 1:2.5; air dried soil in water, 30 minute rolling soake, Cl by ion selective electrode, S as 1:40 IN KCl extract measured by ICP OES.
RESIS:soil resistivity per AS1289.4.4.1 SO4 calculated as S x 3 SO3 calculated as S x 2.5

SAMPLE ID m depth	EC dS/m	pH	Cl mg/kg	S mg/kg	SO4 %	SO3 %	RESIS ohm-cm
BH1 4.5-4.95	0.94	7.6	950	86	<0.1	<0.1	580
BH2 1.6-1.95	0.04	6.6	65	10	<0.1	<0.1	11200
BH3 7-7.45	0.68	6.4	750	50	<0.1	<0.1	450
BH8 9-9.45	0.90	6.2	1049	52	<0.1	<0.1	370

Signatory [signature] For and behalf of Bio-Track Pty Ltd

D08936415

DETERMINATION OF ACID SULFATE SOIL PROPERTIES

CERTIFICATE OF ANALYSIS

Analysis By: Bio-Track Pty Ltd ABN 91 056 237 275

781 Mt Cotterell Road Highvale, Brisbane, Australia, 4520 Ph: 07 3289 7179 Fx: 07 3289 7155

LAB REFERENCE LR070512.740 DATE OF REPORT 14 MAY 2012 @09:38:31 Page 1 of 1 Report Pages.
CLIENT NAME Adam Holzhauser c/o Regional Geotechnical Solutions Pty Ltd 1/21 Cook Drive Coffs Harbour Coffs Harbour 2450
PROJECT NAME YOUR PROJECT/JOB REFERENCE RGS
SAMPLING DATE NUMBER OF SAMPLES 8 Samples supplied by client SAMPLE TYPE:Soil
DATE RECEIVED 7/05/2012 5:44:24 PM PACKAGING Plastic Bag Ground Oven Dry Samples DISPOSED ON 7/05/2013

Sample ID as received. METHODOLOGY: As per (DNR QASSIT May 2004), oven dried (85°C), >1000 um shell removed, fine grind. All reported values gravimetric, dry mass.
%sEQ (equivalent sulphur) calculated as moles TAA/624 + %S Cr + %sNAS - sANC_BT (sNAS included irrespective of pH).
LIME1 rates calculated to neutralise TPA (or TAA if >TPA)+ aS_RAS -ANC_BT/1.5 LIME2 rates calculated to neutralise TAA + aS_POS or S_Cr + aS_RAS -ANC_BT/ 1.5
NB. Lime rates assume 97% lime neutralisation but DO NOT include any safety factors. Suggested factor=1.5-2. Rates are kg/ton. Multiply by bulk density to convert to kg/m3.
Fineness Factor (FF)=1.5 CBN POS= moles carbonate alkalinity released by oxidation assuming (Ca POS - Ca KCl) + (Mg POS - Mg KCl) is due to carbonate solution.
Blanks represent unmeasured values, zeros & <0.x represent measured values. If pH KCl>4.5 then s-RAS (calculated from acid extract) may be zero for undisturbed soil. Ca NAS is the acid reactive calcium calculated as the difference between 1 M KCl and 4 M HCl soluble Ca.

ID. DEPTH	pH	pH	TAA	TPA	TSA	S KCl	S P	S POS	S Cr	s-NAS	s EQ	Ca KCl	Ca P	Mg KCl	Mg P	CBN POS	LIME1	LIME2	sANC_BT	Ca NAS
m	KCL	ox	m/t	m/t	m/t	%	%	%	%	%	%	mg/kg	mg/kg	mg/kg	mg/kg	m/t	kg/t	kg/t	%	mg/kg
Analytical Method Codes	23A	23B	23F	23G	23H	23Ce	23De	23Ee	22B	s20Je	s	23Vh	23Wh	23Sm	23Tm	a23U&X			s19A2	20E
BH1 3-3.45	5.65		3			0.01			0.13	<0.01	0.138	265		384				4		<10
BH2 1.6-1.95	5.35		<1			<0.01			0.01	<0.01	0.013	140		23				0		23
BH4 1.5-1.95	5.85		<1			<0.01			<0.01	<0.01	0.008	158		55				0		<10
BH5 3.1-3.45	5.39		<1			<0.01			0.14	<0.01	0.138	231		453				4		<10
BH6 1.5-1.95	5.02		8			0.02			0.14	<0.01	0.155	186		112				5		32
BH7 3-3.45	5.93		3			0.02			0.53	<0.01	0.538	333		369				17		36
BH7 6-6.45	5.49		<1			<0.01			0.05	<0.01	0.054	164		517				2		<10
BH8 3-3.45	5.43		<1			0.03			0.61	<0.01	0.612	320		667				19		<10

Signatory P. Schmidt For and on behalf of Bio-Track Pty Ltd

D08936415

A.S.S. FIELD SCREEN ANALYSIS REPORT

CERTIFICATE OF ANALYSIS

Analysis By: **Bio-Track Pty Ltd** ABN 91 056 237 275 781 Mt. Glorious Road Highvale, Brisbane, Australia, 4520 Ph. 07 3289 7179 EMAIL pe@biotrack.com.au

DATE OF REPORT 04 MAY 2012
CLIENT NAME Adam Holzhauser
CLIENT FIRM Regional Geotechnical Solutions Pty Ltd YOUR PROJECT/JOB REFERENCE RGS
CLIENT ADDRESS 1/21 Cook Drive Coffs Harbour Coffs Harbour 2450
PROJECT NAME SAMPLING DATE
NUMBER OF SAMPLES 21 SAMPLE TYPE Soil
PACKAGING Plastic Bag
SAMPLES DISPOSED ON 1/08/2012
LOG-IN DATE 3/05/2012 4:08:38 PM LAB REF. LR030512.676

TEST METHODOLOGY FOR pH_f AND pH_fox AS PER QASSIT 2004 Laboratory Methods. Indications based on pH data only.
RATE: 0=none 1=slight 2=moderate 3=high 4=very high (steam evolved) visual observation at 0-5 minutes.
TEMP: Surface temperature rise ('C) oxidised sample at 5 minutes.

SAMPLE ID	Upper	Lower (m)	pH_f	pH_fox	change	RATE	TEMP	INDICATION
BH1	0.5	0.6	5.7	4.4	-1.3	2	4	low TAA
BH1	1.6	1.95	4.2	1.7	-2.5	4	3	high TPA & sulphide possible
BH1	3	3.45	5.4	2.7	-2.7	2	7	low TAA & moderate TPA & sulphide possible
BH1	6	6.45	6.0	3.4	-2.6	2	5	low TAA & moderate TPA & sulphide possible
BH2	1.6	1.95	5.6	2.7	-2.9	2	3	low TAA & moderate TPA & sulphide possible
BH2	3	3.45	5.7	3.8	-1.9	3	7	low TAA
BH3	4	4.95	6.5	6.4	-0.1	4	18	low TAA & low TPA & low sulphide
BH4	1.5	1.95	5.4	2.5	-2.9	2	4	low TAA & moderate TPA & sulphide possible
BH4	2.5	2.6	5.7	1.9	-3.8	4	0	low TAA & high TPA & high sulphide/low buffer
BH4	3	3.45	7.0	3.0	-4.0	3	4	no TAA & moderate TPA & high sulphide/low buffer
BH4	4.5	4.95	7.8	7.5	-0.3	3	7	no TAA & no TPA & low sulphide
BH5	3.1	3.45	6.7	3.8	-2.9	3	5	no TAA & sulphide possible
BH5	6	6.45	6.6	5.6	-1.0	1	5	no TAA & low TPA
BH6	1.5	1.95	4.5	1.8	-2.7	4	3	low TAA & high TPA & sulphide possible
BH6	4.5	4.95	6.5	6.1	-0.4	2	8	low TAA & low TPA & low sulphide
BH7	0.5	0.6	8.1	6.1	-2.0	4	5	no TAA & low TPA
BH7	3	3.45	6.3	2.0	-4.3	4	3	low TAA & high TPA & high sulphide/low buffer
BH7	6	6.45	6.8	2.4	-4.4	2	6	no TAA & high TPA & high sulphide/low buffer
BH8	1.5	1.6	7.9	6.6	-1.3	1	5	no TAA & no TPA
BH8	3	3.45	6.9	2.6	-4.3	4	2	no TAA & moderate TPA & high sulphide/low buffer
BH8	6	6.45	6.3	4.8	-1.5	4	15	low TAA & low TPA

P. Robertson _____ Signatory For and behalf of Bio-Track Pty Ltd

Chandler Morrison Geotechnical Pty Ltd
3/18 Jambali Road, Port Macquarie NSW 2444
Tel: +61 2 65815992 Fax: +61 2 6581 5669 ABN 55 139 985 050

CMG

Client:	Regional Gotechnical Solutions	Project No:	P12018	Report No:	P12018-1
Address:	1/21 Cook Drive				
	Coffs Harbour	Test Date:	23/05/12	Technician:	TM
Project:					
Location:	Belmont, Newcastle	Sample Date:	Submitted by client	Page	1 of 1
Material:	Submitted Core Samples				

DETERMINATION OF THE POINT LOAD STRENGTH OF ROCK SPECIMENS
Test Method: RTA T223

Sample No.	Sample Location	Test Type	$I_{s(50)}$ (Mpa)	Rock Type	Moisture Condition	Interpreted Rock Strength
S-3280	BH1, 10.52m	A	0.45	SS	D	Medium
S-3281	BH1, 12.48m	A	1.42	SS	D	High
S-3282	BH2, 10.34m	A	0.38	SS	D	Medium
S-3283	BH2, 12.00m	A	1.00	SS	D	Medium/High
S-3284	BH3, 12.37m	A	1.02	SS	D	Medium/High
S-3285	BH3, 12.96m	A	1.36	SS	D	High
S-3286	BH4, 12.70m	A	0.49	SS	D	Medium
S-3287	BH4, 14.23m	A	1.30	SS	D	High
S-3288	BH5, 15.20m	A	5.80	SS	D	Very High
S-3289	BH6, 12.14m	A	0.49	SS	D	Medium
S-3290	BH6, 13.80m	A	1.09	SS	D	High
S-3291	BH6, 14.09m	A	0.12	SS	D	Low
S-3292	BH7, 13.34m	A	0.41	SS	D	Medium
S-3293	BH7, 14.33m	A	0.90	SS	D	Medium
S-3294	BH8, 13.86m	A	0.37	SS	D	Medium
S-3295	BH8, 14.29m	A	1.35	SS	D	High

Test Type	Moisture Condition	Rock Type
A= Axial	W= Wet	SS= Sandstone
D= Diametral	M= Moist	ST= Siltstone
I= Irregular	D= Dry	SH= Shale
C= Cube	N= Natural	BA= Basalt

Remarks:

$I_{s(50)}$ (Mpa)	Interpreted Rock Strength Term	Abbreviation
>10	Extremely High	EH
3-10	Very High	VH
1-3	High	H
0.3-1	Medium	M
0.1-0.3	Low	L
0.03-0.1	Very Low	VL
<0.03	Extremely Low	EL

NATA
WORLD RECOGNISED ACCREDITATION

Approved Signatory: S Chandler
NATA Accredited Laboratory No. 17255

25/05/2012
Date

Appendix C

Preliminary Acid Sulfate Soil Management Plan

APPENDIX C - ACID SULFATE SOILS MANAGEMENT PLAN

C.1 INTRODUCTION

The site investigations undertaken for the development encountered a profile of minor topsoil and fill overlying wind-blown sand, with alluvial clays below depths averaging 2.5m. Testing indicated some acidity in the sand, although the source of the acidity was predominantly found to be other than acid sulphate related pyrite. The underlying alluvial clays were found to be Potential Acid Sulfate Soils or PASS. The groundwater table was encountered within the sand at depths of 0.6m to 1.3m below the ground surface.

The proposed development incorporates a single basement level car park and therefore bulk excavations to depths of the order of 3m are anticipated. The majority of the excavation will therefore encounter acidic sands, with the lower 0.5m or so to involve removal of PASS clays. Dewatering of the site will involve sealing the basement excavation into the low permeability clays using sheet piling or similar to restrict water inflow. There will, however, be a need to remove water from the sand profile within the excavation area. Management of the removal and discharge of water will be covered by a separate document and does not form part of this Acid Sulfate Soils Management Plan (ASSMP)

The ASSMP outlined herein has been prepared for the management of the acidic sands and the PASS and is to be adopted for all works undertaken at the site where disturbance of the natural soils is likely to occur. Of particular importance will be works such as excavation to depths of more than 2.5m where alluvial clay soils will be exposed. The purpose of the ASSMP is to allow for management of the risks associated with Acid Sulfate Soils (ASS) on the site.

Project specific details such as full extent and depth of proposed excavations, and the off-site or on-site disposal/re-use preferences were not known at the time of writing this plan. The plan should therefore be considered preliminary in nature and should be revised and finalised once further details of the proposed development are known.

C2. RESPONSIBILITY FOR IMPLEMENTATION

Implementation of the ASSMP will be the responsibility of the Contractor undertaking the bulk earthworks. Where ambiguity or uncertainty exists in the requirements of the ASSMP, the Project Manager or Superintendent must be referred to for clarification.

C3. TRAINING AND ORIENTATION

Training and orientation sessions should be conducted for all Contractors' staff involved in the excavation, transport or handling of soils or earthworks on the site. The training sessions should be designed by an appropriately qualified ASS consultant and must be conducted prior to the excavation of any soils on the site. The sessions shall be designed to ensure that staff are aware of the ASS issues involved on the site, that they can recognise the ASS on the site and that they are familiar with their responsibilities in managing the acidity.

Training is to include coverage of the health and safety issues associated with working with lime.

C4. PRE-EXCAVATION TESTING REGIME

All soils to be excavated shall be sampled and tested prior to disturbance. The sampling frequency shall be 1 sample per 100m^3. The location and depth of all test samples shall be accurately recorded on a plan of the works area. The recommended test regime is TAA and pre-oxidation sulphur (Skcl) to determine the nature and severity of the actual acidity and chromium reducible sulfur (CRS) to determine acid sulfate potential. The analytical results should be reviewed by an ASS consultant who will classify the soils as:-

- Non acidic (pH >5.5 and CRS< 0.03%)
- Naturally acidic but not sulphuric (TAA>18 moles per tonne, CRS and S_{KCl} < 0.03%)
- AASS or PASS (TAA>18 moles/tonne and S_{KCl} > 0.03% or CRS>0.03%)

Soils shall be treated according to category as set out in this ASSMP.

C5. TREATMENT

Soils shall be treated according to their acidity classification as set out above. It is therefore important that the sands and underlying PASS clay soils be excavated and stockpiled separately, and treated as outlined below:

- **Non acidic** soils may be handled and disposed of without specific treatment or management in regards to acid sulfate soils. These include existing fill and topsoil.
- **Naturally acidic** soils. These are likely to include the majority of the naturally occurring sands on site that typically occur to depths of the order of 2.5m. Soils which are to be re-used on site shall be limed at a rate determined based on neutralising the measured TAA. The soil shall be placed in a treatment area or on any proposed final fill platform and mixed with lime applied at the appropriate rate by discing or rotary hoeing. Initial testing undertaken during the site investigation indicates a likely liming rate of the order of $6kg_{lime}/tonne_{soil.}$ Soils to be removed from site should be treated at the site prior to removal by being placed in a prepared treatment area. The rate of lime application shall be determined from the testing based on neutralising the TAA with a factor of safety of 1.5.
- **AASS and PASS** shall be placed in a prepared treatment area. The soil shall be spread in layers not more than 100 mm thick and lime applied at the appropriate rate and mixed with the soil by discing or rotary hoeing. The rate of lime application shall be as determined as TAA plus the acidity equivalent of the measured CRS with a factor of safety of 1.5. Validation testing of treated soils shall be undertaken as specified in this ASSMP. If it is necessary to remove the soils from the site in order to treat them, they must be removed in leak proof, covered trucks so that no soil can fall from the truck during transport.

C6. TREATMENT AREA

The treatment area shall be at a location approved by Council prior to the disposal of any PASS/AASS. The treatment area shall be bunded to a height of at least 0.5 metres with nonPASS or treated PASS material. The base and bund batters shall be limed at the rate of 10 kilograms fine agricultural lime per square metre.

The lime to be used in the treatment process will be a medium-fine aglime with at least 85% by weight passing 1mm and 100% passing 2.5mm. The aglime purity is to be >90%.

C7. POST TREATMENT VALIDATION TESTING

The treated PASS/AASS shall be subject to validation testing at the rate of 1 test per 100m^3 of treated soil. The validation testing shall consist of the measurement of soil pH, the soil pH after peroxide oxidation (pHox), TAA, Sras and Scr and the measurement of acid neutralising capacity (ANC) to pH 6. A soil shall be deemed to be effectively treated when pH and pHox are greater than 6 and the ANC is greater than the sum of the acidity (TAA+Sras+Scr) by a factor not less than 1.5.

C8. WATER QUALITY MONITORING

Any waters collected in the excavation shall be tested for pH on a daily basis during construction. If the recorded pH of any sample is less than 6, it shall be immediately retested. If the pH is again below 6, the pH shall be adjusted by the application of hydrated lime until it is in the range 6 to 8 prior to discharge.

Where the pH is less than 4.0, the ASS Consultant shall be engaged within 6 hours to review the site practices and monitoring results and to recommend remedial measures. Where ponded leachate requires rapid neutralisation prior to disposal a calcium hydroxide solution can be used. Solution can be prepared from slaked lime or quicklime, by stirring approximately 0.3kg into a 200 litre drum of water. The slurry should be allowed to settle and the clear solution pumped or sprayed into the ponded leachate in small doses with agitation of the water body until the pH reaches acceptable levels. Constant monitoring is to be undertaken to avoid overdosing. Complete records of all monitoring results shall be maintained by the Contractor.

Quicklime is a reactive and corrosive substance requiring specific handling and safety procedures. Mixing quicklime with water will generate heat. It is therefore critical to add the substance slowly and avoid contact.

C9. MANAGEMENT PRACTICES

At all times, current best management practices shall be adopted by the Contractor.

Complete records of all testing and treatment shall be maintained by the Contractor. Such records shall be available to Council for inspection. Any amendments proposed to the ASSMP shall be discussed with and approved by Council prior to the implementation of such changes.



TRAFFIC AND PARKING IMPACT ASSESSMENT OF

MIXED USE DEVELOPMENT

AT 32 - 44 BROOKS PARADE, 2-10 SHARP STREET & 5-11 EDGAR STREET, BELMONT

Address: Shop 7, 720 Old Princes Highway Sutherland NSW 2232
Postal: P.O Box 66 Sutherland NSW 1499

Telephone: +61 2 8355 2440
Fax: +61 2 9521 7199
Web: www.mclarentraffic.com.au
Email: admin@mclarentraffic.com.au

Division of RAMTRANS Australia ABN: 45067491678 RPEQ: 19457

Transport Planning, Traffic Impact Assessments, Road Safety Audits, Expert Witness

18061.01FA – 27th July 2018

Development Type: Mixed Use Development

Site Address: 32 - 44 Brooks Parade, 2-10 Sharp Street & 5-11 Edgar Street, Belmont

Prepared for: Monteath & Powys

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1 INTRODUCTION

M^{C}Laren Traffic Engineering (MTE) was commissioned by *Monteath & Powys* to provide a Traffic and Parking Impact Assessment of the Mixed Use Development at 32 - 44 Brooks Parade, 2-10 Sharp Street & 5-11 Edgar Street, Belmont as shown in **Annexure A**. The subject development was part of a previous development application, which included a traffic and parking report dated 28th November 2016 by *MTE*.

1.1 Description and Scale of Development

The proposed mixed-use development includes 140 units divided between four blocks above mixed commercial and retail tenancies and associated basement carparking. The development consists of the following relevant to this traffic and parking report:

- 140 Residential Units as per the following:
    - 23 One-bedroom + study units;
    - 11 Two-bedroom units;
    - 67 Two-bedroom + study units;
    - 13 Three-bedroom units;
    - 26 Three-bedroom + study units;
- 700m^2 Commercial / retail GFA;
- 121 Residential spaces;
- 44 Visitor spaces.

1.2 State Environmental Planning Policy (Infrastructure) 2007

The proposed development does not qualify as a development with relevant size and/or capacity under Clause 104 of the SEPP (Infrastructure) 2007. Accordingly, formal referral to the Roads and Maritime Services (RMS) is not necessary and Lake Macquarie Council officers can determine this proposal accordingly.

1.3 Site Description

The subject site is currently occupied by residential and commercial lots that will be combined to accommodate the proposed development. The site has three boundaries facing local roads with its western boundary being a drainage spillway and other properties. Vehicular access to the site will be via two driveways, a commercial / visitor and residential carpark along Edgar Street which accesses a basement car park and a service vehicle driveway to the east on Sharp Street.

The site is generally surrounded by low to medium density residential dwellings as well as retail and commercial businesses.

1.4 Site Context



Site Location

FIGURE 1: SITE CONTEXT – AERIAL PHOTO



Site Location

FIGURE 2: SITE CONTEXT – STREET MAP

2 EXISTING TRAFFIC AND PARKING CONDITIONS

2.1 Road Hierarchy

Brooks Parade has the following characteristics within close proximity to the site:

- Unclassified LOCAL road;
- Approximately 12m in width facilitating one lane in each direction;
- Signposted 50km/h; 40km/hr in areas of high pedestrian activity;
- Unrestricted kerbside parking permitted along both sides of the road.

Edgar Street has the following characteristics within close proximity to the site:

- Unclassified LOCAL road;
- Approximately 12m in width facilitating two-way passing;
- Signposted 50km/h speed limit;
- Unrestricted kerbside parking permitted along both sides of the road.

Sharp Street has the following characteristics within close proximity to the site:

- Unclassified LOCAL road;
- Approximately 12m in width facilitating two-way passing;
- Signposted 50km/h speed limit;
- 1 hour restricted kerbside parking along both sides of the road.

2.2 Existing Traffic Management

- Round-a-bout controlled intersection of Herbert Street / Edgar Street.
- GIVE WAY controlled intersection of Edgar Street / Maude Street.
- GIVE WAY controlled intersection of Brooks Parade / Maude Street.
- GIVE WAY controlled intersection of Sharp Street / Brooks Parade.
- Priority intersection of Sharp Street / Edgar Parade.

2.3 Existing Traffic and Parking Environment

Traffic surveys undertaken in July 2016 showed generally light traffic volumes at the Edgar Street / Herbert Street roundabout.

Traffic counts were completed at the intersection of Edgar Street / Herbert Street on Thursday 21 July 2016 between 7:00am – 9:00am and 4:00pm – 6:00pm, representing a typical weekday. The survey results are provided in **Annexure B** for reference.

In response to the original *MTE* report dated 28th November, 2016, the Roads and Maritime Services (RMS) requested that additional traffic analysis be performed in a letter dated 10th March, 2017. Additional traffic counts were undertaken at the intersections of Macquarie Street / Edgar Street, Brooks Parade / Sharp Street, and Brooks Parade / Maude Street on Friday, 9 June 2017 between 7:00am – 9:30am and 2:30pm – 6:00pm, representing a typical weekday. The survey results are provided in **Annexure B** for reference.

2.3.1 Intersection Performances

Existing intersection performances have been assessed using SIDRA INTERSECTION 6.1 and 7 for all of the intersections surveyed. The existing intersection conditions are discussed in the following subsections.

2.3.1.1 Edgar Street / Herbert Street

Existing performance for the Edgar Street / Herbert Street intersection have been assessed using SIDRA INTERSECTION 6.1. The SIDRA output is provided in **Annexure C** and summarised in **Table 1** below.

TABLE 1: INTERSECTION PERFORMANCES (SIDRA INTERSECTION 6.1)

Intersection	Peak Hour	Degree of Saturation(1)	Average Delay(2) (sec/vehicle)	Level of Service(3)	Control Type	Worst Movement
EXISTING PERFORMANCE						
Edgar St / Herbert St / Property Access	AM	0.086	5.5 (7.7)	**A** (Worst: A)	Round-about	RT from Edgar St.
	PM	0.141	5.4 (7.7)	**A** (Worst: A)		RT from Edgar St.

NOTES:

(1) Degree of Saturation is the ratio of demand to capacity for the most disadvantaged movement.
(2) Average delay is the delay experienced on average by all vehicles. The value in brackets represents the delay to the most disadvantaged movement.
(3) Level of Service is a qualitative measure of performance describing operational conditions. There are six levels of service, designated from A to F, with A representing the best operational condition and level of service F the worst. The LoS of the intersection is shown in bold, and the LoS of the most disadvantaged movement is shown in brackets.

As shown above, the existing intersection is operating satisfactorily at Level of Service (LoS) A during the morning and afternoon peak periods. This represents minimal delays and additional spare capacity.

2.3.1.2 Additional Intersection Network

Existing performances for the intersections of Brooks Parade / Sharp Street, Brooks Parade / Maude Street, and Macquarie Street / Edgar Street have been assessed as a network using SIDRA INTERSECTION 7. The SIDRA network output is provided in **Annexure C** and summarised in **Table 2** below.

It is important to note two observations from our traffic survey consultants;

- Firstly, a local 'rat run' was identified along Walter Street. It was observed that many vehicles travelling from the north from Brooks Parade would turn into Walter Street instead of continuing on along Macquarie Street to the Pacific Highway. It is assumed that this is to avoid the lights at the end of Macquarie Street and join the highway further south. This was also observed in the opposite direction/

- Secondly, while it was identified that the observed queuing on the right-hand turn from Maude Street onto Brooks Parade was about 6 vehicles in the peak hour, on some occasions reaching a queue length of 8 vehicles. The traffic surveyors also identified that right turning movements were possible in groups of 3-4 vehicles at a time, due to platooning effects caused by traffic lights further south along Macquarie Street. The SIDRA Intersection model is unable to realistically replicate this scenario, with results producing unrealistic delays of greater than 70 minutes, (refer to **Table 2**), which is not reflective of the true operation of the intersection. Adjustments to headway to 2.5 seconds and critical gap to 3.45 seconds were able to replicate similar queue lengths to what was observed. While it is typical for drivers to accept less gaps as wait times increase, these adjustments were not deemed realistic for the right-hang manoeuvre to be completed and hence were not used in the final SIDRA INTERSECTION analysis.

TABLE 2: NETWORK ANALYSIS RESULTS – SIDRA INTERSECTION 7

Intersection	Peak Hour	Degree of Saturation(1)	Average Delay(2) (sec/vehicle)	Level of Service (3)(4)	Control Type	Worst Movement
EXISTING PERFORMANCE						
Macquarie Street / Edgar Street	AM	0.12	2.5 (Worst: 10.8)	**N/A** (Worst: A)	Give Way	RT from Edgar Street (N)
	PM	0.21	3 (Worst: 14)	**N/A** (Worst: A)		RT from Edgar Street (N)
Brooks Parade / Sharp Street	AM	0.32	0.3 (Worst: 20.8)	**N/A** (Worst: B)	Give Way	RT from Sharp Street (E)
	PM	0.57	1.2 (Worst: >70)	**N/A** (Worst: F)		RT from Sharp Street (E)
Brooks Parade / Maude Street	AM	0.39	2.5 (Worst: 24.9)	**N/A** (Worst: B)	Give Way	RT from Maude Street (E)
	PM	6.12	409.9 (Worst: >70)	**N/A** (Worst: F)		RT from Maude Street (E)

NOTES:

(1) Degree of Saturation is the ratio of demand to capacity for the most disadvantaged movement.

(2) Average delay is the delay experienced on average by all vehicles. The value in brackets represents the delay to the most disadvantaged movement.

(3) Level of Service is a qualitative measure of performance describing operational conditions. There are six levels of service, designated from A to F, with A representing the best operational condition and level of service F the worst. The LoS of the intersection is shown in bold, and the LoS of the most disadvantaged movement is shown in brackets.

(4) NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

As shown above, the intersection of Macquarie Street / Edgar is operating satisfactorily at Level of Service (LoS) A for the worst turning movement during the morning and afternoon peak periods. Additionally, the intersections of Brooks Parade / Sharp Street and Brooks Parade / Maude Street are operating satisfactorily at LoS B during the AM peak period. This represents minimal delays and additional capacity.

Both the Brooks Parade / Sharp Street and Brooks Parade / Maude Street intersections have worst turning movements of LoS F (right turn movements from the minor roads) under the existing conditions. Again, it is noted that SIDRA Intersection was unable to realistically model the right-hand manoeuvre from Maude Street. The right-turn from Sharp Street, although performing at a Level of Service of F, experiences delays of approximately three-minutes, which are also somewhat unrealistic, as the intersection would also benefit from platooning effects from the signalised intersection to the south.

2.4 Public Transport

The subject site has access to existing bus routes 310 and 318 provided by Newcastle Buses which runs through Brooks Parade, with the nearest bus stop located near the intersection of Brooks Parade and Maude Street. Route 318 provides local access around Belmont whilst route 310 provides intercity access to Newcastle via Charlestown. The public transport infrastructure within close proximity to the subject site is shown below in **Figure 3**.



FIGURE 3: PUBLIC TRANSPORT MAP

3 PARKING ASSESSMENT

3.1 Car Parking Requirement

The subject site is zoned B4 – Mixed Use as per Sheet 010CA of Council's LEP 2014.

The *Lake Macquarie City Council DCP 2014 Revision 16, Part 4 – Development within Business Zones* Table 6 provides the following car parking rates for developments within 400m of a major bus route:

Residential Flat Building – Criteria A

1 bedroom – 0.5 space per unit

2 bedroom – 0.75 spaces per unit

3 bedroom – 1.0 space per unit

Visitor parking – 1 per 4 units

Business & Office

1 space per 40m² GFA

Shops or Group of Shops - <5,000m² GFA

1 space per 25m² GFA

The above car parking rates are summarised in **Table 3** below.

TABLE 3: DCP PARKING REQUIREMENTS

Land Use	Type	Scale	Rate	Spaces Required	Spaces Provided
Residential	1 bed	23	0.5 per unit	11.5	121
	2 bed	78	0.75 per unit	58.5	
	3 bed	39	1 per unit	39	
	Visitor	140	1 per 4 units	35	35
Sub-total	**-**	**-**	**-**	**144**	**156**
Commercial / retail	-	700m²	1 per 40m² / 1 per 25m²	17.5 / 28	9
Sub-total	**-**	**-**	**-**	**18 / 28**	**9**
Total	**-**	**-**	**-**	**162 - 172**	**165**

As shown above, the proposal requires a total of 162 - 172 car spaces, whereby the range is based on either a commercial or retail outcome for the non–residential floor space.

The proposal details a total of **165** car parking spaces (including 17 disabled spaces), representing a potential shortfall of some 7 car parking spaces based upon an outcome where all non-residential floor space is dedicated to retail. It is considered that the requirement of 172 car parking spaces warrants reduction based on the following factors:

- Developments which propose mixed uses often result in a "dual use" outcome, whereby non-residential parking is shared amongst users. The dual use of residential visitor parking and the commercial / retail parking is appropriate due to the offset peak parking accumulation of the two uses. Residential visitor peak parking occurs Friday and Weekday evenings, often outside of business hours or when commercial / retail uses are not at peak operation.

The dual use of the residential visitor parking and the commercial / retail parking warrants a 25% dual usage between residential visitor and commercial / retail parking resulting in a reduction in the car parking requirement of up to 16 spaces. The application of dual usage results in a combined parking requirement for residential visitor and commercial / retail parking of **47** parking spaces and a combined cumulative parking requirement of **156** spaces (assuming all tenancies are used by retail). The proposal details a total of **165** car parking spaces (including 17 disabled spaces) representing a numerical surplus of nine (**9**) car parking spaces.

The proposal also details **44** visitor / commercial parking spaces representing a numerical shortfall of some three (**3**) visitor / commercial parking spaces. The shortfall of three (**3**) visitor / commercial parking spaces can easily be accommodated within the excess residential parking with adjustment to the boom gate location which can be conditioned as part of Council's consent.

3.2 Bicycle & Motorcycle parking Requirements

Lake Macquarie City Council DCP 2014 Revision 16, Part 4 – Development within Business Zones Section 5.3 requires the following with respect to bicycle parking:

> *For customers and short-term users;*
>
> > *Five bike parking spaces plus an additional 10% of bike parking spaces/ car parking spaces for up to 50 car parking spaces.*
> >
> > *For developments requiring over 50 car parking spaces, a flat 10% ratio of bike parking spaces/car parking spaces applies.*
>
> *The following bike facilities must be provided for employees:*
>
> > *One employee bike parking space for each 10 employees, or part thereof;*

Therefore, based on the above bicycle rate applied to the requirement of 63 non-residential car parking spaces (i.e 35 residential visitor parking plus 28 retail parking spaces), the development requires a minimum of seven (7) bicycle spaces for retail / commercial customers and residential visitors. Employee numbers are not known at the time of this report; however, 52 bicycle parking spaces have been provided. Given that 7 of these are

allocated for retail / commercial customers, the remaining 45 bicycle spaces are assumed to be sufficient for employees.

Lake Macquarie City Council DCP 2014 Revision 7, Part 4 – Development within Business Zones Section 5.4 requires the following with respect to motorcycle parking:

> *One motorbike parking space for each 20 car parking spaces*

Based on the provision of 165 car parking spaces outlined in **Section 3.1** of this report, 9 motorcycle spaces are required. The proposal provides 9 motorcycle spaces, satisfying the DCP requirement.

3.3 Servicing & Loading

Lake Macquarie City Council DCP 2014 Revision 16, Part 9.13 – Residential Flat Building Section 13.14 states the following:

> *Kerbside collection may only occur when:*
> - *Mobile garbage bins (MGBs) are utilised, and can be accommodated on the subject property frontage at a rate of one MGB per 2.5 metres of available property frontage; or*
> - *The development is not greater than three storeys high; or*
> - *The development contains no more than 16 dwellings.*

Lake Macquarie City Council Waste Management Guideline specifies the following in regard to waste collection:

> *If access onto the site is required and Council agrees to collect waste on the site or permits the on-site collection by a private contractor, the following matters should be considered:*
> - *The convenient placement of waste storage and recycling areas and/or rooms,*
> - *Location of the area away from living/working space in buildings,*
> - *The area should be weather protected,*
> - *Appropriate signposting, such as for recycling bins,*
> - *Proposed truck sizes to be entering the site,*
> - *Adequate driveway widths and height at entrance ways – minimum driveway width of 3.5 metres, maximum grade of 1:8, minimum vertical clearance 4.3 metres,*
> - *Structural capability of driveway to carry fully loaded waste collection vehicles,*
> - *On-site manoeuvrability – turning circles or three point turn arrangements so that vehicles enter and leave the site moving in a forward direction, minimum turning circle 21.7 metres*

Council's DCP does not strictly require on-site loading, however if on-site loading is to be provided then it must achieve certain design outcomes as listed above.

Although not specified, a vehicle with 21.7 metres turning circle and 4.3m minimum vertical clearance is equivalent, albeit slightly larger than an 8.8m Medium Rigid Vehicle (MRV) as listed by AS2890.2:2002 which requires 4.5m vertical clearance and operates with a 20m

turning circle but smaller than a 12.5m Heavy Rigid Vehicle which operates with a 25m turning circle.

The proposed plans provide an on-site waste collection bay accessed via Sharp Street with a turning circle platform located in the loading bay. The turning bay in its current design would require a redesign of the loading area to accommodate the rotation of an MRV on the turning circle. Swept path tests have been conducted (with results depicted in **Annexure D**) showing the MRV passing over the walls of the loading area while using the turning circle.

Alternatively, it is recommended a reverse manoeuvre from Sharp Street be undertaken to enter the loading area. Whilst this reverse manoeuvre is contrary to Council's DCP, it is considered that this variation is justified by the following:

- Sharp Street is the lower order road in comparison to Brooks Parade and Edgar Street;
- The frequency of waste collection is expected to be relatively low and outside of peak commuter hours;
- Strict application of Council's DCP does not require an on-site loading provision, and thus the provision of any loading facility is beneficial.

The swept path tests of the turning circle and the reverse entry into the loading bay are reproduced in **Annexure D**.

3.4 Disabled Parking

Lake Macquarie City Council DCP 2014 Revision 16, Part 4 – Development within Business Zones Table 7 requires the following:

> *1 space per 50 spaces. Where the requirement is between 5 and 50 spaces, at least 1 space is to be provided for persons with a disability.*

Furthermore, *Lake Macquarie City Council DCP 2014 Revision 16, Part 9.13 – Residential Flat Building Section 13.13* requires the following:

> 1) *For proposal for more than 10 dwellings, one adaptable dwelling must be provided for every 10 dwellings*
> 2) *Adaptable dwellings must have a car park linked to the dwelling by an unobstructed path of travel, at a suitable gradient for wheelchair access*
> 3) *Adaptable dwelling must have entries, doors and passageways that are of suitable dimensions to facilitate wheelchair access*
> 4) *Adaptable dwellings must be designed and constructed to meet the performance requirements stated in Clause 2.2 and to include the essential features listed in Appendix A of AS 4299.*

Further to the above, Appendix A of AS4299 lists car parking, 3.8m x 6.0m as an essential required feature.

Therefore, based on Council's DCP and *AS4299*, one (1) disabled space is required for non-residential tenants (i.e. residential visitor and commercial / retail) whilst a minimum of 14 adaptable dwellings are to be provided with appropriate disabled parking measuring minimum 3.8m in width. AS4299 allows a concession to car parking lengths from 6.0m reduced to 5.4m.

The appropriate design outcome for residential tenants are a disabled space measuring 3.8m in width by 5.4m in length whilst non-residential tenant parking shall be provided with a 2.4m wide space and an adjacent 2.4m wide shared zone as per AS2890.6:2009.

The plans allocated 15 disabled spaces for residential tenants, and a further 2 disabled spaces for non-residential uses, satisfying Council DCP's requirements.

3.5 Access Design

The proposal details an entry and exit driveway directly from the existing roundabout controlled intersection of Edgar Street & Herbert Street, creating a fourth leg on the western side of this intersection. This driveway provides access to 165 car parking spaces, containing 124 residential spaces and 44 visitor spaces (to be modified to provide 121 residential spaces and 47 visitor spaces).

A secondary access is proposed off Sharp Street providing access to the loading bay only.

With respect to the driveway onto the existing roundabout at Edgar Street & Herbert Street, consideration is given to AUSTROADS Guide to Road Design Part 4B – Roundabouts which requires the following design criterion (based on Figure 3.1 as shown in **Annexure E**):

1) Should provide the desirable Approach Sight Distance for the new leg. Distance based on the absolute minimum Approach Sight Distance using the 85th percentile speed on the entry curve
2) Should provide adequate sight distance for drivers to detect an acceptable gap of 4s to 5s. Refer to *Table 3.1* of the Guide
3) Provide sight triangle to allow recognition of potential conflict

Further to the above, *Section 4.10.2* of the AUSTROADS Guide outlines the following:

> *Generally, it is desirable that the gradient on approaches to roundabouts be limited to 3% to 4% and should not exceed 6%. Whilst the gradient may extend along part of the length of the entry curve it is essential that on:*
>
> • *An uphill approach – a flat area (say 2 – 3% maximum) is provided on the immediate approach to the roundabout to accommodate the length of one design vehicle. This flat area will assist heavy vehicles to start up and move into gaps, ensure that capacity is not unduly compromised and also assist with respect to sight distance*

- *A downhill approach – a sag curve will be required to match the higher gradient to a 3% positive superelevation on the roundabout.*

Based on an approach speed of 10km/h to 20km/h, the ASD requirement would be 6.6 to 15.5m. A 15km/h approach speed would require an ASD of 10.8m. it is considered that a 15km/h approach speed is a conservative approach.

In this regard, the proposed driveway achieves 3.5m verge width plus a 7.3m ramp length (at 5%) achieving the 10.8m considered to be acceptable sight distance to approach the roundabout.

3.6 Car Park Design & Compliance

Referring to **Annexure A**, the car park design and access has been assessed in accordance with AS2890.1:2004 and AS2890.6:2009 where applicable and has found to be generally compliant with any required changes outlined in **Section 3.6.1**. The on-site parking achieves the following:

- Residential tenant spaces measure 2.4m wide by 5.4m in length;
- Residential visitor spaces measure minimum 2.5m wide by 5.4m in length;
- Minimum aisle width in the basement level is 5.8m complying with User Class 1, 1A & 2;
- Retail parking spaces provided at 2.5m wide by 5.4m in length;
- Minimum aisle width on the visitor section of the basement floor is 6.4m which exceeds the requirements of User Class 3;
- Additional 300mm clearance provided to obstructions and walls;
- Disabled parking spaces comply with the requirements set out in *AS4299* and *AS2890.6*;
- Minimum headroom of 2.2m for passenger cars achieved in all areas, increasing to 2.5m above disabled parking spaces and shared zones.

While the plans have been assessed for compliance it is usual that as a condition of consent a construction certificate is required prior to construction to accommodate for any changes during or after the DA stage.

3.6.1 Required Changes

While the carpark has been found to be generally compliant the following changes shall be implemented before the issue of a design certificate:

- Spaces R3, R2, R18, R19, R20, and R117 require wheel stops;
- The maximum ramp grade is to be 20%;
- Space R59 need to be moved slightly to ensure 300mm clearance is provided to high obstructions;
- Turning Bay Required for the eastern end of the visitor carpark, resulting in a loss of one visitor space;

- Removal of turning circle or increase in loading area to accommodate MRV swept paths;
- Set back boom gate further into basement to achieve the required 47 visitor parking spaces;
- Modify the boom gate to be a roller door, to ensure the opening of the garage does not swing out and obstruct residential spaces R46, R45.

4 TRAFFIC ASSESSMENT

The impact of the expected traffic generation levels associated with the subject proposal is discussed in the following sub-sections.

4.1 Traffic Generation

The RTA (now RMS) Guide to Traffic Generation Developments and more recent RMS Technical Direction TDT2013/04a supplement details the following traffic generation rates:

High Density Residential
AM Peak – 0.53 vehicles trip per unit
PM Peak – 0.32 vehicles trips per unit

Commercial
2 trips per 100m^2

Retail
5.6 trips per 100m^2

The high density residential trip generation is adopted from the RMS Guide for High Density development in sub-regional areas. The Technical Direction adopts a revised traffic generation level of 0.15 to 0.19 trips per unit however it is considered that the 0.29 is a more appropriate outcome given the sites location outside of Sydney with limited access to a rail network, with only high frequency buses servicing the area.

The traffic generation is summarised in **Table 4** below.

TABLE 4: TRAFFIC GENERATION OF SITE

Type	Scale	Rate	Traffic Generation	Directional Split(1)(2)	
				AM	PM
Residential	140	0.53 per unit - AM	74 trips	14 IN, 60 OUT	60 IN, 14 OUT
		0.32 per unit – PM	45 trips	9 IN, 36 OUT	36 IN, 9 OUT
Commercial / Retail	700m²	3.8 trips per 100m^2	27 trips	14 IN, 13 OUT	13 IN, 14OUT
Total	**-**	**-**	**AM – 101 trips PM – 72 trips**	**28 IN, 73 OUT**	**49 IN, 23 OUT**

NOTES
(1) Residential Flat traffic generation taken as 20% in, 80% out for AM peak hour and vice versa for PM.
(2) Retail traffic generation taken as 50% in each direction for both AM and PM.
(3) Adopted as the average between commercial and retail based upon previous advice from the RMS

As shown above, the proposal is estimated to generate 101 and 72 vehicle trips in the AM (28 in, 73 out) and PM (49 in, 23 out) peak hour period respectively. As a worst-case scenario, it is assumed that the retail peak hour traffic generation occurs in the AM, despite the likely retail uses would peak during the evening only.

4.2 Existing Traffic Generation

The site will demolish eleven (11) existing residential dwellings (3 along Edgar Street, 5 along Sharp Street and 2 along Brooks Parade) and three (3) commercial / retail properties along Brooks Parade. The resulting traffic generation from the existing properties is summarised in **Table 3** and the net traffic generation provided in **Table 6**.

TABLE 5: TRAFFIC GENERATION OF EXISTING SITE

Type	Scale	Peak Hour	Trip Rate	Traffic Generation	Direction
Residential	11	AM	1 per dwelling	11 trips	2 in;9 out
		PM			9 in; 2 out
Commercial / Retail	650m²	AM	3.8 per 100m²	25 trips	13 in; 12 out
		PM			12 in; 13 out
Total	**-**	**AM**	**-**	**36 Trips**	**15 in; 21 out**
		PM	**-**	**36 Trips**	**21 in; 15 out**

TABLE 6: CHANGE IN TRAFFIC GENERATION

Case	AM Trips		PM Trips	
	IN	OUT	IN	OUT
Existing	15	21	21	15
Future	28	73	49	23
Net Change	+13	+52	+28	+8
Total Change	+65		+36	

The net traffic generation of the proposal is up to 65 vehicle trips during the AM peak hour and 36 vehicle trips during the PM peak hour. This is equivalent to an additional 1 vehicle every 55 seconds in the AM and 1 vehicle every 100 seconds in the PM.

For the purpose of this assessment, it has been assumed that the peak hourly traffic volumes generated by the site occur during the recorded weekday commuter peak hour periods of 8:15 AM -9:15 AM and 4.30 PM - 5.30 PM.

4.3 Traffic Assignment

The traffic assignment adopted has been completed in accordance with the existing traffic flow patterns past the site and as previously provided within a letter dated 28th August 2017 by MTE. The previous design provided a retail car park off Sharp Street, which is now combined with the residential car park from Edgar Street. Based upon this redesign the adopted traffic distribution for residential and commercial / retail uses will follow that shown in **Figure 4** below.

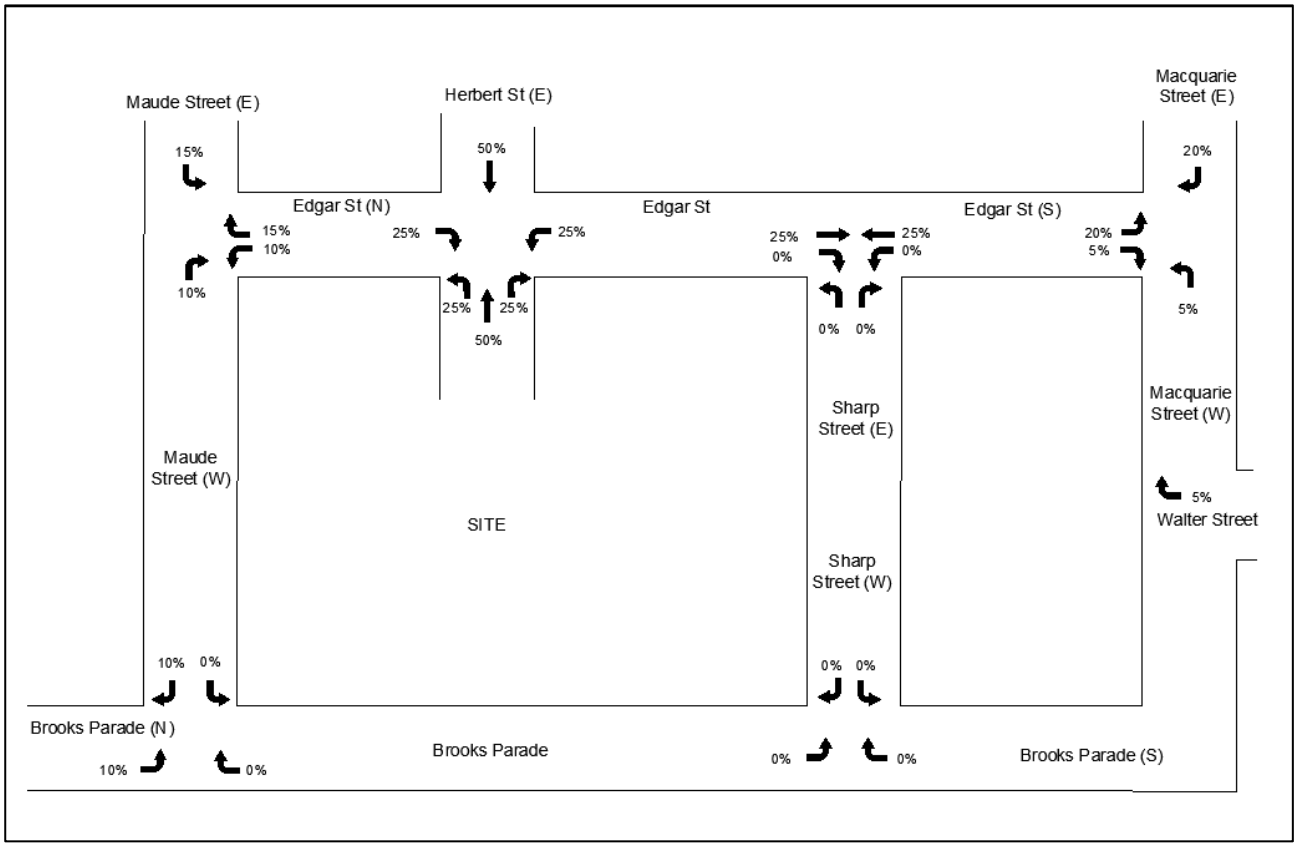


FIGURE 4: INBOUND / OUTBOUND TRAFFIC ASSIGNMENT

4.4 Traffic Impact

The traffic generation outlined in **Section 4.1, 4.2 & 4.3** above has been added to the existing traffic volumes recorded. SIDRA INTERSECTION 7 was used to assess the intersections performance. The purpose of this assessment is to compare the existing intersection operations to the future scenario under the increased traffic load. The results of this are provided in **Annexure F** and summarised in **Table 7** below.

TABLE 7: INTERSECTION PERFORMANCES (SIDRA INTERSECTION 7)

Intersection	Peak Hour	Degree of Saturation(1)	Average Delay(2) (sec/vehicle)	Level of Service(3)	Control Type	Worst Movement
EXISTING PERFORMANCE						
Edgar St / Herbert St / Property Access	AM	0.086	5.5 (7.7)	**A** (Worst: A)	Round-about	RT from Edgar St.
	PM	0.141	5.4 (7.7)	**A** (Worst: A)		RT from Edgar St.
FUTURE PERFORMANCE (Post development)						
Edgar St / Herbert St / Property Access	AM	0.10	5.7 (8)	**A** (Worst: A)	Round-about	RT from Site Driveway
	PM	0.154	5.6 (8.7)	**A** (Worst: A)		RT from Site Driveway

NOTES:

(1) Degree of Saturation is the ratio of demand to capacity for the most disadvantaged movement.
(2) Average delay is the delay experienced on average by all vehicles. The value in brackets represents the delay to the most disadvantaged movement.
(3) Level of Service is a qualitative measure of performance describing operational conditions. There are six levels of service, designated from A to F, with A representing the best operational condition and level of service F the worst. The LoS of the intersection is shown in bold, and the LoS of the most disadvantaged movement is shown in brackets.

As shown in **Table 7** above, the surrounding intersections remain unaltered under the future scenario. The existing LoS has been retained with minimal delays and additional capacity maintained.

The intersection of Macquarie Street / Edgar Street, Brooks Parade / Sharp Street, Brooks Parade / Maude Street have previously been assessed as a network in a letter dated 6th December 2017 by MTE based upon a residential car park from Edgar Street and Retail car park along Sharp Street. The results of this assessment are reproduced in **Table 8** below with detailed SIDRA results shown in **Annexure G**.

The additional traffic generation of the site over what was previously assessed is 12 vehicle trips in the AM (4 in, 8 out) and 10 vehicle trips in the PM (5 in, 5 out) peak period.

TABLE 8: NETWORK ANALYSIS RESULTS – SIDRA INTERSECTION 7.0

Intersection	Peak Hour	Degree of Saturation[1]	Average Delay[2] (sec/vehicle)	Level of Service[3][4]	Control Type	Worst Movement	95th Percentile Queue
EXISTING PERFORMANCE							
Macquarie Street / Edgar Street	AM	0.12	2.5 (Worst: 10.8)	**N/A** (Worst: A)	Give Way	RT from Edgar Street (N)	0.6 veh (3.9m) Macquarie Street (E)
	PM	0.21	3 (Worst: 14)	**N/A** (Worst: A)		RT from Edgar Street (N)	1 veh (6.8m) Macquarie Street (E)
Brooks Parade / Sharp Street	AM	0.32	0.3 (Worst: 20.8)	**N/A** (Worst: B)	Give Way	RT from Sharp Street (E)	0.1 veh (0.8m) Sharp Street (E)
	PM	0.57	1.2 (Worst: >70)	**N/A** (Worst: F)		RT from Sharp Street (E)	1.3 veh (8.9m) Sharp Street (E)
Brooks Parade / Maude Street	AM	0.39	2.5 (Worst: 24.9)	**N/A** (Worst: B)	Give Way	RT from Maude Street (E)	1.5 veh (10.6m) Maude Street (E)
	PM	6.12	409.9 (Worst: >70)	**N/A** (Worst: F)		RT from Maude Street (E)	124 veh (867.9m) Maude Street (E)
FUTURE PERFORMANCE							
Macquarie Street / Edgar Street	AM	0.12	2.6 (Worst: 10.9)	**N/A** (Worst: A)	Give Way	RT from Edgar Street (N)	0.6 veh (4.1m) Macquarie Street (E)
	PM	0.22	3.1 (Worst: 14.3)	**N/A** (Worst: A)		RT from Edgar Street (N)	1.1 veh (7.6m) Macquarie Street (E)
Brooks Parade / Sharp Street	AM	0.33	0.3 (Worst: 21)	**N/A** (Worst: B)	Give Way	RT from Sharp Street (E)	0.1 veh (1m) Sharp Street (E)
	PM	0.57	1.6 (Worst: >70)	**N/A** (Worst: F)		RT from Sharp Street (E)	1.6 veh (11.2m) Sharp Street (E)
Brooks Parade / Maude Street	AM	0.42	2.6 (Worst: 25.7)	**N/A** (Worst: B)	Give Way	RT from Maude Street (E)	1.7 veh (11.7m) Maude Street (E)
	PM	6.25	420.8 (Worst: >70)	**N/A** (Worst: F)		RT from Maude Street (E)	125.3 veh (877m) Maude Street (E)

NOTES:

(1) Degree of Saturation is the ratio of demand to capacity for the most disadvantaged movement.

(2) Average delay is the delay experienced on average by all vehicles. The value in brackets represents the delay to the most disadvantaged movement.

(3) Level of Service is a qualitative measure of performance describing operational conditions. There are six levels of service, designated from A to F, with A representing the best operational condition and level of service F the worst. The LoS of the intersection is shown in bold, and the LoS of the most disadvantaged movement is shown in brackets.

(4) NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

As shown above the future intersection assessments indicate that Macquarie Street / Edgar Street has ample additional spare capacity, while the right turn movements out of Sharp Street and Maude Street onto Brooks Parade operate at LoS F.

Based upon the relocated retail driveway and modified trip distribution, results in a decrease of retail trips at the intersection of Brooks Parade / Sharp Street. This would improve the operation for the intersection over the results shown in **Table 8** above. Conversely there will be minor additional vehicle trips at the intersection of Brooks Parade / Maude Street over what was previously assessed.

The additional traffic movements at the intersection of Brooks Parade / Maude Street as a result of the proposed development (entire development) result in 7 and 4 vehicle movements during the AM (2 in, 5 out) and PM (3 in, 1 out). This is a minor increase compared to the existing traffic flow at this intersection.

The additional traffic generated from the proposed development is not expected to be detrimental to the local road network over what was previously assessed in terms of level of service or road safety considerations.

4.5 Residential Amenity

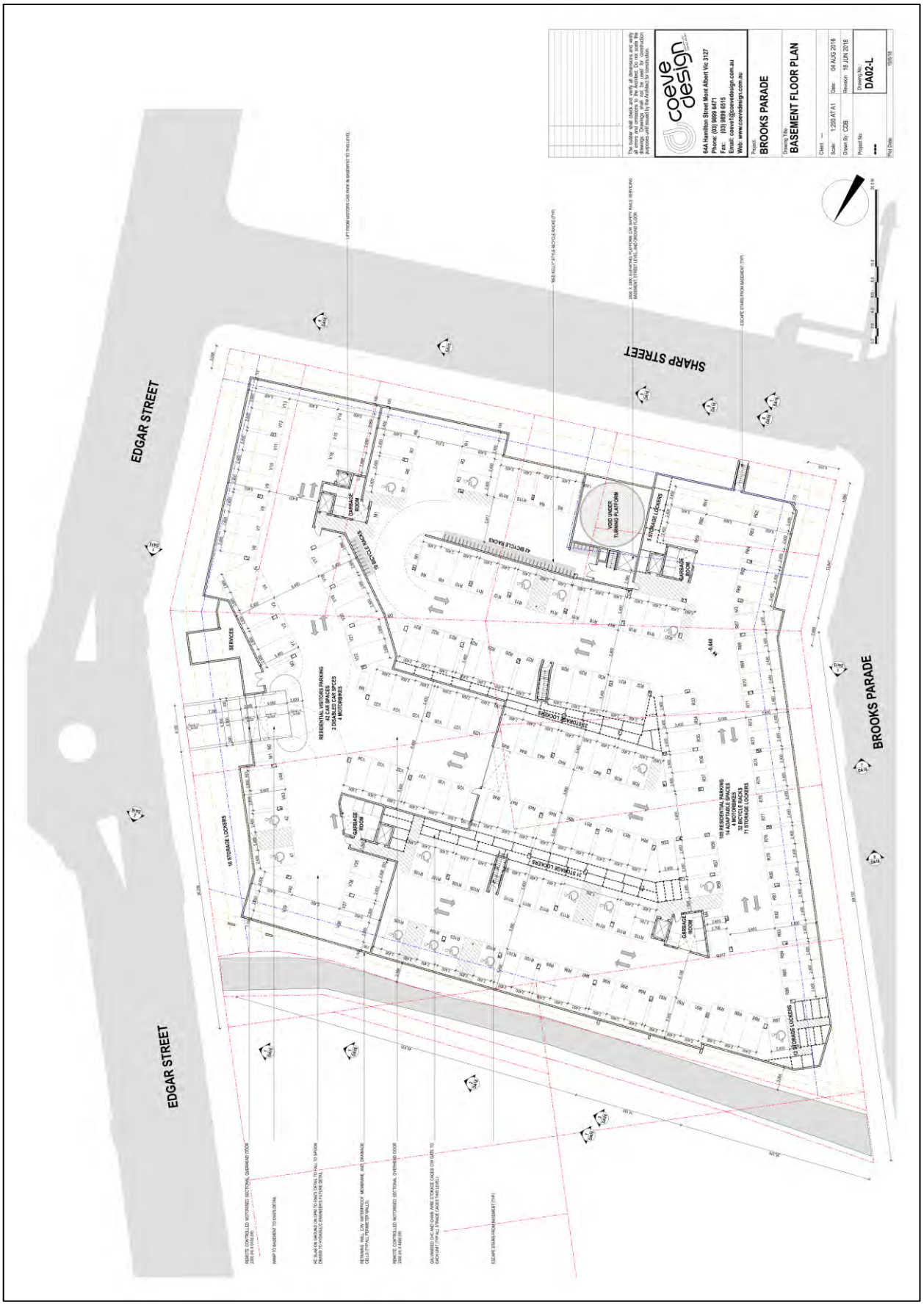
The net increase of some 65 vehicle trips within this town centre precinct will not adversely impact residential amenity threshold considerations.

5 CONCLUSION

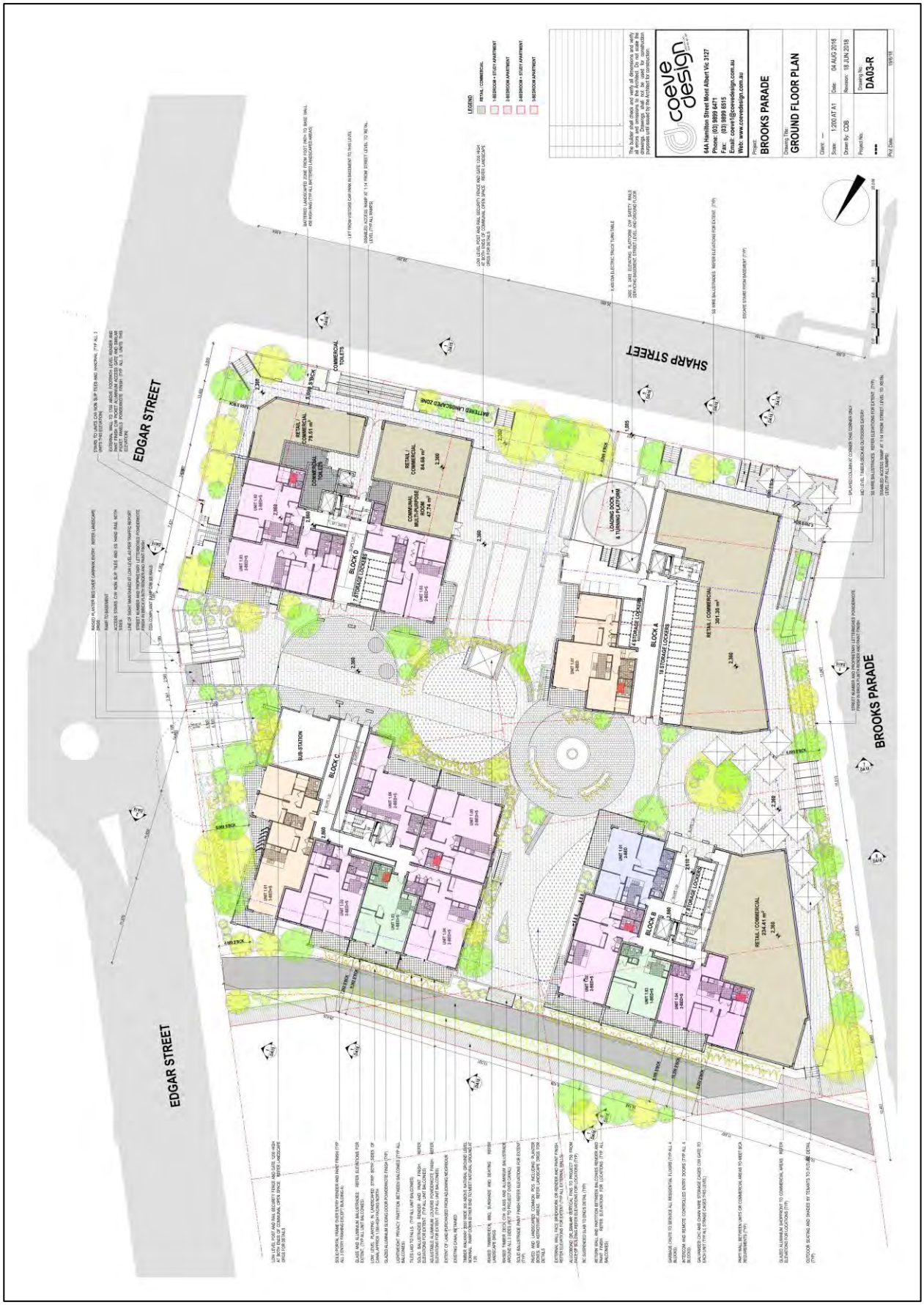
In view of the foregoing, the subject proposal (as depicted in **Annexure A**) is fully supportable in terms of its traffic and parking impacts. The following outcomes of this traffic impact assessment are relevant to note:

- The proposal details a total of 165 car parking spaces, representing a shortfall of 7 car parking spaces with Council's DCP, however it is considered that the requirement of 172 car parking spaces could warrant reduction to 156 based on the following:
    - Developments which propose mixed uses often result in a "dual use" outcome, whereby non-residential parking is shared amongst users. The dual use of residential visitor parking and the commercial / retail parking is appropriate due to the offset peak parking accumulation of the two uses. Residential visitor peak parking occurs Friday and Weekday evenings, often outside of business hours or when commercial / retail uses are not at peak operation.
- The site proposes to provide an on-site waste collection bay accessed via Sharp Street with a turning circle platform located in the loading bay. The turning bay in its current design would require a redesign of the loading area to accommodate the rotation of an MRV on the turning circle. Alternatively, it is recommended a reverse manoeuvre from Sharp Street be undertaken to enter / exit the loading area. Whilst this reverse manoeuvre is contrary to Council's DCP, it is considered that this variation is justified by the following:
    - Sharp Street is the lower order road in comparison to Brooks Parade and Edgar Street;
    - The frequency of waste collection is expected to be relatively low and outside of peak commuter hours;
    - Strict application of Council's DCP does not require an on-site loading provision, and thus the provision of any loading facility is beneficial.
- The proposed driveway to Edgar Street roundabout achieves a 3.5m verge width plus a 7.3m ramp length (at 5%) achieving the 10.8m considered to be acceptable sight distance to approach the roundabout.
- The car park design and access has been assessed in accordance with AS2890.1:2004 and AS2890.6:2009 where applicable and has found to be generally compliant, with any required changes to be implemented before the design certificate stage.
- The surrounding intersections remain unaltered under the future scenario. The existing LoS has been retained with generally minimal delays and additional capacity maintained.

ANNEXURE A: PROPOSED PLANS
(SHEET 1 of 2)



ANNEXURE A: PROPOSED PLANS
(SHEET 2 of 2)

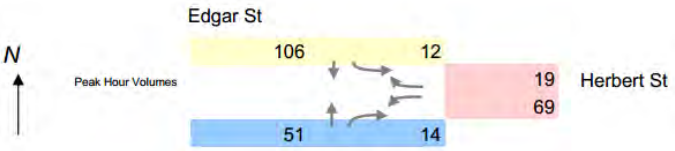


ANNEXURE B: TRAFFIC SURVEYS

Curtis Traffic Surveys

Turning movement count

Job: 160703mcl
Day, date: 21/07/16
Location: Edgar St & Herbert St
Weather: Fine
Client: McLaren Traffic Engineering

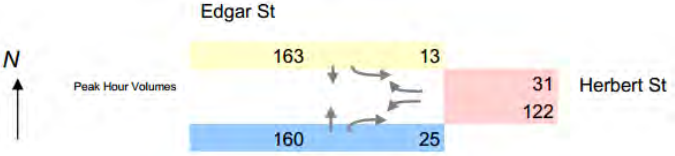


Time Period	From Edgar St south through	From Edgar St south right	From Herbert St left	From Herbert St right	From Edgar St north left	From Edgar St north through	Total vehicles	Peak
07:00 to 07:15	6	1	7	1	3	6	24	
07:15 to 07:30	6	1	12	0	3	8	30	
07:30 to 07:45	11	0	5	1	2	10	29	
07:45 to 08:00	11	7	8	1	6	10	43	
08:00 to 08:15	17	1	12	2	1	20	53	
08:15 to 08:30	14	3	14	1	3	25	60	
08:30 to 08:45	13	6	14	7	3	27	70	
08:45 to 09:00	7	4	29	9	5	34	88	peak
Total	85	23	101	22	26	140		
Hourly summary								
07:00 to 08:00	34	9	32	3	14	34	126	
07:15 to 08:15	45	9	37	4	12	48	155	
07:30 to 08:30	53	11	39	5	12	65	185	
07:45 to 08:45	55	17	48	11	13	82	226	
08:00 to 09:00	51	14	69	19	12	106	271	peak hour

Curtis Traffic Surveys

Turning movement count

Job: 160703mcl
Day, date: 21/07/16
Location: Edgar St & Herbert St
Weather: Fine
Client: McLaren Traffic Engineering



Time Period	From Edgar St south through	From Edgar St south right	From Herbert St left	From Herbert St right	From Edgar St north left	From Edgar St north through	Total vehicles	Peak
07:00 to 07:15	27	3	20	8	5	41	104	
07:15 to 07:30	30	3	28	9	5	40	115	
07:30 to 07:45	33	8	37	5	6	45	134	
07:45 to 08:00	40	6	21	3	3	33	106	
08:00 to 08:15	46	8	37	16	2	42	151	peak
08:15 to 08:30	41	3	27	7	2	43	123	
08:30 to 08:45	28	4	32	7	4	29	104	
08:45 to 09:00	27	4	23	3	1	22	80	
Total	272	39	225	58	28	295		
Hourly summary								
07:00 to 08:00	130	20	106	25	19	159	459	
07:15 to 08:15	149	25	123	33	16	160	506	
07:30 to 08:30	160	25	122	31	13	163	514	peak hour
07:45 to 08:45	155	21	117	33	11	147	484	
08:00 to 09:00	142	19	119	33	9	136	458	

ANNEXURE B: TRAFFIC SURVEYS

Curtis Traffic Surveys

Turning movement count

Job:	160703mcl
Day, date	21/07/16
Location:	Edgar St & Herbert St
Weather:	Fine
Client:	McLaren Traffic Engineering

N

Edgar St

Peak Hour Volumes: 163 (13) 31 — 160 (25) 122 — Herbert St

Time Period	From Edgar St south: through	right	From Herbert St: left	right	From Edgar St north: left	through	Total vehicles	Peak
16:00 to 16:15	27	3	20	8	5	41	104	
16:15 to 16:30	30	3	28	9	5	40	115	
16:30 to 16:45	33	8	37	5	6	45	134	
16:45 to 17:00	40	6	21	3	3	33	106	
17:00 to 17:15	46	8	37	16	2	42	151	peak
17:15 to 17:30	41	3	27	7	2	43	123	
17:30 to 17:45	28	4	32	7	4	29	104	
17:45 to 18:00	27	4	23	3	1	22	80	
Total	272	39	225	58	28	295		
Hourly summary								
16:00 to 17:00	130	20	106	25	19	159	459	
16:15 to 17:15	149	25	123	33	16	160	506	
16:30 to 17:30	160	25	122	31	13	163	514	peak hour
16:45 to 17:45	155	21	117	33	11	147	484	
17:00 to 18:00	142	19	119	33	9	136	458	

Curtis Traffic Surveys

Turning movement count

Job:	160703mcl
Day, date	21/07/16
Location:	Edgar St & Herbert St
Weather:	Fine
Client:	McLaren Traffic Engineering

N

Edgar St

Peak Hour Volumes: 106 (12) 19 — 51 (14) 69 — Herbert St

Time Period	From Edgar St south: through	right	From Herbert St: left	right	From Edgar St north: left	through	Total vehicles	Peak
07:00 to 07:15	6	1	7	1	3	6	24	0
07:15 to 07:30	6	1	12	0	3	8	30	0
07:30 to 07:45	11	0	5	1	2	10	29	0
07:45 to 08:00	11	7	8	1	6	10	43	0
08:00 to 08:15	17	1	12	2	1	20	53	0
08:15 to 08:30	14	3	14	1	3	25	60	0
08:30 to 08:45	13	6	14	7	3	27	70	0
08:45 to 09:00	7	4	29	9	5	34	88	0
Total	85	23	101	22	26	140		
Hourly summary								
07:00 to 08:00	34	9	32	3	14	34	126	0
07:15 to 08:15	45	9	37	4	12	48	155	0
07:30 to 08:30	53	11	39	5	12	65	185	0
07:45 to 08:45	55	17	48	11	13	82	226	0
08:00 to 09:00	51	14	69	19	12	106	271	0

ANNEXURE B: TRAFFIC SURVEYS

Curtis Traffic Surveys

Turning movement count

Job: 170602mcl (17_315)
Day, date: 09/06/17
Location: Macquarie St & Edgar St
Weather: Fine
Client: McLaren Traffic Engineering

N

Edgar St

Peak Hour Volumes: 29 / 353

62 142 91 280

Macquarie S

Time Period	From Macquarie St east through	right	From Edgar St left	right	From Macquarie St west left	through	Total vehicles	Peak
14:30 to 14:45	51	15	35	10	8	78	197	
14:45 to 15:00	42	16	37	8	9	83	195	
15:00 to 15:15	46	15	42	9	10	88	210	
15:15 to 15:30	56	20	40	13	12	84	225	
15:30 to 15:45	62	21	38	13	11	90	235	
15:45 to 16:00	65	26	40	12	5	75	223	
16:00 to 16:15	70	25	38	11	6	85	235	
16:15 to 16:30	69	23	34	14	5	87	232	
16:30 to 16:45	75	21	40	16	8	84	244	
16:45 to 17:00	66	22	30	21	10	97	246	peak
17:00 to 17:15	52	23	29	18	8	79	209	
17:15 to 17:30	61	18	32	20	9	82	222	
17:30 to 17:45	50	12	30	15	4	76	187	
17:45 to 18:00	48	8	24	17	5	68	170	
Total	813	265	489	197	110	1156		
Hourly summary								
14:30 to 15:30	195	66	154	40	39	333	827	
14:45 to 15:45	206	72	157	43	42	345	865	
15:00 to 16:00	229	82	160	47	38	337	893	
15:15 to 16:15	253	92	156	49	34	334	918	
15:30 to 16:30	266	95	150	50	27	337	925	
15:45 to 16:45	279	95	152	53	24	331	934	
16:00 to 17:00	280	91	142	62	29	353	957	peak hour
16:15 to 17:15	262	89	133	69	31	347	931	
16:30 to 17:30	254	84	131	75	35	342	921	
16:45 to 17:45	229	75	121	74	31	334	864	
17:00 to 18:00	211	61	115	70	26	305	788	

Curtis Traffic Surveys

Turning movement count

Job: 170602mcl (17_315)
Day, date: 09/06/17
Location: Macquarie St & Edgar St
Weather: Fine
Client: McLaren Traffic Engineering

N

Edgar St

Peak Hour Volumes: 52 / 373

28 98 64 112

Macquarie S

Time Period	From Macquarie St east through	right	From Edgar St left	right	From Macquarie St west left	through	Total vehicles	Peak
07:00 to 07:15	42	3	7	3	2	65	122	
07:15 to 07:30	50	4	5	4	2	68	133	
07:30 to 07:45	46	8	11	6	7	77	155	
07:45 to 08:00	37	4	5	5	6	81	138	
08:00 to 08:15	41	7	8	6	5	79	146	
08:15 to 08:30	35	12	15	7	6	80	155	
08:30 to 08:45	22	10	23	5	6	76	142	
08:45 to 09:00	29	16	28	3	16	86	178	
09:00 to 09:15	30	16	26	8	12	95	187	
09:15 to 09:30	31	22	21	12	18	116	220	peak
Total	363	102	149	59	80	823		
Hourly summary								
07:00 to 08:00	175	19	28	18	17	291	548	
07:15 to 08:15	174	23	29	21	20	305	572	
07:30 to 08:30	159	31	39	24	24	317	594	
07:45 to 08:45	135	33	51	23	23	316	581	
08:00 to 09:00	127	45	74	21	33	321	621	
08:15 to 09:15	116	54	92	23	40	337	662	
08:30 to 09:30	112	64	98	28	52	373	727	peak hour

ANNEXURE B: TRAFFIC SURVEYS

Curtis Traffic Surveys	Turning movement count	N	Brooks Pd	Maude St
Job:	170602mcl (17_315)		513 97	
Day, date	09/06/17	Peak Hour Volumes		86
Location:	Brooks Pd & Maude St			44
Weather:	Fine		520 12	
Client:	McLaren Traffic Engineering			

	From Brooks Pd south		From Maude St		From Brooks Pd north			
Time Period	through	right	left	right	left	through	Total vehicles	Peak
07:00 to 07:15	65	1	2	15	4	58	145	
07:15 to 07:30	85	1	1	3	6	71	167	
07:30 to 07:45	95	2	2	5	8	85	197	
07:45 to 08:00	110	3	5	7	15	105	245	
08:00 to 08:15	125	2	6	9	22	135	299	
08:15 to 08:30	124	1	7	12	24	137	305	
08:30 to 08:45	122	2	12	16	25	138	315	
08:45 to 09:00	140	3	10	25	26	125	329	peak
09:00 to 09:15	134	6	15	33	22	113	323	
09:15 to 09:30	125	7	10	28	26	108	304	
Total	1125	28	70	153	178	1075		
Hourly summary								
07:00 to 08:00	355	7	10	30	33	319	754	
07:15 to 08:15	415	8	14	24	51	396	908	
07:30 to 08:30	454	8	20	33	69	462	1046	
07:45 to 08:45	481	8	30	44	86	515	1164	
08:00 to 09:00	511	8	35	62	97	535	1248	
08:15 to 09:15	520	12	44	86	97	513	1272	peak hour
08:30 to 09:30	521	18	47	102	99	484	1271	

Curtis Traffic Surveys	Turning movement count	N	Brooks Pd	Maude St
Job:	170602mcl (17_315)		771 101	
Day, date	09/06/17	Peak Hour Volumes		196
Location:	Brooks Pd & Maude St			109
Weather:	Fine		985 72	
Client:	McLaren Traffic Engineering			

	From Brooks Pd south		From Maude St		From Brooks Pd north			
Time Period	through	right	left	right	left	through	Total vehicles	Peak
14:30 to 14:45	121	8	8	29	27	109	302	
14:45 to 15:00	127	4	9	29	25	106	300	
15:00 to 15:15	132	5	7	31	18	108	301	
15:15 to 15:30	140	3	10	46	17	125	341	
15:30 to 15:45	133	2	14	49	20	110	328	
15:45 to 16:00	137	1	13	56	21	125	353	
16:00 to 16:15	181	4	9	34	19	115	362	
16:15 to 16:30	195	5	12	41	25	165	443	
16:30 to 16:45	254	15	21	45	23	185	543	
16:45 to 17:00	235	18	25	56	24	195	553	
17:00 to 17:15	272	27	38	53	28	206	624	peak
17:15 to 17:30	224	12	25	42	26	185	514	
17:30 to 17:45	167	6	10	35	22	130	370	
17:45 to 18:00	175	4	8	32	21	125	365	
Total	2493	114	209	578	316	1989		
Hourly summary								
14:30 to 15:30	520	20	34	135	87	448	1244	
14:45 to 15:45	532	14	40	155	80	449	1270	
15:00 to 16:00	542	11	44	182	76	468	1323	
15:15 to 16:15	591	10	46	185	77	475	1384	
15:30 to 16:30	646	12	48	180	85	515	1486	
15:45 to 16:45	767	25	55	176	88	590	1701	
16:00 to 17:00	865	42	67	176	91	660	1901	
16:15 to 17:15	956	65	96	195	100	751	2163	
16:30 to 17:30	985	72	109	196	101	771	2234	peak hour
16:45 to 17:45	898	63	98	186	100	716	2061	
17:00 to 18:00	838	49	81	162	97	646	1873	

ANNEXURE B: TRAFFIC SURVEYS

Curtis Traffic Surveys

Turning movement count

Job: 170602mcl (17_315)
Day, date: 09/06/17
Location: Brooks Pd & Sharp St
Weather: Fine
Client: McLaren Traffic Engineering

N

Peak Hour Volumes

Brooks Pd: 582 → 17; 526 → 3
Sharp St: 6; 5

Time Period	From Brooks Pd south through	From Brooks Pd south right	From Sharp St left	From Sharp St right	From Brooks Pd north left	From Brooks Pd north through	Total vehicles	Peak
07:00 to 07:15	65	1	1	1	3	70	141	
07:15 to 07:30	84	0	1	2	0	74	161	
07:30 to 07:45	96	1	0	1	2	88	188	
07:45 to 08:00	113	0	1	0	1	111	226	
08:00 to 08:15	126	0	0	1	5	139	271	
08:15 to 08:30	124	1	0	1	5	144	275	
08:30 to 08:45	122	0	0	2	4	150	278	
08:45 to 09:00	142	1	2	1	5	145	296	peak
09:00 to 09:15	138	1	3	2	3	143	290	
09:15 to 09:30	129	0	2	3	4	132	270	
Total	1139	5	10	14	32	1196		
Hourly summary								
07:00 to 08:00	358	2	3	4	6	343	716	
07:15 to 08:15	419	1	2	4	8	412	846	
07:30 to 08:30	459	2	1	3	13	482	960	
07:45 to 08:45	485	1	1	4	15	544	1050	
08:00 to 09:00	514	2	2	5	19	578	1120	
08:15 to 09:15	526	3	5	6	17	582	1139	peak hour
08:30 to 09:30	531	2	7	8	16	570	1134	

Curtis Traffic Surveys

Turning movement count

Job: 170602mcl (17_315)
Day, date: 09/06/17
Location: Brooks Pd & Sharp St
Weather: Fine
Client: McLaren Traffic Engineering

N

Peak Hour Volumes

Brooks Pd: 955 → 12; 1048 → 2
Sharp St: 9; 4

Time Period	From Brooks Pd south through	From Brooks Pd south right	From Sharp St left	From Sharp St right	From Brooks Pd north left	From Brooks Pd north through	Total vehicles	Peak
14:30 to 14:45	128	0	0	1	3	135	267	
14:45 to 15:00	129	1	4	2	4	131	271	
15:00 to 15:15	134	0	2	3	3	136	278	
15:15 to 15:30	142	1	3	1	2	169	318	
15:30 to 15:45	133	0	1	2	4	155	295	
15:45 to 16:00	137	0	1	1	3	178	320	
16:00 to 16:15	180	0	1	5	7	142	335	
16:15 to 16:30	197	1	2	3	5	201	409	
16:30 to 16:45	265	0	1	4	4	226	500	
16:45 to 17:00	251	1	0	2	3	248	505	
17:00 to 17:15	298	0	1	1	2	257	559	peak
17:15 to 17:30	234	1	2	2	3	224	466	
17:30 to 17:45	173	0	0	0	4	161	338	
17:45 to 18:00	178	0	0	1	3	154	336	
Total	2579	5	18	28	50	2517		
Hourly summary								
14:30 to 15:30	533	2	9	7	12	571	1134	
14:45 to 15:45	538	2	10	8	13	591	1162	
15:00 to 16:00	546	1	7	7	12	638	1211	
15:15 to 16:15	592	1	6	9	16	644	1268	
15:30 to 16:30	647	1	5	11	19	676	1359	
15:45 to 16:45	779	1	5	13	19	747	1564	
16:00 to 17:00	893	2	4	14	19	817	1749	
16:15 to 17:15	1011	2	4	10	14	932	1973	
16:30 to 17:30	1048	2	4	9	12	955	2030	peak hour
16:45 to 17:45	956	2	3	5	12	890	1868	
17:00 to 18:00	883	1	3	4	12	796	1699	

ANNEXURE C: EXISTING SIDRA OUTPUTS

(SHEET 1 OF 8)

MOVEMENT SUMMARY

Site: Edgar / Herbert Street EX AM

Edgar Street / Herbert Street
Existing
AM
Roundabout

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Edgar Street											
2	T1	54	0.0	0.051	4.9	LOS A	0.2	1.7	0.10	0.53	53.8
3	R2	15	0.0	0.051	7.7	LOS A	0.2	1.7	0.10	0.53	53.4
Approach		68	0.0	0.051	5.5	LOS A	0.2	1.7	0.10	0.53	53.7
East: Herbert Street											
4	L2	73	0.0	0.065	5.3	LOS A	0.3	2.2	0.07	0.58	52.8
6	R2	20	0.0	0.065	7.6	LOS A	0.3	2.2	0.07	0.58	53.2
Approach		93	0.0	0.065	5.8	LOS A	0.3	2.2	0.07	0.58	52.9
North: Edgar Street											
7	L2	112	0.0	0.086	5.3	LOS A	0.4	3.0	0.08	0.55	53.2
8	T1	13	0.0	0.086	4.8	LOS A	0.4	3.0	0.08	0.55	54.0
Approach		124	0.0	0.086	5.2	LOS A	0.4	3.0	0.08	0.55	53.3
All Vehicles		285	0.0	0.086	5.5	LOS A	0.4	3.0	0.08	0.55	53.2

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: Edgar / Herbert Street EX PM

Edgar Street / Herbert Street
Existing
PM
Roundabout

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Edgar Street											
2	T1	168	0.0	0.141	4.9	LOS A	0.7	5.0	0.14	0.52	53.8
3	R2	26	0.0	0.141	7.7	LOS A	0.7	5.0	0.14	0.52	53.4
Approach		195	0.0	0.141	5.3	LOS A	0.7	5.0	0.14	0.52	53.8
East: Herbert Street											
4	L2	128	0.0	0.110	5.3	LOS A	0.6	3.9	0.08	0.58	52.8
6	R2	33	0.0	0.110	7.6	LOS A	0.6	3.9	0.08	0.58	53.2
Approach		161	0.0	0.110	5.8	LOS A	0.6	3.9	0.08	0.58	52.9
North: Edgar Street											
7	L2	172	0.0	0.132	5.4	LOS A	0.7	4.8	0.12	0.54	53.0
8	T1	14	0.0	0.132	4.9	LOS A	0.7	4.8	0.12	0.54	53.9
Approach		185	0.0	0.132	5.3	LOS A	0.7	4.8	0.12	0.54	53.1
All Vehicles		541	0.0	0.141	5.4	LOS A	0.7	5.0	0.11	0.54	53.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 1.1 [EX - Macquarie Street and Edgar Street - AM]

Network: N101 [EX AM]

Macquarie Street and Edgar Street
Exisiting
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Macquarie Street (E)													
5	T1	118	0.0	118	0.0	0.112	1.1	LOS A	0.6	3.9	0.27	0.20	46.5
6	R2	67	0.0	67	0.0	0.112	7.7	LOS A	0.6	3.9	0.43	0.33	49.1
Approach		185	0.0	185	0.0	0.112	3.5	NA	0.6	3.9	0.33	0.25	48.0
North: Edgar Street (N)													
7	L2	103	0.0	103	0.0	0.090	6.2	LOS A	0.3	2.3	0.27	0.57	46.4
9	R2	29	0.0	29	0.0	0.060	10.8	LOS A	0.2	1.5	0.57	0.78	38.5
Approach		133	0.0	133	0.0	0.090	7.2	LOS A	0.3	2.3	0.34	0.62	44.9
West: Macquarie Street (W)													
10	L2	55	0.0	55	0.0	0.115	5.5	LOS A	0.0	0.0	0.00	0.15	54.5
11	T1	393	0.0	393	0.0	0.115	0.0	LOS A	0.0	0.0	0.00	0.06	58.3
Approach		447	0.0	447	0.0	0.115	0.7	NA	0.0	0.0	0.00	0.07	57.6
All Vehicles		765	0.0	765	0.0	0.115	2.5	NA	0.6	3.9	0.14	0.21	52.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

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MOVEMENT SUMMARY

Site: 1.2 [EX - Macquarie Street and Edgar Street - PM]

Network: N101 [EX PM]

Macquarie Street and Edgar Street
Existing
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Macquarie Street (E)													
5	T1	295	0.0	295	0.0	0.209	0.9	LOS A	1.0	6.8	0.25	0.15	48.4
6	R2	96	0.0	96	0.0	0.209	7.7	LOS A	1.0	6.8	0.34	0.21	51.0
Approach		391	0.0	391	0.0	0.209	2.5	NA	1.0	6.8	0.27	0.17	49.6
North: Edgar Street (N)													
7	L2	149	0.0	149	0.0	0.131	6.3	LOS A	0.5	3.5	0.28	0.58	46.4
9	R2	65	0.0	65	0.0	0.174	14.0	LOS A	0.6	4.4	0.70	0.87	34.8
Approach		215	0.0	215	0.0	0.174	8.6	LOS A	0.6	4.4	0.41	0.67	43.1
West: Macquarie Street (W)													
10	L2	31	0.0	31	0.0	0.103	5.5	LOS A	0.0	0.0	0.00	0.09	55.3
11	T1	372	0.0	372	0.0	0.103	0.0	LOS A	0.0	0.0	0.00	0.04	58.9
Approach		402	0.0	402	0.0	0.103	0.4	NA	0.0	0.0	0.00	0.05	58.5
All Vehicles		1007	0.0	1007	0.0	0.209	3.0	NA	1.0	6.8	0.19	0.22	50.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

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MOVEMENT SUMMARY

Site: 2.1 [EX - Brooks Parade and Sharp Street - AM]

Network: N101 [EX AM]

Brooks Parade and Sharp Street
Exisiting
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Brooks Parade (S)													
2	T1	554	0.0	554	0.0	0.284	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
3	R2	3	0.0	3	0.0	0.003	8.0	LOS A	0.0	0.1	0.55	0.62	36.3
Approach		557	0.0	557	0.0	0.284	0.1	NA	0.0	0.1	0.00	0.00	59.6
East: Sharp Street (E)													
4	L2	5	0.0	5	0.0	0.035	8.1	LOS A	0.1	0.8	0.72	0.83	17.5
6	R2	6	0.0	6	0.0	0.035	20.8	LOS B	0.1	0.8	0.72	0.83	17.5
Approach		12	0.0	12	0.0	0.035	15.0	LOS B	0.1	0.8	0.72	0.83	17.5
North: Brooks Parade (N)													
7	L2	18	0.0	18	0.0	0.324	5.5	LOS A	0.0	0.0	0.00	0.02	30.2
8	T1	613	0.0	613	0.0	0.324	0.0	LOS A	0.0	0.0	0.00	0.02	58.8
Approach		631	0.0	631	0.0	0.324	0.2	NA	0.0	0.0	0.00	0.02	56.4
All Vehicles		1199	0.0	1199	0.0	0.324	0.3	NA	0.1	0.8	0.01	0.02	57.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

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MOVEMENT SUMMARY

Site: 2.2 [EX - Brooks Parade and Sharp Street - PM]

Network: N101 [EX PM]

Brooks Parade and Sharp Street
Exisiting
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Brooks Parade (S)													
2	T1	1103	0.0	1103	0.0	0.566	0.0	LOS A	0.0	0.0	0.00	0.00	59.8
3	R2	2	0.0	2	0.0	0.005	12.3	LOS A	0.0	0.1	0.75	0.76	31.4
Approach		1105	0.0	1105	0.0	0.566	0.1	NA	0.0	0.1	0.00	0.00	59.6
East: Sharp Street (E)													
4	L2	4	0.0	4	0.0	0.466	68.5	LOS E	1.3	8.9	0.98	1.02	2.0
6	R2	9	0.0	9	0.0	0.466	221.5	LOS F	1.3	8.9	0.98	1.02	2.0
Approach		14	0.0	14	0.0	0.466	174.4	LOS F	1.3	8.9	0.98	1.02	2.0
North: Brooks Parade (N)													
7	L2	13	0.0	13	0.0	0.522	5.6	LOS A	0.0	0.0	0.00	0.01	30.3
8	T1	1005	0.0	1005	0.0	0.522	0.0	LOS A	0.0	0.0	0.00	0.01	59.3
Approach		1018	0.0	1018	0.0	0.522	0.1	NA	0.0	0.0	0.00	0.01	58.2
All Vehicles		2137	0.0	2137	0.0	0.566	1.2	NA	1.3	8.9	0.01	0.01	53.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 3.1 [EX - Brooks Parade and Maude Street - AM]

Network: N101 [EX AM]

Brooks Parade and Maude Street
Existing
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Brooks Parade (S)													
22	T1	547	0.0	547	0.0	0.281	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
23	R2	13	0.0	13	0.0	0.014	8.2	LOS A	0.1	0.4	0.56	0.67	47.5
Approach		560	0.0	560	0.0	0.281	0.2	NA	0.1	0.4	0.01	0.02	59.6
NorthEast: Maude Street (E)													
24	L2	46	0.0	46	0.0	0.049	7.7	LOS A	0.2	1.3	0.49	0.69	48.0
26	R2	91	0.0	91	0.0	0.386	24.9	LOS B	1.5	10.6	0.87	1.01	41.4
Approach		137	0.0	137	0.0	0.386	19.1	LOS B	1.5	10.6	0.74	0.90	42.6
NorthWest: Brooks Parade (N)													
27	L2	102	0.0	102	0.0	0.332	5.6	LOS A	0.0	0.0	0.00	0.09	57.5
28	T1	540	0.0	540	0.0	0.332	0.0	LOS A	0.0	0.0	0.00	0.09	58.3
Approach		642	0.0	642	0.0	0.332	0.9	NA	0.0	0.0	0.00	0.09	58.0
All Vehicles		1339	0.0	1339	0.0	0.386	2.5	NA	1.5	10.6	0.08	0.14	55.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

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MOVEMENT SUMMARY

Site: 3.2 [EX - Brooks Parade and Maude Street - PM]

Network: N101 [EX PM]

Brooks Parade and Maude Street
Existing
Giveway / Yield (Two-Way)

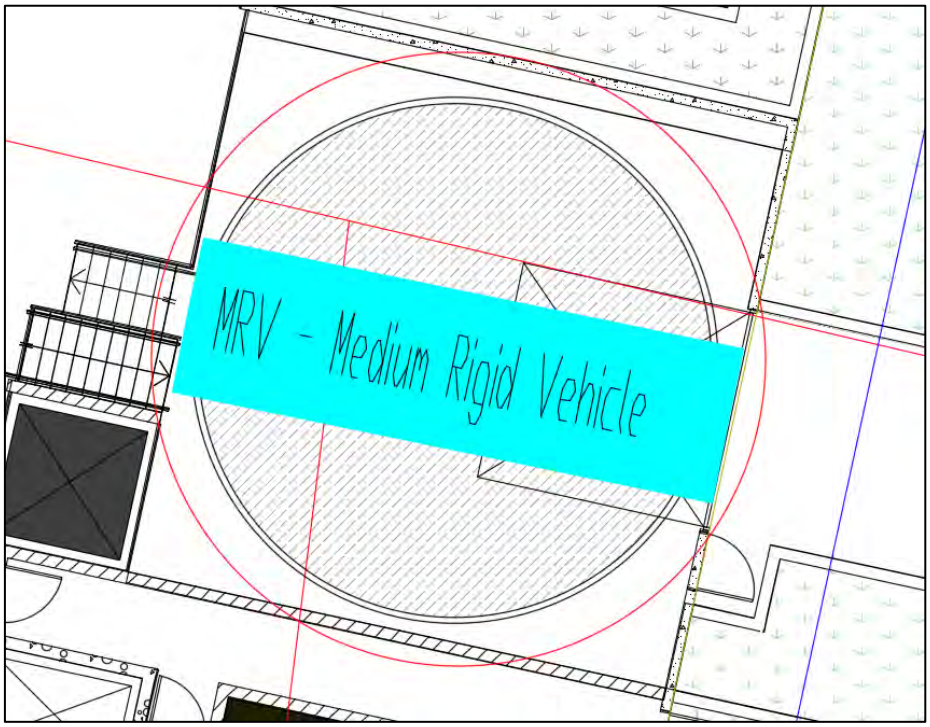
Movement Performance - Vehicles

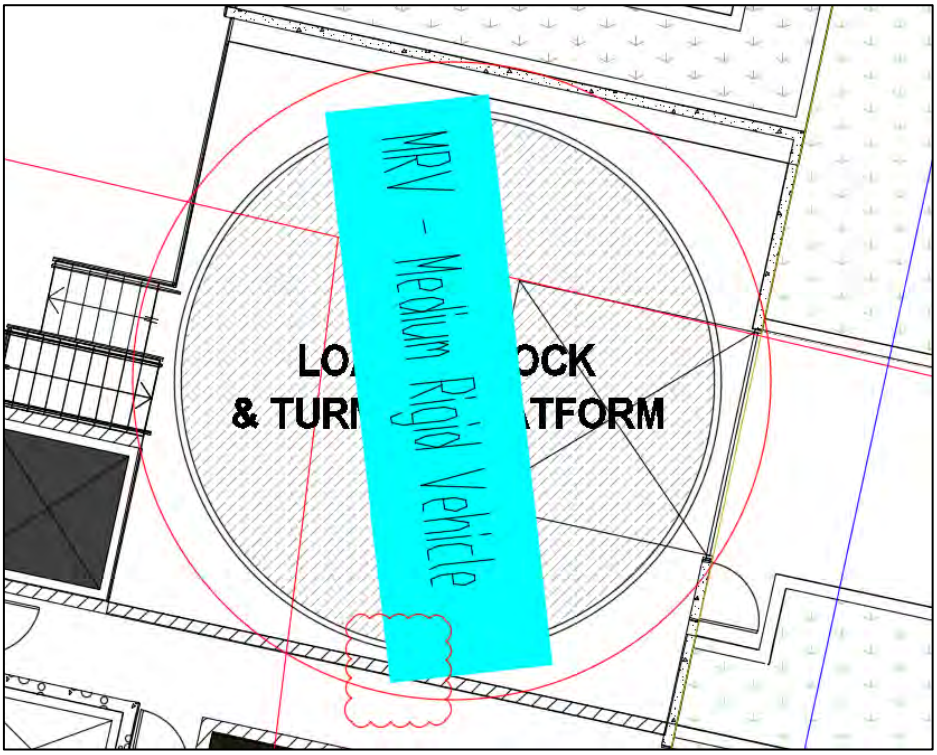
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Brooks Parade (S)													
22	T1	1037	0.0	1037	0.0	0.532	0.0	LOS A	0.0	0.0	0.00	0.00	49.9
23	R2	76	0.0	76	0.0	0.135	10.5	LOS A	0.5	3.5	0.72	0.87	40.0
Approach		1113	0.0	1113	0.0	0.532	0.7	NA	0.5	3.5	0.05	0.06	49.1
NorthEast: Maude Street (E)													
24	L2	115	0.0	115	0.0	0.180	9.3	LOS A	0.6	4.5	0.66	0.84	40.0
26	R2	206	0.0	206	0.0	6.121	4660.6	LOS F	124.0	867.9	1.00	2.99	0.8
Approach		321	0.0	321	0.0	6.121	2998.3	LOS F	124.0	867.9	0.88	2.22	1.0
NorthWest: Brooks Parade (N)													
27	L2	106	0.0	106	0.0	0.473	4.6	LOS A	0.0	0.0	0.00	0.06	49.1
28	T1	812	0.0	812	0.0	0.473	0.1	LOS A	0.0	0.0	0.00	0.06	49.2
Approach		918	0.0	918	0.0	0.473	0.6	NA	0.0	0.0	0.00	0.06	49.2
All Vehicles		2352	0.0	2352	0.0	6.121	409.9	NA	124.0	867.9	0.14	0.36	5.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

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ANNEXURE D: SWEPT PATH TESTS
(SHEET 1 OF 2)

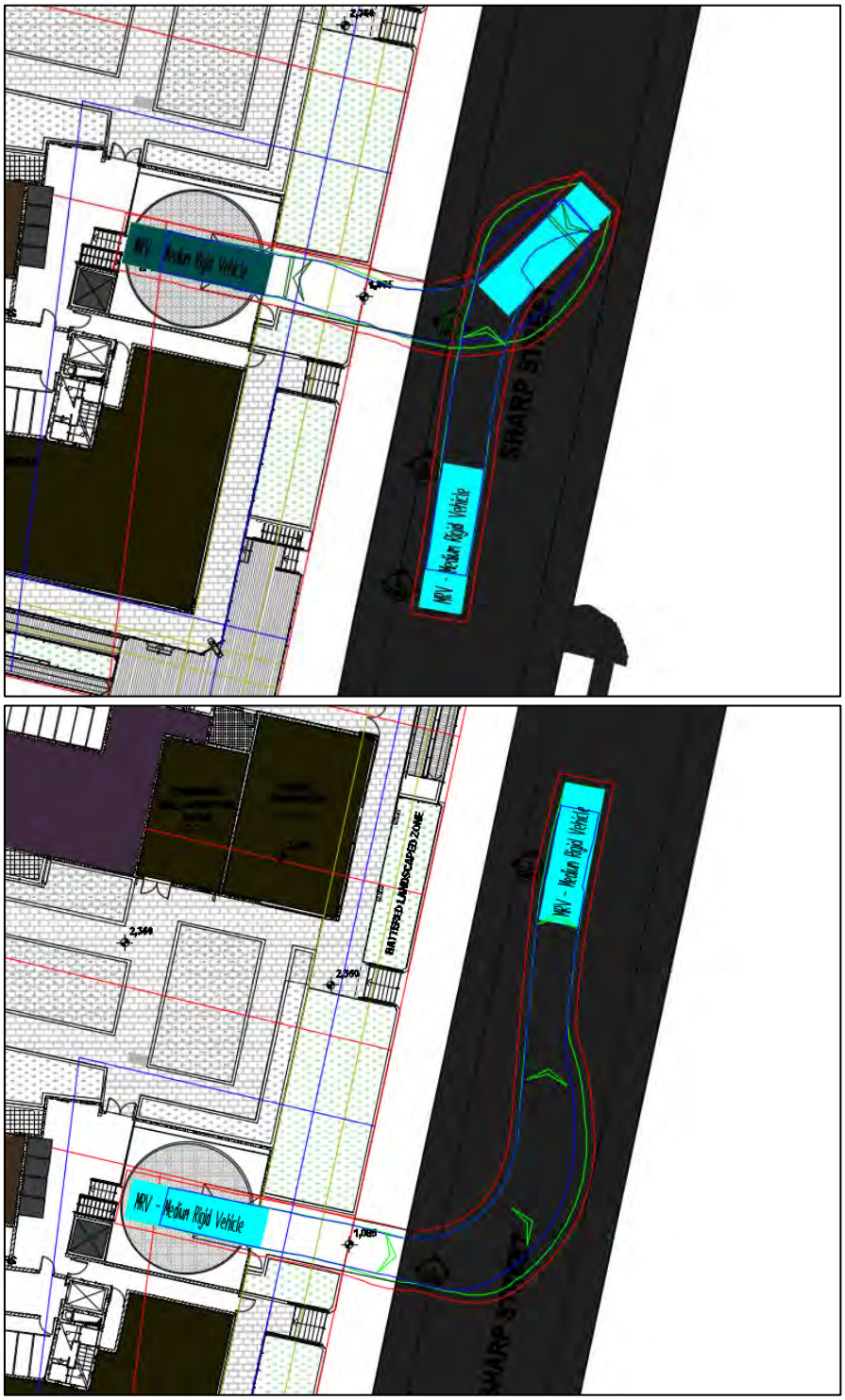




MRV using turning circle in loading Bay
Unsuccessful – vehicle body passes over walls
Recommend removal of turning circle and reversing into loading bay from Sharp Street (See below)

Red: 300mm Clearance

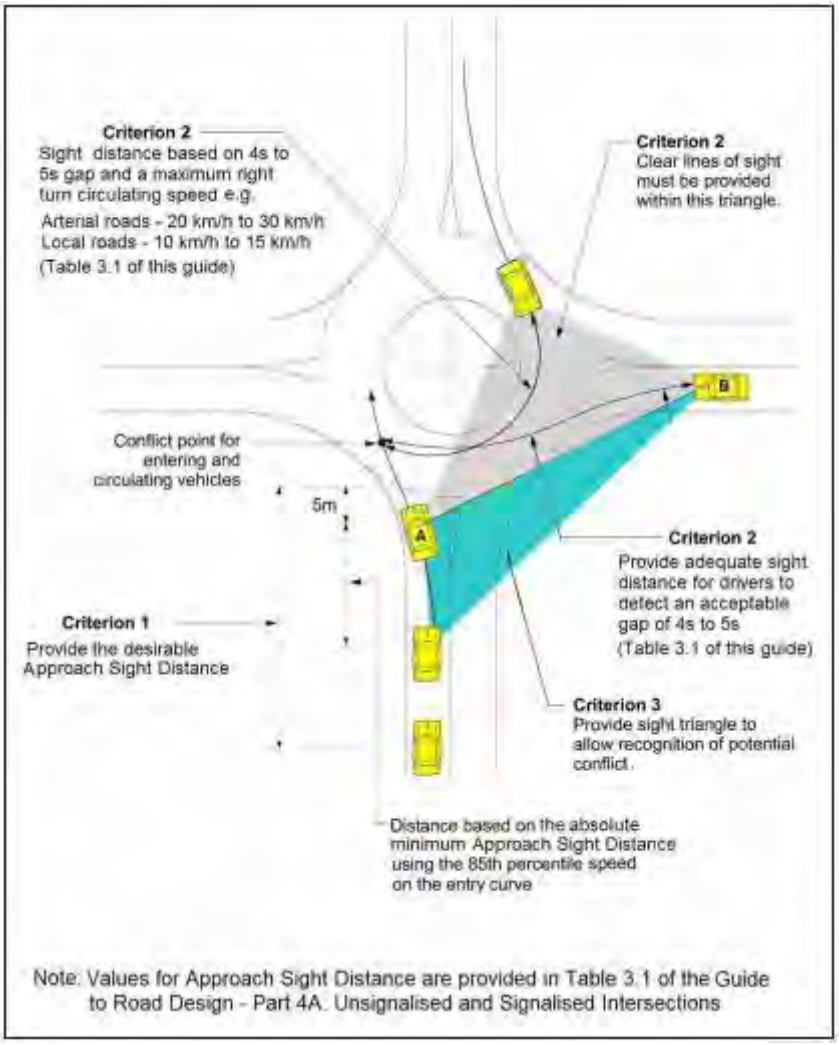
ANNEXURE D: SWEPT PATH TESTS
(SHEET 2 OF 2)



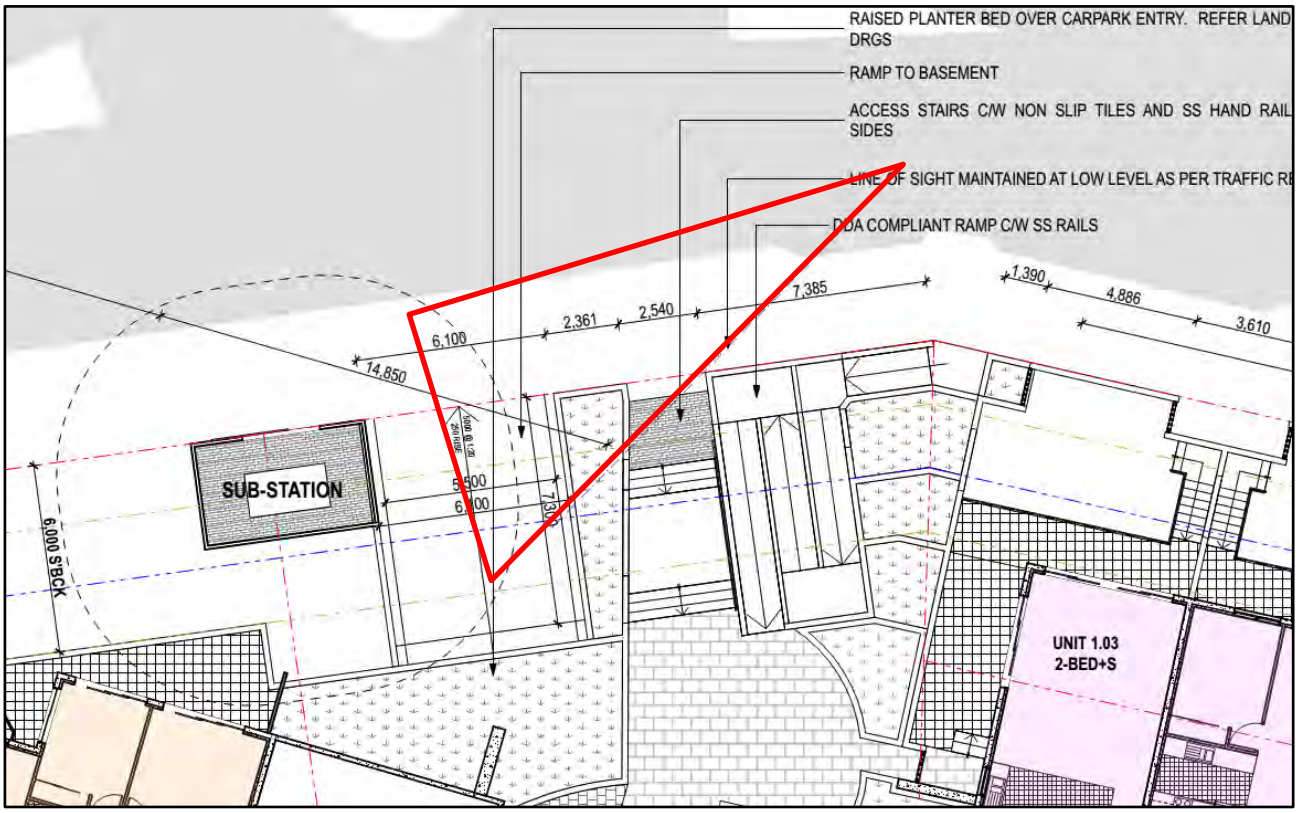
MRV REVERSE Entry / FORWARD Exit Loading Bay
Tested @ 5km/h
Successful

Blue – Wheels
Green – Vehicle body
Red – 500mm clearance

ANNEXURE E: ACCESS DESIGN
(SHEET 1 OF 2)



ANNEXURE E: ACCESS DESIGN
(SHEET 2 OF 2)



ANNEXURE F: FUTURE SIDRA OUTPUTS

(SHEET 1 OF 2)

MOVEMENT SUMMARY

Site: 101 [Edgar / Herbert Street FU AM]

Edgar Street / Herbert Street
Existing + Future
AM Peak Period
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Edgar Street											
1	L2	3	0.0	0.055	5.4	LOS A	0.3	1.8	0.13	0.53	52.9
2	T1	54	0.0	0.055	4.9	LOS A	0.3	1.8	0.13	0.53	53.7
3	R2	15	0.0	0.055	7.7	LOS A	0.3	1.8	0.13	0.53	53.3
Approach		72	0.0	0.055	5.5	LOS A	0.3	1.8	0.13	0.53	53.6
East: Herbert Street											
4	L2	73	0.0	0.075	5.4	LOS A	0.4	2.5	0.12	0.56	52.7
5	T1	7	0.0	0.075	4.9	LOS A	0.4	2.5	0.12	0.56	53.5
6	R2	20	0.0	0.075	7.7	LOS A	0.4	2.5	0.12	0.56	53.1
Approach		100	0.0	0.075	5.8	LOS A	0.4	2.5	0.12	0.56	52.8
North: Edgar Street											
7	L2	112	0.0	0.100	5.5	LOS A	0.5	3.5	0.19	0.54	52.8
8	T1	13	0.0	0.100	5.1	LOS A	0.5	3.5	0.19	0.54	53.6
9	R2	3	0.0	0.100	7.9	LOS A	0.5	3.5	0.19	0.54	53.2
Approach		127	0.0	0.100	5.5	LOS A	0.5	3.5	0.19	0.54	52.9
West: Driveway											
10	L2	14	0.0	0.046	5.7	LOS A	0.2	1.5	0.23	0.55	52.4
11	T1	27	0.0	0.046	5.2	LOS A	0.2	1.5	0.23	0.55	53.2
12	R2	14	0.0	0.046	8.0	LOS A	0.2	1.5	0.23	0.55	52.8
Approach		55	0.0	0.046	6.0	LOS A	0.2	1.5	0.23	0.55	52.9
All Vehicles		354	0.0	0.100	5.7	LOS A	0.5	3.5	0.16	0.55	53.0

MOVEMENT SUMMARY

Site: 101 [Edgar / Herbert Street FU PM]

Edgar Street / Herbert Street
Existing + Future
PM Peak Period
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Edgar Street											
1	L2	7	0.0	0.154	5.5	LOS A	0.8	5.6	0.19	0.52	52.9
2	T1	168	0.0	0.154	5.1	LOS A	0.8	5.6	0.19	0.52	53.7
3	R2	26	0.0	0.154	7.9	LOS A	0.8	5.6	0.19	0.52	53.3
Approach		202	0.0	0.154	5.4	LOS A	0.8	5.6	0.19	0.52	53.6
East: Herbert Street											
4	L2	128	0.0	0.124	5.3	LOS A	0.6	4.4	0.11	0.56	52.8
5	T1	15	0.0	0.124	4.9	LOS A	0.6	4.4	0.11	0.56	53.6
6	R2	33	0.0	0.124	7.7	LOS A	0.6	4.4	0.11	0.56	53.2
Approach		176	0.0	0.124	5.7	LOS A	0.6	4.4	0.11	0.56	52.9
North: Edgar Street											
7	L2	172	0.0	0.140	5.4	LOS A	0.7	5.1	0.14	0.54	52.9
8	T1	14	0.0	0.140	4.9	LOS A	0.7	5.1	0.14	0.54	53.7
9	R2	7	0.0	0.140	7.7	LOS A	0.7	5.1	0.14	0.54	53.3
Approach		193	0.0	0.140	5.4	LOS A	0.7	5.1	0.14	0.54	53.0
West: Driveway											
10	L2	2	0.0	0.008	6.3	LOS A	0.0	0.3	0.37	0.55	52.0
11	T1	4	0.0	0.008	5.9	LOS A	0.0	0.3	0.37	0.55	52.8
12	R2	2	0.0	0.008	8.7	LOS A	0.0	0.3	0.37	0.55	52.4
Approach		8	0.0	0.008	6.7	LOS A	0.0	0.3	0.37	0.55	52.5
All Vehicles		579	0.0	0.154	5.5	LOS A	0.8	5.6	0.15	0.54	53.2

ANNEXURE G: PREVIOUSLY ASSESSED NETWORK SIDRA RESULTS

(SHEET 1 OF 6)

MOVEMENT SUMMARY

Site: 1.1 [FU - Macquarie Street and Edgar Street - AM]

Network: N102 [FU AM]

Macquarie Street and Edgar Street
Future
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Macquarie Street (E)													
5	T1	118	0.0	118	0.0	0.118	1.1	LOS A	0.6	4.1	0.26	0.21	46.3
6	R2	74	0.0	74	0.0	0.118	7.7	LOS A	0.6	4.1	0.44	0.35	48.7
Approach		192	0.0	192	0.0	0.118	3.6	NA	0.6	4.1	0.33	0.27	47.8
North: Edgar Street (N)													
7	L2	118	0.0	118	0.0	0.103	6.2	LOS A	0.4	2.7	0.27	0.57	46.4
9	R2	31	0.0	31	0.0	0.063	10.9	LOS A	0.2	1.6	0.58	0.78	38.4
Approach		148	0.0	148	0.0	0.103	7.2	LOS A	0.4	2.7	0.33	0.62	45.0
West: Macquarie Street (W)													
10	L2	56	0.0	56	0.0	0.116	5.5	LOS A	0.0	0.0	0.00	0.15	54.4
11	T1	393	0.0	393	0.0	0.116	0.0	LOS A	0.0	0.0	0.00	0.06	58.3
Approach		448	0.0	448	0.0	0.116	0.7	NA	0.0	0.0	0.00	0.07	57.6
All Vehicles		788	0.0	788	0.0	0.118	2.6	NA	0.6	4.1	0.14	0.22	52.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

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ANNEXURE G: PREVIOUSLY ASSESSED NETWORK SIDRA RESULTS

(SHEET 2 OF 6)

MOVEMENT SUMMARY

Site: 1.2 [FU - Macquarie Street and Edgar Street - PM]

Network: N103 [FU PM]

Macquarie Street and Edgar Street
Future
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Macquarie Street (E)													
5	T1	295	0.0	295	0.0	0.220	0.9	LOS A	1.1	7.6	0.26	0.16	47.8
6	R2	108	0.0	108	0.0	0.220	7.7	LOS A	1.1	7.6	0.37	0.24	50.6
Approach		403	0.0	403	0.0	0.220	2.8	NA	1.1	7.6	0.29	0.18	49.2
North: Edgar Street (N)													
7	L2	155	0.0	155	0.0	0.136	6.3	LOS A	0.5	3.7	0.28	0.58	46.4
9	R2	66	0.0	66	0.0	0.181	14.3	LOS A	0.7	4.6	0.71	0.88	34.5
Approach		221	0.0	221	0.0	0.181	8.7	LOS A	0.7	4.6	0.41	0.67	43.0
West: Macquarie Street (W)													
10	L2	33	0.0	33	0.0	0.104	5.5	LOS A	0.0	0.0	0.00	0.10	55.2
11	T1	372	0.0	372	0.0	0.104	0.0	LOS A	0.0	0.0	0.00	0.04	58.8
Approach		404	0.0	404	0.0	0.104	0.5	NA	0.0	0.0	0.00	0.05	58.4
All Vehicles		1028	0.0	1028	0.0	0.220	3.1	NA	1.1	7.6	0.20	0.23	50.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

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ANNEXURE G: PREVIOUSLY ASSESSED NETWORK SIDRA RESULTS

(SHEET 3 OF 6)

MOVEMENT SUMMARY

Site: 2.1 [FU - Brooks Parade and Sharp Street - AM]

Network: N102 [FU AM]

Brooks Parade and Sharp Street
Future
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Brooks Parade (S)													
2	T1	554	0.0	554	0.0	0.284	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
3	R2	4	0.0	4	0.0	0.005	8.0	LOS A	0.0	0.1	0.55	0.63	36.3
Approach		558	0.0	558	0.0	0.284	0.1	NA	0.0	0.1	0.00	0.00	59.5
East: Sharp Street (E)													
4	L2	6	0.0	6	0.0	0.046	8.1	LOS A	0.1	1.0	0.73	0.84	17.1
6	R2	8	0.0	8	0.0	0.046	21.0	LOS B	0.1	1.0	0.73	0.84	17.1
Approach		15	0.0	15	0.0	0.046	15.5	LOS B	0.1	1.0	0.73	0.84	17.1
North: Brooks Parade (N)													
7	L2	20	0.0	20	0.0	0.325	5.5	LOS A	0.0	0.0	0.00	0.02	30.2
8	T1	613	0.0	613	0.0	0.325	0.0	LOS A	0.0	0.0	0.00	0.02	58.7
Approach		633	0.0	633	0.0	0.325	0.2	NA	0.0	0.0	0.00	0.02	56.0
All Vehicles		1205	0.0	1205	0.0	0.325	0.3	NA	0.1	1.0	0.01	0.02	56.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

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MOVEMENT SUMMARY

Site: 2.2 [FU - Brooks Parade and Sharp Street - PM]

Network: N103 [FU PM]

Brooks Parade and Sharp Street
Future
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Brooks Parade (S)													
2	T1	1103	0.0	1103	0.0	0.566	0.0	LOS A	0.0	0.0	0.00	0.00	59.8
3	R2	1	0.0	1	0.0	0.002	12.3	LOS A	0.0	0.1	0.75	0.72	31.4
Approach		1104	0.0	1104	0.0	0.566	0.1	NA	0.0	0.1	0.00	0.00	59.7
East: Sharp Street (E)													
4	L2	5	0.0	5	0.0	0.572	91.3	LOS F	1.6	11.2	0.99	1.04	1.8
6	R2	12	0.0	12	0.0	0.572	245.9	LOS F	1.6	11.2	0.99	1.04	1.8
Approach		17	0.0	17	0.0	0.572	197.6	LOS F	1.6	11.2	0.99	1.04	1.8
North: Brooks Parade (N)													
7	L2	15	0.0	15	0.0	0.523	5.6	LOS A	0.0	0.0	0.00	0.01	30.2
8	T1	1005	0.0	1005	0.0	0.523	0.0	LOS A	0.0	0.0	0.00	0.01	59.3
Approach		1020	0.0	1020	0.0	0.523	0.1	NA	0.0	0.0	0.00	0.01	58.0
All Vehicles		2141	0.0	2141	0.0	0.572	1.6	NA	1.6	11.2	0.01	0.01	51.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

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ANNEXURE G: PREVIOUSLY ASSESSED NETWORK SIDRA RESULTS

(SHEET 5 OF 6)

MOVEMENT SUMMARY

Site: 3.1 [FU - Brooks Parade and Maude Street - AM]

Network: N102 [FU AM]

Brooks Parade and Maude Street
Future
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Brooks Parade (S)													
22	T1	549	0.0	549	0.0	0.282	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
23	R2	13	0.0	13	0.0	0.014	8.2	LOS A	0.1	0.4	0.56	0.67	47.4
Approach		562	0.0	562	0.0	0.282	0.2	NA	0.1	0.4	0.01	0.02	59.6
NorthEast: Maude Street (E)													
24	L2	46	0.0	46	0.0	0.049	7.7	LOS A	0.2	1.3	0.49	0.69	48.0
26	R2	97	0.0	97	0.0	0.417	25.7	LOS B	1.7	11.7	0.88	1.02	41.0
Approach		143	0.0	143	0.0	0.417	19.9	LOS B	1.7	11.7	0.75	0.91	42.2
NorthWest: Brooks Parade (N)													
27	L2	103	0.0	103	0.0	0.334	5.6	LOS A	0.0	0.0	0.00	0.10	57.5
28	T1	542	0.0	542	0.0	0.334	0.0	LOS A	0.0	0.0	0.00	0.10	58.2
Approach		645	0.0	645	0.0	0.334	0.9	NA	0.0	0.0	0.00	0.10	58.0
All Vehicles		1351	0.0	1351	0.0	0.417	2.6	NA	1.7	11.7	0.09	0.15	55.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

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ANNEXURE G: PREVIOUSLY ASSESSED NETWORK SIDRA RESULTS

(SHEET 6 OF 6)

MOVEMENT SUMMARY

Site: 3.2 [FU - Brooks Parade and Maude Street - PM]

Network: N103 [FU PM]

Brooks Parade and Maude Street
Future
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Brooks Parade (S)													
22	T1	1039	0.0	1039	0.0	0.533	0.0	LOS A	0.0	0.0	0.00	0.00	49.9
23	R2	76	0.0	76	0.0	0.136	10.6	LOS A	0.5	3.5	0.72	0.87	40.0
Approach		1115	0.0	1115	0.0	0.533	0.7	NA	0.5	3.5	0.05	0.06	49.0
NorthEast: Maude Street (E)													
24	L2	115	0.0	115	0.0	0.181	9.3	LOS A	0.7	4.6	0.66	0.84	40.0
26	R2	207	0.0	207	0.0	6.251	4777.4	LOS F	125.3	877.0	1.00	2.96	0.7
Approach		322	0.0	322	0.0	6.251	3079.0	LOS F	125.3	877.0	0.88	2.21	0.9
NorthWest: Brooks Parade (N)													
27	L2	109	0.0	109	0.0	0.476	4.6	LOS A	0.0	0.0	0.00	0.06	49.1
28	T1	814	0.0	814	0.0	0.476	0.1	LOS A	0.0	0.0	0.00	0.06	49.2
Approach		923	0.0	923	0.0	0.476	0.6	NA	0.0	0.0	0.00	0.06	49.2
All Vehicles		2360	0.0	2360	0.0	6.251	420.8	NA	125.3	877.0	0.14	0.35	4.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

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26 June 2018

Ref: 14919/6440C

Monteath & Powys
PO Box 1107
NEWCASTLE NSW 2300

RE: ACOUSTIC ASSESSMENT – BROOKS PARADE SHARP STREET AND EDGAR STREET, BELMONT

This letter report presents the results of a noise impact assessment conducted for a proposed commercial and residential development at 32-44 Brooks Parade, 2-10 Sharp Street and 5-11 Edgar Street, Belmont. The proposal is to demolish the existing structures on site and construct a multi-storey residential building with ground floor commercial areas. The assessment has been prepared to address traffic noise impacts in accordance with the Infrastructure SEPP (2007) and impacts from potential noise emissions from the proposal, for inclusion with a Development Application to Lake Macquarie City Council.

AMBIENT NOISE LOGGING

Ambient noise levels were monitored by Spectrum Acoustics in the front yard of No 11 Edgar Street and on the roof of No 38 Brooks Parade during the period 8-14 April 2016. Data was recorded at 15 minute statistical intervals using a Rion NL-42 environmental noise logger. Since the dominant noise source in the area is road traffic, the NSW Industrial Noise Policy (INP) requires a minimum of three days valid data at each location, which was successfully obtained during the survey. The measurements were conducted in accordance with relevant EPA guidelines and AS 1055-1997 "Acoustics – Description and Measurement of Environmental Noise". The noise logger used complies with the requirements of AS 1259.2-1990 "Acoustics – Sound Level Meters", and has current NATA calibration certification.

The logger was programmed to continuously register environmental noise levels over the 15 minute intervals, with internal software calculating and storing Ln percentile noise levels for each sampling period. Calibration of the logger was performed during the instrument's initialisation procedures, with calibration results being within the allowable $\pm$ 0.5 dB(A) range.

Figure 1 shows the project site and the noise logger locations.

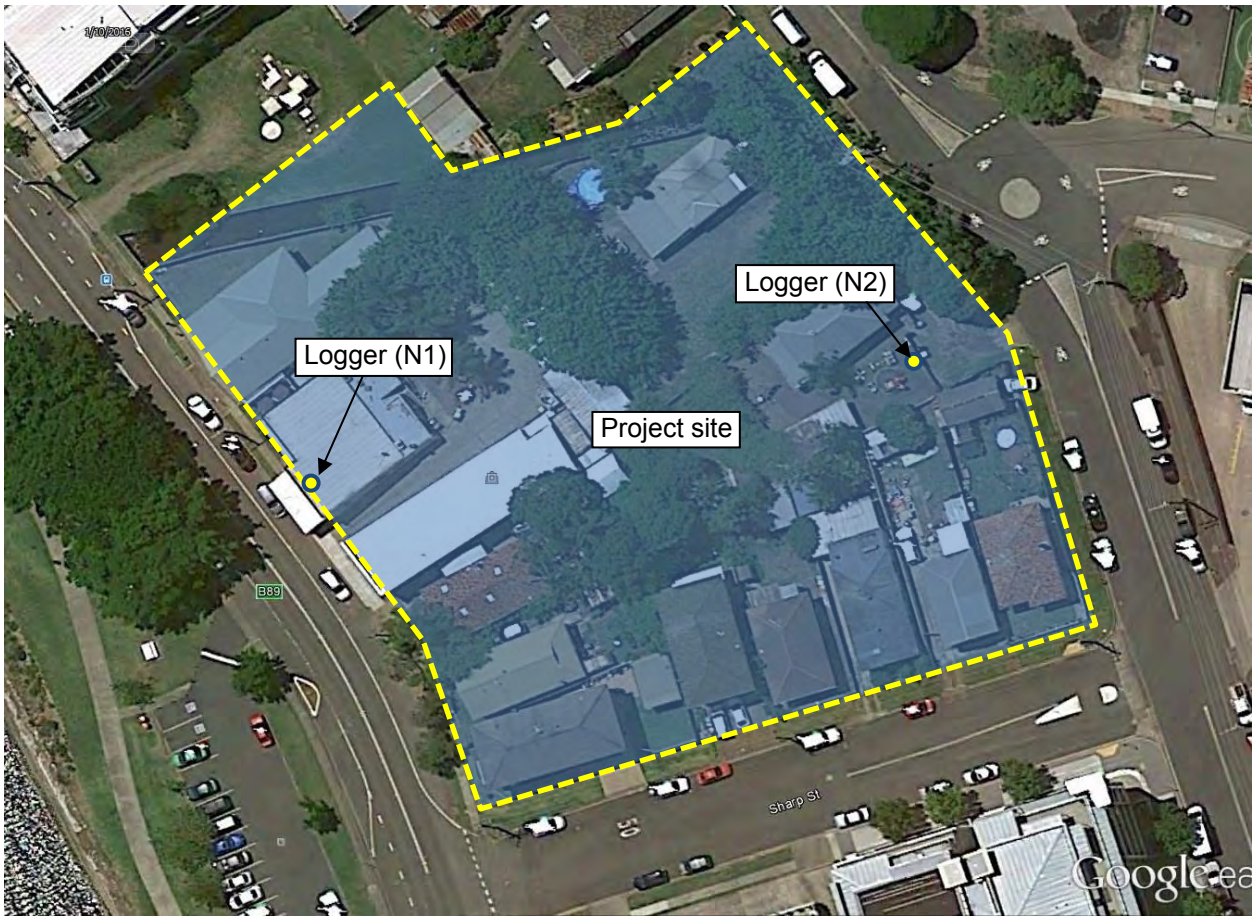


Figure 1. Project site and logger locations (Source: Google Earth).

Ambient L_{Aeq} and background (L_{A90}) noise levels, obtained from the logger, are summarised below in **Table 1** and shown graphically in **Appendix A**. Table 1 includes the background (L90) levels, the Leq over the full day (11 hour, 7am-6pm), evening (4 hour, 6pm-10pm) and night (9 hour, 10pm-7am) periods as well as the 90th percentile (P90) of the measured $L_{Aeq(15minute)}$ levels. The data for Brooks Parade is typical of the acoustic environment close to a major road.

TABLE 1
MEASURED AMBIENT NOISE LEVELS 15/2/16 to 19/2/16

Location	Day	Evening	Night
Brooks Parade, Belmont (N1)	52 dB(A) L90	41 dB(A) L90	35 dB(A) L90
	62 dB(A) Leq (period)	58 dB(A) Leq (period)	55 dB(A) Leq (period)
	65 dB(A) Leq (P90)	60 dB(A) Leq (P90)	57 dB(A) Leq (P90)
Edgar Street, Belmont (N2)	44 dB(A) L90	35 dB(A) L90	31 dB(A) L90
	55 dB(A) Leq (period)	55 dB(A) Leq (period)	45 dB(A) Leq (period)
	59 dB(A) Leq (P90)	58 dB(A) Leq (P90)	47 dB(A) Leq (P90)

TRAFFIC NOISE IMPACTS

The NSW Road Noise Policy (RNP, 2012), as adopted by the Roads and Maritime Services (RMS) of NSW, recommends various criteria for different road developments and uses. For new residential developments near roads, the RNP advises that land use developers must meet internal noise goals in

the Infrastructure SEPP (Department of Planning NSW, 2007). The SEPP (2007) is supported by the Department of Planning guideline "Development near Rail Corridors and Busy Roads – Interim Guideline" (2008) which gives the following internal noise level criteria in Section 3.5:

In any bedroom in the building: **35 dB(A),L_{eq}** at any time 10pm – 7am, and
Anywhere else in the building (other than a garage, kitchen, bathroom or hallway): **40dB(A),L_{eq}** at any time.

These criteria originated from the Rail Infrastructure Corporation (RIC) publication "Consideration of Rail Noise and Vibration in the Planning Process" (2003) where it is explicit that the criteria apply with windows and doors closed. The criteria correspond with those in AS/NZS 2107, where the noise is considered to be "quasi-continuous" in nature.

Noise criteria for traffic noise impacts on new housing near busy roads have historically been based on the geometric average (LAeq) levels over a 15-hour period (7am – 10pm) for day and 9-hour period (10pm – 7am) for night. To allow for fluctuations in noise levels throughout the day/night periods, the 90th percentile LAeq noise levels of 65dB(A)(day) and 57dB(A)(night) as recorded in Table 1 will be used in the assessment of traffic noise impacts along the Brooks Parade frontage.

Figure 2 is a reproduction of Figure B2 from the Interim Guideline (2008) showing a typical situation of a dwelling adjacent to a busy road and fully calculated internal noise levels relative to external noise levels using the UK Calculation of Road Traffic Noise (CoRTN) methodology. Acoustic consultants often use this Guideline (and Figure B2 specifically) in recommending architectural modifications to achieve the recommended noise levels.

Figure 2 shows a traffic noise level of 68 dB(A) at windows W1 and W2 directly facing the road. Windows W3 and W4 are on facades perpendicular to the road, thereby being shielded from 50% of the traffic noise by the building structure, and noise levels are 2-3 dB below the traffic noise level at W1 and W2. Window W5 is approximately twice the distance from the road as W4 and experiences an external traffic noise level 4 dB below the level at W4.

Figure 2 also gives the traffic noise loss for three constriction scenarios labelled A, B and C. The following specifications for these construction scenarios are reproduced from the Guideline. The specification for walls includes insulation in the wall cavity, however brick veneer achieves Rw >45 without insulation, which will not reduce the overall noise insulation of the room as a whole, since windows are the acoustically weakest elements. Any recommendations regarding the following construction specifications assume no insulation in facade walls.

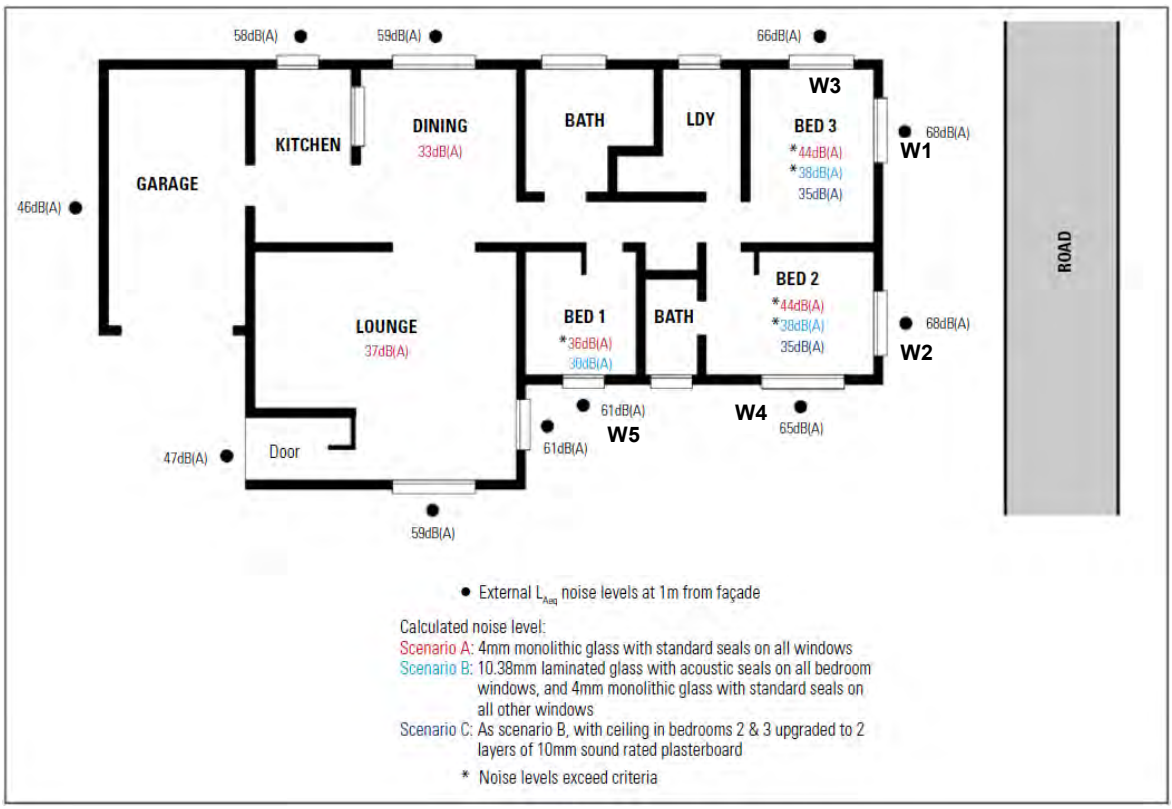


Figure 2. Traffic noise reduction for various construction types.

Specification A

Windows	standard 4mm monolithic glass with standard weather seals on all windows	(Rw 25)
Doors	30mm solid core timber – lounge room aluminium framed glass sliding door – lounge and dining rooms	(Rw 24)
Walls	brick-veneer and standard plasterboard on timber studs with insulation in cavity	(Rw 52)
Roof	tiled roof and standard plasterboard ceiling with insulation	(Rw 43)
Floor	concrete slab	

Note: 'Rw' is the weighted sound reduction index of a building element

Specification B

Windows	10.38mm laminated glass with acoustic seals on all bedroom windows, standard 4mm monolithic glass with standard seals on all other windows	(Rw 35)
Doors	30mm solid core timber – lounge room aluminium framed glass sliding door – lounge and dining rooms	(Rw 24)
Walls	brick-veneer and standard plasterboard on timber studs with insulation in cavity	(Rw 52)
Roof	tiled roof and standard plasterboard ceiling with insulation	(Rw 43)
Floor	concrete slab	

Note: 'Rw' is the weighted sound reduction index of a building element

Specification C

Windows	10.38mm laminated glass with acoustic seals on all bedroom windows, standard 4mm monolithic glass with standard seals on all other windows	(Rw 35)
Doors	30mm solid core timber – lounge room aluminium framed glass sliding door – lounge and dining rooms	(Rw 24)
Walls	brick-veneer and standard plasterboard on timber studs with insulation in cavity	(Rw 52)
Roof	as per Specification B, except the single layer of standard plasterboard ceiling is replaced with a double-layer of 10mm sound-rated plasterboard ceiling	(Rw 52)
Floor	concrete slab	

Note: 'Rw' is the weighted sound reduction index of a building element

Table 2 summarises the traffic noise reduction provided by each construction scenario for the cases in Figure 2 where a room contains either one or two windows.

TABLE 2 Traffic noise reduction in dB (from Figure B2 of the Interim Guideline (2008))		
Construction scenario	**Noise reduction (2 windows)**	**Noise reduction (1 window)**
Scenario A	23	25
Scenario B	29	31
Scenario C	32	34 (estimated)

Between the minimum 23dB reduction for Scenario A and minimum 29dB reduction for Scenario B lies what will be called Scenario A/B in which 23-28 dB traffic noise reduction is required[1]. This will be achieved with the same construction as scenario B except using 6.5mm Vlam Hush (or equivalent) in lieu of the 10.38mm glazing (for which 8.5mm Vlam Hush provides the same acoustic rating). This conservative measure is based on adopting the 23dB noise reduction for 4mm glass, whether there are one or two windows in the room.

Since acoustic performance can vary greatly depending upon framing and seals, glazing suppliers should certify that their windows/doors will achieve the required noise reduction and not simply defer to the minimum glazing thickness recommended in this report. Where upgrades from standard 4mm glazing is recommended, confirmation of acoustic performance should be supplied by the glazing company for the purposes of certification for occupation certificate.

Figure 3 shows the proposed layout typical of the first three proposed residential levels, fronting Brooks Parade, and traffic noise levels incorporating corrections commensurate with Figure 2. Night time levels are shown for bedrooms and daytime levels for other habitable spaces. Levels higher up in the building(s) are assumed to be effectively screened from enough traffic noise, via greater setback, so as to not require assessment. Traffic noise levels measured on Edgar Street were sufficiently low that upgraded construction to attenuate traffic noise will not be required.

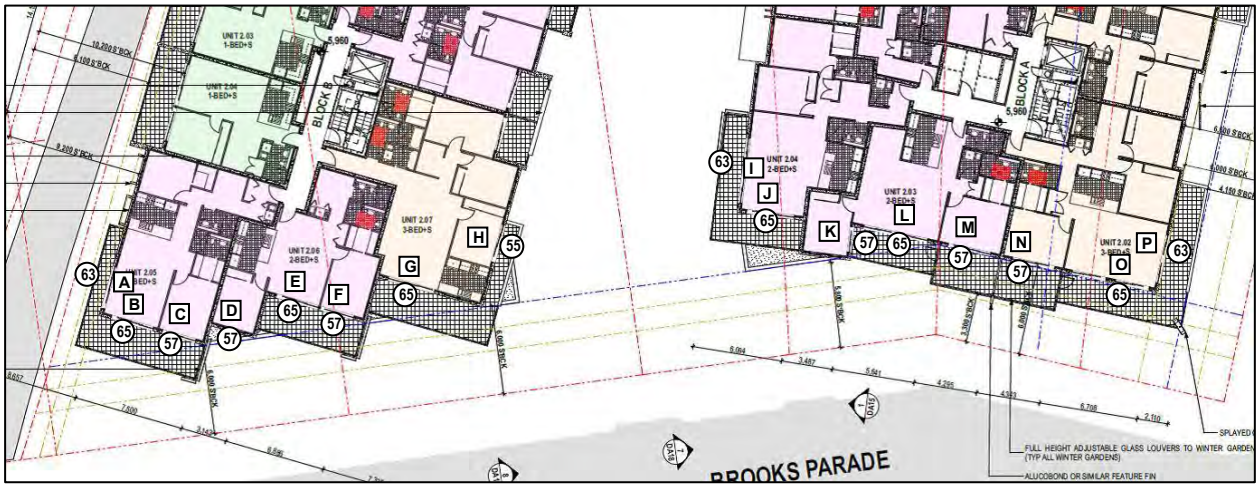


Figure 3. Traffic noise levels at building facade.

[1] The value of 23dB has been included in the Scenario A/B category as a measure of conservatism for living rooms. Traffic noise reduction of 22 dB or more for bedrooms will be included in the Scenario A/B category.

Table 3 summarises the traffic noise levels at facades exposed to the traffic, the noise criteria, traffic noise reduction and recommended minimum acoustic treatment.

TABLE 3
Required traffic noise reduction and recommended construction scenarios

Window/Room	External traffic noise dB(A)	Required internal dB(A)	Required reduction dB	Construction scenario
A – Living	63	40	23	Scenario A/B
B – Living	65	40	25	Scenario A/B
C – Bed	57	35	22	Scenario A/B
D – Bed	57	35	22	Scenario A/B
E – Living	65	40	25	Scenario A/B
F – Bed	57	35	22	Scenario A/B
G – Living	65	40	25	Scenario A/B
H – Bed	55	35	20	Scenario A
I – Living	63	40	23	Scenario A/B
J – Living	65	40	25	Scenario A/B
K – Bed	57	35	22	Scenario A/B
L – Living	65	40	25	Scenario A/B
M – Living	65	40	25	Scenario A/B
N – Bed	57	35	22	Scenario A/B
O – Living	65	40	25	Scenario A/B
P – Living	63	40	23	Scenario A/B

* Sliding doors will require laminated glazing for safety purposes regardless of acoustic requirement.

The results in Table 3 indicate that glazing upgrade to minimum 6.5mm Vlam Hush (or similar) will be required for all windows A-P in Figure 3 except window H, although glazing upgrade to this bedroom window is recommended.

Section 3.6.1 of the Guideline states: "If internal noise levels with windows or doors open exceed the criteria by more than 10 dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also meet the ventilation requirements of the Building Code of Australia." This condition applies to all assessed windows in Figure 3.

NOISE EMISSIONS

Operational Noise

The NSW Noise Policy for Industry (NPI) recommends noise emission trigger levels of "background + 5 dB" for 15-minute LAeq noise emissions from industrial premises. Council usually accepts the NPI trigger levels for any noise-generating development with potential to impact on residential amenity. The trigger levels for the proposal, based on the background noise levels at the Edgar Street logger, are

49 dB(A),$L_{eq(15minute)}$ (Day)
40 dB(A), $L_{eq(15minute)}$ (Evening)
36 dB(A), $L_{eq(15minute)}$ (Night)

Noise emissions from mechanical plant at several locations throughout the site were computer modelled using the SoundPLAN software by EMF Griffiths (May 2012) for an assessment for a previous proposal for the site. EMF's estimated sound power levels up to 70 dB(A) for external mechanical plant such as air conditioners and exhaust fans concur with Spectrum Acoustics' file data. Based on the night time criterion of 36 dB(A) the minimum setback distance for individual mechanical noise sources from neighbouring residential boundaries is 20m if there is no barrier shielding the line of sight. Final selection and placement of external mechanical plant should be reviewed by the acoustic consultant to confirm compliance with the noise emission criterion.

Commercial Premises

The proposal incorporates ground floor commercial/retail tenancies in Block D opposite residences in Sharp Street. The applicable evening noise criterion is 40 dB(A),Leq(15minute) for these residences based on the background levels recorded in Table 1. Mechanical plant for this tenancy should be selected and located/screened such that the above criterion is achieved and should be signed off by the project acoustical consultant prior to installation.

These tenancies would be retail/commercial with minimal noise generation and a quantitative noise impact assessment is not warranted.

Sleep Disturbance

To help protect against sleep disturbance at night, the EPA prefers L_{max} noise levels from short-term impacts to not exceed the greater of 52 dB(A) and 15dB above the background level when measured or calculated at 1m from any bedroom window. The sleep disturbance criterion for the current assessment is **52 dB(A),L_{max}**.

There is a proposed loading dock on the southern (Sharp Street) side of the site which is within 35m of residences on the opposite side of the street. Typical maximum impact noises from trucks in loading docks are up to 90 dB(A). There will be no reverse alarms as a truck turntable is proposed. Allowing just for distance loss, this reduces to 51 dB(A),Lmax at the nearest residences. This is 1 dB below the night time sleep disturbance criterion.

The carpark entry off Edgar Street would have a remote controlled roller door. A properly maintained and lubricated roller door emits minimal noise in the order of 70 dB(A). Adopting a worst case of 80 dB(A) gives a level of no more than 36 dB(A),Lmax at the nearest Edgar Street residence. This is 16 dB below the sleep disturbance criterion.

We trust this report fulfils your requirements at this time, however, should you require additional information or assistance please contact the undersigned on 49542276.

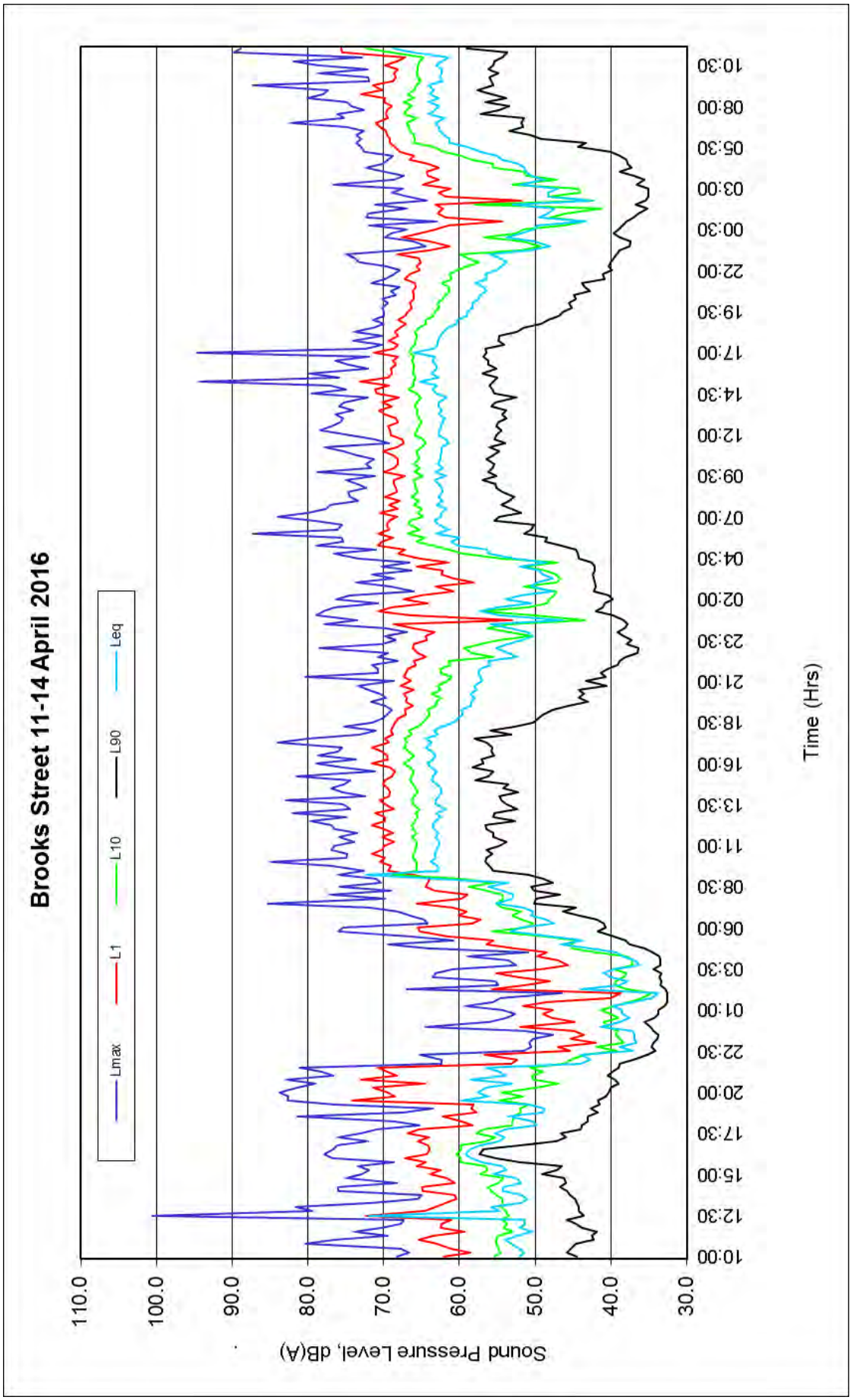
SPECTRUM ACOUSTICS PTY LIMITED

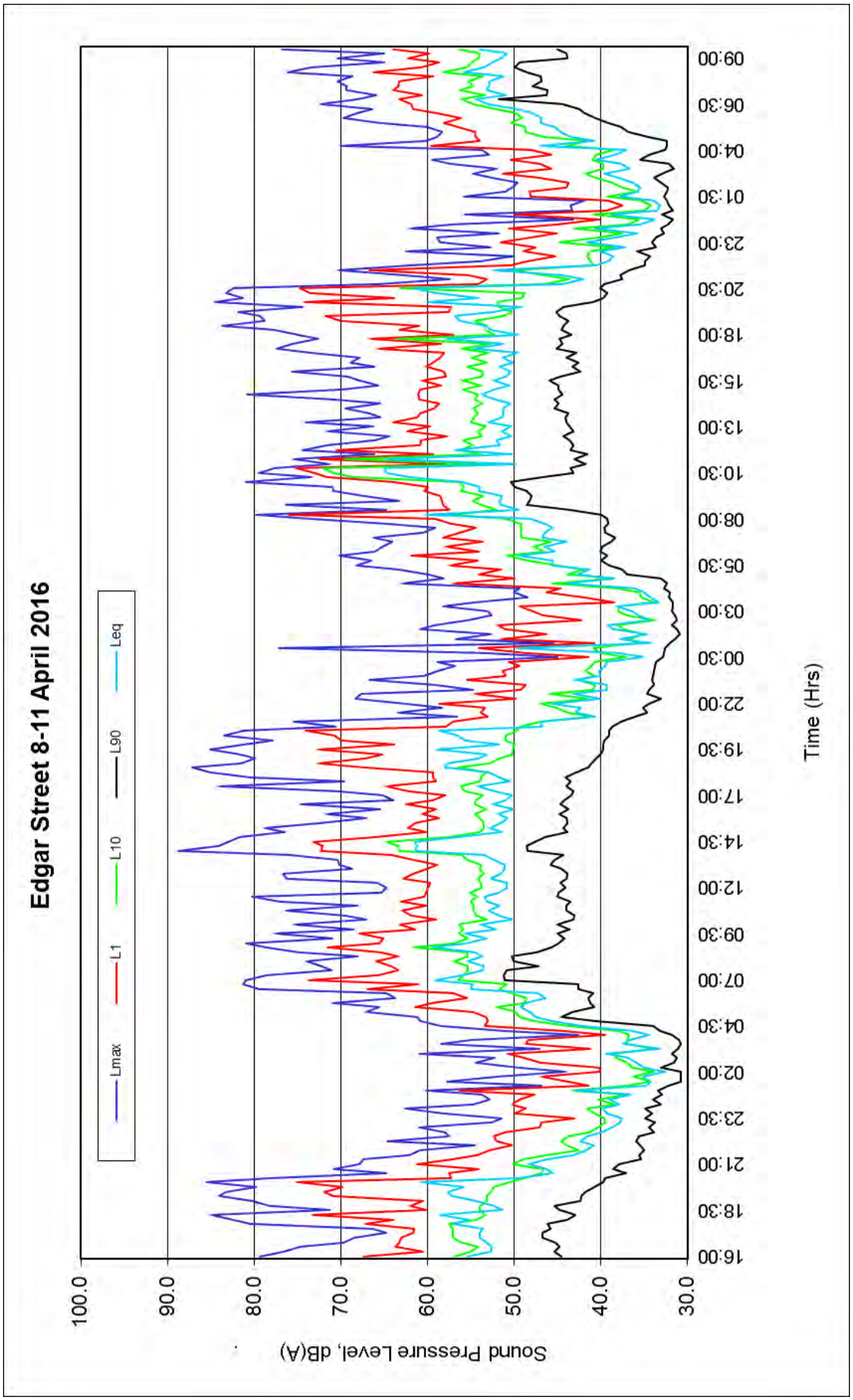


Neil Pennington MAIP, MAAS
B.Sc., B.Math. (Hons)
Principal/Director

APPENDIX A

NOISE LOGGER DATA CHARTS


Brooks Street 11-14 April 2016
Lmax
L1
L10
L90
Leq
Sound Pressure Level, dB(A)
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
Time (Hrs)
10:00
12:30
15:00
17:30
20:00
22:30
01:00
03:30
06:00
08:30
11:00
13:30
16:00
18:30
21:00
23:30
02:00
04:30
07:00
09:30
12:00
14:30
17:00
19:30
22:00
00:30
03:00
05:30
08:00
10:30


Edgar Street 8-11 April 2016
Lmax
L1
L10
L90
Leq
Sound Pressure Level, dB(A)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
Time (Hrs)
16:00
18:30
21:00
23:30
02:00
04:30
07:00
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Monteath & Powys Pty Ltd

SURVEYING, PLANNING, ENGINEERING DESIGN, PROJECT MANAGEMENT






MIXED USE DEVELOPMENT

BROOKES PARADE,

BELMONT

Economic Impact Statement

Liability limited by a scheme approved under Professional Standards Legislation

Quality ISO 9001 Certified System

This Report was prepared by:-

Monteath & Powys Pty Ltd
Suite 13 Tonella Commercial Centre
125 Bull Street
NEWCASTLE WEST NSW 2302

PO Box 2270
DANGAR NSW 2302

Telephone: (02) 4926 1388
Facsimile: (02) 4929 3475
Web: www.monteathpowys.com.au

PROJECT:	Economic impact assessment for a proposed mixed use development
CLIENT:	KML Joint Venture
OUR REFERENCE:	13/0524
VERSION:	FINAL (2 February 2016) Amended – 25 June 2018
AUTHOR:	Darren Holloway BSc (Hons), MBEnv Registered Planner
CERTIFICATION:	I hereby certify that this assessment has been prepared in accordance with the requirements of the Environmental Planning and Assessment Act 1979 and its associated Regulations. I certify that to the best of my knowledge the information contained within this Report is neither false nor misleading.
SIGNATURE:	

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1. INTRODUCTION

Monteath & Powys has been engaged by KML Joint Venture to undertake an economic impact assessment (EIA) for a multi-storey mixed use development in Brookes Parade, Belmont. The purpose of this EIA is to determine the economic impacts of the proposed development and provide recommendations to mitigate impacts of concern. This EIA will accompany the development application to Lake Macquarie City Council (LMCC) for the proposed development.

1.1 SITE DESCRIPTION

The site is located in the suburb of Belmont, within the Lake Macquarie Local Government Area (LGA). The subject site is within the Belmont Town Centre which is some 17 kilometres from Newcastle CBD. It is generally surrounded by a mix of land uses including existing residential development, mixed use multi-storey buildings, and commercial/retail premises. The site is bounded by Edgar Street to the east, Sharp Street to the south, Brooks Parade to the west and Maude Street to the north. The Belmont Town Centre is dissected by the Pacific Highway which is approximately 250 metres to the east of the site.

The site comprises fifteen lots in total as identified in Table 1.1 and is approximately 7,083 square metres in size.

Table 1.1: Property Descriptions

Lot	Section	DP
11	B	585
A	-	400644
B	-	400644
2	-	353066
1	-	353066
4	-	12898
5	-	12898
6	-	12898
7	-	12898
10	B	585
8	-	12898
B	-	339105
A	-	339105
4	B	585
3	B	585

The site is zoned B4 Mixed Use under Lake Macquarie LEP 2014. Access to the site is available from Brooks Parade, Sharp Street and Edgar Street. Lake Macquarie is to the west of the site. The site is shown in Figures 1.1 to 1.2 below.

1.2 GUIDELINES

As part of preparing this economic impact assessment relevant guidelines were considered. Any guideline was considered in relation to the size, location and potential impacts of the proposed development. These guidelines included:

- Lake Macquarie City Council Economic Impact Assessment Guideline, 2013;

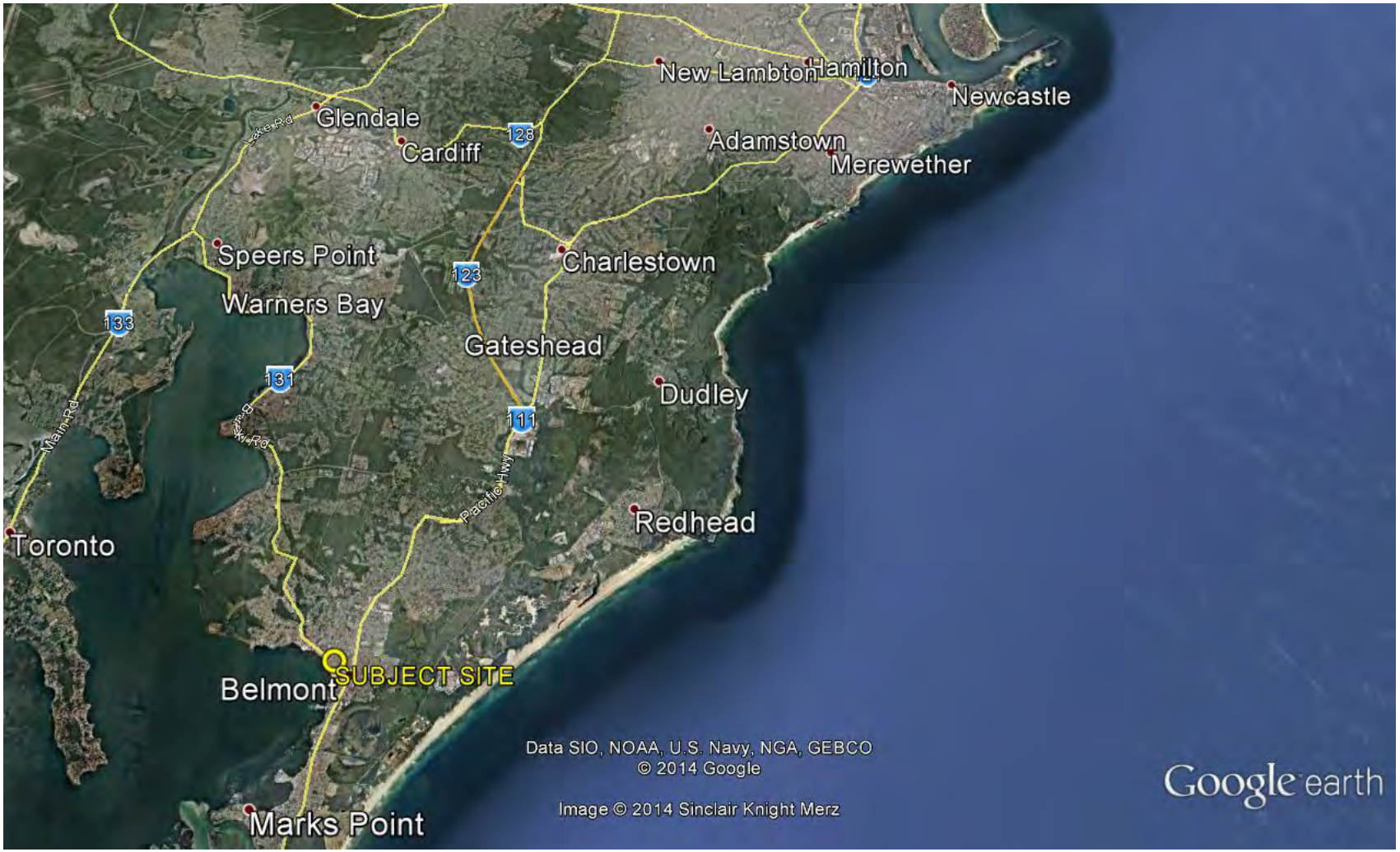


Figure 1.1: Regional Locality Map



Figure 1.2: Locality Map

2. PROPOSED DEVELOPMENT

2.1 THE PROPOSAL

The proposed development involves the demolition of the existing structures and the construction of a mixed use development comprising four separate buildings. The development comprises a 140 residential units, 4 retail/commercial areas, 1 communal multi-purpose room, basement car parking and associated landscaping. The development specifically includes:

Summary of Proposed Development	
Number of units and unit mix (Residential)	23, one-bedroom + study units 11, two-bedroom units 67, two-bedroom + study units 13, three-bedroom units 26, three-bedroom + study units
Number of units and size (Retail/Commercial)	Building B, 234.4m² Building A, 301.3m² Building D, 146.2m²
Parking	Car Parking (Res + Retail) – 158 spaces Motorbike Parking – 4 spaces Bicycle Parking – 52 spaces

3. METHODOLOGY

A multi method approach was undertaken as part of this economic impact assessment in order to ascertain the potential impacts of the proposed development. This methodology includes:

- Review of economic and employment data from the ABS;
- Review of relevant documentation including economic development strategies;
- Review of the economic impacts of residential development;
- Consideration of employment opportunities and increases in demand for the additional population;
- Review of ABS Input-Output data and National Accounts;
- Identification of the economic impacts of the proposed residential development including multiplier effects

4. STRATEGIC AND PLANNING CONSIDERATIONS

This section identifies the strategic and planning policies that are applicable to the proposed development in relation to this economic impact assessment.

4.1 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

The proposed development will be assessed under Part 4 of the Environmental Planning and Assessment Act 1979. The Joint Regional Planning Panel (JRPP) will be the determining authority for the development, as the development is greater than $20 million. The development is proposed under Lake Macquarie Local Environmental Plan (LEP) 2014.

4.2 HUNTER REGIONAL PLAN

The Hunter Regional Plan (HRP) was released in 2016 by the NSW Department of Planning and Environment. The Plan is the strategic plan and vision document for guiding growth in the Hunter to 2036. At its centrepiece is the strategic direction for the Greater Newcastle area, which includes Lake Macquarie. The Greater Newcastle area is anticipated to accommodate and extra 600,000 people to 2036. With comes an anticipated 62,000 increase in job numbers. The Plan identifies that the aims for Greater Newcastle include:

- Connect strategic centres in Greater Newcastle;
- Develop a national Centre of Excellence for Health and Education;
- Expand the capacity of Global Gateways – Newcastle port and airport; and
- Establish governance.

Thee aims are very broad. Nonetheless, the Belmont to Charlestown corridor is identified as an urban renewal corridor, with Belmont identified as a significant local centre.

The proposed development will continue to emphasis Belmont as a town centre and address the urban renewal potential of Belmont.

4.3 LAKE MACQUARIE LIFESTYLE 2030 STRATEGY

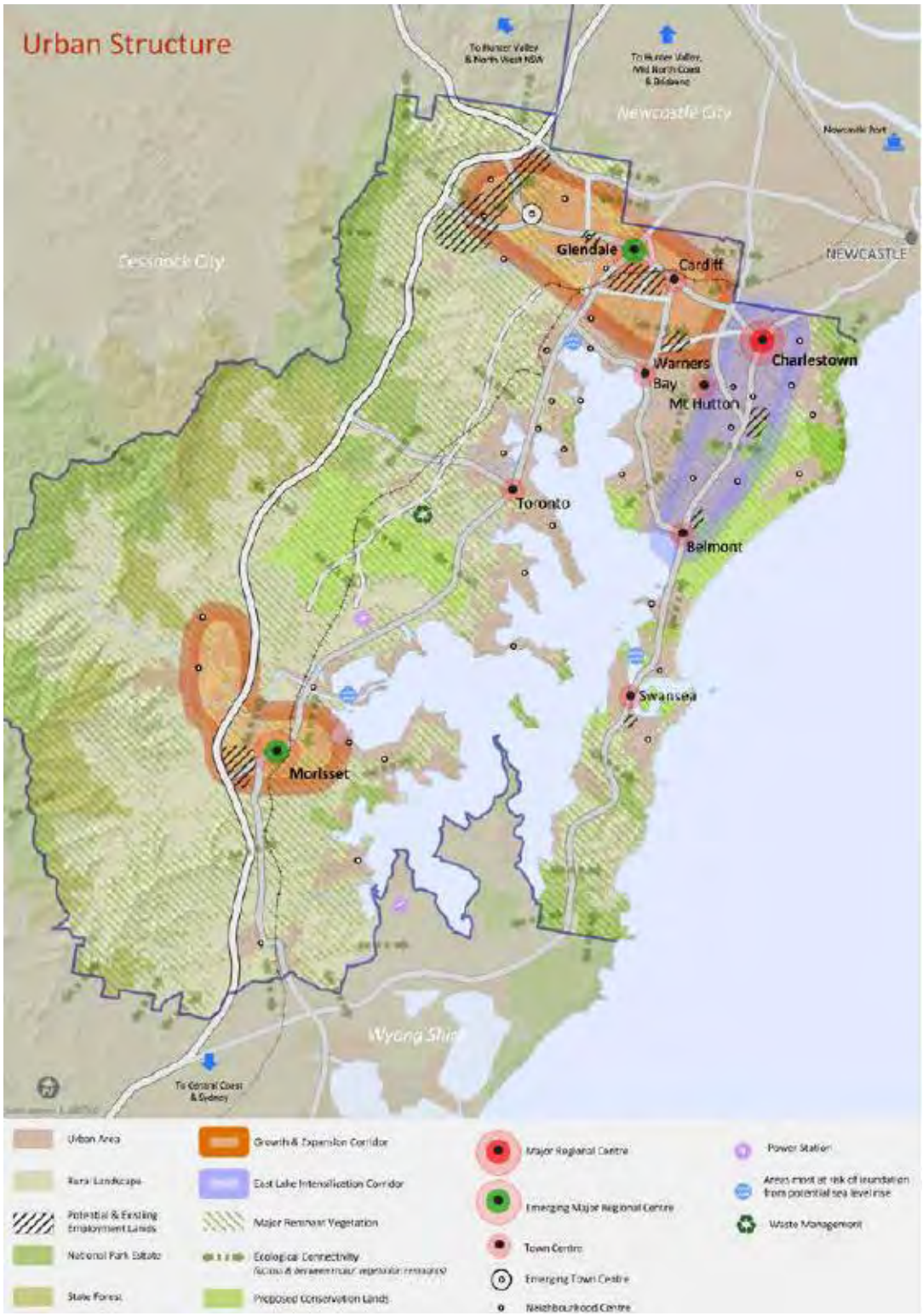
Lifestyle 2030 Strategy is the strategic land use plan prepared by Lake Macquarie City Council to inform the development of the local government area. The current strategy was adopted by Council in March 2013. The extent of Lake Macquarie local government area and its urban structure are illustrated in Figure 4.1 below. Lifestyle 2030 has seven strategic directions, each illustrated by numerous statements of the desired outcomes. The key desired outcomes for each strategic direction are supported by the potential development of the subject site. Overall, the potential development is consistent with the objectives of the Lake Macquarie Lifestyle 2030 Strategy.

4.3.1 Belmont Town Centre

Belmont is identified in the Strategy as a Town Centre within the East Lake Intensification Corridor. The strategy expects urban zoned land in the corridor to be developed for multi-unit housing close to centres and well serviced by public transport routes, as well as employment, community services and facilities. The intensification for housing assists to maintain the supply of industrial land for manufacturing activities in the corridor, such as

Redhead and Bennetts Green, which plays an important role in the local and regional economy. Intensification limits the growth of the urban footprint, protecting ecological lands along the along the east and west sides of the corridor from Belmont to Charlestown.

Figure 4.1: Lake Macquarie Urban Structure



4.4 LAKE MACQUARIE COMMUNITY STRATEGIC PLAN

The Lake Macquarie Community Strategic Plan 2013-2023, represents Council's vision for the City of Lake Macquarie. As Council's key strategic planning document, this Plan presents the main priorities of the community, and sets out the long-term strategies developed to respond to these priorities. The Plan identifies that a cooperative approach is required to ensure the priorities of the community are addressed. For Council, this involves building and maintaining partnerships with external partners, including state and federal government departments and agencies, non-government organisations and community groups. The Strategy covers areas such as sustainability/environment, population growth, economic development etc but does not specifically identify any geographical areas or centres. The Strategy is more an LGA wide vision for Lake Macquarie and subsequent strategies (e.g. land use strategy, social plan etc) will provide more detail.

4.5 LAKE MACQUARIE DEVELOPMENT CONTRIBUTIONS PLAN

It is identified that the proposal will be required to pay development contributions under Lake Macquarie's relevant development contributions plan.

5. ECONOMIC CONSIDERATIONS

5.1 INTRODUCTION

This section presents an overview of the economic characteristics of the Belmont area and Lake Macquarie more generally. The potential economic impacts of the proposed development are also examined. It is noted that the data presented for 'Belmont' includes the state suburb of Belmont as identified by the Australian Bureau of Statistics (ABS).

5.2 CENSUS ECONOMIC PROFILE

Household Income

The median weekly household income in Belmont in 2016 was $1,040 which is lower than the median household income for Lake Macquarie LGA ($1,313).

Some 24% of households in Belmont earn more than $2,000 per week, which is less than that for Lake Macquarie LGA (28%). Belmont has a very large proportion of households who earn less than $1,000 per week. The proportion of households earning less than $1,000 per week in Belmont (44%) is significantly higher than that for Lake Macquarie (35%).

Labour Force

In 2016, 8% of persons in Belmont were unemployed which is slightly higher than that for Lake Macquarie LGA (7%). In 2016, the labour force participation rate in Belmont (52%) was lower than that for Lake Macquarie LGA as a whole (57%). Interestingly, the proportion of the labour force employed part time in Belmont is similar to that for Lake Macquarie, however, the proportion of the labour force employed full time is slightly less than the figure for Lake Macquarie.

Occupation

Given some of the income data above it is surprising that there is a higher proportion of Managers in Belmont compared to Lake Macquarie LGA as a whole (9.7%). Nonetheless, Belmont has a slightly lower proportion of Professionals and Technicians compared with other areas in Lake Macquarie, while the proportion of Clerical and Administrative Workers is slightly higher than that for Lake Macquarie.

Industry of Employment

The largest employment sectors in Belmont are Health Care and Social Assistance, Retail, Manufacturing and Construction which represents just under half of employed persons in Belmont. When compared to the average for Lake Macquarie as a whole, Belmont has an under representation of persons in the Health Care and Social Assistance and Education and Training Sectors, but is over-represented in the Construction sector.

Table 5.1: Social and Economic Profile, Belmont (2016)

	Belmont (SSC)	Lake Macquarie LGA
Persons	7,114	197,371
Occupied Dwellings	2,943	73,075
Median Household Income	1,040	1,313
Dwelling Type		
Separate Houses	69.2%	77.9%
Semi Detached Dwellings	14.6%	8.9%
Flats and Units	12.7%	3.5%
Other Dwelling Type/Not Stated	3.4%	9.8%
Tenure		
Owned (with or without mortgage)	66.0%	73.6%
Privately Rented Dwelling	22.7%	17.1%
Rented from Social Housing Provider	6.8%	5.0%
Other Tenure Type/Not Stated	4.5%	4.4%
Number of Motor Vehicles		
No motor vehicles	11.5%	5.7%
One motor vehicle	37.3%	33.0%
Two motor vehicles	32.8%	38.3%
Three or More Motor Vehicles	14.5%	19.7%
Not Stated	3.9%	3.4%
Labour Force		
Employed Full-time	53.9%	54.9%
Employed Part-time	33.7%	33.3%
Employed (not at work)	4.7%	5.0%
Field of Study		
Natural and Physical Sciences	1.7%	2.2%
Information Technology	1.4%	1.8%
Engineering and Related Technologies	20.4%	20.6%
Architecture and Building	10.5%	8.3%
Agriculture, Environmental and Related Studies	1.4%	1.8%
Health	13.7%	13.3%
Education	9.0%	9.4%
Management and Commerce	19.8%	20.1%
Society and Culture	9.6%	11.0%
Creative Arts	2.1%	2.6%
Food, Hospitality and Personal Services	6.3%	5.4%
Mixed Field Programmes	0.0%	0.1%
Field of study inadequately described	1.2%	1.0%
Field of study not stated	2.8%	2.4%

	Belmont (SSC)	Lake Macquarie LGA
Industry of Employment		
Agriculture, Forestry and Fishing	0.5%	0.3%
Mining	6.0%	3.1%
Manufacturing	8.8%	6.4%
Electricity, Gas, Water and Waste Services	2.9%	1.9%
Construction	23.2%	10.6%
Wholesale Trade	2.9%	1.9%
Retail Trade	5.7%	6.3%
Accommodation and Food Services	3.7%	3.5%
Transport, Postal and Warehousing	4.8%	3.4%
Information Media and Telecommunications	0.9%	0.8%
Financial and Insurance Services	3.2%	3.4%
Rental, Hiring and Real Estate Services	2.0%	1.4%
Professional, Scientific and Technical Services	4.6%	6.5%
Administrative and Support Services	1.7%	2.9%
Public Administration and Safety	6.7%	6.8%
Education and Training	5.1%	11.6%
Health Care and Social Assistance	8.2%	20.2%
Arts and Recreation Services	0.7%	1.0%
Other Services	4.2%	4.8%
Occupation		
Managers	11.7%	11.1%
Professionals	26.3%	27.9%
Technicians and trades workers	20.5%	19.3%
Community and personal service workers	11.2%	11.7%
Clerical and administrative workers	13.4%	13.0%
Sales workers	6.3%	5.4%
Machinery operators and drivers	4.2%	4.8%
Labourers	5.7%	5.4%
Not Stated	1.1%	1.3%
Household Income		
Less than $400	9.4%	6.5%
$400-$649	17.6%	12.8%
$650-$999	16.9%	15.6%
$1,000 - $1,499	14.1%	15.7%
$1,500 - $1,999	8.8%	11.1%
$2,000 - $2,999	12.5%	16.8%
$3,000 or more	11.4%	11.8%
Not Stated	9.1%	9.6%

Dwelling Type

The suburb of Belmont is approximately 69% separate houses which is significantly lower than the proportion of separate houses in Lake Macquarie LGA (78%). Belmont has nearly three times the proportion of flats/units (13%) than the average for Lake Macquarie as a whole (4%). The proportion of semi-detached dwellings is significantly higher in Belmont (15%) than for Lake Macquarie LGA (9%).

Tenure

The proportion of households in Belmont that are renting a dwelling (23%) is significantly higher than the proportion for Lake Macquarie LGA (17%). Conversely, the proportion of households who own or a purchasing a dwelling is lower in Belmont (66%) than for the LGA as a whole (74%).

Motor Vehicles

The households in Belmont with no or one motor vehicle (49%) is significantly higher than that for the LGA as a whole (39%). Conversely, the proportion of households with two or more vehicles in Belmont is lower than that for the LGA.

Field of Study

Some 40% of the labour force in Belmont is qualified in Engineering and Related Technologies and Management and Commerce. This is similar across the LGA. Belmont has a slight under-representation of workers qualified in the fields of Society and Culture and Creative Arts and a slight over-representation of workers qualified in Food, Hospitality and Personal Services compared to the LGA as a whole. Overall though the field of study in Belmont is similar to the trends identified across the LGA.

5.3 OTHER ECONOMIC DATA

Table 5.2 considers the Output ($) of the Lake Macquarie economy which represents the gross revenue generated by businesses/organisations in by industry sectors in Lake Macquarie. Gross revenue is also referred to as total sales or total income. The output generated by the Lake Macquarie economy is estimated at $17.8 billion. Lake Macquarie represents about 19% of the output generated in Hunter Region, and approximately 1.70 % of the output generated in New South Wales. The largest sectors that contribute to this output in Lake Macquarie is Manufacturing, Rental, Hiring & Real Estate Services, Construction and Mining. These four sectors represent 55% of the output generated in Lake Macquarie. Conversely, Agriculture, Forestry and Fishing contribute the least gross revenue of industry sectors in Lake Macquarie.

Table 5.2: Output by Industry
(source: REMPlan)

Industry	Lake Macquarie	Hunter Region
Total	**$17,816.563 M**	**$92,180.184 M**
Manufacturing	$4,200.931 M	$21,136.016 M
Rental, Hiring & Real Estate Services	$2,036.292 M	$8,049.476 M
Construction	$1,899.279 M	$8,972.652 M
Mining	$1,603.410 M	$12,083.509 M
Financial & Insurance Services	$1,040.794 M	$4,287.182 M
Retail Trade	$1,008.783 M	$3,493.672 M
Health Care & Social Assistance	$880.934 M	$3,881.547 M
Electricity, Gas, Water & Waste Services	$679.851 M	$4,549.967 M
Professional, Scientific & Technical Services	$672.415 M	$3,926.347 M
Wholesale Trade	$627.028 M	$2,774.684 M
Education & Training	$569.996 M	$2,674.522 M
Accommodation & Food Services	$528.680 M	$2,644.440 M
Public Administration & Safety	$503.196 M	$4,008.310 M
Transport, Postal & Warehousing	$488.430 M	$3,334.777 M
Other Services	$364.676 M	$1,578.591 M
Administrative & Support Services	$346.545 M	$1,876.529 M
Information Media & Telecommunications	$196.034 M	$1,194.910 M
Arts & Recreation Services	$110.565 M	$512.846 M
Agriculture, Forestry & Fishing	$58.723 M	$1,200.209 M

Table 5.3: Wages and Salaries by Industry
(source: REMPlan)

Industry	Lake Macquarie	Hunter Region
Total	**$4,071.390 M**	**$20,547.682 M**
Health Care & Social Assistance	$580.745 M	$2,509.707 M
Manufacturing	$538.420 M	$2,423.461 M
Retail Trade	$386.216 M	$1,337.563 M
Education & Training	$378.731 M	$1,778.577 M
Construction	$301.589 M	$1,441.518 M
Mining	$249.006 M	$1,861.118 M
Financial & Insurance Services	$238.277 M	$952.922 M
Public Administration & Safety	$237.604 M	$1,898.331 M
Professional, Scientific & Technical Services	$218.190 M	$1,279.782 M
Wholesale Trade	$193.200 M	$854.938 M
Accommodation & Food Services	$150.752 M	$710.771 M
Administrative & Support Services	$148.859 M	$822.621 M
Other Services	$119.770 M	$542.146 M
Transport, Postal & Warehousing	$117.663 M	$782.002 M
Rental, Hiring & Real Estate Services	$75.448 M	$376.755 M
Electricity, Gas, Water & Waste Services	$73.865 M	$554.606 M
Information Media & Telecommunications	$31.775 M	$190.502 M
Arts & Recreation Services	$24.092 M	$111.793 M
Agriculture, Forestry & Fishing	$7.188 M	$118.568 M

The wages and salaries paid by businesses in Lake Macquarie is estimated at $4.07 billion. Lake Macquarie represents about 20% of the $20.5 billion in wages and salaries paid by businesses in Hunter Region. The largest sectors for wage and salary earners in Lake Macquarie ae Health Care and Social Assistance, Manufacturing and Retail Trade. The sector with the lowest contribution to wages and salaries in Lake Macquarie is Agriculture, Forestry and Fishing.

Table 5.4: Regional Exports by Industry
(source: REMPlan)

Industry	Lake Macquarie	Hunter Region
Total	**$5,186.360 M**	**$30,606.725 M**
Manufacturing	$2,259.845 M	$11,030.838 M
Mining	$1,415.277 M	$10,908.426 M
Electricity, Gas, Water & Waste Services	$444.180 M	$1,677.353 M
Financial & Insurance Services	$231.947 M	$876.683 M
Construction	$154.822 M	$1,528.884 M
Wholesale Trade	$136.905 M	$605.823 M
Retail Trade	$102.248 M	$155.523 M
Accommodation & Food Services	$78.282 M	$418.672 M
Transport, Postal & Warehousing	$77.802 M	$663.114 M
Other Services	$51.767 M	$154.599 M
Rental, Hiring & Real Estate Services	$47.011 M	$340.149 M
Professional, Scientific & Technical Services	$39.862 M	$228.980 M
Administrative & Support Services	$36.488 M	$177.670 M
Information Media & Telecommunications	$33.863 M	$192.824 M
Health Care & Social Assistance	$33.263 M	$283.237 M
Education & Training	$24.832 M	$218.483 M
Agriculture, Forestry & Fishing	$11.583 M	$455.013 M
Arts & Recreation Services	$5.445 M	$21.734 M
Public Administration & Safety	$0.941 M	$668.717 M

The Regional Exports data presented above indicates the value ($) of goods and services exported outside of Lake Macquarie LGA that have been generated by businesses. No distinction is made between domestic and international exports. For instance, so exports of goods and services from Lake Macquarie include sales to the rest of the Hunter Region. The value of regional exports generated by the Lake Macquarie economy is estimated at $5.186 billion. In Lake Macquarie, the Manufacturing and Mining sectors contribute approximately 71% of the value of goods exported outside of Lake Macquarie LGA.

Table 5.5: Regional Imports by Industry
(source: REMPlan)

Industry	Lake Macquarie	Hunter Region
Total	**$4,793.094 M**	**$24,135.455 M**
Manufacturing	$2,326.067 M	$12,332.359 M
Mining	$365.215 M	$2,417.320 M
Construction	$342.839 M	$1,847.498 M
Rental, Hiring & Real Estate Services	$256.430 M	$991.762 M
Financial & Insurance Services	$230.789 M	$686.726 M
Retail Trade	$155.851 M	$462.657 M
Electricity, Gas, Water & Waste Services	$150.099 M	$489.022 M
Professional, Scientific & Technical Services	$142.828 M	$710.629 M
Wholesale Trade	$139.899 M	$551.784 M
Accommodation & Food Services	$134.182 M	$699.542 M
Transport, Postal & Warehousing	$95.320 M	$638.267 M
Public Administration & Safety	$87.639 M	$525.756 M
Health Care & Social Assistance	$72.562 M	$301.274 M
Other Services	$68.639 M	$249.280 M
Administrative & Support Services	$66.604 M	$312.297 M
Education & Training	$57.627 M	$233.716 M
Information Media & Telecommunications	$57.429 M	$333.316 M
Arts & Recreation Services	$28.143 M	$100.920 M
Agriculture, Forestry & Fishing	$14.931 M	$251.332 M

The Regional Imports data represents the value ($) of goods and services imported into the Lake Macquarie LGA by businesses in each of the industry sectors. No distinction is made between domestic and international imports, and so imports into Lake Macquarie include goods and services sourced from the broader Hunter Region. The value of intermediate goods and services imported into Lake Macquarie LGA by local industry sectors is estimated at $4.793 billion. Of this the Manufacturing sector contributes approximately half of the value of goods and services imported into the LGA.

Table 5.6: Value Added by Industry
(source: REMPlan)

Industry	Lake Macquarie	Hunter Region
Total	**$8,113.378 M**	**$40,334.283 M**
Rental, Hiring & Real Estate Services	$1,426.812 M	$5,457.682 M
Manufacturing	$931.669 M	$3,898.350 M
Health Care & Social Assistance	$684.800 M	$2,989.057 M
Mining	$660.317 M	$5,006.907 M
Retail Trade	$597.668 M	$2,069.875 M
Construction	$576.322 M	$2,770.847 M
Financial & Insurance Services	$569.077 M	$2,612.720 M
Education & Training	$430.364 M	$2,011.328 M
Electricity, Gas, Water & Waste Services	$342.004 M	$2,040.764 M
Professional, Scientific & Technical Services	$333.248 M	$1,949.695 M
Wholesale Trade	$305.106 M	$1,350.137 M
Public Administration & Safety	$285.417 M	$2,436.632 M
Accommodation & Food Services	$248.667 M	$1,209.682 M
Transport, Postal & Warehousing	$220.578 M	$1,488.975 M
Administrative & Support Services	$181.216 M	$991.909 M
Other Services	$176.113 M	$788.329 M
Information Media & Telecommunications	$77.727 M	$506.805 M
Arts & Recreation Services	$41.048 M	$190.482 M
Agriculture, Forestry & Fishing	$25.226 M	$564.107 M

Table 5.6 identifies the Value-Added ($) that is added by each industry sector in Lake Macquarie. Value-Added is calculated by subtracting local expenditure and expenditure on regional imports from the output generated by an industry sector, or alternatively, by adding the Wages & Salaries paid to local employees, the gross operating surplus and taxes on products and production. Value-Added by industry sector is the major element in the calculation of Gross Regional Product (GRP). The total Value Added by the Lake Macquarie economy is estimated at $8.113 billion. Lake Macquarie represents approximately 20 % of the $40 billion Value Added in Hunter Region. Rental, Hiring & Real Estate Services contribute the largest Value Add to the Lake Macquarie economy ($1.4 M), while the Agriculture, Forestry and Fishing sector contribute the lowest Value Add in Lake Macquarie.

Table 5.7: Gross Regional Product
(source: REMPlan)

GRP Expenditure Method	Lake Macquarie	Hunter Region
Household Consumption	$9,405.000 M	$30,878.037 M
Government Consumption	$2,412.146 M	$9,197.276 M
Private Gross Fixed Capital Expenditure	$3,090.211 M	$11,762.517 M
Public Gross Fixed Capital Expenditure	$684.388 M	$2,609.505 M
Gross Regional Expenses	$15.591.745 M	$54,447.335 M
plus Regional Exports	$5,238.427 M	$30,991.770 M
minus Domestic Imports	-$10,164.769 M	-$32,760.532 M
minus Overseas Imports	-$1,682.983 M	-$9,363.036 M
GRP	$8,982.420 M	$43,315.537 M
Population	189,005	620,532
Per Capita GRP	$47,525	$69,804
Per Worker GRP	$174,132	$180,445

Gross Regional Product (GRP) is the net measure of wealth generated by a region. GRP can be measured by using the incomes approach, where all incomes earned by individuals (wages and salaries), firms (gross operating surplus) and governments (taxes on products or services) are added. Alternatively an expenditure approach can be taken where all forms of final expenditure, including consumption by households, consumption by governments, additions or increases to assets (minus disposals) and exports (minus imports), are added. The expenditure approach does not include intermediate expenditure, as this would lead to double counting, for example, the wheat and flour in a loaf of bread. These methodological approaches are the same as those used to calculate Gross State Product (GSP) at a state level and Gross Domestic Product (GDP) at a national level. The GRP for the Lake Macquarie LGA is estimated at $8,982 M, which represents a GRP of approximately $47,525 per person in the LGA and $174,132 per worker.

Table 5.8: Workers by Age, 2011
(source: REMPlan)

Age	% of Workers (Lake Macquarie LGA) (n = 51,584)	% of Workers (Hunter Region)
15 - 19	8.90%	6.90%
20 - 24	10.63%	9.95%
25 - 34	17.93%	19.66%
35 - 44	21.11%	22.45%
45 - 54	23.17%	23.49%
55 - 64	15.37%	14.71%
65 - 74	2.59%	2.51%
75 - 84	0.29%	0.30%
Over 84	0.02%	0.02%

At the 2011 Census, some 44% of workers in Lake Macquarie LGA were between 35 and 54 years of age which is slightly less than the proportion of 35-54 year old worker in the Hunter Region (46%). On the other hand, Lake Macquarie has a higher proportion of workers aged between 15 and 24 years (20%) compared to the Hunter Region as a whole (17%). Lake Macquarie LGA also has a slightly higher proportion of older workers (greater than 55 years) compared to the broader Hunter Region.

Table 5.9: Workers by Education Level, 2011
(source: REMPlan)

Education Level	% of Workers (Lake Macquarie LGA) (n = 51,584)	% of Workers (Hunter Region)
Postgraduate Degree	2.36%	3.15%
Graduate Diploma and Graduate Certificate	1.65%	1.73%
Bachelor Degree	12.97%	14.29%
Advanced Diploma and Diploma	9.32%	9.75%
Certificate	29.42%	29.48%
Level of education inadequately described	1.28%	1.29%
Level of education not stated	2.61%	2.55%
Not applicable	40.39%	37.76%

Compared to the broader Hunter Region, Lake Macquarie LGA has a slightly lower proportion of workers with university qualifications as well as a slightly lower proportion of workers with other tertiary qualifications.

Table 5.10: Business Counts (Staff), Lake Macquarie
(source: REMPLan)

	Lake Macquarie				Hunter Region			
Business Counts (Staff)	**Jun-12**	**Jun-13**	**Jun-14**	**Jun-15**	**Jun-12**	**Jun-13**	**Jun-14**	**Jun-15**
Non employing	7,412	7309	7,326	7,344	25,182	24,770	24,874	25,066
1-4	4,525	4,360	4,364	4,420	13,318	12,824	13,018	13,226
5-19	1,584	1,486	1,510	1,563	5,243	5,196	5,199	5,107
20-199	333	325	304	294	1,240	1,263	1,244	1,212
200+	6	0	6	12	9	6	9	57
Total	13,860	13,480	13,510	13,633	44,992	44,059	44,344	44,668

Business Counts are based on snapshots of actively trading businesses as at June in each of the years identified. The counts are sourced from the Australian Bureau of Statistics Business Register (ABSBR). The ABSBR contains counts and rates of business entries and exits from the Australian economy. This count only includes businesses which actively traded in goods or services during the reference period.

Most businesses in Australia need to obtain an Australian Business Number (ABN)., however, for a relatively small number of businesses, the ABN unit is not suitable for ABS economic statistics purposes and the ABS maintains its own units structure through direct contact with these 'non-profiled' businesses. These businesses constitute the profiled population. This population consists typically of large, complex and diverse groups of businesses.

The methodology used to derive business counts is based on the ABS's best estimate of an average number of employees over the reference year and as such is a more representative view than a cumulative total number of employees throughout the year. Due to a change in ABS methodology, care should be taken when comparing data since the 2014 release with earlier releases.

It is important to note that the counts also reflect turnover and staffing level changes in businesses. Therefore, a large percentage change, for example in businesses employing 200+ staff, does not necessarily mean an exit or entry of large firms but may instead relate to changes in staffing levels, resulting in a business being assigned to a different 'number of staff' cohort.

In general, the significant majority of businesses in Lake Macquarie LGA employ less than 20 workers, while 86% of businesses employ less than 5 staff. This is also similar to other businesses across the entire Hunter Region.

Table 5.11: Business Counts (Turnover), Lake Macquarie
(source: REMPlan)

	Lake Macquarie				Hunter Region			
Business Counts (Staff)	**Jun-12**	**Jun-13**	**Jun-14**	**Jun-15**	**Jun-12**	**Jun-13**	**Jun-14**	**Jun-15**
Zero to $50k	3,570	3,421	3,367	3,220	12,491	11,935	12,002	11,599
$50k to less than $100k	2,338	2,245	2,280	2,200	7,459	7,072	7,012	7,047
$100k to less than $200K	2,644	2,530	2,615	2,712	7,787	7,577	7,881	8,035
$200k to less than $500k	2,706	2,680	2,656	2,784	8,399	8,320	8,322	8,630
$500k to less than $2m	1,854	1,854	1,856	1,949	6,192	6,414	6,443	6,516
$2m or more	739	743	729	758	2,681	2,752	2,692	2,828
Total	13,851	13,473	13,503	13,623	45,009	44,070	44,352	44,655

Annual turnover values are based on data reported to the ATO through Business Activity Statements (BASs) and includes imputation for missing periods for all businesses in the Non-profiled population. Where businesses report zero values on their BAS or have failed to report at all, these data are compared with auxiliary BAS data, which are then used for the

purposes of assigning annual turnover values for each in scope business. In cases where auxiliary BAS data are not available, an imputation based on auxiliary ABSBR data (including wages and salaries and employment data) is used. Due to a change in ABS methodology, care should be taken when comparing data since the 2014 release with earlier releases. Given that a significant proportion of businesses in Lake Macquarie employ less than 5 staff it is not surprising that a large proportion of businesses turnover less than $500,000 per year, which is also similar across the Hunter Region.

6. ECONOMIC IMPACTS

6.1 TERMINOLOGY

There are a number of different terms that are used to identify the economic impact of a project.

Input-output **multipliers** are summary measures used for predicting the total impact on all industries in an economy of changes in the demand for the output of any one industry.

Output multipliers are defined as the total value of production by all industries of the economy required to satisfy one extra dollar's worth of final demand for that industry's output.

The initial requirement for an extra dollar's worth of output of a given industry is called the **initial output effect**. By definition it is equal to one in total for all industries since an additional dollar's worth of output from any industry will require the initial one dollar's worth of output from that industry plus any induced extra output.

The **first round effect** is the amount of output required from all industries of the economy to produce the initial output effect. For example, the output of the construction industry is increased by one dollar, than inputs from other industries such as manufacturing and mining will be required as well as inputs from the construction industry itself.

Similarly, the extra output from manufacturing and mining industries from creating extra output from a one dollar increase in the construction industry will **induce extra output (production induced effects)** from all other industries of the economy and, in turn, these will induce extra output, and so on.

The combined results of the initial effect plus all of the production induced rounds of extra output are called the **simple multipliers**.

For example, the **initial effects** of one dollar of additional output in the mining industry will create the need for the economy's output to increase in order to provide inputs into the mining industry **(first round effects)**. The economy's output will also need to increase to provide inputs to the suppliers of the mining industry **(industrial support effect)**. The combined result of the first round effects and industrial support effect is referred to as the **production induced effect.**

The household sector receives wages and salaries for work done in the production process and spends some or all of this on goods and services. This expenditure can be regarded as generating the production of goods and services by the industries of the economy. This induced production of extra goods and services is referred to as **consumption induced effects**.

A new set of multipliers can be calculated taking into account the initial effects, the production induced effects and the consumption induced effects. These are called the **total multipliers**.

Employment multipliers are calculated by dividing the number of employed persons in a given industry by the level of production generated by that industry.

There are other types of output multipliers which are referred to as **Type 1A, Type 1B, Type 2A and Type 2B**. These output multipliers include:

Multiplier	Details
Type 1A	Equals the Initial Output Effect + First Round Effect
Type 1B	Equals the Initial Output Effect + Production Induced Effect
Type 2A	Equals the Total Multiplier
Type 2B	Equals the Production Induced Effect + Consumption Induced Effect

6.2 ASSUMPTIONS AND CAVEATS

It should be noted that there are a number of assumptions that are inherent in using IO models. Firstly, IO models assume that industry dynamics are static, when in reality an economy will evolve and change over time. Secondly, although multipliers that are used to estimate flow-on effects and are developed from a robust methodology, they should be viewed as having a theoretical element. They are estimates and do not completely reflect the nature of the economy. For example, an economy may evolve as a result of a project, or a local business may change their business operations to better capture the benefits of a major project. Nonetheless, the results produced by using the multipliers generated by IO models will provide reliable information under current conditions and interactions.

The economic modelling conducted in this study provides an assessment on the industries likely to be impacted upon, and the levels of those impacts. A sufficient amount of data was provided to assess the economic impacts of the project; however, the availability of information relating directly to the project was limited to a certain extent, as it is for most other projects at this stage of the process (i.e. DA process). In particular, limited information is available on all expenditures associated with the project and the destination location of those expenditures. The findings of the economic assessment estimate where workers on the project would spend their money. Obviously, the workforce for the project is not yet present and so actual information on expenditures is not known, although one would expect some locally specific spending on day-to-day items (e.g. construction workers buying lunches locally).

6.3 PREVIOUS RESEARCH

There are a number of studies that have examined the economic impacts of residential development.

The ABS in 2002[1] identified that the construction industry accounted for 5.5% of national GDP in 1999-2000 and employed almost 8% of the workforce. This same report identified the following impacts of the construction industry for every $1m spent on a project:

[1] ABS (2002) The Construction Industry's Linkages with the Economy, Cat No 1301.0.

	Initial effects (1)	First round effects (2)	Industrial support effects (3)	Production induced effects (4 = 2 + 3)	Consumption induced effects (5)	Total Multiplier (6 = 1 + 4 + 5)
Output ($m)	1.000	0.466	0.438	0.904	0.962	2.866
Employment (no.)	9	3	4	7	21	37

The Housing Industry Association (HIA) in 2010[2] notes that in 2008/09, Australia's Housing and Renovation Industries directly contributed approximately $64 billion to Australia's Economy, which is approximately 5.3% of Australia's GDP. The HIA identifies that the total multiplier for output and employment in the construction industry is estimated by the ABS to be 2.866. So, for every $1 million increase in construction output, there is an increase in output elsewhere in the economy of $2.9 million. In output terms, an extra $1 million of construction expenditure also involves $217,000 of employee earnings and $241,000 of corporate and small business profits. In terms of employment, HIA state that an extra $1 million of construction expenditure generates 9 construction jobs, such as carpenters, brick layers, plasterers, etc. In addition to this initial effect there are also are production induced effects generating 7 jobs across those businesses manufacturing the materials needed for the additional construction, such as concrete and steel frames, and those businesses supplying and servicing the concrete and steel frame businesses, such as aggregate quarrying and raw steel production. The spending of these wages and salaries induces a further round of consumption effects in other areas of the economy which is estimated to create an additional 21 jobs.

The NSW Treasury (2009)[3] identifies the following employment multipliers in 2004-05 for every $1m of spend.

ABS Industry Sector	Initial impact (1)	Production-induced effect (2)	Simple employment multiplier = (1) + (2)	Consumption induced effect
Scientific research, technical & computer services	5.9	16.3	22.3	7.0
Motor vehicles & parts, other transport equipment	4.4	4.7	9.1	7.6
Other electrical equipment	3.8	2.1	5.9	1.0
Photographic and scientific equipment	4.4	0.5	4.9	0.6
Other machinery and equipment	4.4	1.6	6.0	0.7
Other property services	1.9	27.8	29.7	19.3
Construction trade services	7.2	11.8	18.9	5.4
Residential building	2.2	1.8	4.0	1.0
Other construction	2.1	3.0	5.0	1.5

[2] HIA (2010) The Economic Multiplier Effects of Housing.
[3] NSW Treasury (2009) Employment Support Estimates – Methodological Framework

In 2013 further research from NSW Treasury[4] identified that for every $1 million spent on extra residential construction, a possible $2.5 million would be generated in the overall economy. The spending would give rise to an additional three full-time jobs in the construction industry and a total of eight full-time jobs in the overall economy.

Although this proposal is based on a mixed use development of predominantly residential construction a number of other studies have identified broader construction related impacts. For example, in 2005 an economic assessment of construction (only) of facilities at Newcastle Airport[5] would entail the following impacts:

	Initial effects (1)	First round effects (2)	Industrial support effects (3)	Production induced effects (4)=(2+3)	Consumption induced effects (5)	Total multiplier (6=1+4+5)
Output ($m)	1.000	0.456	0.425	0.881	0.915	2.796
Employment (no.)	6	3	2	5	6	17

SGS (2016)[6] attempted to derive the economic impacts of mixed use development in the Newcastle CBD. This report presented the direct and indirect impacts of mixed use development for a section of Newcastle CBD. In particular, the report attempted to consider the impacts from both the residential and non-residential construction. The report identifies that of a $268.2 million construction project approximately an additional $124.5 million in industry output will occur within the LGA, 600 additional construction jobs and a gross added value of $98 million to the local economy.

More recently, Hill PDA (2015)[7] examined the impact of the Auburn Village development in Sydney. Auburn Village if developed will consist of a mixed use development (approximately 518 residential apartments, retail and public space). Hill PDA note the following construction multipliers as part of this development:

		Production Induced Effects			
	Direct	First Round Effects	Industrial Support Effects	Consumption Induced Effects	Total
Output Multipliers (Construction Works)	1	0.65	0.67	0.99	3.31
Output Multipliers (Construction Related Employment Only)	1	0.643	0.695	1.338	3.676

Hill PDA state that for the $215m construction of Auburn Village some 613 jobs would be created with 2,253 jobs created directly and indirectly.

[4] NSW Treasurer Economic Update, Sept 2013.
[5] Parsons Brinckerhoff (2005) Economic Impact Assessment Newcastle Airport Limited
[6] SGS (2016) Newcastle Urban Transformation & Transport Program: Rezoning of Surplus Rail Corridor Lands Economic Assessment.
[7] Hill PDA (2015) Auburn Village Economic Impact Assessment

6.4 ECONOMIC IMPACTS OF THE PROPOSAL

The proposed mixed use development has been estimated to cost in the order of $39m. This includes all residential development, retail/commercial space, landscaping, car parking etc.

Table 6.1 considers the economic impacts of the proposed development. It is noted that several of the studies presented above are used for comparative purposes.

Table 6.1: Economic Impacts of the Proposed Development

	Direct/Initial Effects	First Round Effects	Industrial Support Effects	Production Induced Effects	Consumption Induced Effects	Total Multiplier
	(1)	(2)	(3)	(4) = (2) + (3)	(5)	(6) = (1) + (4) + (5)
Construction ($)						
ABS (2002)	1	0.466	0.438	0.904	0.962	2.866
HIA (2010)						2.866
NAL (2005)	1	0.456	0.425	0.881	0.915	2.796
Hill PDA (2016)	1	0.65	0.67	1.32	0.99	3.31
Employment (No)						
ABS (2002)	9	3	4	7	21	37
HIA (2010)	9			7	21	
NAL (2005)	6	3	2	5	6	17
Hill PDA (2016)*	2.85	0.643	0.695		1.338	3.676
Proposed Development (CIV $39m)						
Construction ($)						
ABS (2002)	39	18	17	35	38	112
HIA (2010)	-	-	-	-	-	112
NAL (2005)	39	18	17	34	36	109
Hill PDA (2016)	39	25	26	51	39	129
Employment (No)						
ABS (2002)	351	117	156	273	819	1443
HIA (2010)	351	-	-	273	819	-
NAL (2005)	234	117	78	195	234	663
Hill PDA (2016)*	111	25	27	-	52	143

* Construction Related Employment Only, i.e. non-construction employment not considered.

Based on the analysis above it is considered that the proposed mixed use development will likely created approximately 351 jobs during the construction phase across the economy and some 819 jobs through flow on effects in the broader economy. The effects on the local economy vary between different studies from 40%-60% depending on the type of development. The local employment effects would therefore be estimated at 140 - 211 jobs directly during the construction phase and 328 – 491 local jobs through flow on effects. Even if the research by Hill PDA (2016) is considered for construction related impacts only

some 11 construction only jobs will be created by the proposal with an additional 52 construction only jobs through flow on effects. Nonetheless, once non-construction employment in the broader economy is considered (e.g. goods and services purchased by workers) than the employment related to the proposed works is significant.

Importantly, the $39 million investment will likely see flow effects in the order of $73 million in the broader economy.

Based on estimates of gross regional product ($174,132 per worker) the proposed development will add $24.4m - $36.7m during the construction phase to the Lake Macquarie GRP and $57.1m - $85.5m in flow on effects to the GRP.

6.4.1 Retail and Commercial Space

There will be a minor component of retail/commercial space within the proposed development. There are generally slight differences in the direct employment created by retail and commercial premises. Typical employment densities for commercial space is approximately one worker per 25 square metres of office space, while there is approximately one worker per 30 square metres of retail space[8]. For the purposes of this report a conservative approach has been utilised, and as such the figure of one worker per 30 square metres is utilised.

The results here are also caveated by the fact that there may be a relocation of businesses from elsewhere in Belmont to the subject site, however, for the purposes of this report, all else being equal any relocation of workers will be 'back filled' by other businesses.

It is proposed that 716 square metres of retail space will be provided in the development. It is estimated that this will create in the order of approximately 23 new jobs. This will also create some additional flow on effects in the local economy through workers purchasing other goods and services.

[8] SGS (2016) Newcastle Urban Transformation & Transport Program: Rezoning of Surplus Rail Corridor Lands Economic Assessment.

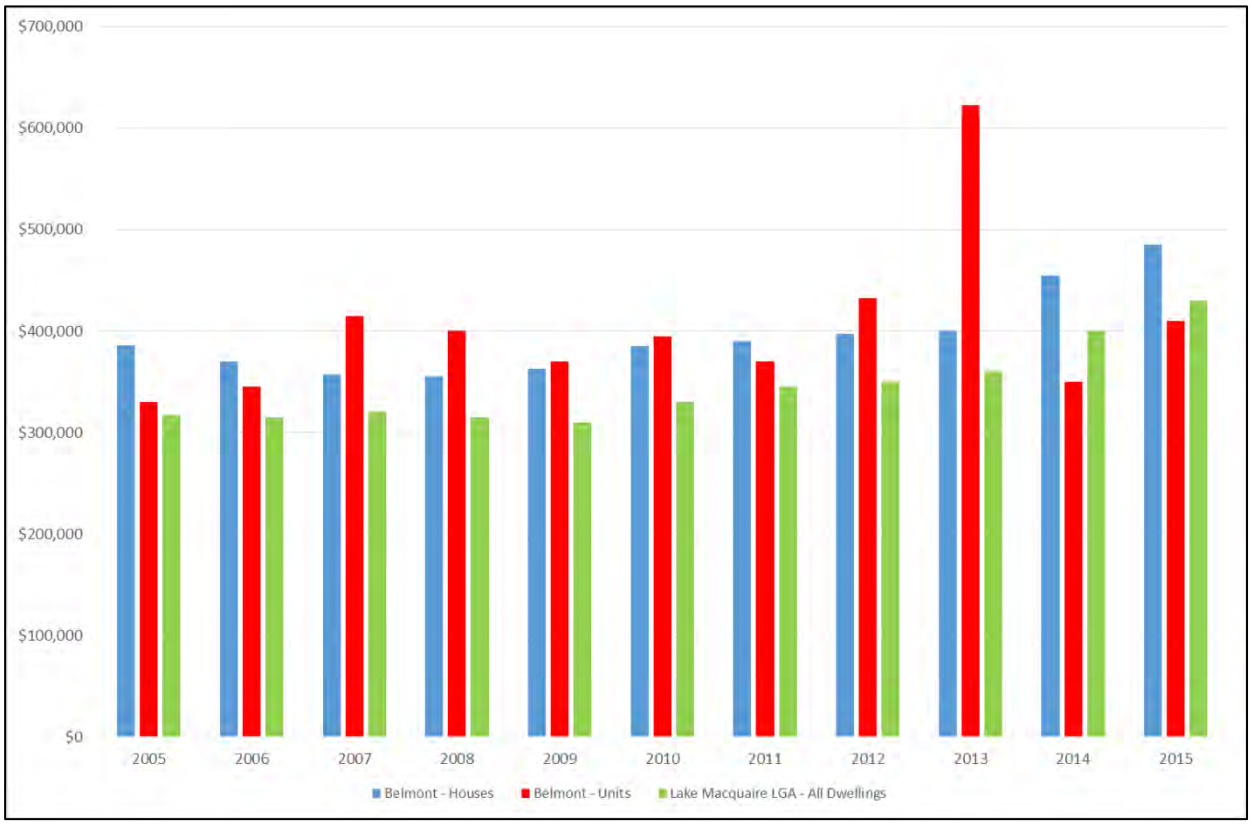
7. HOUSING MARKET ANALYSIS

The proposed development is located within the Belmont town centre. Over the last few years there has been some significant higher density development in the town centre.

7.1 SALES PRICES

Between 2005 and 2015 the median sales price of a dwelling in Belmont was consistently higher than for Lake Macquarie LGA as a whole (Figure 6.1), although units have dipped below the LGA median in recent years. Between 2005 and 2015 the median sales price of a house in Belmont increased from $386,000 to $485,000 a 26% increase. The median sales price of a unit in Belmont increased in the same period from $330,000 to $410,000, a 24% increase. For all dwellings in Lake Macquarie LGA, between 2005 and 2015 the median sales price increased 36% from $317,000 to $430,000. In general, sales prices in Belmont are higher than the median for the LGA.

Figure 7.1: Median Sales Prices, 2005-2015
(source: PriceFinder)

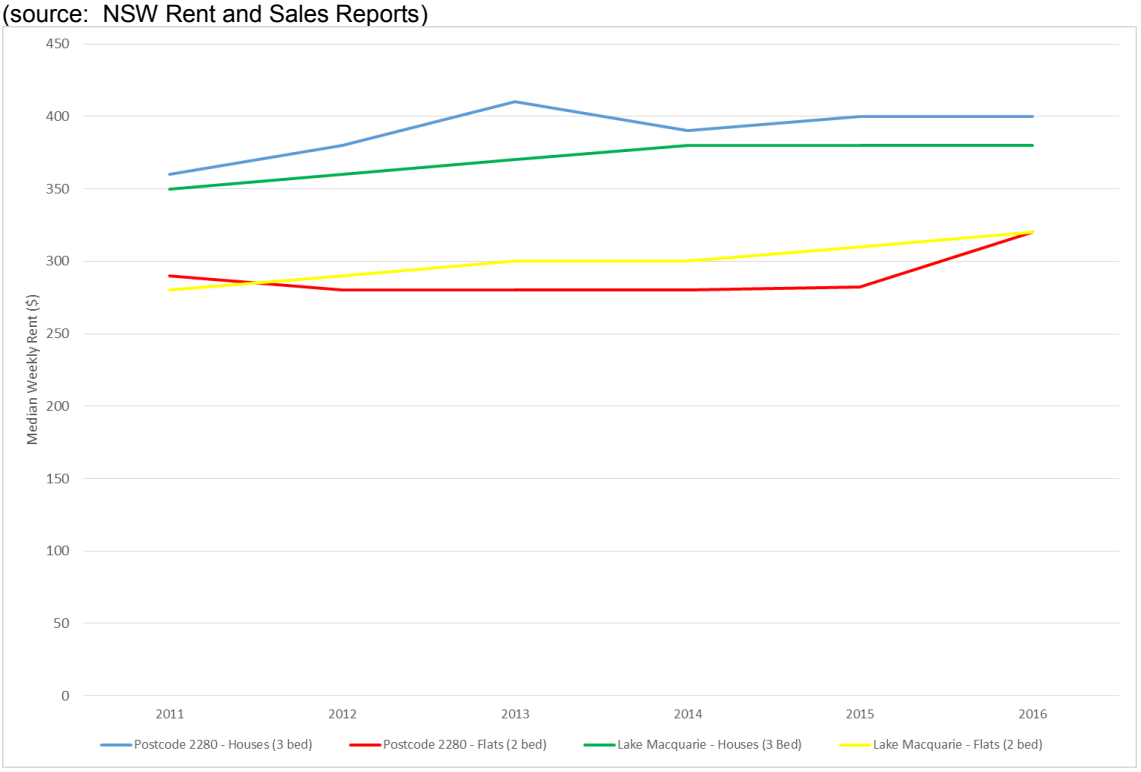


7.2 RENT

Figure 6.2 below identifies the median weekly rent for a house and flat/unit in postcode 2280 (which includes Belmont) and the Lake Macquarie LGA[9]. In general, over the last five years the median weekly rent in postcode 2280 has been slightly higher than the median weekly rent for the LGA as a whole. At June 2016 the median weekly rent for a 3 bedroom house in postcode 2280 was $400 compared to $380 for the LGA.

In regards to the median weekly rent for flats/units, the rent for a flat/unit across the LGA has generally been higher than for postcode 2280, however, in recent times the median weekly rent has been similar. The median weekly rent for a 2 bedroom flat/unit in both postcode 2280 and the Lake Macquarie LGA is $320.

Figure 7.2: Median Rent, 2011-2016
(source: NSW Rent and Sales Reports)



7.3 MARKET DEMAND

The Census notes that there are approximately 1.6 persons per household in flats and units in Belmont. This ranges from 1.6 persons in one or two story buildings, 1.5 persons per flat/unit in a three storey block and 1.7 persons per flat/unit in a building with fur or more storeys. From the Census we also know that 22% of flats/units are owned, 12% are being purchased while about 40% are privately rented. While there is a significant proportion of investors in the flat/unit market there is also a significant proportion who buy a flat/unit outright.

[9] Data presented here is for a 2 bedroom flat and a 3 bedroom house which tend to be the predominant housing type in those two categories.

Discussions with the proponent and other developers in the area have identified several markets for the proposed dwellings. This includes empty nesters/downsizers who are selling existing properties in nearby areas and moving into flats/units in Belmont. There is obviously and investor market. The third market will be those individuals or couples who are looking for more affordable housing options, although given average household sizes are unlikely to have children.

8. IMPACT ASSESSMENT

This economic impact assessment has identified that the proposed development will cost in the order of $39 million to construct. Based on this, the development will provide a significant number of construction jobs which will have multiple flow on effects in the broader and local economy. The proposal will also create additional jobs in the local economy through the provision of additional retail/commercial workers.

Overall, the development positive economic impacts. It is anticipated that the development will cater to a number of housing sub-markets including 'empty nesters' or 'downsizers' as well as households looking for more affordable housing options in Belmont. The developer will be required to pay development contributions which can be used by Council to manage existing/new infrastructure in the area.

Monteath & Powys Pty Ltd

SURVEYING, PLANNING, ENGINEERING DESIGN, PROJECT MANAGEMENT






MIXED USE DEVELOPMENT

BROOKES PARADE,

BELMONT

Social Impact Assessment

Liability limited by a scheme approved under Professional Standards Legislation

Quality ISO 9001 Certified System

This Report was prepared by:-

Monteath & Powys Pty Ltd
Suite 13 Tonella Commercial Centre
125 Bull Street
NEWCASTLE WEST NSW 2302

PO Box 2270
DANGAR NSW 2302

Telephone: (02) 4926 1388
Facsimile: (02) 4929 3475
Web: www.monteathpowys.com.au

PROJECT:	Social impact assessment for a proposed mixed use development
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AUTHOR:	Darren Holloway BSc (Hons), MBEnv Registered Planner
SIGNATURE:	

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1. INTRODUCTION

Monteath & Powys has been engaged by KML Joint Venture to undertake a social impact assessment (SIA) for a multi-storey mixed use development in Brookes Parade, Belmont. The purpose of this SIA is to determine the social impacts of the proposed development and provide recommendations to mitigate impacts of concern. This SIA will accompany the development application to Lake Macquarie City Council for the proposed development.

1.1 SITE DESCRIPTION

The site is located in the suburb of Belmont, within the Lake Macquarie Local Government Area (LGA). The subject site is within the Belmont Town Centre which is some 17 kilometres from Newcastle CBD. It is generally surrounded by a mix of land uses including existing residential development, mixed use multi-storey buildings, and commercial/retail premises. The site is bounded by Edgar Street to the east, Sharp Street to the south, Brooks Parade to the west and Maude Street to the north. The Belmont Town Centre is dissected by the Pacific Highway which is approximately 250 metres to the east of the site.

The site comprises fifteen lots in total as identified in Table 1.1 and is approximately 7,083 square metres in size.

Table 1.1: Property Descriptions lodgement

Lot	Section	DP
11	B	585
A	-	400644
B	-	400644
2	-	353066
1	-	353066
4	-	12898
5	-	12898
6	-	12898
7	-	12898
10	B	585
8	-	12898
B	-	339105
A	-	339105
4	B	585
3	B	585

The site is zoned B4 Mixed Use under Lake Macquarie LEP 2014. Access to the site is available from Brooks Parade, Sharp Street and Edgar Street. Lake Macquarie is to the west of the site. The site is shown in Figures 1.1 to 1.2 below.

1.2 GUIDELINES

As part of preparing this social impact assessment a number of guidelines were considered. Each guideline was considered in relation to the size, location and potential impacts of the proposed development. These guidelines included:

- Lake Macquarie City Council Social Impact Assessment Guideline, 2013;

- Guidelines for Assessing Social Impacts, prepared by the NSW Cabinet Office in 1997;
- Social and Community Planning Reporting Manual and Guidelines, prepared by NSW Department of Local Government in 2002;
- Guidebook on Social Impact Assessment, prepared as part of the NSW Department of Planning's Comprehensive Coastal Assessment Project in 2005.

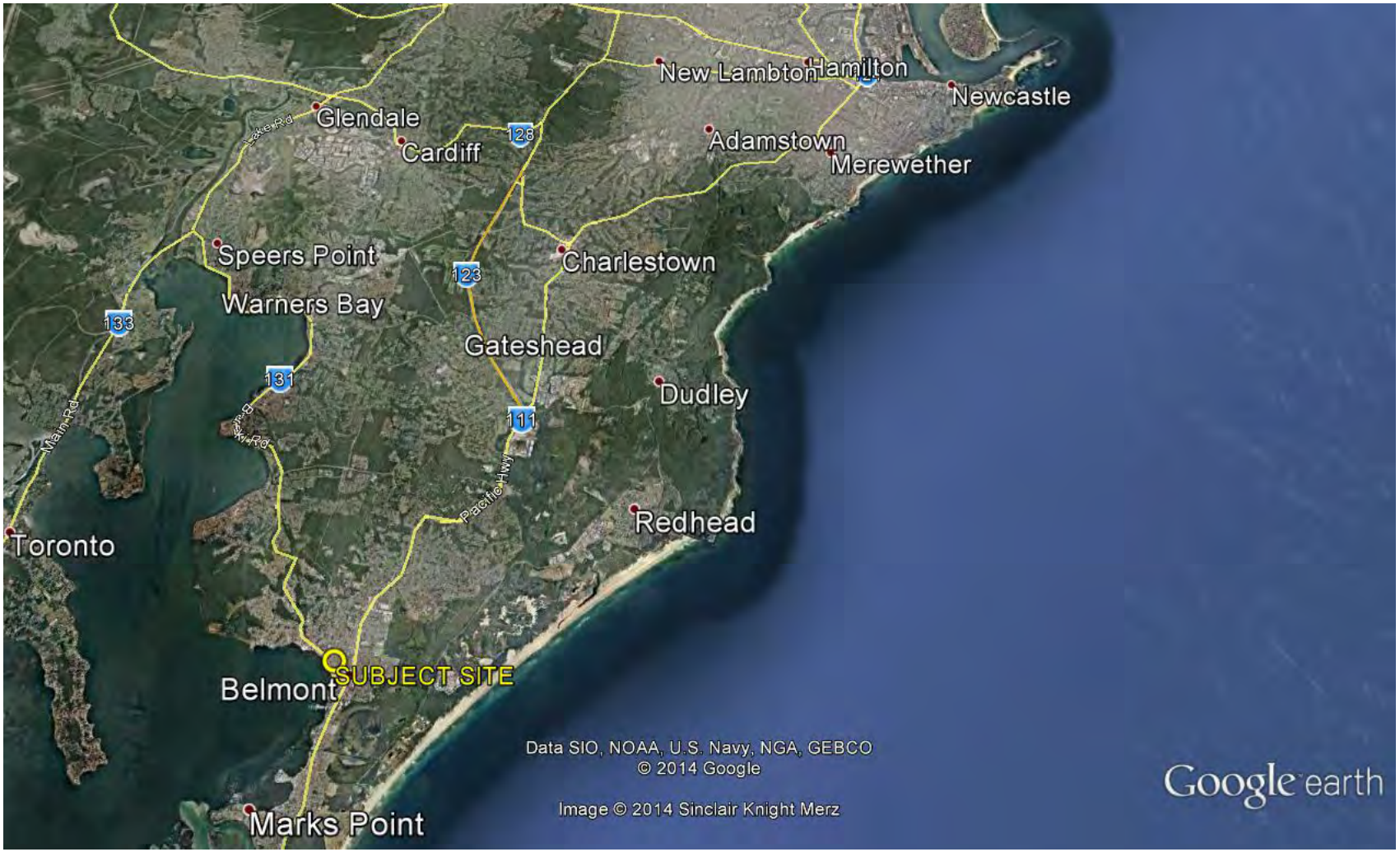


Figure 1.1: Regional Locality Map



Figure 1.2: Locality Map

2. PROPOSED DEVELOPMENT

2.1 THE PROPOSAL

The proposed development involves the demolition of the existing structures and the construction of a mixed use development comprising four separate buildings. The development comprises of 140 residential units, 4 retail/commercial areas, 1 communal multi-purpose room, basement car parking and associated landscaping. The development specifically includes:

Summary of Proposed Development	
Number of units and unit mix (Residential)	23, one-bedroom + study units 11, two-bedroom units 67, two-bedroom + study units 13, three-bedroom units 26, three-bedroom + study units
Number of units and size (Retail/Commercial)	Building B, 234.4m² Building A, 301.3m² Building D, 146.2m²
Parking	Car Parking (Res + Retail) – 158 spaces Motorbike Parking – 4 spaces Bicycle Parking – 52 spaces

3. METHODOLOGY

A multi method approach was undertaken as part of this social impact assessment in order to ascertain the potential impacts of the proposed development. This methodology includes:

- Analysis of Census data from the Australian Bureau of Statistics (ABS) to profile Belmont and the Lake Macquarie Local Government Area (LGA);
- Review of other published social data;
- Review of existing documentation relating to the subject site (e.g. previous Council reports);
- Review of Lake Macquarie social and community plans (where available);
- Review of relevant strategic and statutory planning documents;
- Review of existing social and community infrastructure;
- Discussion of the potential impact of the development;
- Consideration of possible mitigation and/or management options.

4. STRATEGIC AND PLANNING CONSIDERATIONS

This section identifies the strategic and planning policies that are applicable to the proposed development in relation to this social impact assessment. It is noted that Council have some policies that apply to its own assets and organisation (e.g. open space), but do not apply to the proposal.

4.1 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

The proposed development will be assessed under Part 4 of the Environmental Planning and Assessment Act 1979. The Joint Regional Planning Panel (JRPP) will be the determining authority for the development. The development is proposed under Lake Macquarie Local Environmental Plan (LEP) 2004.

4.2 HUNTER REGIONAL PLAN 2016

The Hunter Regional Plan (HRP) was released in 2016 by the NSW Department of Planning and Environment. The Plan is the strategic plan and vision document for guiding growth in the Hunter to 2036. At its centrepiece is the strategic direction for the Greater Newcastle area, which includes Lake Macquarie. The Greater Newcastle area is anticipated to accommodate and extra 600,000 people to 2036. With comes an anticipated 62,000 increase in job numbers. The Plan identifies that the aims for Greater Newcastle include:

- Connect strategic centres in Greater Newcastle;
- Develop a national Centre of Excellence for Health and Education;
- Expand the capacity of Global Gateways – Newcastle port and airport; and
- Establish governance.

These aims are very broad. Nonetheless, the Belmont to Charlestown corridor is identified as an urban renewal corridor, with Belmont identified as a significant local centre.

The proposed development will continue to emphasis Belmont as a town centre and address the urban renewal potential of Belmont.

4.3 NSW IN THE FUTURE: PRELIMINARY 2013 POPULATION PROJECTIONS

The NSW Department of Planning and Environment recently released their population projections for the period 2011 to 2036. Based on the findings of these projections, Lake Macquarie is likely to experience in increase of 30,000 persons between 2011 and 2036. This represents an increase of 15,850 households. In terms of age distribution, it is likely that the 65+ age bracket will experience the highest rate of growth during the period of 2011-2036; that is, approximately a 69% increase.

The population projections should be used to assist in determining the adequate supply of housing stock and services required for the future population.

It is considered that the proposed development is consistent with the outcomes identified in the population projections released by NSW Department of Planning as it will provide further housing within the Lake Macquarie LGA for the growing population. In addition, the housing type is will assist in providing suitable housing for smaller households, such as retirees. This is an important point for Belmont.

Table 4.2: Population Projections, Lake Macquarie, 2011-2036
(Source: NSW Department of Planning and Environment)

	2011	2016	2021	2026	2031	2036
Total Population	196,800	202,350	208,850	214,800	220,500	226,800
Total Households	77,300	80,550	84,050	87,150	90,100	93,150
Average Household Size	2.51	2.47	2.44	2.42	2.39	2.37
Implied Dwellings	84,150	87,700	91,500	94,850	98,100	101,400
CHANGE:		**2011-16**	**2016-21**	**2021-26**	**2026-31**	**2031-36**
Total Population Change		5,550	6,500	5,900	5,750	6,300
Average Annual Population Growth		0.6%	0.6%	0.6%	0.5%	0.6%
Total Household Change		3,250	3,500	3,100	2,950	3,050
Average Annual Household Growth		0.8%	0.9%	0.7%	0.7%	0.7%
HOUSEHOLD TYPES:	**2011**	**2016**	**2021**	**2026**	**2031**	**2036**
Couple only	21,750	23,450	24,950	26,200	27,200	28,100
Couple with children	24,350	24,550	25,000	25,400	25,750	26,200
Single parent	9,250	9,400	9,550	9,750	10,000	10,200
Other family households	750	750	750	750	800	800
Multiple-family households	1,200	1,250	1,300	1,350	1,400	1,400
Total family households	*57,300*	*59,350*	*61,650*	*63,450*	*65,100*	66,800
Lone person	18,200	19,400	20,600	21,900	23,200	24,500
Group	1,800	1,800	1,800	1,800	1,800	1,850
Total non-family households	*20,000*	*21,200*	*22,450*	*23,700*	*25,050*	26,350
Total	77,300	80,550	84,050	87,150	90,100	93,150
AGE GROUPS	**2011**	**2016**	**2021**	**2026**	**2031**	**2036**
0-4	11,700	12,050	12,200	12,150	12,000	12,050
5-9	11,850	12,200	12,700	12,850	12,900	12,850
10-14	12,750	12,250	12,750	13,200	13,400	13,550
15-19	13,550	12,850	12,450	12,900	13,350	13,700
20-24	12,050	11,750	11,200	10,800	11,100	11,600
25-29	10,800	11,150	11,000	10,450	10,150	10,600
30-34	10,450	12,050	12,550	12,300	11,800	11,750
35-39	12,200	11,400	13,000	13,550	13,300	12,950
40-44	12,950	12,600	11,900	13,500	14,050	13,850
45-49	13,350	13,050	12,750	12,100	13,650	14,300
50-54	13,900	13,200	12,950	12,650	12,100	13,700
55-59	13,050	13,850	13,300	13,050	12,850	12,400
60-64	12,450	12,900	13,850	13,350	13,150	13,050
65-69	10,600	12,200	12,750	13,700	13,350	13,200
70-74	8,100	10,000	11,650	12,250	13,300	13,050
75-79	6,650	7,300	9,150	10,750	11,450	12,500
80-84	5,500	5,500	6,150	7,750	9,300	10,050
85+	4,900	6,000	6,650	7,500	9,300	11,600

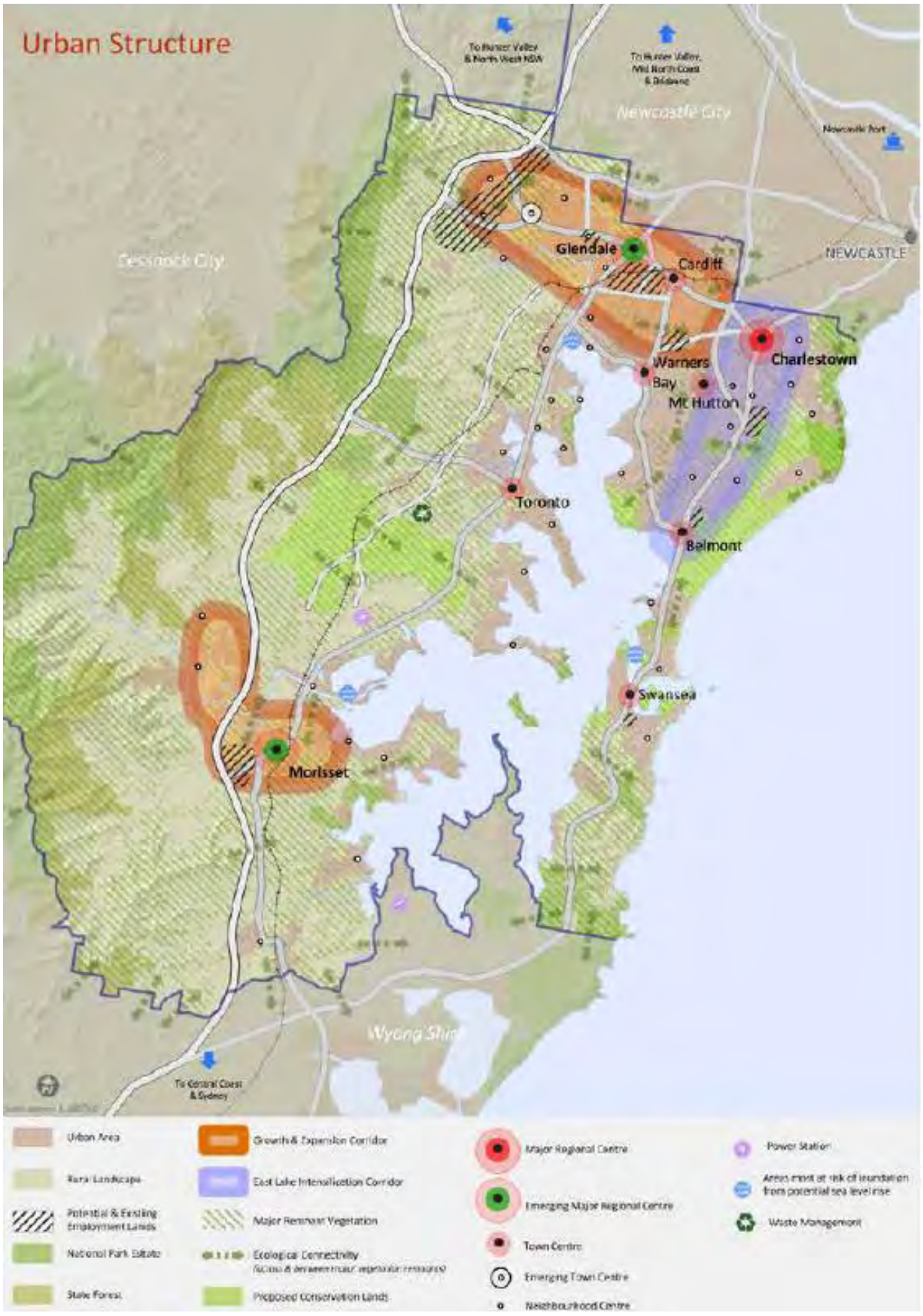
4.4 LAKE MACQUARIE LIFESTYLE 2030 STRATEGY

Lifestyle 2030 Strategy is the strategic land use plan prepared by Lake Macquarie City Council to inform the development of the local government area. The current strategy was adopted by Council in March 2013. The extent of Lake Macquarie local government area and its urban structure are illustrated in Figure 4.1 below. Lifestyle 2030 has seven strategic directions, each illustrated by numerous statements of the desired outcomes. The key desired outcomes for each strategic direction are supported by the potential development of the subject site. Overall, the potential development is consistent with the objectives of the Lake Macquarie Lifestyle 2030 Strategy.

4.4.1 Belmont Town Centre

Belmont is identified in the Strategy as a Town Centre within the East Lake Intensification Corridor. The strategy expects urban zoned land in the corridor to be developed for multi-unit housing close to centres and well serviced by public transport routes, as well as employment, community services and facilities. The intensification for housing assists to maintain the supply of industrial land for manufacturing activities in the corridor, such as Redhead and Bennetts Green, which plays an important role in the local and regional economy. Intensification limits the growth of the urban footprint, protecting ecological lands along the along the east and west sides of the corridor from Belmont to Charlestown.

Figure 4.1: Lake Macquarie Urban Structure



4.5 LAKE MACQUARIE COMMUNITY STRATEGIC PLAN

The Lake Macquarie Community Strategic Plan 2013-2023, represents Council's vision for the City of Lake Macquarie. As Council's key strategic planning document, this Plan presents the main priorities of the community, and sets out the long-term strategies developed to respond to these priorities. The Plan identifies that a cooperative approach is required to ensure the priorities of the community are addressed. For Council, this involves building and maintaining partnerships with external partners, including state and federal government departments and agencies, non-government organisations and community groups. The Strategy covers areas such as sustainability/environment, population growth, economic development etc but does not specifically identify any geographical areas or centres. The Strategy is more an LGA wide vision for Lake Macquarie and subsequent strategies (e.g. land use strategy, social plan etc) will provide more detail.

4.6 SOCIAL IMPACT ASSESSMENT GUIDELINE

Lake Macquarie City Council has a Social Impact Assessment Guideline which was adopted in 2013. The purpose of a social impact assessment according to the guideline is to:

1. Assist in establishing the full facts about the development, to support a well-informed decision about the appropriateness of the development proposal;

2. Minimise adverse impacts and maximise beneficial impacts of the development;

3. Assess the impacts of the development on future generations;

4. Inform the community and facilitate participation by the community in the planning and development assessment process;

5. Facilitate the consideration of alternative development proposals; and

6. Enhance existing data to inform the planning and development assessment process.

It is noted that this policy provides guidance on assessing the social impacts of a development. Other instruments and policies such as Lake Macquarie Local Environmental Plan (LEP), Lake Macquarie Development Control Plan (DCP) and Lake Macquarie Social Plan should also be considered. Each development will also have its own unique circumstances and impacts. As such, the content and issues addressed in a social impact assessment will vary depending on the type and scale of the development.

4.7 LAKE MACQUARIE SOCIAL PLAN 2009-2014

The Lake Macquarie Social Plan is a direction of the 10 Year Community Strategic Plan, in response to the identified priority of 'planning for facilities, services, and programs in response to new urban development, social trends, and demographic changes'. Council has developed, or is in the process of developing, a number of other strategic plans, including an Ageing Population Plan, a Disability Lake Macquarie City Social Plan 2009–2014 5 Action Plan, a Youth Community Plan, a Crime Prevention Plan, a Children's Plan, an Aboriginal Community Plan, a Sports Facility Strategy, and a Cemetery Plan. These plans identify the projects, programs and initiatives planned in response to specific needs or for specific demographic groups. However, the Social Plan is an overarching document that identifies the broader key trends and issues affecting all people that live and work in the City.

The social plan is a strategic document and addresses the most significant social issues for the Lake Macquarie LGA. The Plan identifies priority issues that were considered to be of the highest need as specified in the consultation or research and policy. Priorities were included in the Action Plans. The Action Plan(s) have been developed for each of the major themes of the Social Plan (e.g. housing, education, health, community safety). They provides details of the priority issues, strategies to address each of these issues, and the proposed timeframe for implementation of the strategies. Whilst it is the responsibility of Council's Social and Community Planning team to facilitate the implementation of the strategies identified within this Plan, where appropriate, this will be undertaken with relevant partners and stakeholders.

4.8 LAKE MACQUARIE AGEING POPULATION STRATEGY 2014-2017

The overall aims of the Lake Macquarie Ageing Population Strategy are to:

- Update the Lake Macquarie Ageing Population Plan 2008-17;
- Identify priority actions for Council that will assist in meeting the needs of the ageing population, and to integrate these actions into Council's strategic plans;
- Outline a work program that ensures continuous improvement in the provision of services and facilities for the City's older residents.

In regards to the strategy for the proposed development, the strategy aims to provide more housing options for people to age in the local area and have the ability to 'downsize' in their local area, as well as provide increasing access to public transport. The proposed development addresses these aims of the Strategy.

4.9 LAKE MACQUARIE YOUTH STRATEGY 2014-2019

The Lake Macquarie Youth Strategy 2014-2019 specifically identifies the needs of young people and proposes strategies to address those needs and facilitate the delivery of outcomes in the community. The Youth Strategy provides the basis for the delivery of initiatives that have grassroots significance and that address the needs of young people identified through the community consultation conducted as part of the development of the strategy. The Youth Strategy will be delivered in line with other Council plans and strategies through internal collaboration and external partnerships increasing the likelihood of achieving sustainable outcomes in the community for young people

The Youth Strategy states that to address the needs of the youth of Lake Macquarie four objectives will be actioned, which are:

- Increase access to services for young people;
- Ensure that space, places and facilities are designed for, and encourage use by young people;
- Supporting existing service and facility providers to ensure they are responsive to the needs of young people;
- Ensure that young people have the opportunity to make a meaningful contribution to public life and decision-making processes.

The Youth Strategy is not specifically geographical based and is a strategy that will be actioned through Council's operational plans and budgets.

4.10 LAKE MACQUARIE DISABILITY ACTION PLAN 2013-2017

This Plan aims to:

- Update the Lake Macquarie Disability Action Plan 2010-13 currently lodged with the Australian Human Rights Commission (AHRC);
- Identify priority actions for Council that will remove barriers faced by people with a disability, and to integrate these actions into Council's strategic plans; and
- Outline a work program that ensures continuous improvement in access for people with a disability to all Council facilities and services.

The Disability Action Plan is an action plan which identifies priority areas (e.g. accessible toilets, disability parking) for future planning and operational actioning/funding. The Plan is not specifically geographical based but priority areas will be addressed through ongoing budgetary processes.

4.11 LAKE MACQUARIE COMMUNITY FACILITIES STRATEGY 2011

This Strategy aims to ensure that Council's community facilities meet the expectations and needs of current and future residents. The Strategy will seek to ensure that Council funds, maintains, and improves its ongoing, viable long-term assets, and will investigate possible outcomes for unsustainable facilities, in consultation with the community. Only those facilities that are not currently leased, or are due to shortly come off a lease, are considered in this Strategy. The leased facilities, along with the libraries, will be considered in separate strategies.

The Strategy identifies facilities from 'high' to 'low' to determine the 'intervention' required by Council. In relation to the Belmont area the strategy identified:

- Belmont Senior Citizens Centre - Maintain facility in its current form. The facility is the highest ranked facility. It has very high levels of utilisation, is in very good condition having had a major upgrade in 2009/10, and is suitable for its function. No intervention is required.

4.12 LAKE MACQUARIE DEVELOPMENT CONTRIBUTIONS PLAN

It is identified that the proposal will be required to pay development contributions under Lake Macquarie's relevant development contributions plan.

5. SOCIAL AND DEMOGRAPHIC PROFILE

The subject site is located in the suburb of Belmont, within the Lake Macquarie LGA. This section presents an overview of the socio-demographics of the Belmont locality in the context of the wider Lake Macquarie LGA. It is noted that, at the time of writing, some 2016 Census data has been released but some data may refer to the 2011 Census as the latest 2016 data may not have bene released.

5.1 SOCIAL DISADVANTAGE AND ADVANTAGE

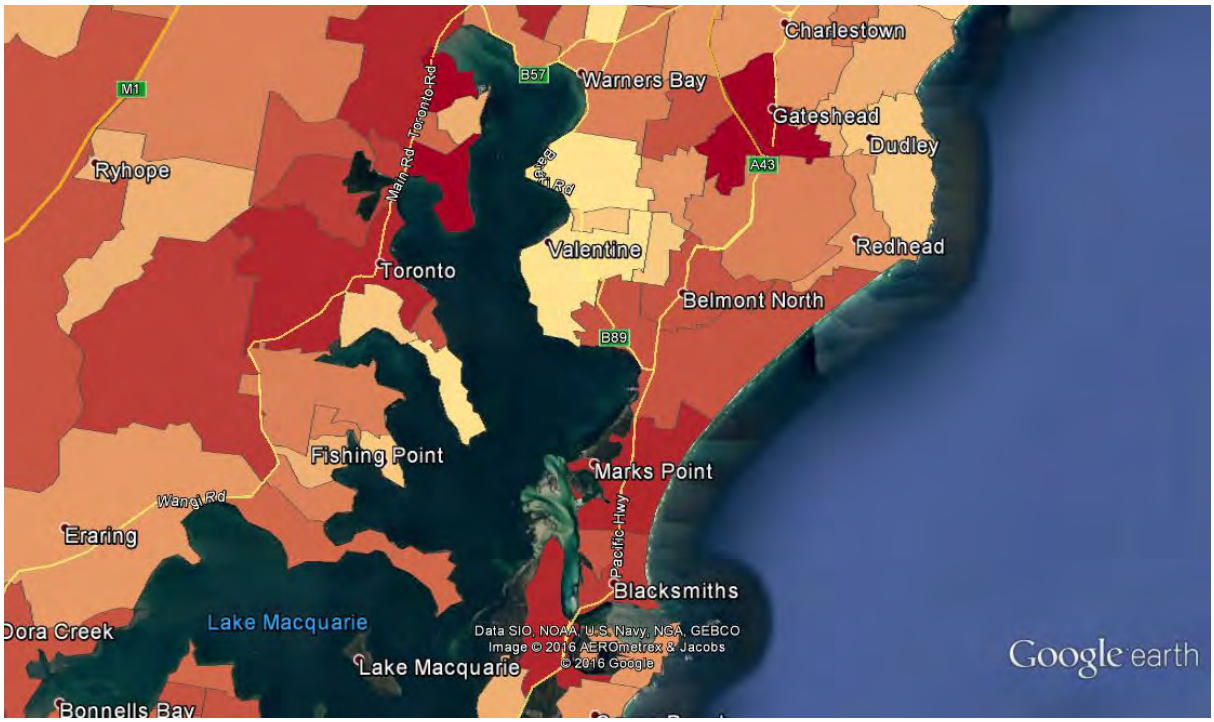
The Australian Bureau of Statistics (ABS) releases Socio-Economic Indexes for Areas (SEIFA) data which identifies the relative socio-economic advantage or disadvantage of a locality compared with other areas in Australia. The ABS broadly defines relative socio-economic advantage or disadvantage in terms of people's access to material and social resources, and their ability to participate in society. A lower number on the index means that an area is relatively more disadvantaged than other areas. A higher number on the index means that an area is relatively less disadvantaged than other areas (i.e. a high number for the index means that an area is relatively more advantaged than other areas).

Figure 5.1 demonstrates the Index of Relative Socio-economic Disadvantage (IRSD) released by the ABS for suburbs around Belmont. Belmont is ranked in the 4 decile, suggesting it is one of the less disadvantaged than neighbouring suburbs such as Marks Point, Blacksmiths and Swansea, however, is comparatively more disadvantaged than Warners Bay and Valentine.

Belmont is identified as a Town Centre and is earmarked for growth and renewal. The proposed development will provide approximately 130 new dwellings in Belmont, an established and well-serviced locality. It is anticipated that the proposed housing type, will provide some more affordable housing within Belmont.

It is noted SEIFA is a general measure of relative socio-economic advantage and disadvantage. SEIFA is an area-level measure and is not intended to reflect individual people or households. As the SEIFA score is an average, it provides a summary measure of the people and households within a selected area. That is, an area may have pockets of disadvantage (or advantage) but the overall statistics for a local area are compared (or ranked) with other areas. The SEIFA index of socio-economic disadvantage should be used as a guide only. Section 5.2 below provides more detail on the socio-economic characteristics of Belmont.

Figure 5.1: ABS Index of Disadvantage (ABS 2011)



5.2 SOCIO-DEMOGRAPHIC PROFILE OF THE LOCALITY

This section provides a more detailed analysis of the ABS census data from 2016 (and 2001 where the 2016 data is not available). This section analyses the data collected for Belmont in context to the Lake Macquarie LGA. Some economic data from the 2011 Census is presented in the economic impact assessment.

5.2.1 Selected Medians

Table 5.1 below provides a snapshot profile for Belmont. In comparison to Lake Macquarie LGA Belmont experiences lower median household incomes. The median weekly household income in Belmont is $860 compared to $1,117 per week for the LGA as a whole. This result is also reinforced through the Median household sizes in Belmont are also less than the LGA, being 2.38 persons per household. The median age of a person in Belmont is 46 years of age which is higher than the median age for Lake Macquarie LGA (41).

Table 5.1: Selected medians and averages, 2016

	Belmont (SSC)	Lake Macquarie LGA
Persons	7,114	197,371
Occupied Dwellings	2,943	73,075
Average Household Size	2.42	2.70
Median Weekly Household Income	1,040	1,313
Median Age	46	42
Age		
0-14	15.7%	18.3%
15-24	11.6%	11.7%
25-44	20.5%	23.0%
45-64	27.6%	26.4%
65 Years or More	24.5%	20.6%
Indigenous Persons	3.0%	4.1%
Persons Born in Australia	85.2%	85.2%
Household Type		
Couple without Dependents	27.4%	29.7%
Couple with Dependents	24.6%	31.6%
One Parent Family	12.4%	6.7%
Lone Person Household	32.4%	24.1%
Other Household Type/Not Stated	*3.1%*	7.9%
Dwelling Type		
Separate Houses	69.2%	77.9%
Semi Detached Dwellings	14.6%	8.9%
Flats and Units	12.7%	3.5%
Other Dwelling Type/Not Stated	3.4%	9.8%
Tenure		
Owned (with or without mortgage)	66.0%	73.6%
Privately Rented Dwelling	22.7%	17.1%
Rented from Social Housing Provider	6.8%	5.0%
Other Tenure Type/Not Stated	4.5%	4.4%
Lived at the Same Address 1 year Prior to Census	79.4%	82.2%
Lived at the Same Address 5 years Prior to Census	57.8%	59.9%
University Qualification (persons over 15 years)	23.1%	26.5%
Number of Motor Vehicles		
No motor vehicles	11.5%	5.7%
One motor vehicle	37.3%	33.0%
Two motor vehicles	32.8%	38.3%
Three or More Motor Vehicles	14.5%	19.7%
Not Stated	3.9%	3.4%

	Belmont (SSC)	Lake Macquarie LGA
Labour Force		
Unemployment Rate (at Census)	7.8	6.9
Labour Force Participation Rate (at Census)	51.6	56.8
Employed Full-time	53.9%	54.9%
Employed Part-time	33.7%	33.3%
Employed (not at work)	4.7%	5.0%
Method Of Travel to Work (Who Went to Work on Census Night)		
Car	75.5%	77.3%
Bus or Train	1.5%	1.5%
Other Method (Tram, Ferry, Taxi, Motorbike, Scooter)	1.6%	2.1%
Multiple Method	1.2%	1.4%
Cycle, Walk	3.1%	1.8%
Household Income		
Less than $400	9.4%	6.5%
$400-$649	17.6%	12.8%
$650-$999	16.9%	15.6%
$1,000 - $1,499	14.1%	15.7%
$1,500 - $1,999	8.8%	11.1%
$2,000 - $2,999	12.5%	16.8%
$3,000 or more	11.4%	11.8%
Not Stated	9.2%	9.6%

5.2.2 Population

At the 2016 Census, Belmont had a population of 7,114 with a relatively even ratio of males (49%) to females (51%). The suburb comprises a total of 2,943 households. Some 3% of the Belmont population are identified as Indigenous Persons compared to 4% for the rest of Lake Macquarie. The majority of the population of Belmont were born in Australia (85%).

5.2.3 Age

The median age for persons in Belmont is 46. This is higher than that of the wider Lake Macquarie LGA (42), and much higher than for NSW, which is 38 years.

As shown in Table 5.1, just over 52% of Belmont's population is aged over 45 years, which is higher than for Lake Macquarie (47%). Conversely, Belmont has a lower proportion of persons aged under 25 (27%) when compared with Lake Macquarie LGA as a whole (30%).

5.2.4 Household Type

Household sizes in Belmont are predominately smaller than for other areas in Lake Macquarie. The median household size in Belmont is 2.4 persons, which is less than Lake Macquarie LGA (2.7 persons).

The lower household sizes experienced in Belmont is also reflected by the household type. Lone person households are the predominant household type in Belmont (32%) followed by couples without children (27%). Couple families with children make up 25% of the households. The suburb contains few single-parent households (12%) in comparison to other household types. The largest difference between Belmont and Lake Macquarie LGA is the proportion of single person households. There are some 8% more lone person households in Belmont compared to the Lake Macquarie LGA as a whole. Conversely, there is a larger proportion of couples with children in Lake Macquarie LGA (32%) compared with Belmont (25%).

5.2.5 Tenure

For the most part, dwellings in Belmont are owned outright or owned with a mortgage (66%), although this is much lower than for Lake Macquarie as a whole (74%). Private rented dwellings are proportionally higher in Belmont (23%) compared to the rest of Lake Macquarie (17%). The proportion of social housing in Belmont is slightly higher (7%) than for the LGA as a whole (5%).

5.2.6 Migration

At the 2016 Census, 79% of persons (aged over 1 year of age) in Belmont had lived at the same address for the previous 12 months. For those persons aged over 5 in Belmont, at the 2016 Census some 58% had lived at the same address for 5 years. That is, some 42% of persons (aged over 5 years) in Belmont had moved to Belmont in the 5 years before the Census. These are relatively similar figures for Lake Macquarie LGA.

5.2.7 Dwellings

Approximately 69% of dwellings in Belmont are separate houses, while 15% are semi-detached and 13% are flats and units. The proportion of flats and units in Belmont (13%) is significantly higher than for Lake Macquarie as a whole (4%). This reflects Belmont's status as a town centre which has seen significant flat and unit development in recent years.

5.2.8 Motor Vehicles

In Belmont some 37% of households have one motor vehicle while 33% of households have two motor vehicles. The comparative figures for Lake Macquarie LGA are 33% and 38%. Given the larger proportion of units in Belmont compared to Lake Macquarie it is not surprising that 13% of households in Belmont have three or more vehicles compared to 18% across the LGA. The proportion of households in Belmont with no motor vehicle (12%) is also significantly higher than the proportion of households across Lake Macquarie LGA (6%).

5.2.9 Employment

At the 2016 Census approximately 8% of the workforce was unemployed which was slightly higher the the unemployment rate across the LGA (6.9%). The rates of full time versus part time employment amongst those employed was similar for Belmont and the LGA as a whole.

5.2.10 Travel to Work

Some 75% of workers in Belmont travel to work by car which is slightly less than that for Lake Macquarie as a whole (77%). Other motorized methods of travel to work are similar for Belmont and the LGA. Belmont does have a higher proportion of workers who walk or cycle to work (3%) than for other areas in Lake Macquarie (2%).

5.3 CRIME

A review was undertaken of data maintained by the NSW Bureau of Crime Statistics and Research (BOCSAR). Table 5.2 presents an overview of trends for Lake Macquarie LGA.

Table 5.2: Recorded Crime Trends, Lake Macquarie LGA

		Jan-Dec 2011		Jan-Dec 2016		
Offence group	**Offence type**	**Number of incidents**	**Rate per 100,000 popn**	**Number of incidents**	**Rate per 100,000 popn**	**NSW 2016 (Rate per 100,000 popn)**
	Murder^	2	1.0	1	0.5	0.8
	Assault - domestic violence related	630	320.1	738	361.5	381.3
	Assault - non-domestic violence related	836	424.8	642	314.5	414.0
	Sexual assault	165	83.8	153	74.9	66.5
	Indecent assault, act of indecency and other sexual offences	191	97.0	203	99.4	89.8
	Robbery without a weapon	51	25.9	32	15.7	17.9
	Robbery with a firearm	7	3.6	2	1.0	2.1
	Robbery with a weapon not a firearm	24	12.2	18	8.8	10.8
	Break and enter dwelling	979	497.4	734	359.5	389.3
	Break and enter non-dwelling	727	369.4	331	162.1	153.4
	Motor vehicle theft	801	407.0	524	256.7	172.0
	Steal from motor vehicle	1617	821.6	1,204	589.7	531.0
	Steal from retail store	687	349.1	682	334.0	307.5
	Steal from dwelling	587	298.3	585	286.5	279.7
	Steal from person	110	55.9	83	40.7	65.1
	Fraud	860	437.0	1,326	649.5	655.9
	Malicious damage to property	2960	1504.0	1,846	904.2	823.1

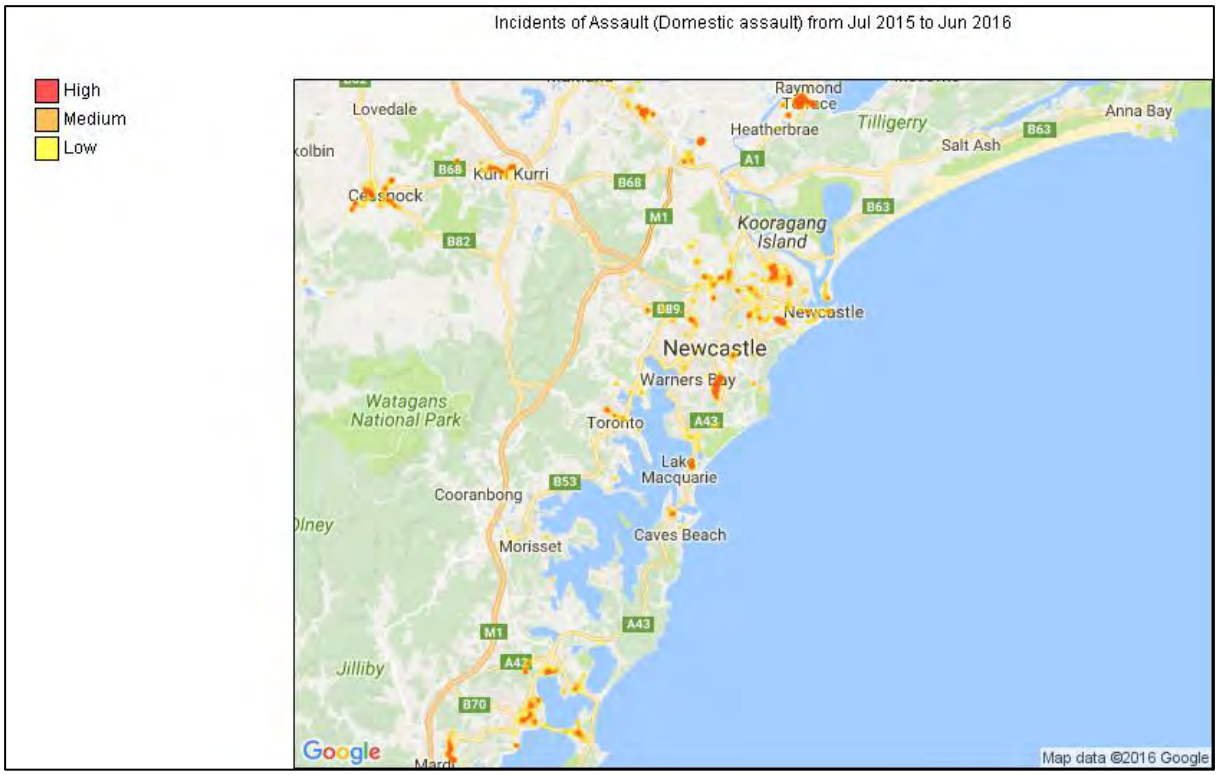
		Jan-Dec 2011		Jan-Dec 2016		
Offence group	**Offence type**	**Number of incidents**	**Rate per 100,000 popn**	**Number of incidents**	**Rate per 100,000 popn**	**NSW 2016 (Rate per 100,000 popn)**
Other Homicide	Attempted murder	4	2.0	2	1.0	0.4
	Murder accessory, conspiracy	0	0.0	0	0.0	0.0
	Manslaughter ^	0	0.0	0	0.0	0.1
Other Assault	Assault Police	36	18.3	23	11.3	30.3
Abduction and kidnapping		6	3.0	1	0.5	3.0
Blackmail and extortion		0	0.0	2	1.0	1.5
Harassment, threatening behaviour and private nuisance		700	355.7	725	355.1	399.5
Other offences against the person		30	15.2	35	17.1	16.5
Other Theft	Receiving or handling stolen goods	111	56.4	137	67.1	109.3
	Stock theft	6	3.0	4	2.0	8.9
	Other theft	952	483.7	665	325.7	386.2
Arson		333	169.2	237	116.1	73.0
Drug offences	Possession and/or use of cocaine	1	0.5	1	0.5	25.5
	Possession and/or use of narcotics	4	2.0	9	4.4	16.4
	Possession and/or use of cannabis	183	93.0	464	227.3	342.7
	Possession and/or use of amphetamines	46	23.4	205	100.4	132.5
	Possession and/or use of ecstasy	0	0.0	7	3.4	50.3
	Possession and/or use of other drugs	25	12.7	43	21.1	66.2
	Dealing, trafficking in cocaine	0	0.0	3	1.5	5.6
	Dealing, trafficking in narcotics	0	0.0	0	0.0	5.5
	Dealing, trafficking in cannabis	0	0.0	13	6.4	11.3
	Dealing, trafficking in amphetamines	12	6.1	20	9.8	29.3
	Dealing, trafficking in ecstasy	3	1.5	2	1.0	8.3
	Dealing, trafficking in other drugs	0	0.0	0	0.0	3.6
	Cultivating cannabis	26	13.2	41	20.1	15.4
	Manufacture drug	0	0.0	0	0.0	0.7
	Importing drugs	0	0.0	1	0.5	0.7
	Other drug offences	31	15.8	69	33.8	70.1
Prohibited		110	55.9	247	121.0	165.2

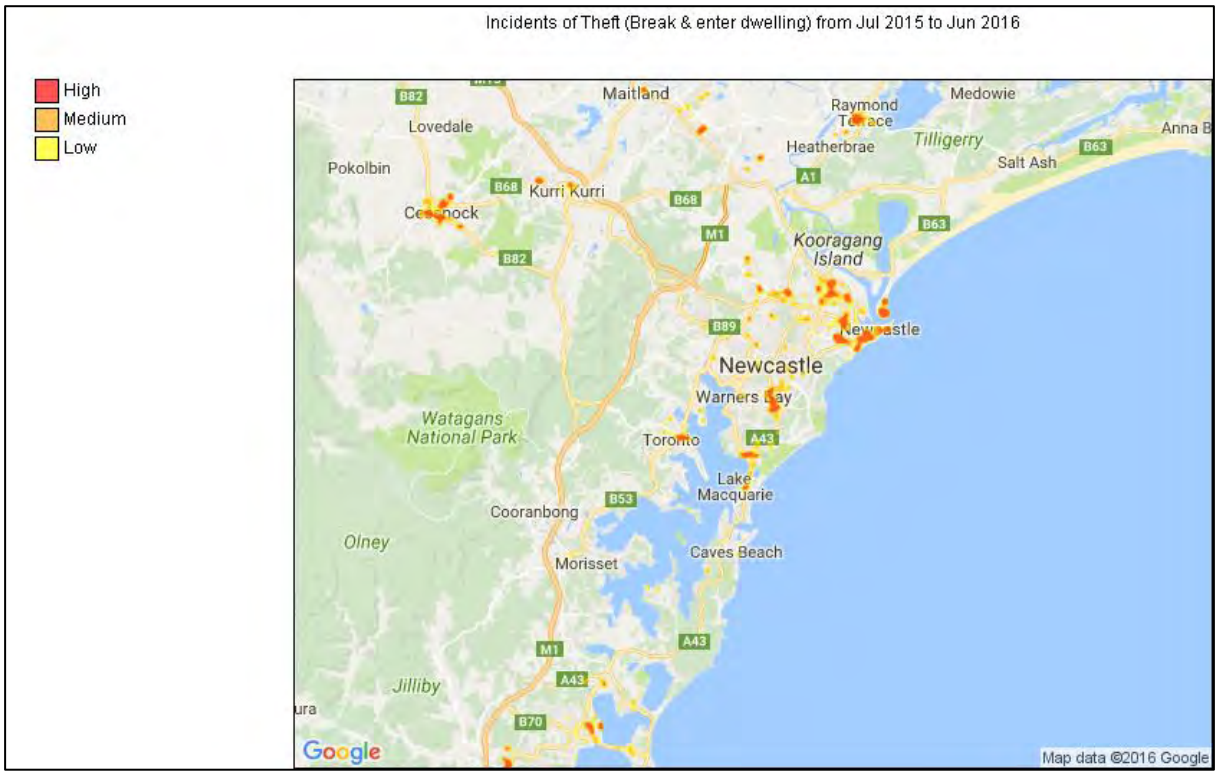
		Jan-Dec 2011		Jan-Dec 2016		
Offence group	**Offence type**	**Number of incidents**	**Rate per 100,000 popn**	**Number of incidents**	**Rate per 100,000 popn**	**NSW 2016 (Rate per 100,000 popn)**
and regulated weapons offences						
Disorderly conduct	Trespass	135	68.6	169	82.8	134.0
	Offensive conduct	79	40.1	58	28.4	72.0
	Offensive language	80	40.6	44	21.6	49.0
	Criminal intent	16	8.1	25	12.2	30.0
Betting and gaming offences		1	0.5	0	0.0	2.4
Liquor offences		69	35.1	42	20.6	143.5
Pornography offences		10	5.1	17	8.3	7.4
Prostitution offences		0	0.0	0	0.0	0.7
Against justice procedures	Escape custody	3	1.5	3	1.5	2.6
	Breach Apprehended Violence Order	360	182.9	466	228.2	203.2
	Breach bail conditions	640	325.2	941	460.9	553.0
	Fail to appear	10	5.1	24	11.8	9.7
	Resist or hinder officer	111	56.4	86	42.1	84.1
	Other offences against justice procedures	3	1.5	4	2.0	7.5
Transport regulatory offences		851	432.4	3,289	1,610.9	1,576.2
Other offences		270	137.2	326	159.7	199.1

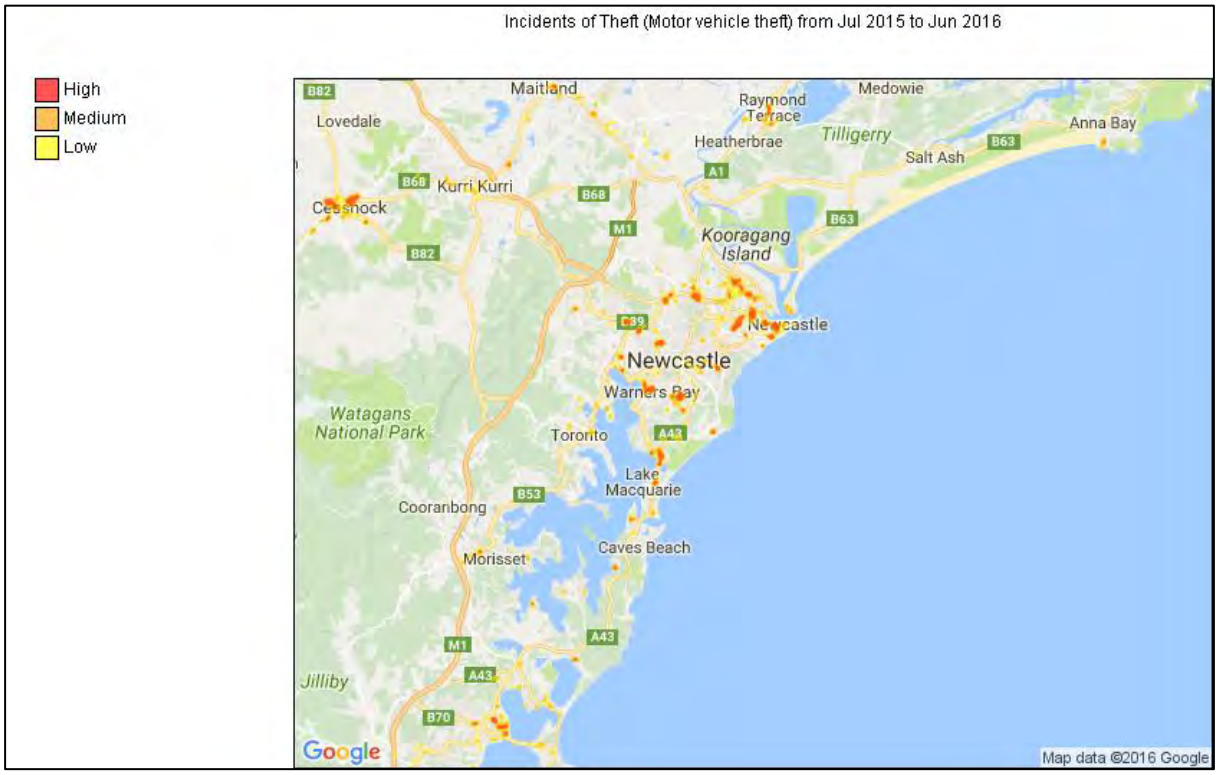
There is no specific data for suburbs, however, across the LGA the highest rate of crime activity is Transport regulatory offences, malicious damage to property and steal from motor vehicle. This is similar for NSW as a whole. Although it is often difficult to compare across time periods there has been a large increase between 2011 and 2016 in fraud and transport regulatory offences.

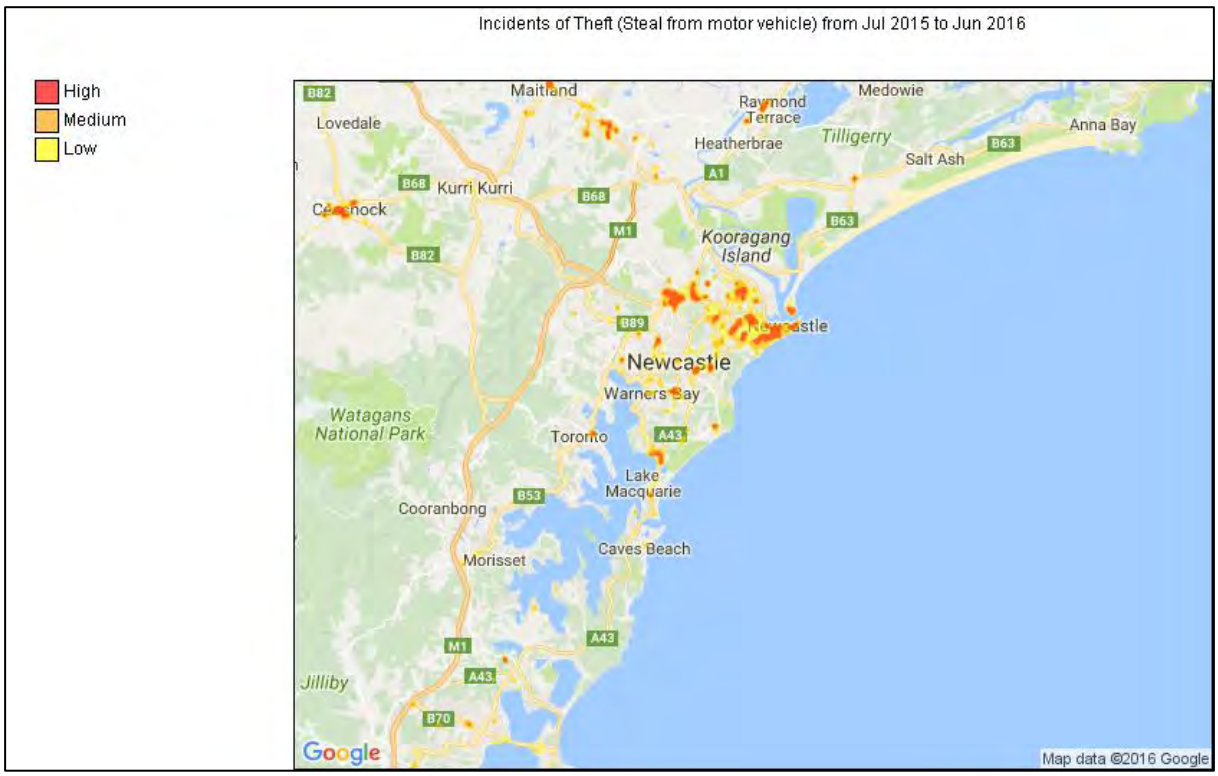
An examination of BOSCAR 'hotspot' mapping was also undertaken. This revealed a few hotspots in Lake Macquarie for domestic assaults (Figure 5.2), including Belmont. A hotspot for break and enter (dwellings and non-dwellings) and motor vehicle theft was also identified in parts of Lake Macquarie.

Figure 5.2: Example of Crime Hotspot Mapping, Lake Macquarie






Incidents of Theft (Motor vehicle theft) from Jul 2015 to Jun 2016
High
Medium
Low
Maitland
Medowie
Raymond Terrace
Lovedale
Heatherbrae
Tilligerry
Anna Bay
Salt Ash
Kurri Kurri
Cessnock
Kooragang Island
Newcastle
Warners Bay
Watagans National Park
Toronto
Lake Macquarie
Cooranbong
Caves Beach
Morisset
Jilliby
Google
Map data ©2016 Google


Incidents of Theft (Steal from motor vehicle) from Jul 2015 to Jun 2016
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Newcastle
Warners Bay
Watagans National Park
Toronto
Lake Macquarie
Cooranbong
Caves Beach
Morisset
Jilliby
Google
Map data ©2016 Google

5.4 HEALTH

A review was undertaken of health data. Data available was only recently available for the Area Health Service (AHS) level for NSW Health. The AHS data covers the Hunter region and northern parts of NSW. As such, the data was considered irrelevant for the proposed development. The data is presented in Figure 5.3 and 5.4. The Australian Institute of Health and Welfare publishes information for states and territories. The My Hospital web site provides local hospital statistics but these are often related to the type of services provided.

John Hunter Hospital is a regional based hospital which services the Hunter through to the Queensland border. This is the main hospital for residents in Belmont. Some services are provided locally. Ambulance services are available in the area. GP services are addressed elsewhere in this assessment, however, Lake Macquarie does have a reasonable rate of GPs and other practitioners compared to other LGAs (Table 5.3).

Table 5.3: Health Workforce (rate per 100,000 people), LGA, 2011
(Source: PHIDU, 2015)

LGA	General Medical Practitioners	Specialist Practitioners	Total Medical Practitioners	Dentists
Cessnock	71.1	-	78.2	19.3
Lake Macquarie	108.1	51.9	203.4	39.9
Maitland	92.0	97.6	280.3	46.3
Newcastle	128.6	345.5	866.1	62.0
Port Stephens	95.3	-	108.5	39.9
Singleton	106.8	25.6	137.6	21.2

Figure 5.3: Hospitalisations, Hunter New England Area Health Service 2013-2014
(Source: Health Statistics NSW)

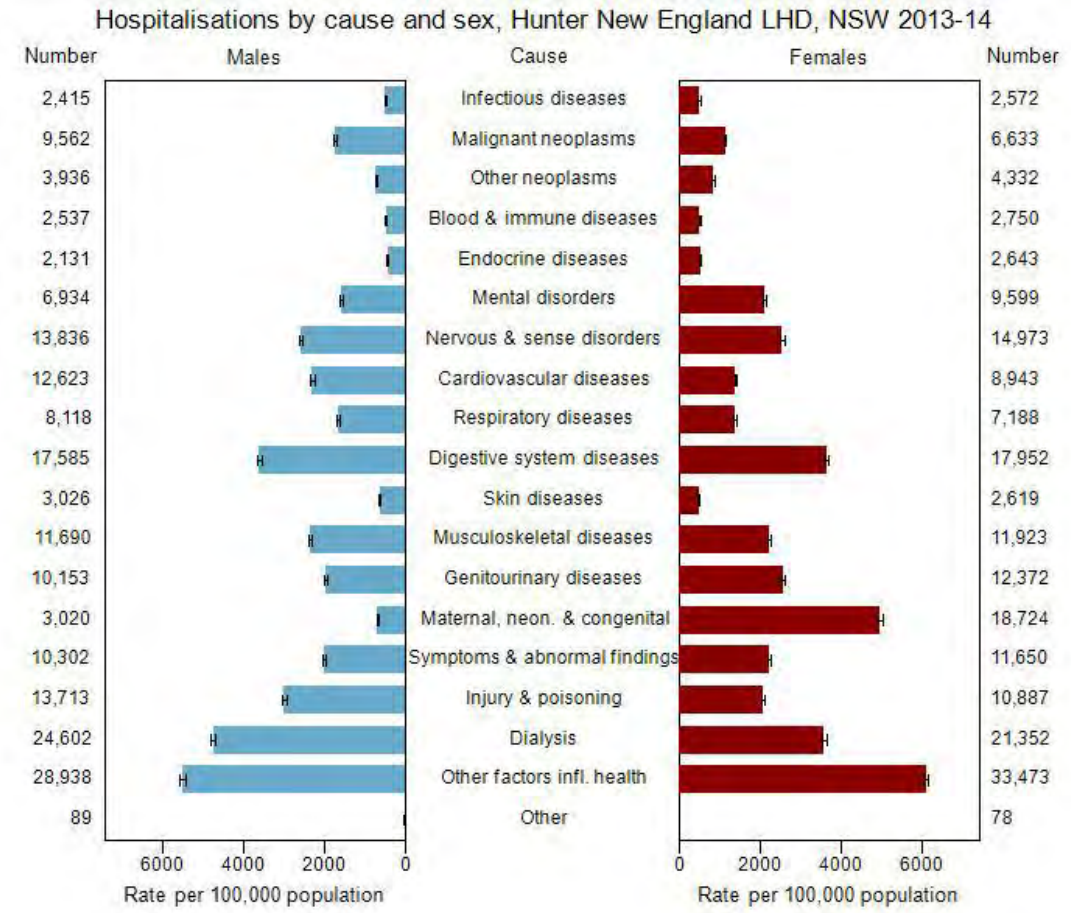
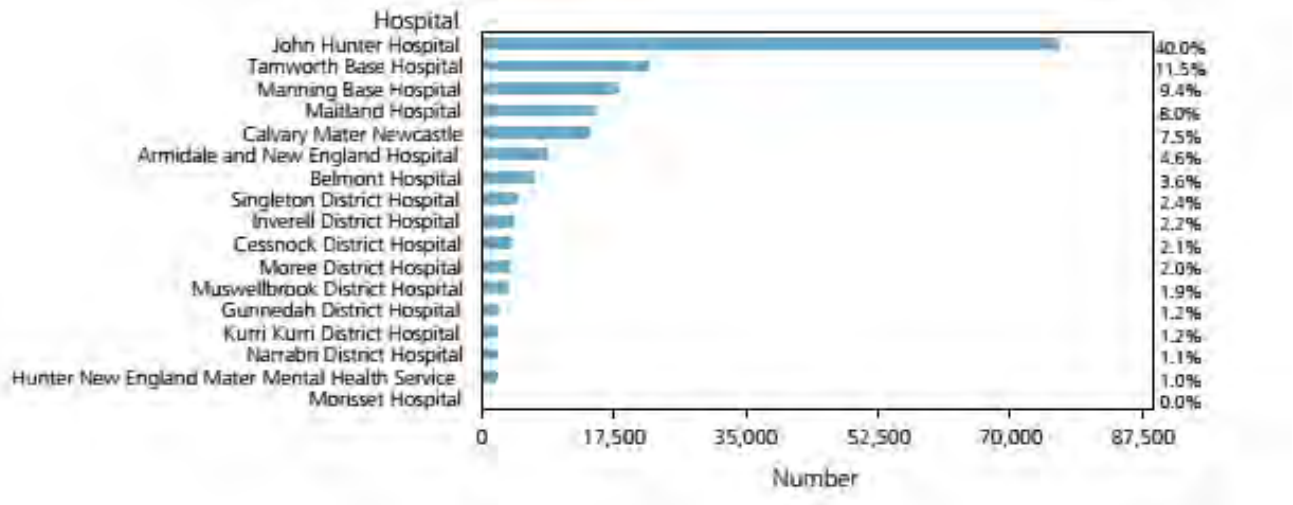


Figure 5.4: Hospitalisations, Hunter Area Health Service 2010-11
(Source: Health Statistics NSW)



Recent data collated for smaller hospitals in the Hunter New England Health District identified a number of patients in Belmont Hospital compared to other hospitals, with the John Hunter hospital the main hospital for servicing Belmont (Figure 5.5).

Figure 5.5: Emergency Department Presentations 2013-2014
(Source: PHN[1])

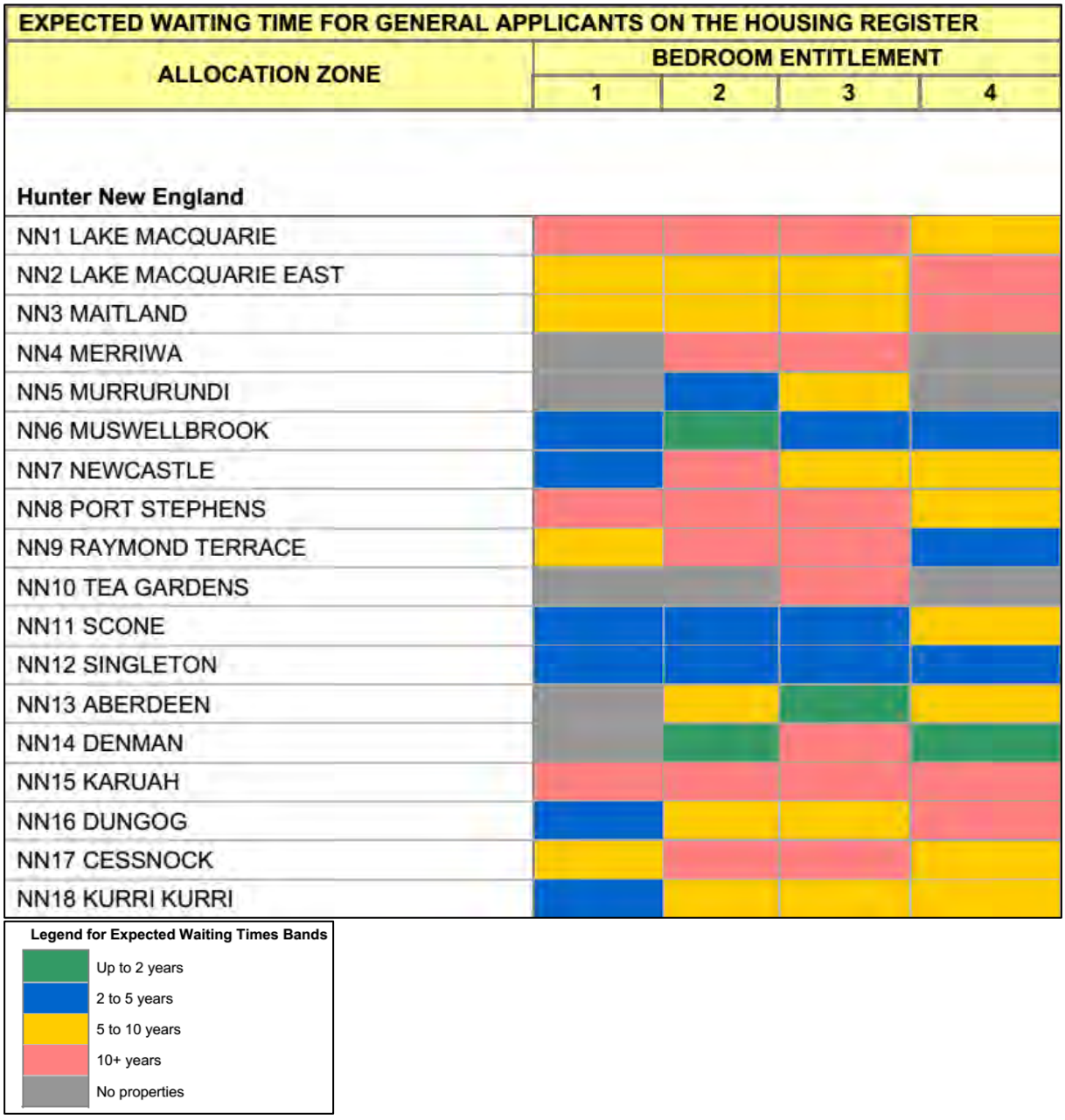
Emergency Department Presentations 2013 - 2014					
Large Hospitals	**Triage 1 Resus.**	**Triage 2 Emergency**	**Triage 3 Urgent**	**Triage 4 Semi-Urgent**	**Triage 5 Non-Urgent**
Armidale & New England Hospital	30	910	3734	8345	1776
Belmont Hospital	30	1472	5789	13695	4474
Calvary Mater Newcastle	211	4233	7911	15268	5470
Cessnock District Hospital	26	1080	4024	8187	2982
Gosford Hospital	822	7248	22422	26015	2156
Gunnedah District Hospital	6	280	1508	5636	1360
Inverell District Hospital	18	802	2427	4655	3238
John Hunter Hospital	509	7048	20400	36587	7694
Kurri Kurri District Hospital	0	426	1444	4120	1112
Maitland Hospital	87	4257	9876	24115	6425
Manning Base Hospital	134	3723	7936	10192	4441
Moree District Hospital	23	449	1850	4346	397
Muswellbrook District Hospital	10	493	1790	3728	1159
Narrabri District Hospital	5	280	1538	2116	1288
Singleton District Hospital	8	652	2618	6452	1392
Tamworth Base Hospital	252	3982	9466	17951	7874
Wyong Hospital	271	5096	15695	30168	6234
Small Hospitals or MPS's	**Triage 1 Resus.**	**Triage 2 Emergency**	**Triage 3 Urgent**	**Triage 4 Semi-Urgent**	**Triage 5 Non-Urgent**
Barraba MPS	0	61	292	928	474
Bingara MPS	0	69	175	348	380
Boggabri MPS	0	18	134	260	269
Bulahdelah Hospital	0	59	96	218	4442
Denman MPS	0	27	68	131	429
Dungog Hospital	0	56	261	1214	1094
Glen Innes Hospital	22	164	762	2103	2370
Gloucester Hospital	0	152	460	1172	765
Guyra MPS	0	83	426	891	637
Manilla Hospital	11	159	553	1243	713
Merriwa MPS	0	24	111	242	421
Quirindi Hospital	0	142	541	1484	1350
Scone Hospital	13	298	1090	1867	1672
Tenterfield Hospital	0	190	483	573	523
Tingha MPS	0	0	0	21	333
Tomaree Hospital	13	733	2391	6312	1561
Vegetable Creek MPS	0	12	38	101	314
Walcha MPS	0	62	197	1263	463
Warialda MPS	0	25	162	350	832
Wee Waa Hospital	0	113	385	877	486
Werris Creek Hospital	0	0	8	25	170
Wilson Memorial Community Hospital (Murrurundi)	0	23	112	247	502

[1] Primary Health Network, Hunter New England and Central Coast

5.5 SOCIAL HOUSING

A review of information available from Housing NSW was undertaken as part of this Social Impact Assessment. Data specific to Belmont as a suburb was not available; therefore, the information assessed relates to the Lake Macquarie Allocation zones (Figure 5.6). In Lake Macquarie there is at least a 5 year waiting list in most categories.

Figure 5.6: Public Housing Waiting Lists, NSW



5.6 SUMMARY

Overall, when compared to the rest of the Lake Macquarie LGA the following socio-demographics have been noted regarding Belmont:

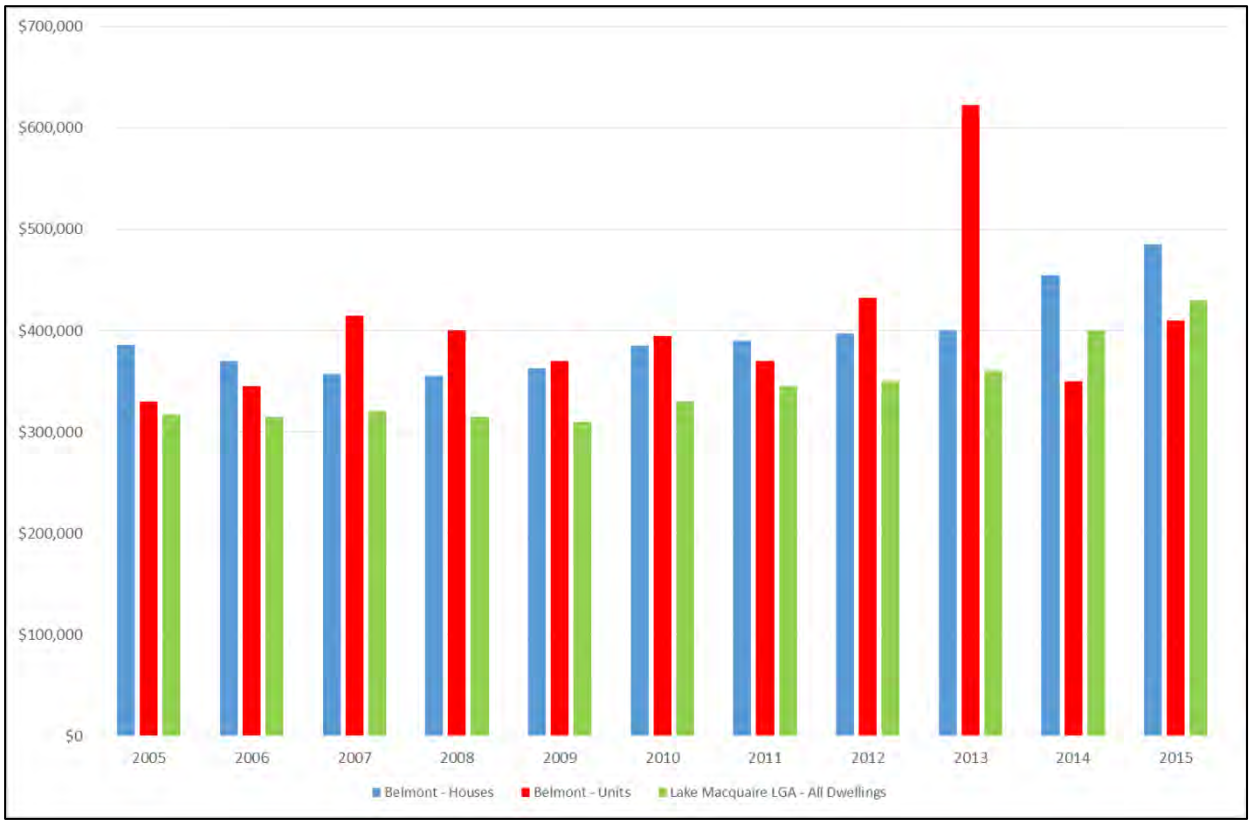
- Median age is higher than the rest of Lake Macquarie LGA, with a higher proportion of persons aged over 65 years.
- Belmont is a lower income area, compared with Lake Macquarie as a whole.
- There is a higher proportion of lone person households.
- There is a lower proportion of outright home owners in Belmont, but a higher proportion of renters;
- Belmont has an under-representation of single detached dwellings;
- Belmont has a lower household size, which is also reflected in the lower number of vehicles per household;
- At the 2016 Census, Belmont had a higher unemployment rate than other areas in Lake Macquarie.

6. HOUSING

6.1 SALES PRICES

Between 2005 and 2015 the median sales price of a dwelling in Belmont was consistently higher than for Lake Macquarie LGA as a whole (Figure 6.1), although units have dipped below the LGA median in recent years. Between 2005 and 2015 the median sales price of a house in Belmont increased from $386,000 to $485,000 a 26% increase. The median sales price of a unit in Belmont increased in the same period from $330,000 to $410,000, a 24% increase. For all dwellings in Lake Macquarie LGA, between 2005 and 2015 the median sales price increased 36% from $317,000 to $430,000. In general, sales prices in Belmont are higher than the median for the LGA.

Figure 6.1: Median Sales Prices, 2005-2015
(Source: PriceFinder)

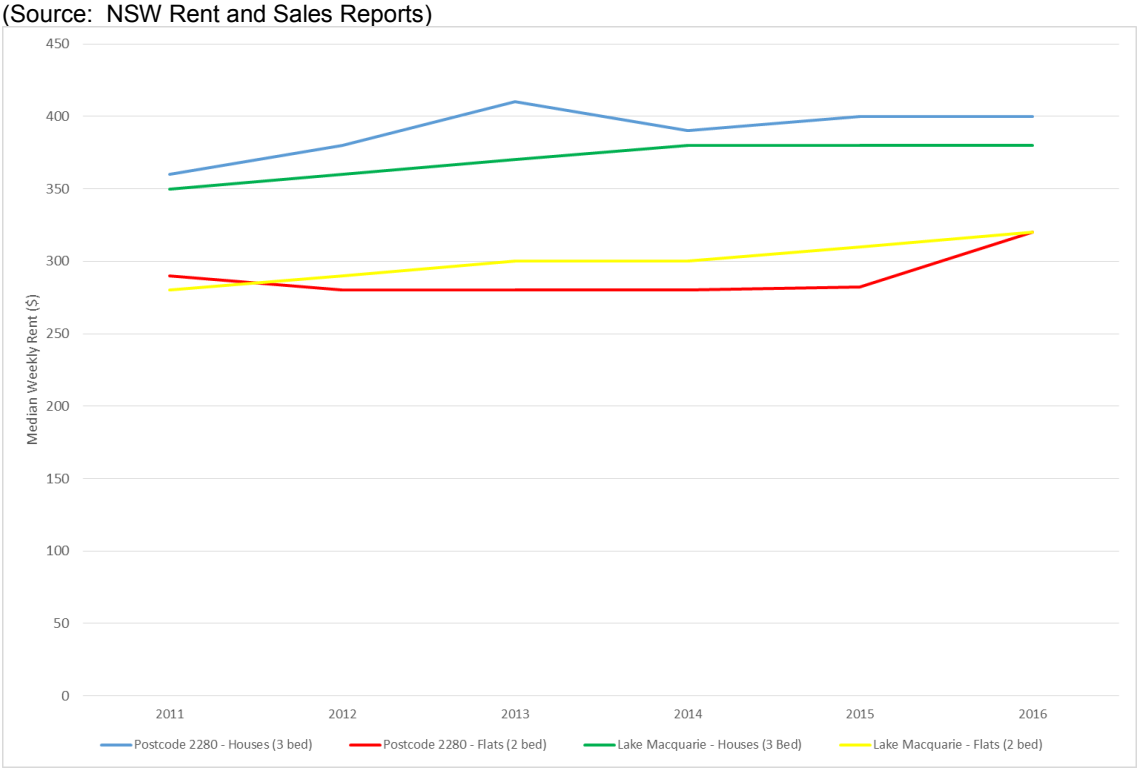


6.2 RENT

Figure 6.2 below identifies the median weekly rent for a house and flat/unit in postcode 2280 (which includes Belmont) and the Lake Macquarie LGA[2]. In general, over the last five years the median weekly rent in postcode 2280 has been slightly higher than the median weekly rent for the LGA as a whole. At June 2016 the median weekly rent for a 3 bedroom house in postcode 2280 was $400 compared to $380 for the LGA.

In regards to the median weekly rent for flats/units, the rent for a flat/unit across the LGA has generally been higher than for postcode 2280, however, in recent times the median weekly rent has been similar. The median weekly rent for a 2 bedroom flat/unit in both postcode 2280 and the Lake Macquarie LGA is $320.

Figure 6.2: Median Rent, 2011-2016
(Source: NSW Rent and Sales Reports)



[2] Data presented here is for a 2 bedroom flat and a 3 bedroom house which tend to be the predominant housing type in those two categories.

7. SOCIAL INFRASTRUCTURE

Belmont is an established suburb within the Lake Macquarie LGA. This section identifies the existing social infrastructure within Belmont and in proximity to the subject site.

7.1 RETAIL & BUSINESS DISTRICT

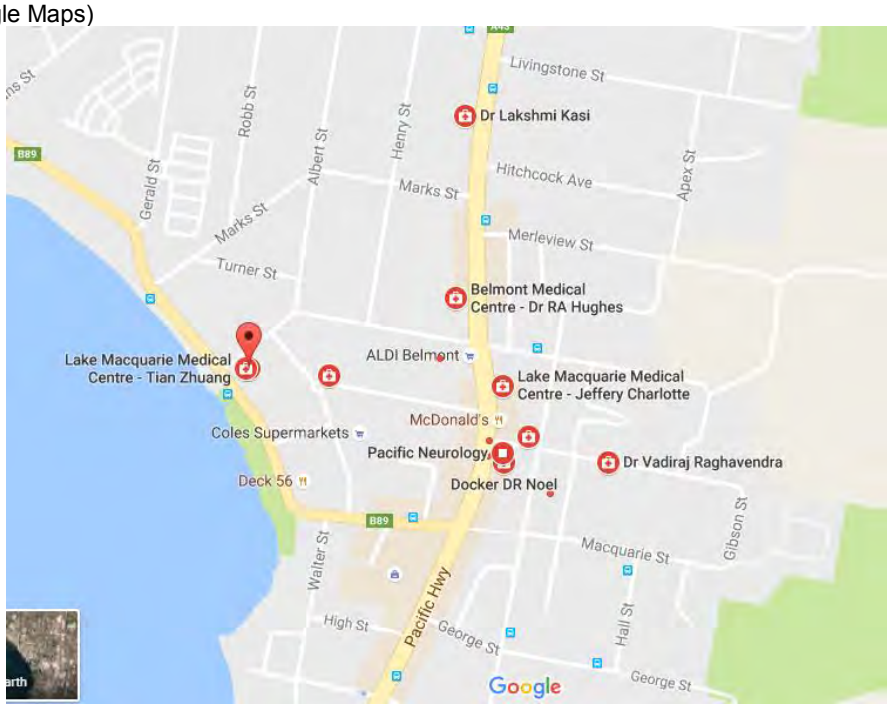
The subject site is just south of the Pacific Highway which is the main arterial road linking Belmont with other major centres. The Highway also carries public transport linkages with other centres. The Belmont CBD is a major sub-regional centre in Lake Macquarie and thus has many civic functions as well as three shopping centres with key anchor tenants (Woolworths, Coles, Aldi). The Pacific Highway 'strip' shopping area also contains commercial (e.g. banks, legal firms, real estate agents etc) as well as retail premises.

Belmont as a major sub-regional centre is well linked by road and public transport with Charlestown (approximately eight kilometres to the north), the main regional centre of Lake Macquarie.

7.2 MEDICAL

Belmont is serviced by a number of medical facilities, which are generally located in the town centre, predominantly within the existing town centre on the Pacific Highway (Figure 7.1). There are several GP services within a few hundred metres of the site. Specialist medical services are also available in Belmont, while others are available in Charlestown to the north. Belmont is also serviced by a hospital. Health data presented above notes that Lake Macquarie has relatively good rates of GP's for its population.

Figure 7.1: Map of GP Services
(source: Google Maps)



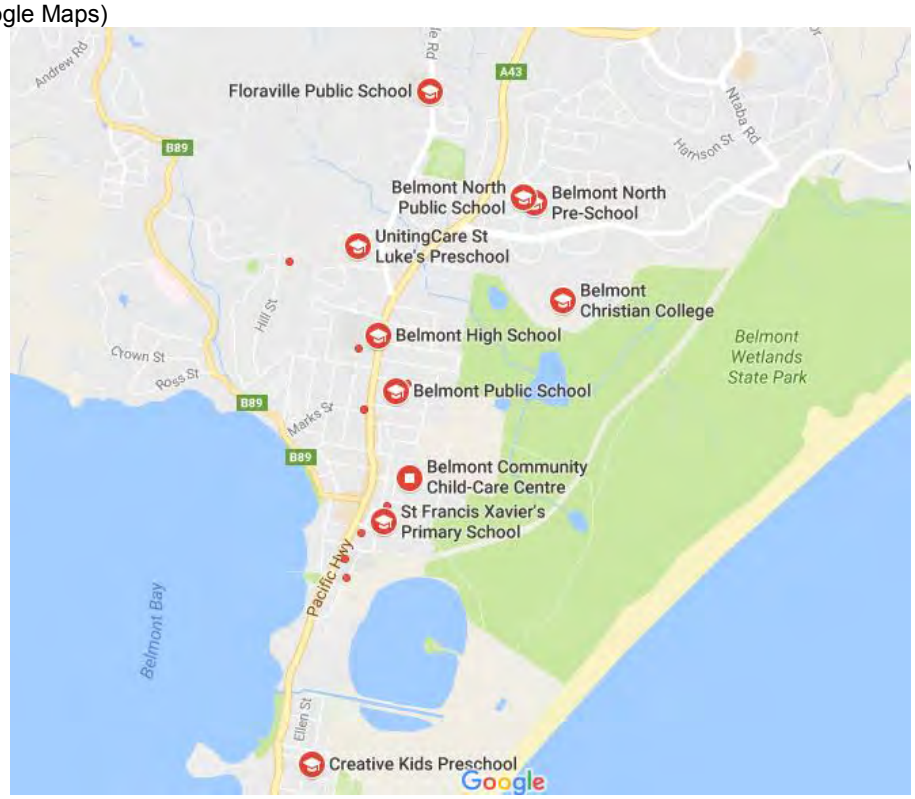
7.3 RECREATION/OPEN SPACE

The subject site is located a short walking distance of a number of open space and recreation areas. Adjacent to the site is Lake Macquarie with walkways linking the foreshore areas of Lake Macquarie. The main recreation facilities (e.g. sports fields, bowling greens) of Belmont are approximately 600 metres to the west of the site. Beyond these facilities is also Belmont Wetlands which contains cycleways linking the area to the north. Across from the subject site is open space and picnic areas along the Lake Macquarie foreshore and a playground id approximately 150 metres to the south of the site.

7.4 EDUCATION

There are a number of public and non-government schools in the Belmont area that can cater for both primary and high school students (Figure 7.2). There are also several pre-schools in the area.

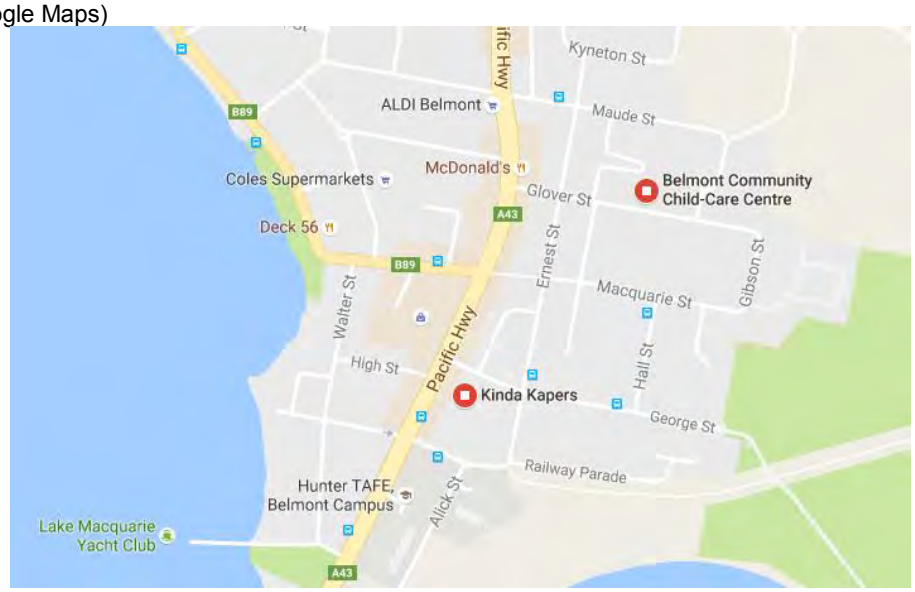
Figure 7.2: Map of Educational Facilities
(source: Google Maps)



7.5 CHILDCARE

There are two child care centres a short drive from the subject site (Figure 7.3).

Figure 7.3: Map of Child Care Facilities
(source: Google Maps)



7.6 PUBLIC TRANSPORT

There are numerous public bus facilities and options in Belmont (Figure 7.4). The Pacific Highway is just under 300 metres from the subject site and has public transport (bus) linkages with the main centres of Charlestown (to the north), Newcastle CBD and Swansea (to the south). Brooks Parade (the subject site) also has some bus services.

There are no public train facilities in the area.

7.7 SENIORS SERVICES AND FACILITES

It is likely that some of the owners of the proposed development will be 'downsizers' or 'empty nesters'. There are several services and facilities, in addition to the others mentioned elsewhere in this report, for seniors in the Belmont area including:

- Meals on wheels;
- Aged care services within Belmont Hospital;
- Senior citizens centre.

7.8 ADDITIONAL SERVICES AND FACILITIES

Belmont is a major sub-regional centre in Lake Macquarie LGA and as such also provides a number of other community, social and recreational services. There are existing hotels, sports facilities as well as a library, police station, and court house. Belmont also has a hospital with casualty support services.

Figure 7.4: Map of Public Bus Routes
(source: Google Maps)



7.9 SUMMARY

Overall, Belmont is a sub-regional centre of Lake Macquarie LGA and contains sufficient social and recreational infrastructure to cater for the residents of the proposed development. There are sufficient services in the area including health, shopping, public transport and other retail facilities (e.g. banks, post office etc).

8. IMPACT ASSESSMENT

8.1 POPULATION

It is estimated that approximately 140 residential units will be constructed on the subject site. Based on the 2016 Census there is approximately 1.6 persons per apartment in Belmont. As such, it is anticipated that approximately 224 persons will reside in the buildings upon completion.

8.2 DISABILITY PROVISIONS

It is understood a disability access report has been prepared for the proposed development. Recommendations in this report should be implemented during the construction works.

8.3 ENVIRONMENTAL MANAGEMENT

It is expected that an environmental management plan be prepared for the construction works and implemented. Management of specific environmental impacts is also addressed in the Statement of Environmental Effects.

8.4 TRAFFIC AND NOISE

An acoustic impact assessment and traffic impact assessment have been prepared for the proposed development. Recommendations in these reports should be implemented.

8.5 SUMMARY OF NET BENEFITS AND CONCERNS

8.5.1 Benefits

Housing Choice
Belmont like other major town centres in Lake Macquarie is continuing to provide apartment living and mixed use developments. While this has been a strategic planning outcome identified by Council, the increasing number of apartments in Belmont (such as this proposed development) will continue to provide housing choice in the LGA. As noted in the urban design report surrounding suburbs with predominantly separate, detached housing (e.g. Valentine, Eleebana) have a relatively high proportion of persons over the age of 55 years. The proposed development will not only provide housing choice but allow older residents to remain in the same area when they chose to downsize.

Proximity to Existing Services
The proposal is located within an existing sub-regional centre of the Lake Macquarie LGA. The site will be within walking distance of day-to-day retail needs of the residents as well as easy access to public transport services, medical/health services and open space areas.

Strategic Outcomes
Lake Macquarie Council is one of the few Council's to have an ageing population strategy. This proposal will provide opportunities for seniors in the area to downsize into an area with access to existing services and public transport.

Housing Affordability
The proposed development is identified as having a price point below the median house price in Lake Macquarie. The median unit price in Belmont is approximately $400,000 which is significantly less than the median dwelling price in Lake Macquarie, which is approximately $510,000. While it is noted that some larger apartments facing the Lake may achieve a higher price point, recent sales in nearby apartment complexes away from the Lake indicate that these units (Edgar St end) are highly likely to be relatively affordable in Lake Macquarie.

8.5.2 Concerns

Community Engagement
One of the risks of such large mixed use developments is the lack of community space for interaction of residents. While open space/landscape areas are generally provided in the forms of development to encourage community interaction, it would be recommended that some form of multi-use space or community hub is provided.

Social Capital and Community
The proposed development, if approved, will be one of the largest apartment/mixed use developments approved in Lake Macquarie. The site is currently occupied by single detached housing and will be replaced by four tower blocks. It is noted though, that most of the existing residents rent/lease their property, and there are few home owners in these dwellings. It is also noted that part of the NSW Ageing Strategy is to allow people to live longer in their communities. The proposal provides opportunities for downsizers and empty nesters to continue to live in the Belmont area. The proposal is likely to attract individuals from nearby areas based on anecdotal evidence from other developments on this site of the Lake (57 Burton Road Mount Hutton; 571 Pacific Highway Belmont; 51 Parklea Ave Croudace Bay). Overall, it is considered that although some existing housing will be demolished the proposal will not have a significant impact in regards to forcing longer term residents in the area, out of the area, and in fact will provide opportunities for residents who wish to downsize to remain in place. It is likely that some of the units will be purchased by investors and current renters may still be able to reside in the area.

Demographic Changes
It is noted that there is likely to be a mix of residents utilising the proposed development upon completion. There will obviously be downsizers/empty nesters moving into the development. There is also likely to be younger people and first home buyers purchasing given some of the units will be relatively affordable for the area. It is also likely that there will be some tenants in the development given the sites location to a TAFE campus, hospital and its public transport linkages to regional centre of Charlestown.

Facilities and Services
Belmont is a major sub-regional centre and provides a range of services and facilities as a major centre on the eastern side of Lake Macquarie. The centre provides medical/health, child care, banking, retail and other civic functions. The proposed increase in population as a result of the development is unlikely to affect these services.

Environment
The proposal will be a major construction process and it is therefore recommended that a construction environmental management plan is prepared prior to works commencing to ensure any community complaints are addressed.

Design

The design of the apartments has been considered under State Environmental Planning Policy No. 65 (SEPP 65) and apartment sizes meet the NSW apartment design guideline. Other design issues will be considered by the Council and SEPP 65 advisory panel of Council.

8.6 SUMMARY

The proposed development provides a number of positive social impacts. The proposal is consistent with local and regional strategies in regards to increasing density within the Belmont town centre. There is sufficient and existing social and recreational infrastructure in the Belmont area to support the proposed development of approximately 137 units (221 persons). No additional social or recreational infrastructure is required. The proposal will provide construction jobs for the local economy.

During the construction process a construction environmental management plan should be prepared and the recommendations of the disability access report, noise report and traffic report prepared for the DA should also be implemented.

9. MITIGATION AND MANAGEMENT

Overall the proposed development will have a positive and social and economic benefit to the Belmont area. The proposal is consistent with the strategic direction of the Belmont town centre. To ensure ongoing management of any potential impacts Table 9.1 identifies management/mitigation measures, if required.

Table 9.1: Summary of Potential Impacts

Item	Potential Impact	Short/Long Term Impact	Management/ Mitigation
Changing Demography	Changing demographic	Potential short and long term	No mitigation required. Residents are likely to be a mix of demographics based on current known information.
Business and Economic	Economic impacts	Potential short and long term	No mitigation required. Economic impacts are positive. The works will create construction work and ongoing employment.
Social Infrastructure	Additional Social Infrastructure	Potential short and long term	No mitigation required. There are sufficient facilities in the area to handle the potential increase in population. Section 94 funding can also provide additional facilities
Community	Isolation	Potential short and long term	Community hub space to be provided
	Removal of existing residents	Potential short and long term	Existing residents on the subject site are renters. There are sufficient rental properties in Belmont or other town centres to cater for these residents. Sufficient notification by the landowners will be given to these existing residents prior to any construction works commencing.
Design	Urban Design and SEPP 65	Potential short and long term	The plans have been architecturally designed and have been presented at SEPP 65 panel meetings.
Access	Lack of Access	Potential short and long term	Pedestrian access through and around the site to be provided
Environment	Construction Management	Potential short and long term	Construction environmental management plan (CEMP) to be prepared by the civil works contractor prior to works commencing. Any relevant mitigation or management measures from the traffic, noise or other relevant studies to be considered as part of the CEMP.

FORUM CONSULTING engineers

30 September 2016
Ref: 40813.02

KML Joint Venture
C/o Coeve Design
PO Box 1107
NEWCASTLE NSW 2300

Attention: Mr Charles De Bono

Dear Sir,

Limited Flood Study Investigation

Re: Lots A and B DP 339105, Lot 8 DP 12898, Lot B DP 400644 and Lot 1 DP (Unregistered) No 38 – 40 Brooks Parade, Belmont

This report presents the results of our Flood Study Investigation undertaken at Lots A and B DP 339105, Lot 8 DP 12898, Lot B DP 400644 and Lot 1 DP (Unregistered) No 38 – 40 Brooks Parade, Belmont.

The purpose of this investigation was to assess the site and surrounding areas in order to determine parameters suitable for use in the estimation of flood levels on and around the subject site. This investigation was undertaken in accordance with Australian Rainfall and Runoff and Lake Macquarie City Council guidelines.

If you have any further enquiries please do not hesitate to contact the undersigned.

Yours faithfully,

Forum Consulting Engineers

Mark Smith

Mark Smith

Environmental Engineer
B.E. (Environmental)

PO Box 261, Wickham NSW 2293 | 67 McMichael Street, Maryville 2293
T: 02 4961 4980 | F: 02 4969 1282 | E: admin@forumengs.com.au
Forum Consulting Engineers is a division of Forum Engineering Solutions Pty Ltd ABN 48 157 853 677

Contents

1. Introduction 3
2. Site Survey 3
3. Site and Surrounding Area Description 3
4. Catchment Description 4
5. Computer Modelling 5
6. Development Recommendations 6

Attachments

1. Photographs 1 – 7
2. Topographic Survey
3. DRAINS Output Files

1. Introduction

At your request Forum Consulting Engineers (Forum) have carried out a Limited Flood Study Investigation at Lots A and B DP 339105, Lot 8 DP 12898, Lot B DP 400644 and Lot 1 DP (Unregistered) No 38 – 40 Brooks Parade, Belmont.

The purpose of this investigation was to determine:

- Upslope developed catchment areas;
- Calculate flowrates for various storm events;
- Determine existing flood levels on and within the area surrounding the site for various storm events and tailwater levels;
- Determine flood levels for the proposed development for various storm events and tailwater levels.
- Determine the influence the proposed development will have on current flood characteristics and surrounding properties.

The catchment runoff volumes and velocities along with the determination of flood levels on and around the site was undertaken using the DRAINS software program version 2014.04

2. Site Survey

A topographical survey of the site and surrounding area was undertaken by Bernie de Witt Consulting and details were provided in their drawing 018DET4/1 dated 2 April 2003.

As required, further topographic survey was undertaken by Forum Engineering.

3. Site and Surrounding Area Description

The subject site was located on the eastern side of Brooks Parade, Belmont. The site is bordered by Brooks Parade to the west, Edgar Street to the east, by a concrete lined open drain and commercial/residential buildings to the north and by residential dwellings to the south. The concrete lined open drain was also located in the northwestern portion of the site and adjacent to the northern site boundary.

At the time of the catchment analysis, the site supported a series of commercial and residential buildings, associated buildings and maintained and unmaintained gardens.

The concrete lined open drain conveyed stormwater flows from the upslope catchment to Lake Macquarie, approximately 30 – 40m to the west of the subject site. Approximately 100m

upslope of the site, the concrete lined open drain was located within an open easement approximately 15m in width before being confined to only the width of the concrete lined drain adjacent to the northwestern boundary of the subject site.

Three 600mm high x 1300mm wide concrete culverts are located beneath the Edgar Street road pavement. Localised surface slopes direct overland flow upslope of and within the Edgar Street road reserve towards the concrete lined open drain and along Edgar Street road pavement to the south of the site.

Adjacent to the existing site, flows were restricted by existing residential dwellings and other infrastructure within private properties and public lands on either side of the concrete lined open drain. To provide worst case flood levels, it was modelled with structures remaining to constrict flows.

Figure 1 below shows the location of the site and the concrete lined open drain upslope of and adjacent to the subject site.



Figure 1: Concrete lined open drain

4. Catchment Description

Estimation of upslope catchment areas was undertaken using NSW Government Land and Property Management Authority's "Swansea Topographic and Orthophoto Map 1:25,000" and

"Six Maps" as well as a visual assessment of the site, surrounding areas and catchment areas.

The catchment area upslope of the site contains primarily residential developments with a small portion containing Belmont High School and isolated commercial buildings. The upslope catchment was estimated to be approximately 28.9 hectares. Based on the primarily residential use, it was assumed that the catchment would be approximately 60% impervious.

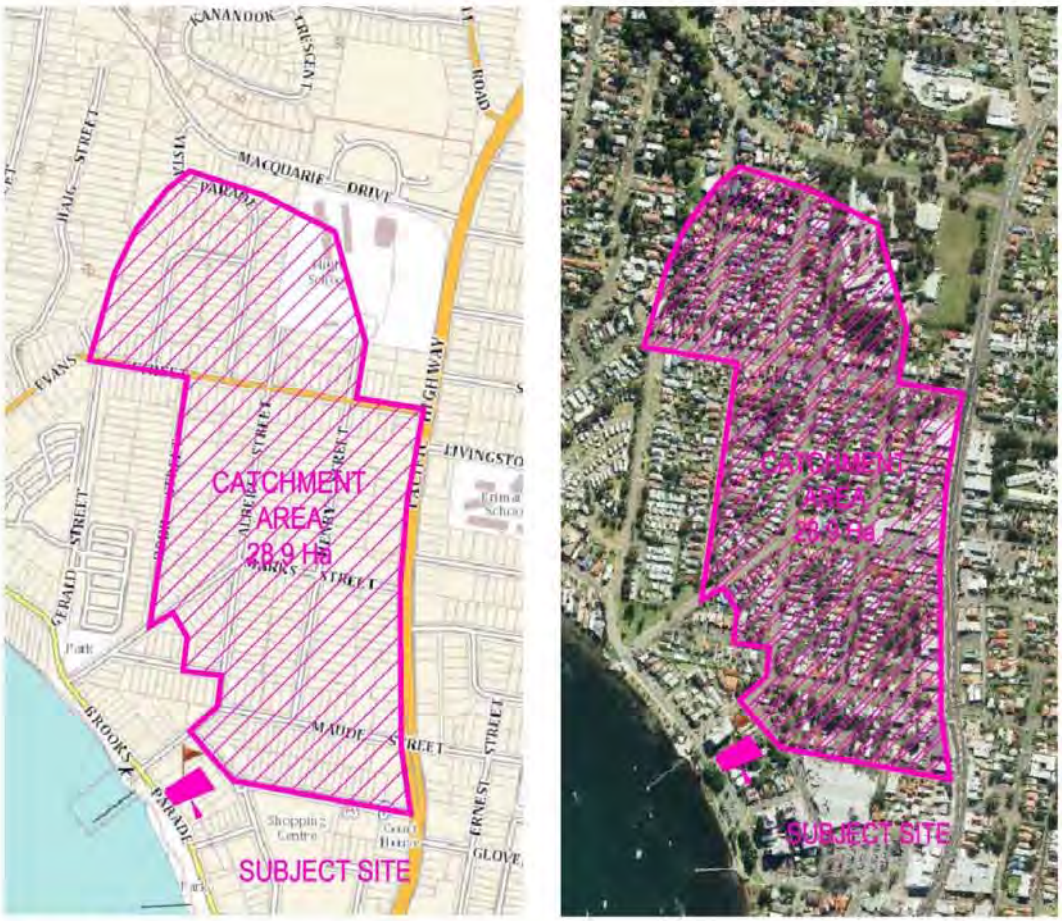


Figure 2: Catchment area

5. Computer Modelling

Table 1 below shows the calculated flow rates for the upslope catchment. Flow rates for the peak storm events have been shown for various storm intensities.

Table 2 shows adopted Lake Macquarie flood levels for various storm events. These levels were adopted as a fixed tailwater level in the DRAINS model.

Table 3 below shows the subject site's Lake Macquarie peak flood levels for various storm intensities.

Table 1: Storm events and catchment flowrates

ARI Storm Event (year)	Time of Concentration (min)	Flow Rate (m^3/s)
1 in 1	30	3.11
1 in 20	20	8.68
1 in 100	18	11.20

Table 2: Lake Macquarie Flood Levels

	1 in 1 year	1in 20 year	1 in 100 year
Tailwater – Baseline Lake Macquarie Flood Level (m AHD)[1]	0.1	1.23	1.5

[1] – flood levels adopted from WMAwater "Lake Macquarie Flood Study" June 2012

Table 3: Calculated flood levels for the subject site

Tailwater – Baseline Lake Macquarie Flood Level (m AHD)[1]		Site Flood Level (m AHD)[2]		
		1 in 1 year	1 in 20 year	1 in 100 year
0.1	Existing site	0.69	1.12	1.17
	Developed site	0.69	1.16	1.24
1.23	Existing site	1.26	1.28	1.28
	Developed site	1.28	1.29	1.32
1.50	Existing site	1.56	1.56	1.56
	Developed site	1.58	1.58	1.58

[1] – flood levels adopted from WMAwater "Lake Macquarie Flood Study" June 2012

[2] – Flood levels obtained using DRAINS software.

Flow rates and flood levels were calculated using DRAINS computer software. Output files can be seen attached. DRAINS computer files can be supplied upon request

6. Development Recommendations

Based on findings of the Limited Flood Study Investigation, it was determined that:

- Storm evens up to and including the 1 in 1 year ARI storm can be conveyed within the concrete lined drain with the remainder conveyed as overland flow;

- Stormwater flows outside of the concrete lined channel are choked by existing buildings to the north and south of the concrete lined channel. To provide conservative flood level heights, it was assumed that these buildings would remain during all storm events;
- Flood levels on the site are dependent on tailwater levels within Lake Macquarie;
- There was no notable increase in flood level when assessing the existing and proposed developments on the subject site. It could be determined that the proposed development would not have a noticeable effect on localised flood levels immediately adjoining the subject site;
- Future developments on the subject site should take into account forces imposed by water flow in the concrete lined drain and overland flow paths;
- Lake Macquarie flood levels provided by Lake Macquarie City Council be adopted for the site.

Yours faithfully,

Forum Consulting Engineers

Mark Smith
Environmental Engineer
B.E. (Environmental)

Graeme Holmes
CPeng Civil Engineer
Director

Attachments



Photograph 1 – Approximately 100m upslope of site looking upslope



Photograph 2 – Approximately 70m upslope of site looking upstream



Photograph 3 – downslope of Edgar Street crossing looking upstream



Photograph 4 – to the north of the site looking upstream



Photograph 5 - to the north of the site looking downstream



Photograph 6 – upstream of Brooks Street crossing looking downstream



Photograph 7 – downstream of Brooks Street crossing looking upstream

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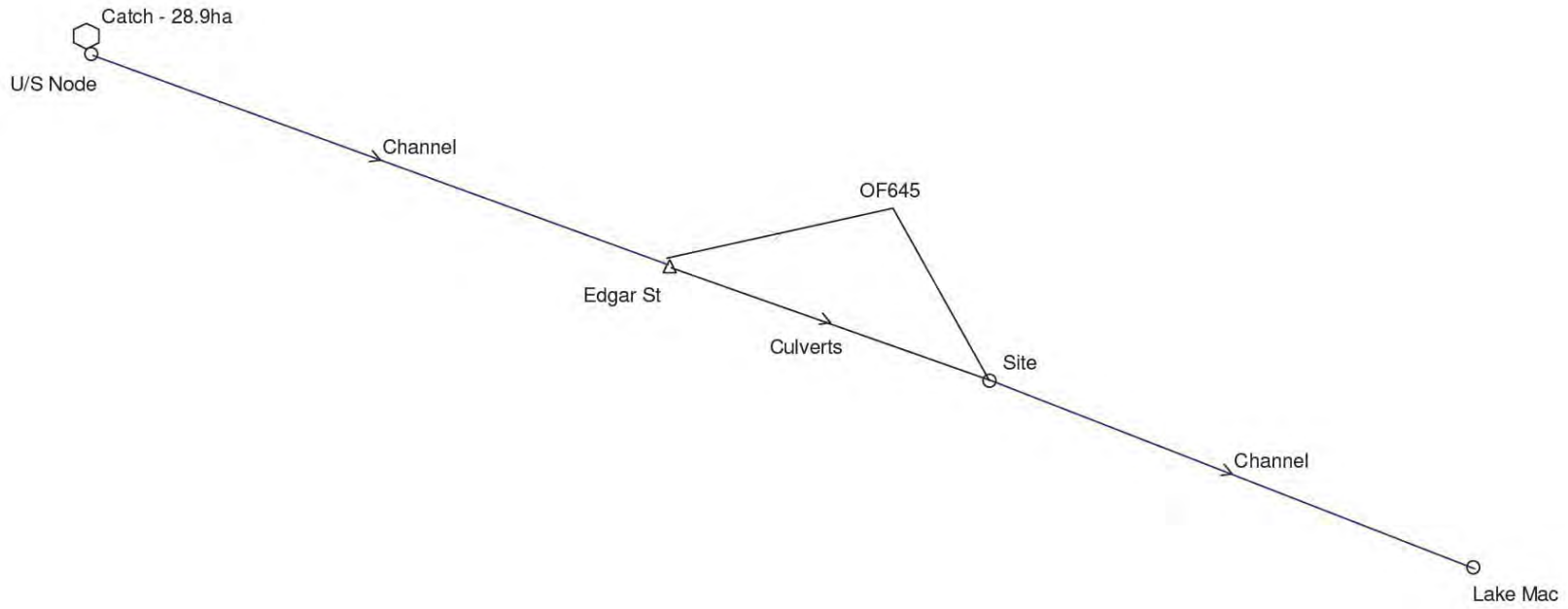


BERNIE de WITT CONSULTING
14 KULLAROO ROAD CHARLESTOWN NSW 2290
Ph. (02) 49425441 Fax. (02) 49425 441
Email Address: dewittb@hunterlink.net.au
ABN 69 645 840 097

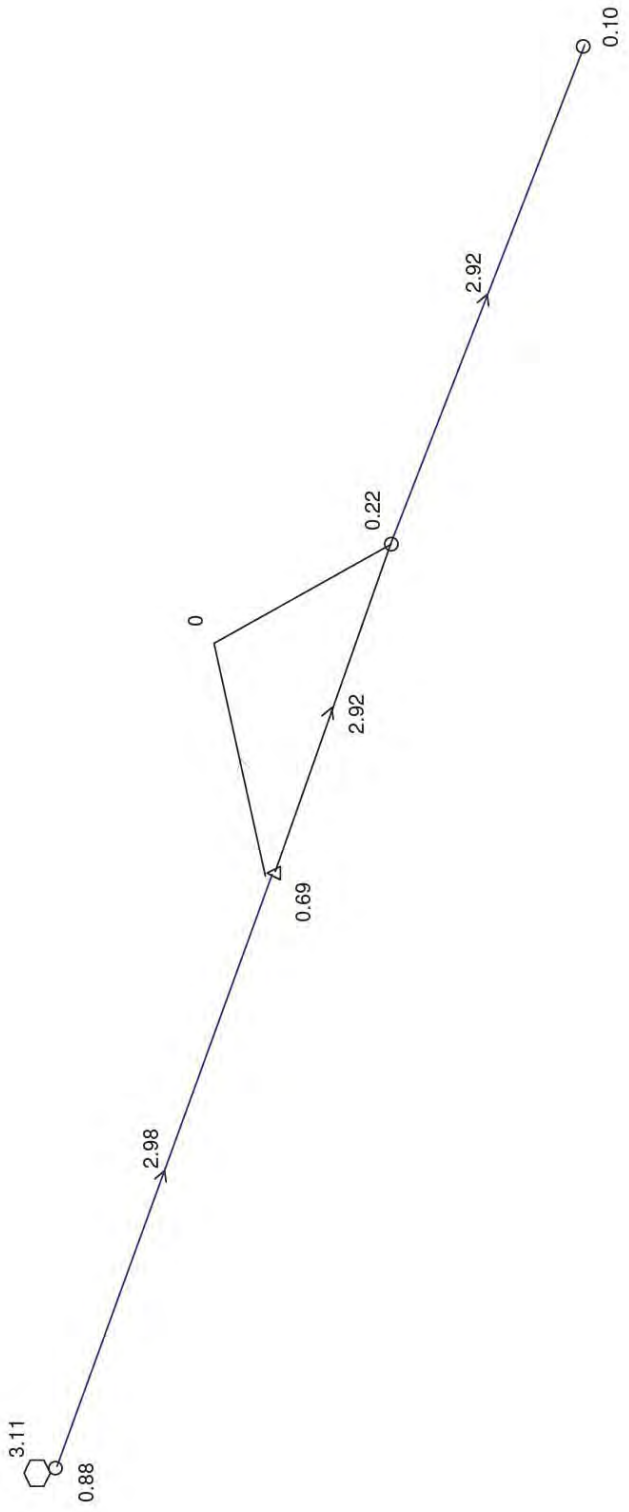
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AND LOT 8 D.P.12898 AND LOT B D.P.400644
AND LOT 1 D.P. (UNREGISTERED)

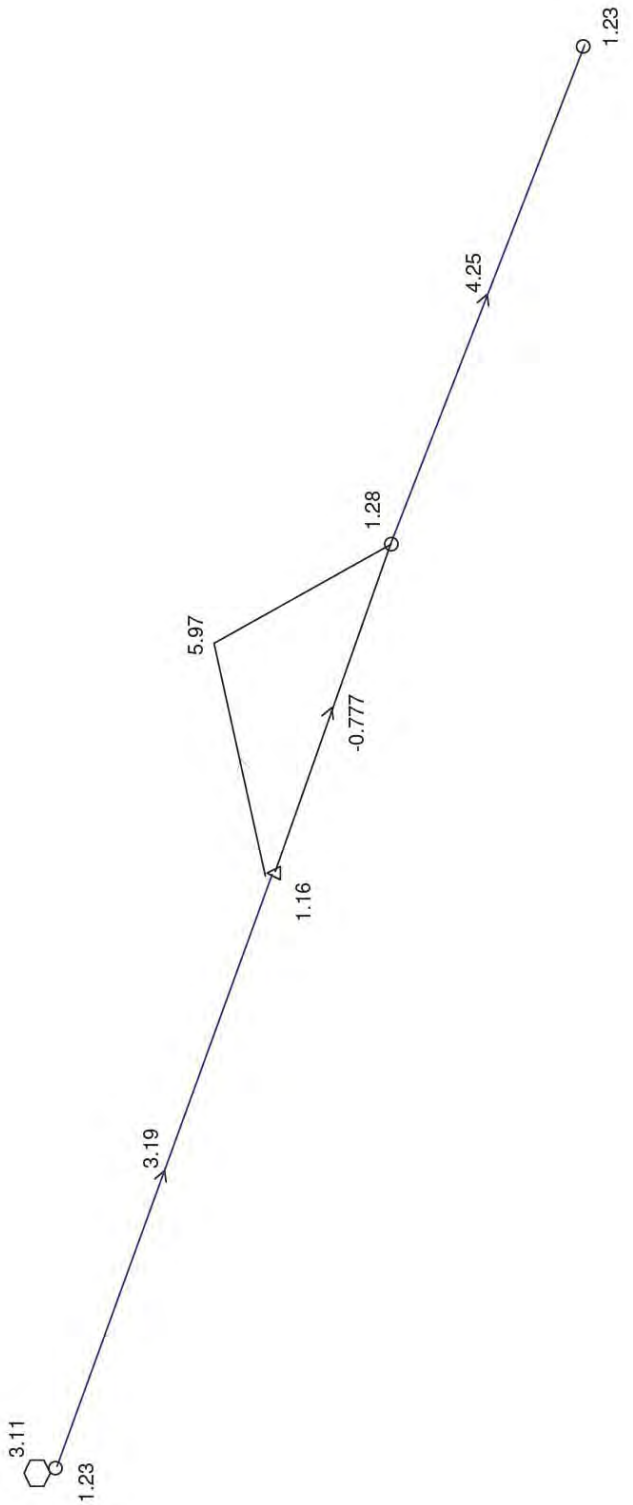
Ed.	Date	Amendment
H		
G		
F		
E		
D		
C		
B		
A		

JOB ADDRESS:	BROOKS PARADE BELMONT	PLAN No 1	JOB REF: 018
CLIENT:	ED KOPANDY		
SCALE:	1:400 A1	DRAWN KU DESIGNED CHECKED JL APPROVED	SHEET No 1
DATE:	2-4-03		
CIVILCAD REF:	018DET4	DRAWING REF: JOBS\018\018DET 2-4-03	

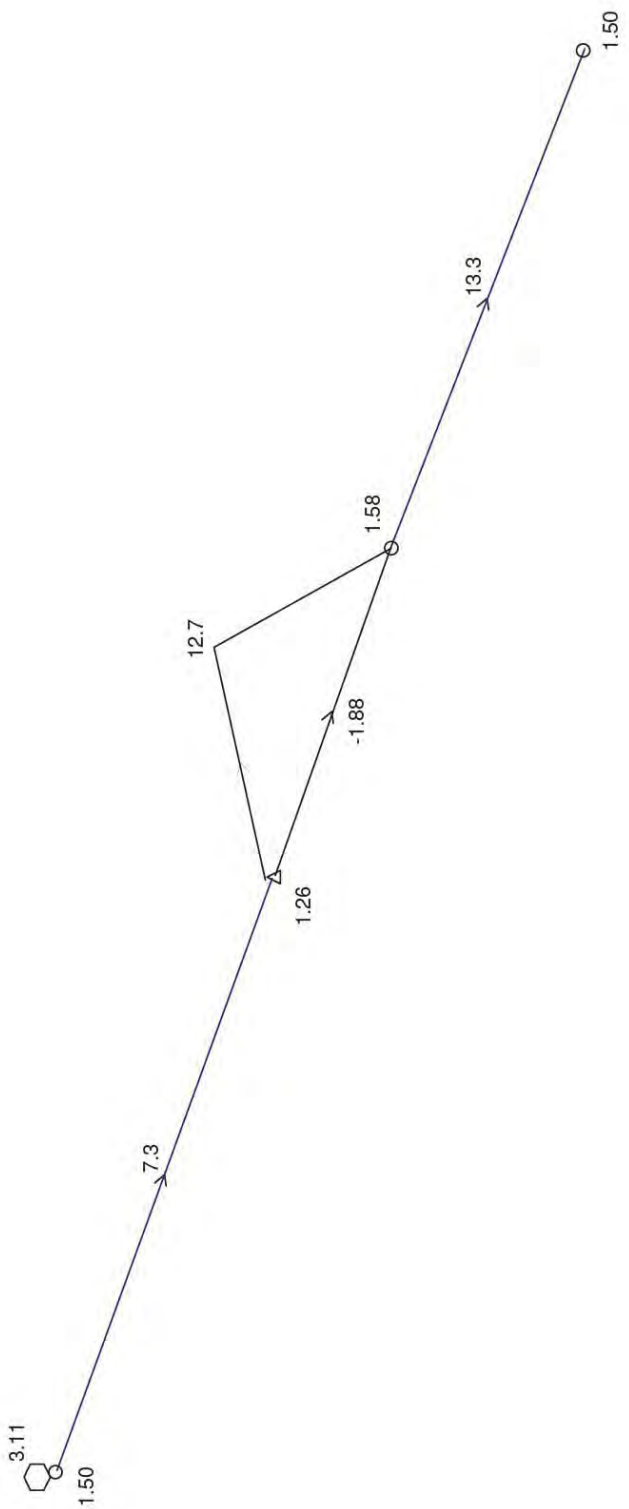

Catch - 28.9ha
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Culverts
Site
Channel
Lake Mac

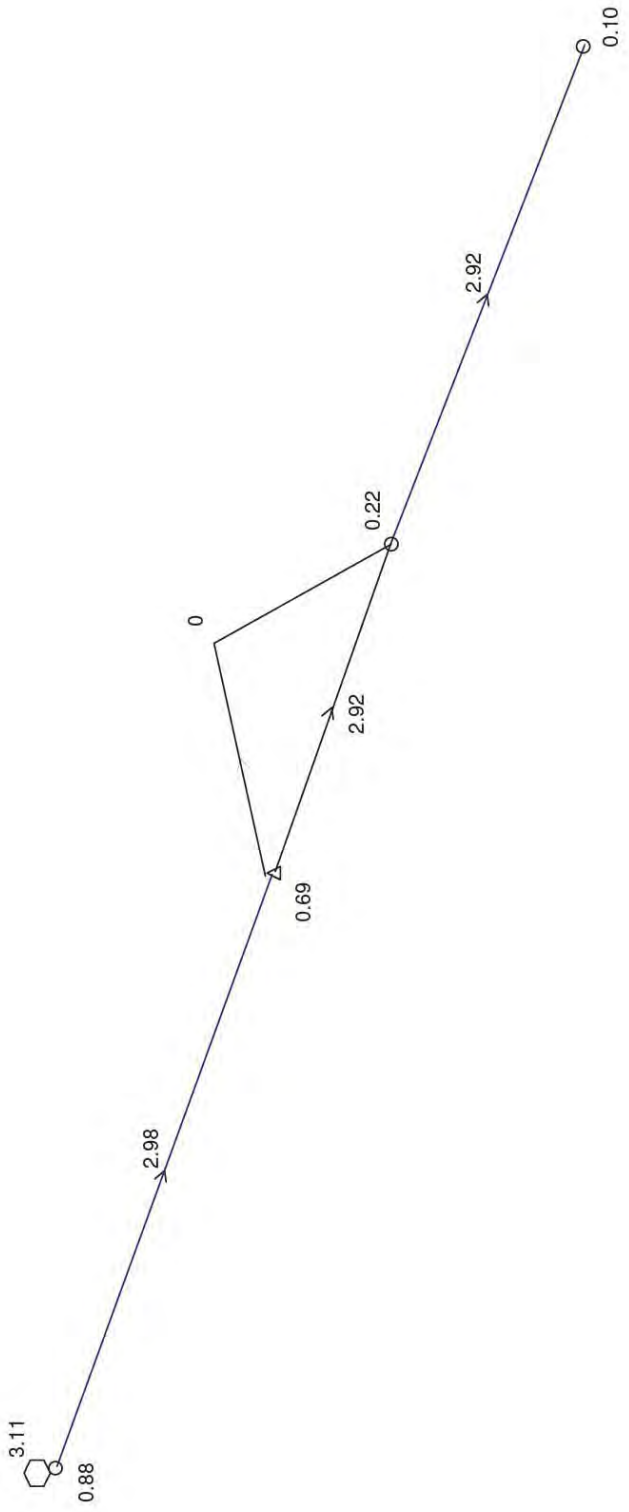
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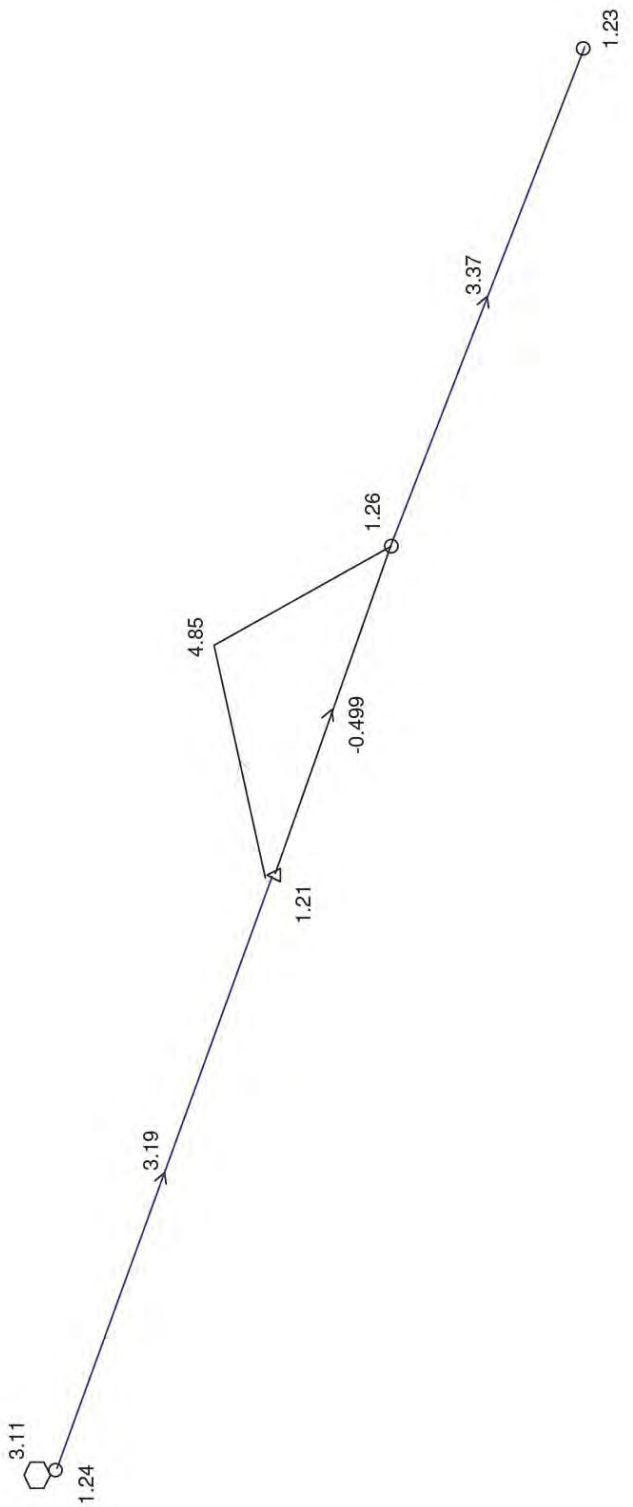

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0.88

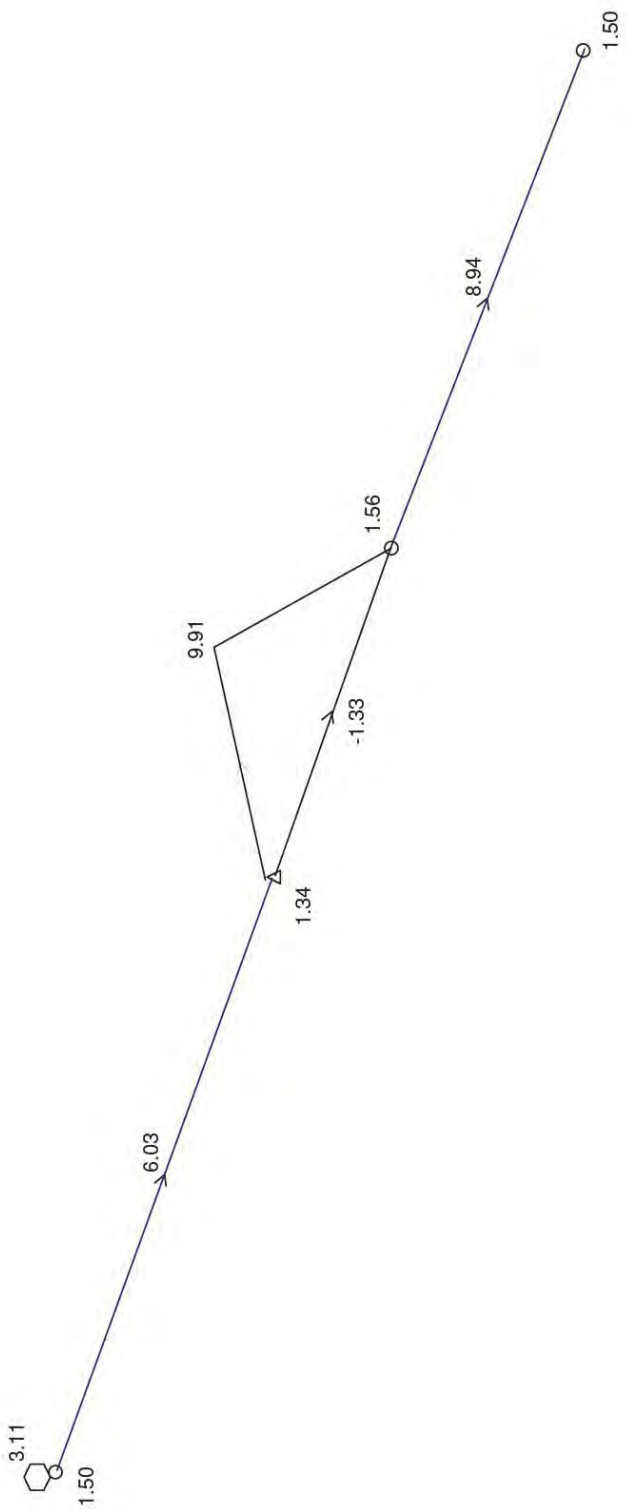

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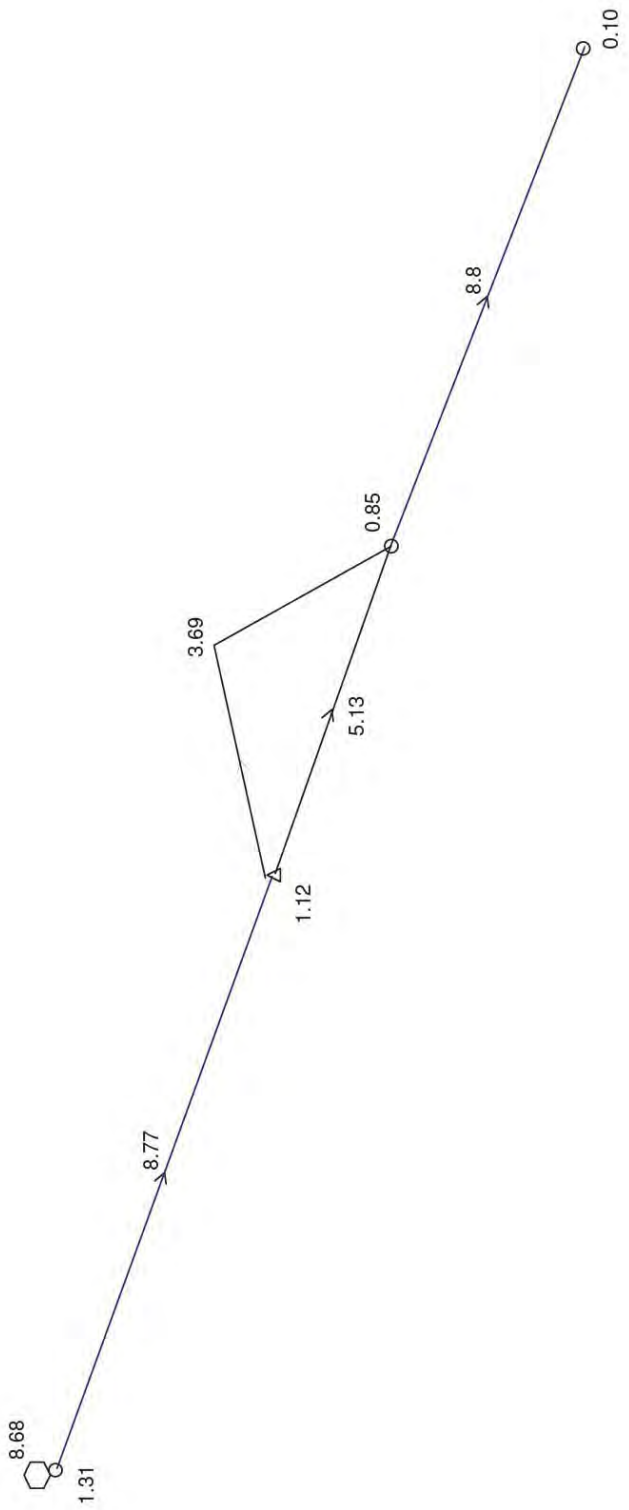
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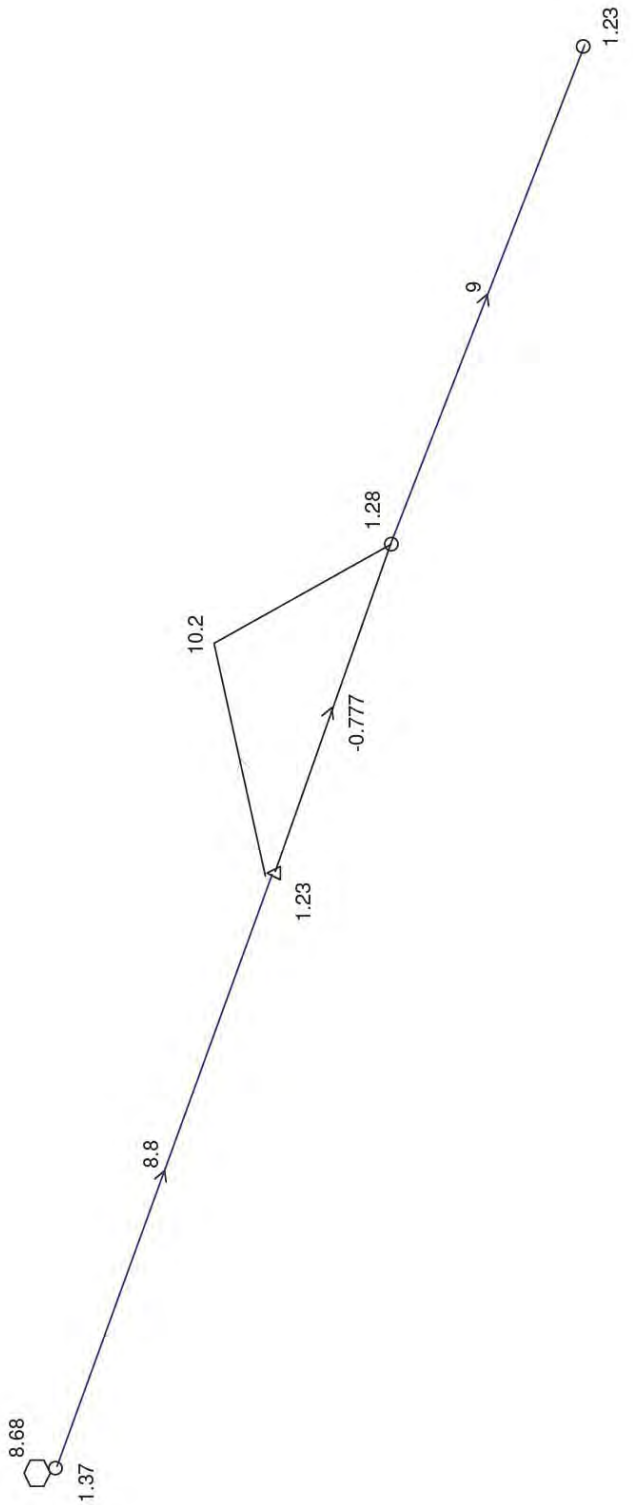


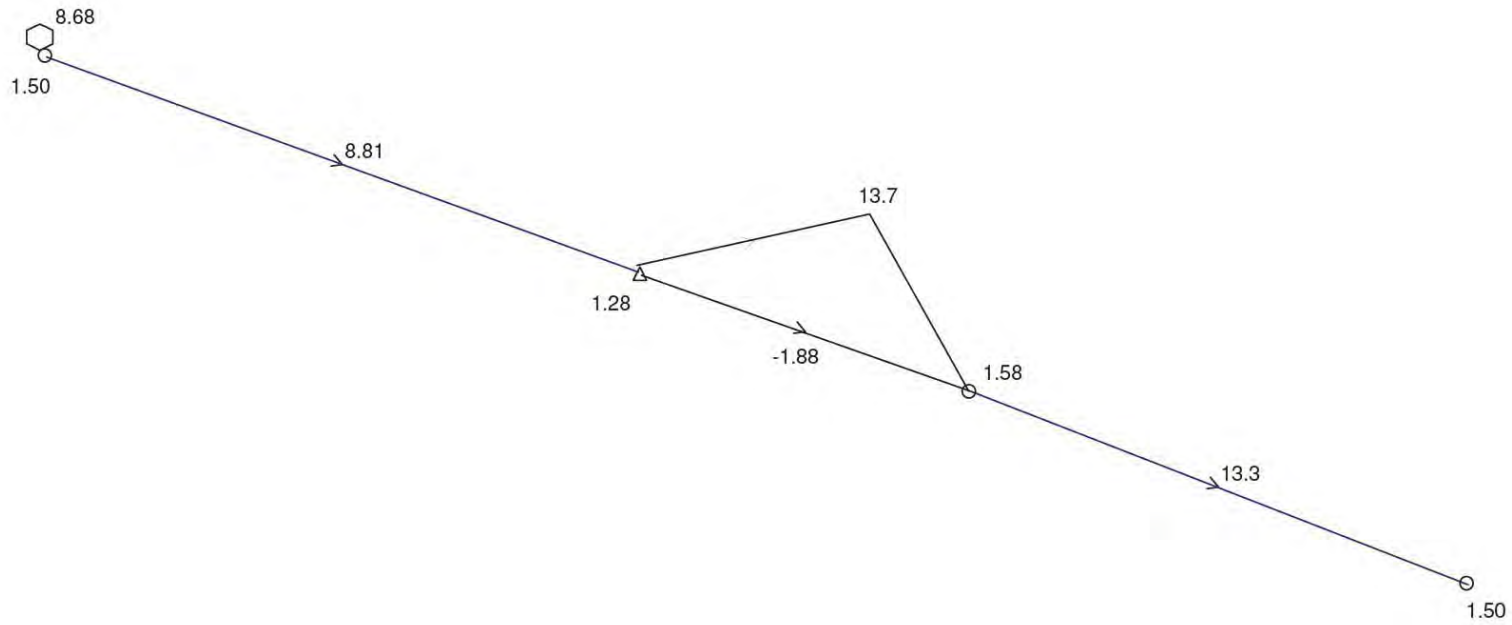

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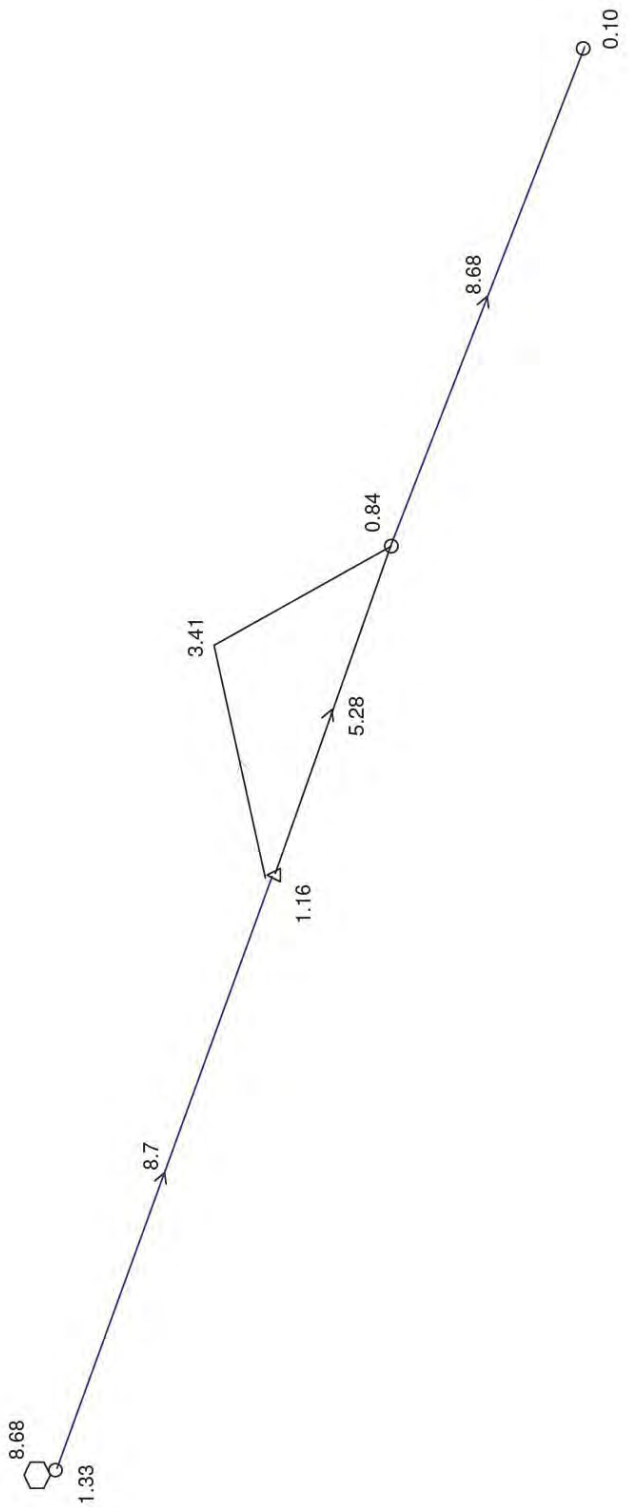

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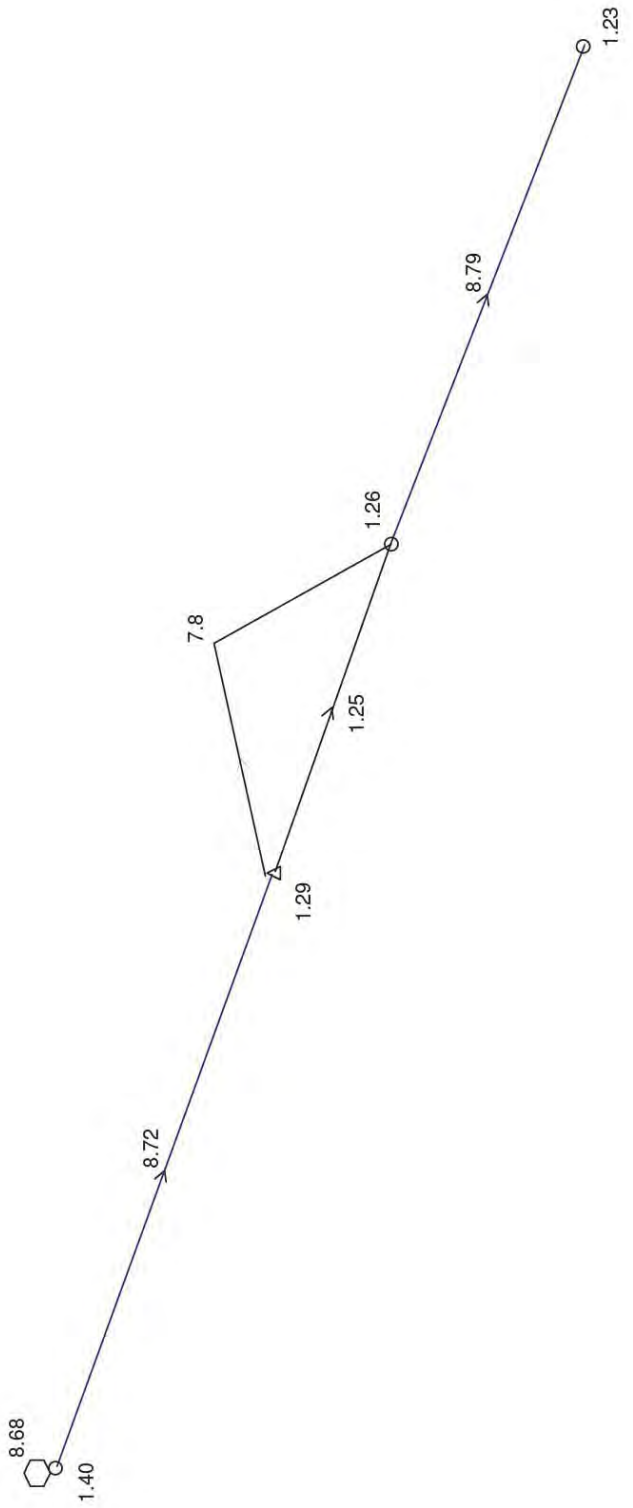

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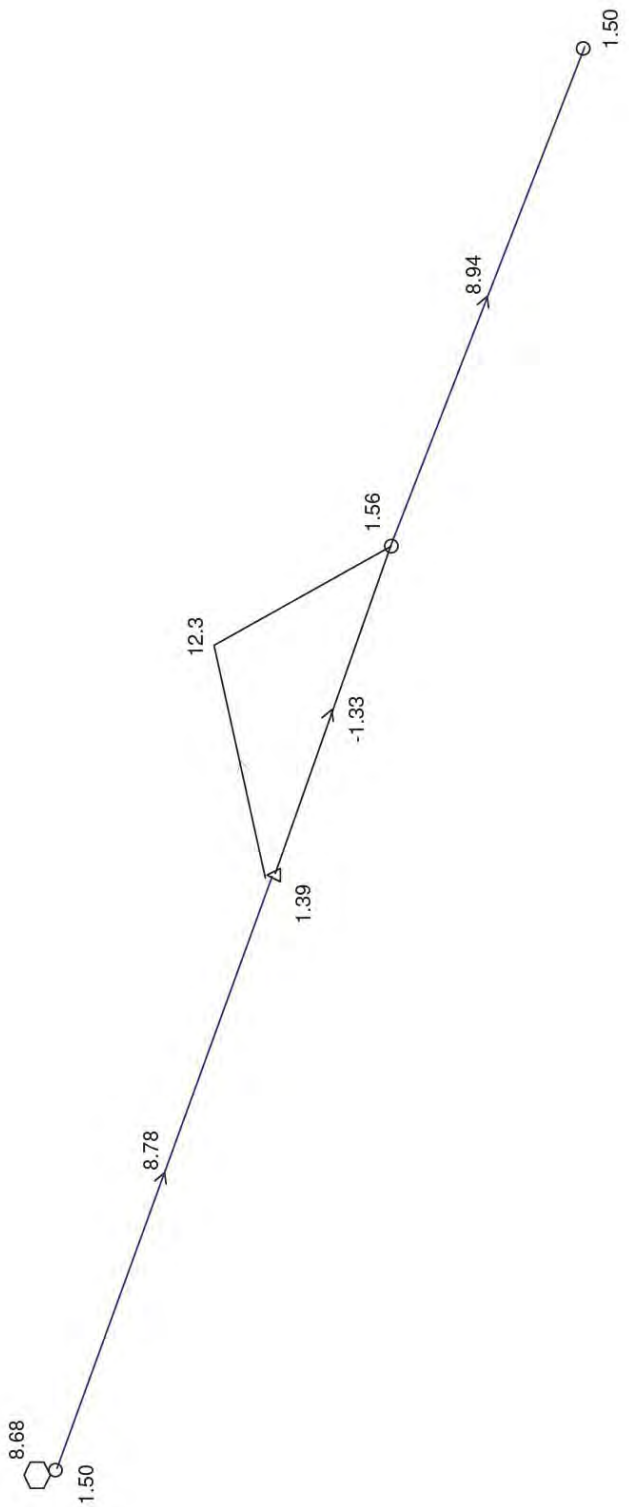


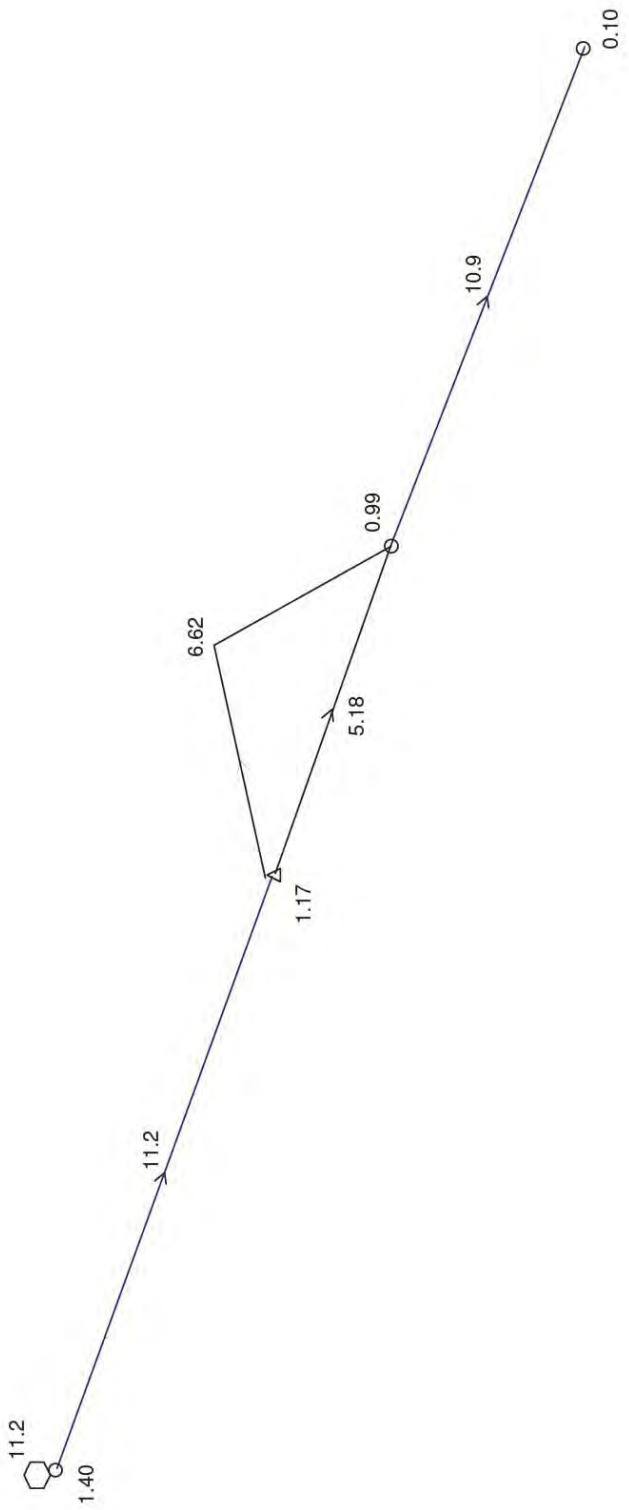
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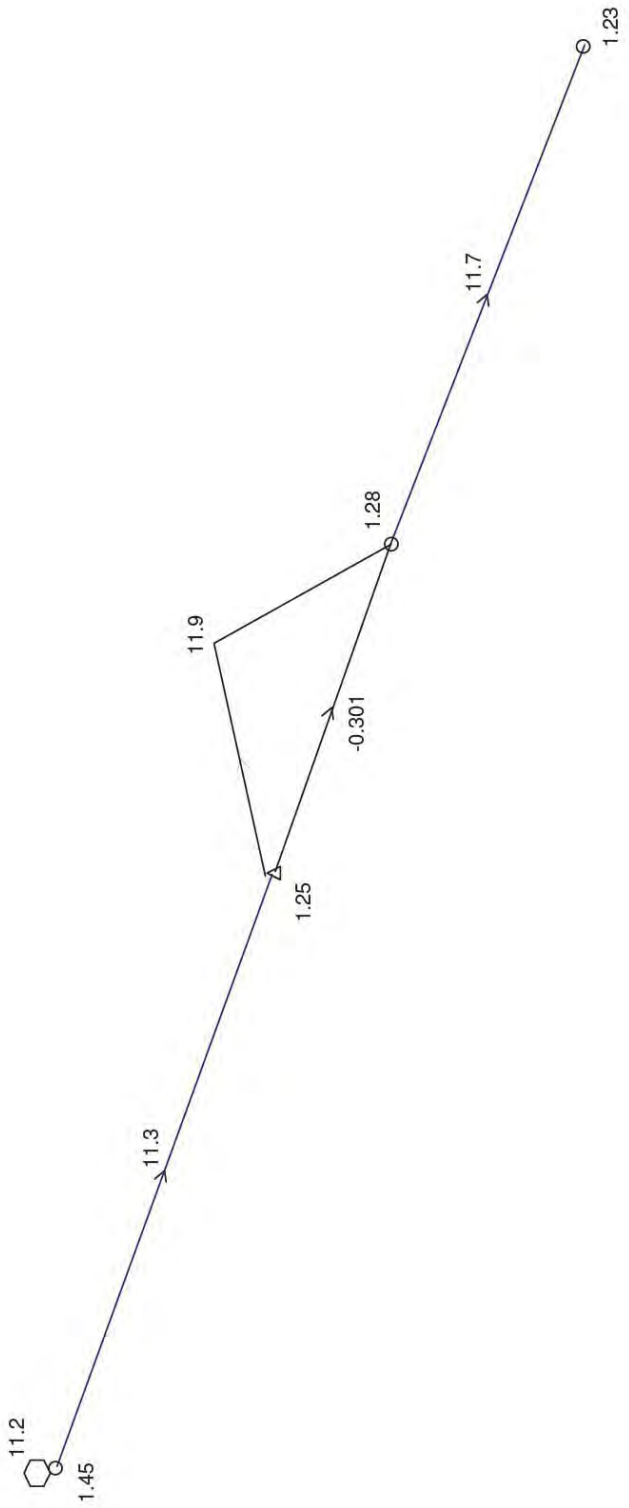

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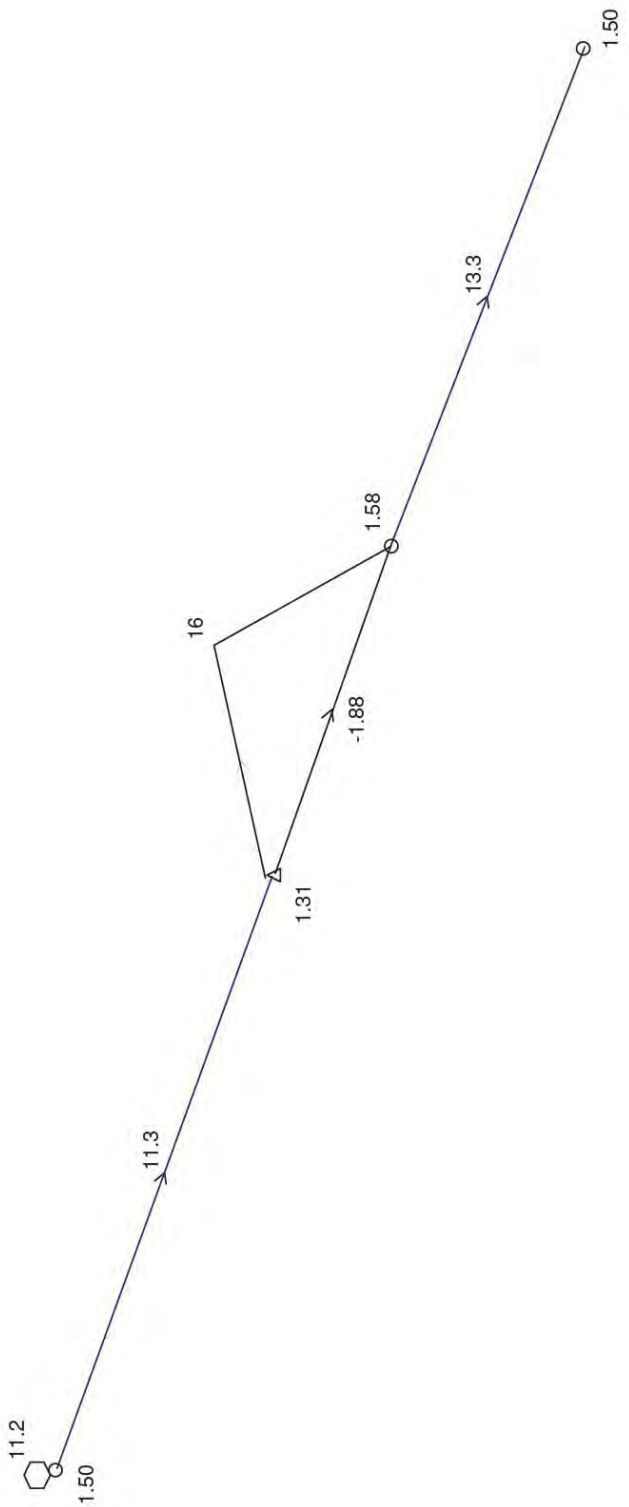

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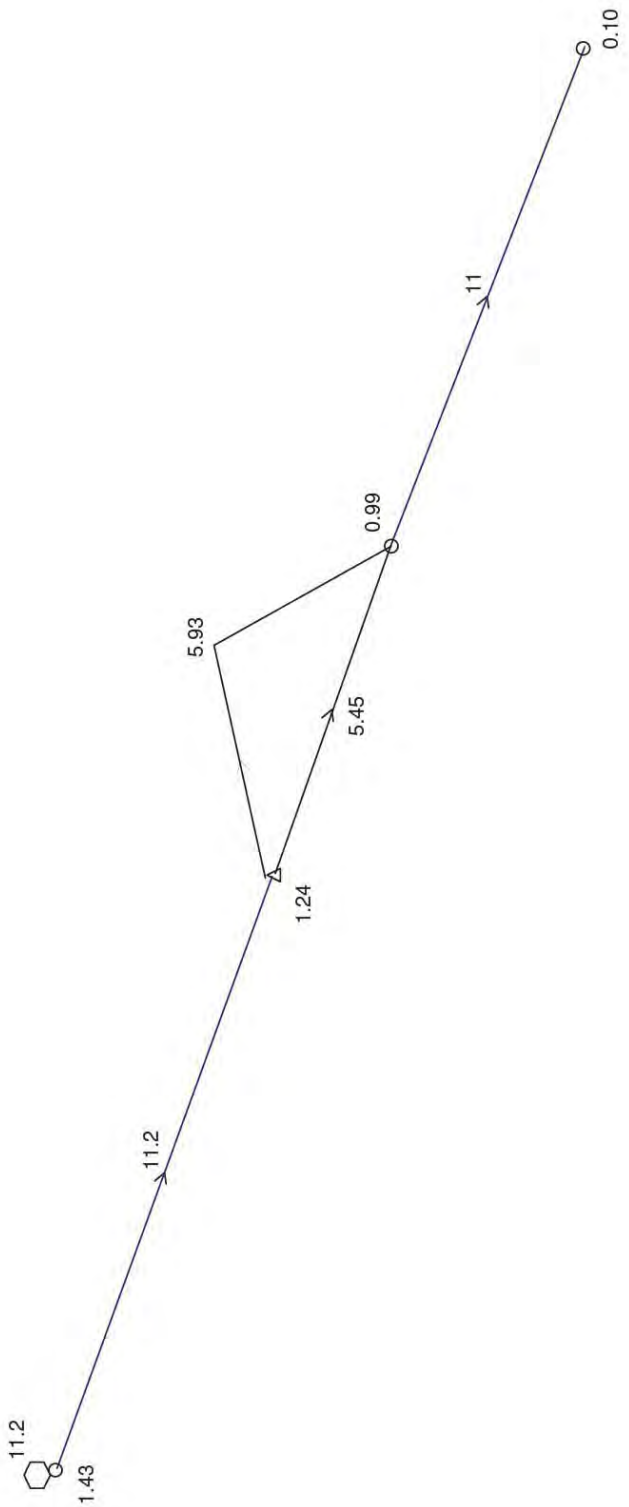
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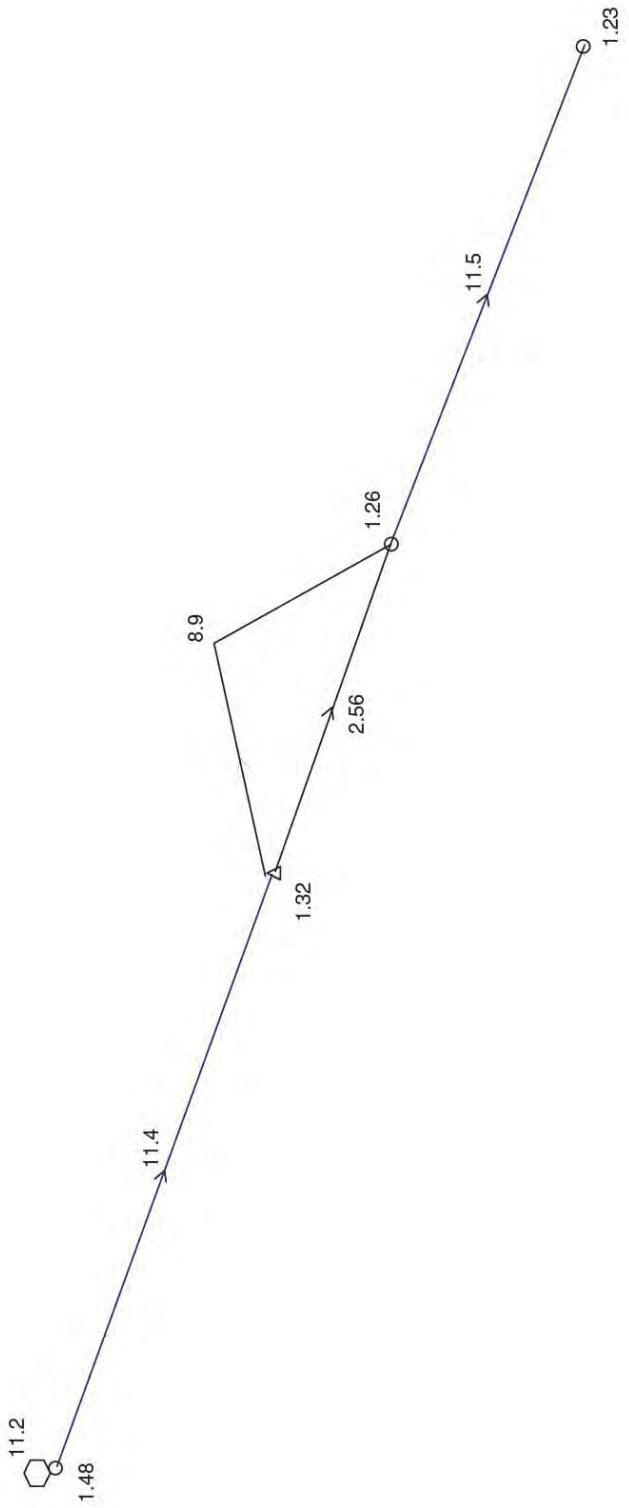


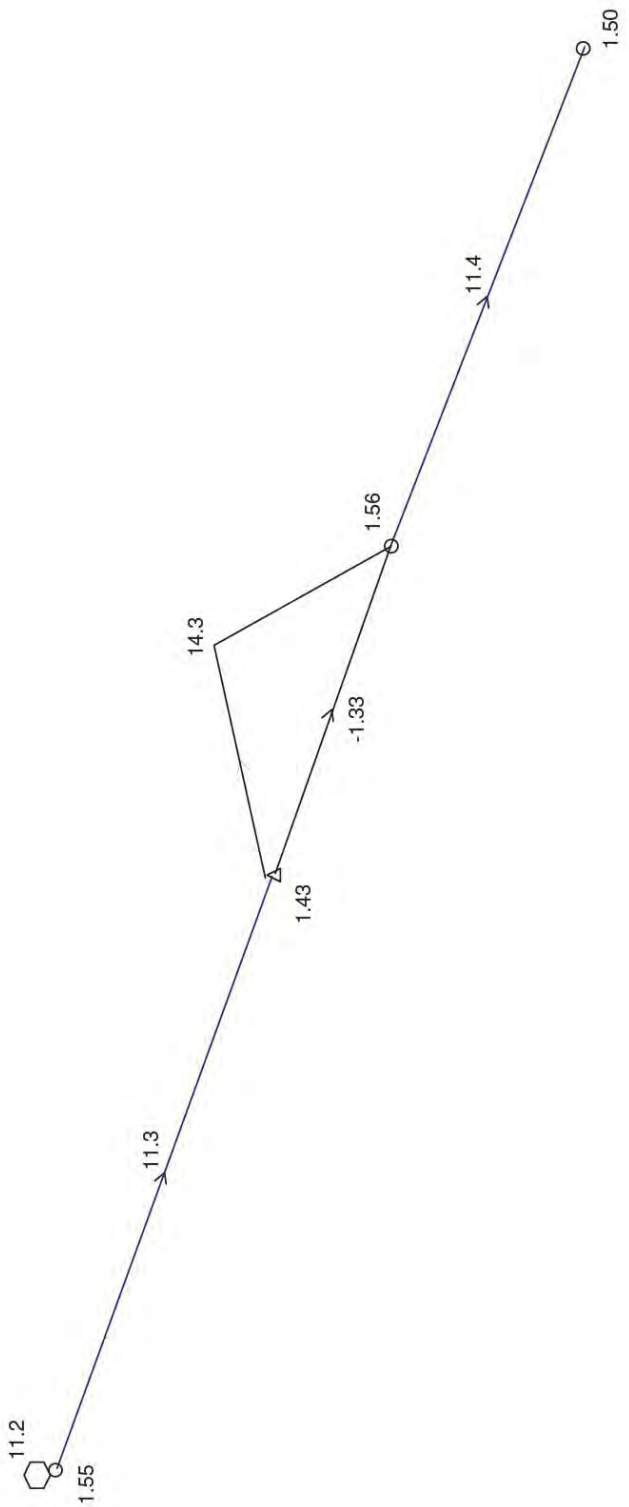

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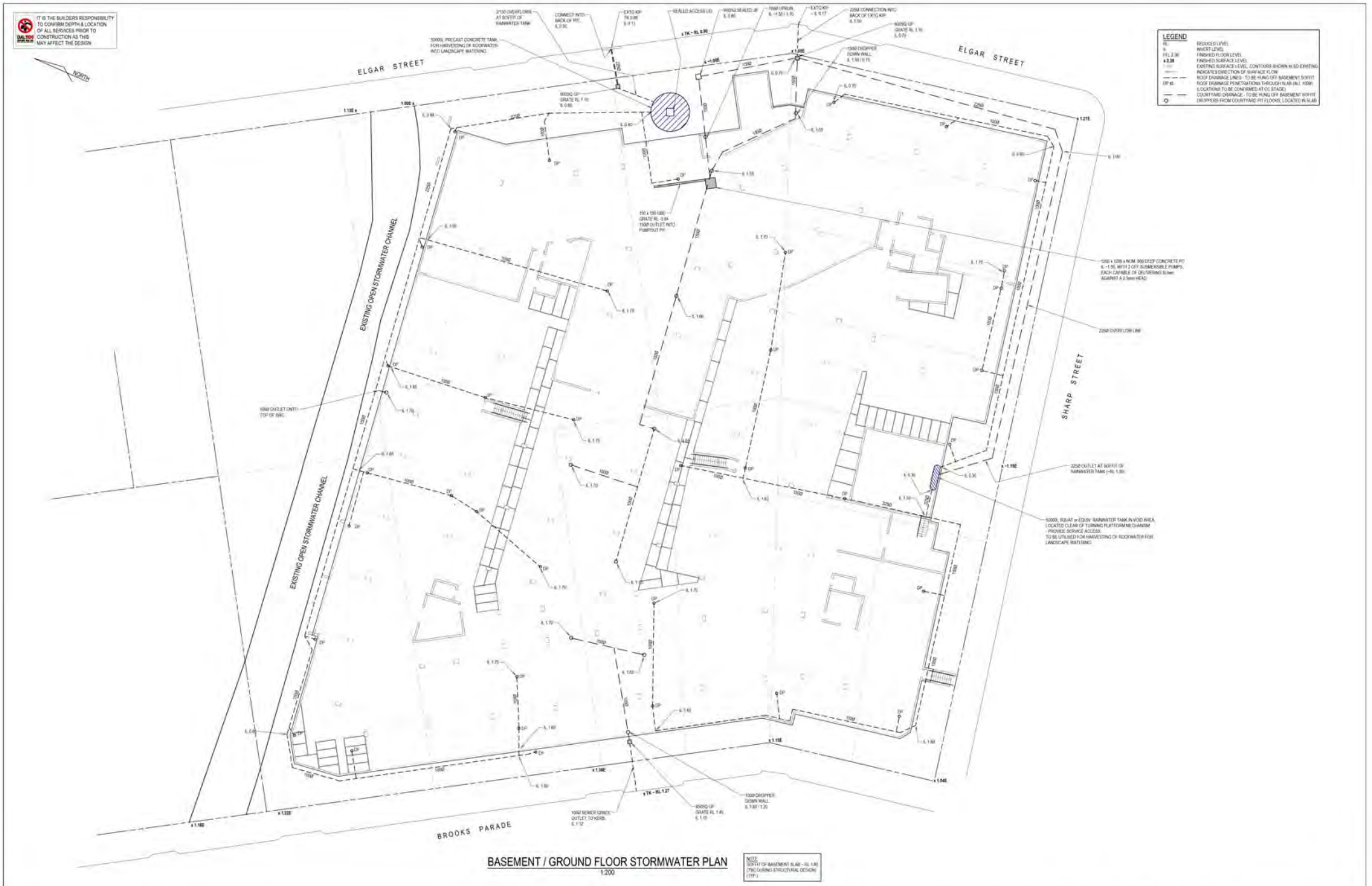

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BASEMENT / GROUND FLOOR STORMWATER PLAN
1:200

NOTE
SOFFIT OF BASEMENT SLAB - RL 1.80
(TBC DURING STRUCTURAL DESIGN STAGE)

Rev	By	Date	Description	Rev'd
C	I.K.	13.02.16	[illegible]	C.K.
B	I.K.	12.02.16	[illegible]	I.K.
A	I.K.	08.09.15	ORIGINAL ISSUE	I.K.

REVISIONS

FORUM CONSULTING ENGINEERS
PO BOX 261, WICKHAM 2293 | 67 McMICHAEL ST, MAryVILLE 2293
T: 02 4961 4980 | F: 02 4969 1282 | E: admin@forumengs.com.au
ABN 48 157 853 677

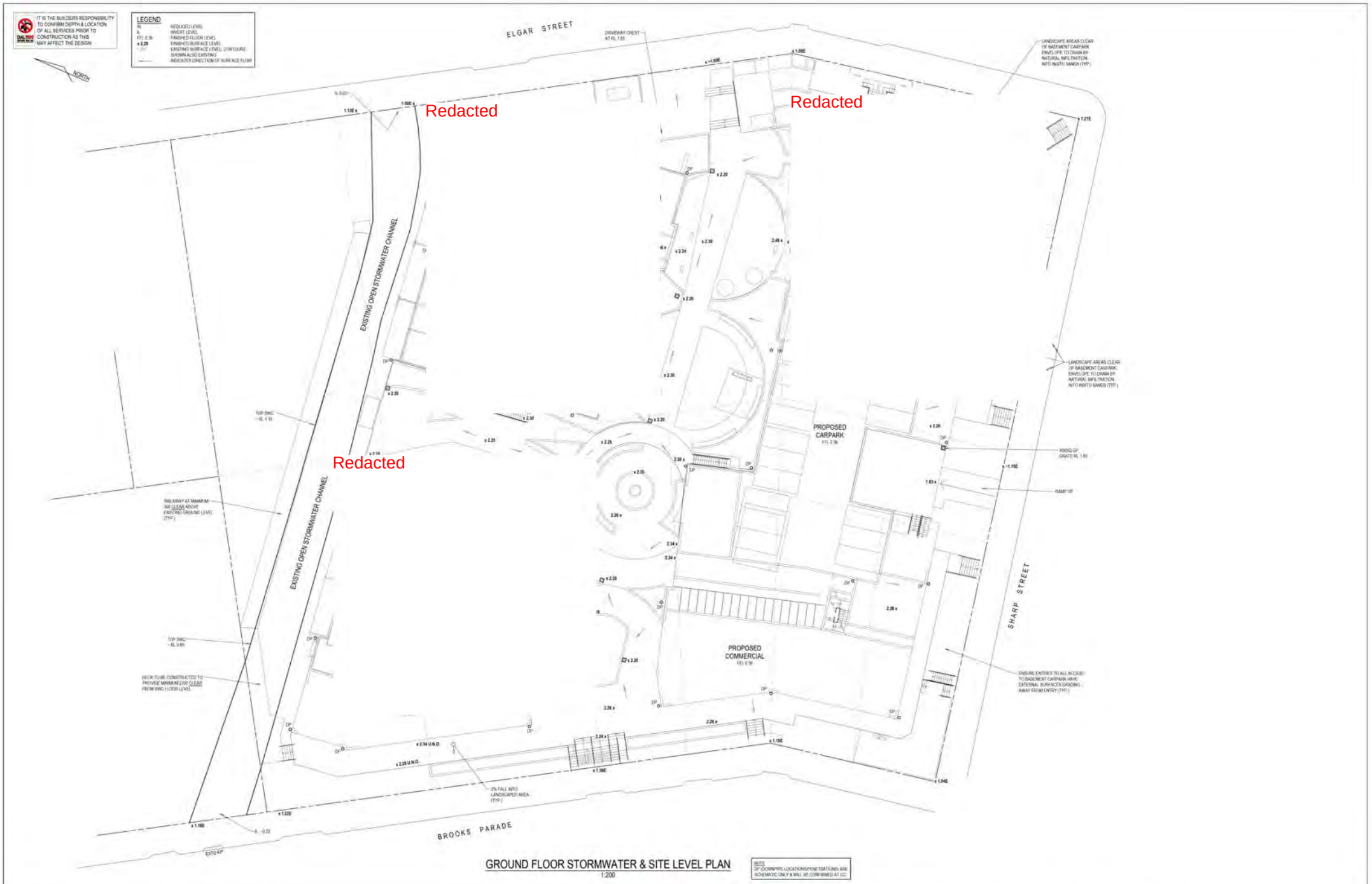
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Client: KML JOINT VENTURE
Project: PROPOSED DEVELOPMENT
BROOKS PARADE
BELMONT

Approved by: [signature] I.J. Kirk (Dir)

Drawing No. 40813 SWD - 01 to 02
Revision C
Sheet A1

D08936518



GROUND FLOOR STORMWATER & SITE LEVEL PLAN
1:200

NOTES
DP - DOWNPIPE LOCATIONS/PENETRATIONS ARE SCHEMATIC ONLY & WILL BE CONFIRMED AT CC

No.	By	Date	Description	Rev #
5	I.K.	13.01.16	LAYOUT REVISION	I.K.
4	I.K.	08.09.15	PLANNING ISSUE	I.K.

FORUM CONSULTING ENGINEERS

PO BOX 261, WICKHAM 2293 | 67 McMICHAEL ST, MAryville 2293
T: 02 4961 4980 | F: 02 4969 1282 | E: admin@forumengs.com.au
ABN: 48 157 853 677

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Client: KML JOINT VENTURE
Project: PROPOSED DEVELOPMENT
BROOKS PARADE
BELMONT

Approved by:

Drawing No.	Revision	Sheet
40813 SWD - 02 01 02	B	41

D08936518

Req:R921151 /Doc:DP 0000585 P /Rev:21-Jul-1992 /Sts:OK.OK /Pgs:ALL /Prt:09-Dec-2016 15:07 /Seq:1 of 7
Ref:13/0524 /Src:M

PLAN

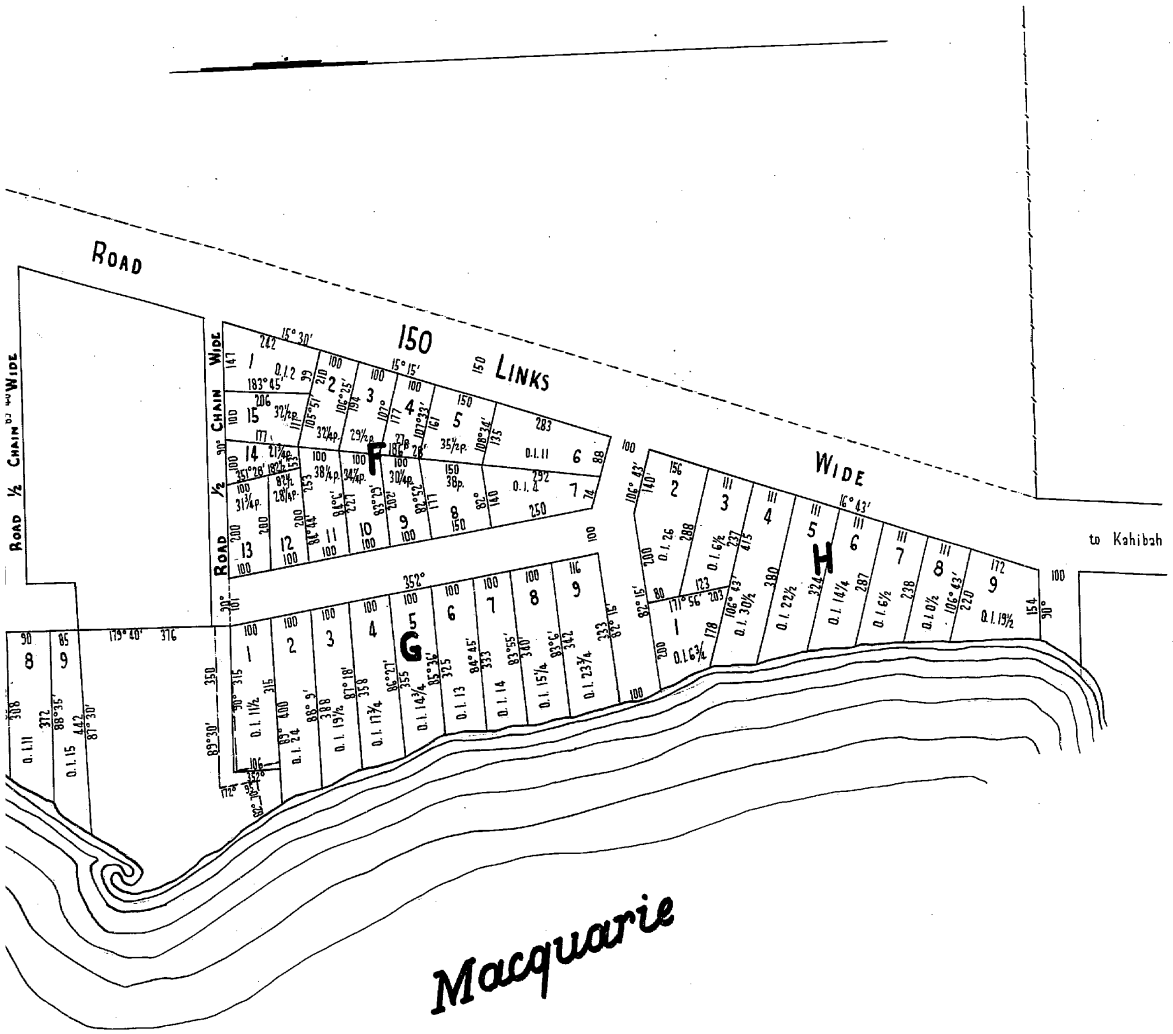
of 85 Allotments at Belmont

LAKE MACQUARIE

PARISH OF KAHIBAH COUNTY OF NORTHUMBERLAND

Scale : 2 chains to an inch

COPY OF
D.P. 585

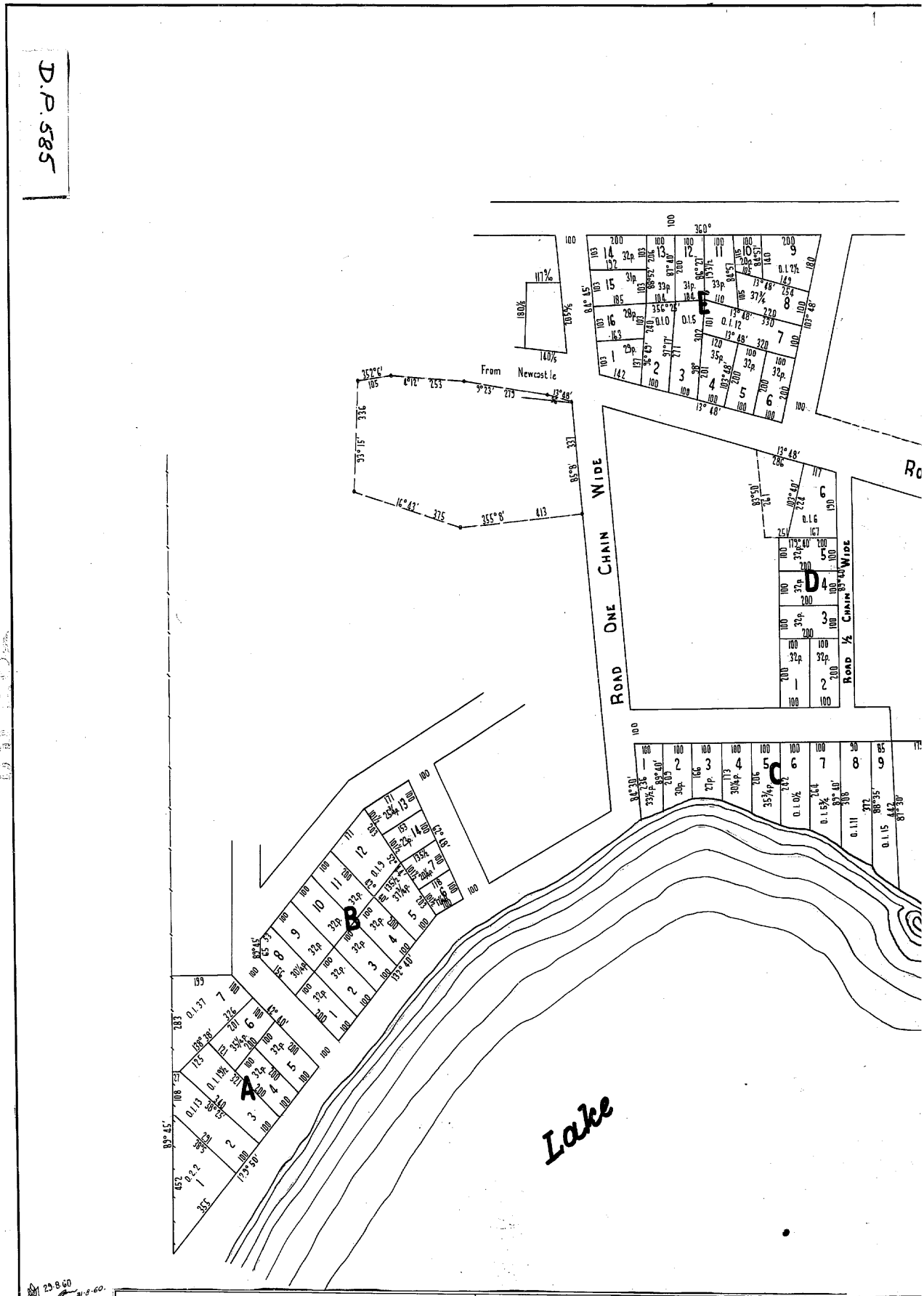


Spd J.J. Tucker LS
Declaration Dated 6th Dec. 1880.

I, Bruce Richard Davies, Registrar General for New South Wales, certify that this negative is a photograph made as a permanent record of a document in my custody this 31st day of May, 1979

Req:R921151 /Doc:DP 0000585 P /Rev:21-Jul-1992 /Sts:OK.OK /Pgs:ALL /Prt:09-Dec-2016 15:07 /Seq:2 of 7
Ref:13/0524 /Src:M

D.P. 585



29.8.60.
31.8.60.

I, Bruce Richard Davies, Registrar General for New South Wales, certify that this negative is a photograph made as a permanent record of a document in my custody this 31st day of May, 1979

Req:R921151 /Doc:DP 0000585 P /Rev:21-Jul-1992 /Sts:OK.OK /Pgs:ALL /Prt:09-Dec-2016 15:07 /Seq:3 of 7
Ref:13/0524 /Src:M

CONVERSION TABLE ADDED IN REGISTRAR GENERAL'S DEPARTMENT

DP 585

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80	-	24.385
100	-	30.48
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200	-	60.96
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203	-	61.87
237	-	72.24
283	-	86.26
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326	-	99.36
340	-	103.63

LINKS	METRES
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166	33.395
167	33.595

CONVERSION TABLE ADDED IN REGISTRAR GENERAL'S DEPARTMENT

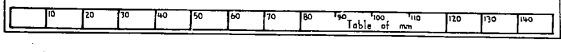
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227	45.665
236	47.475
237	47.675
238	47.88
240	48.28
242	48.685
250	50.29
251	50.49
253	50.9
254	51.1
261	52.5
264	53.11
271	54.52
279	56.13
283	56.93
286	57.53
287	57.74
288	57.94
291	58.54
292	58.74
302	60.75
308	61.96
315	63.37
320	64.37
321	64.57
324	65.18
325	65.38
326	65.58
330	66.39
333	66.99
334	67.19
336	67.59
337	67.79
340	68.4
342	68.8
350	70.41
355	71.41
358	72.02
372	74.83
375	75.44
376	75.64
380	76.44
388	78.05
400	80.47
413	83.08
415	83.48
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452	90.93

CONVERSION TABLE ADDED IN REGISTRAR GENERAL'S DEPARTMENT

DP 585 CONTINUED

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-	-	20 1/4	512.2
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-	-	28	708.2
-	-	28 1/4	714.5
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-	-	29 1/2	746.1
-	-	30	758.8
-	-	30 1/4	765.1
-	-	30.55	772.7
-	-	31	784.1
-	-	31 3/4	803
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-	-	33	834.7
-	-	33 1/2	847.3
-	-	34 1/4	866.3
-	-	35	885.2
-	-	35 1/4	891.6
-	-	35 1/2	897.9
-	-	35 3/4	904.2
-	-	37 3/4	954.8
-	-	38	961.1
-	-	38 1/4	967.5
-	1	-	1012
-	1	1/2	1024
-	1	1 1/2	1050
-	1	2	1062
-	1	2 1/2	1075
-	1	4	1113
-	1	5	1138
-	1	5 3/4	1157
-	1	6	1163
-	1	6 1/2	1176
-	1	6 3/4	1182
-	1	9	1239
-	1	11	1290
-	1	11 1/2	1303
-	1	12	1315
-	1	13	1341
-	1	14	1366
-	1	14 1/4	1372
-	1	14 3/4	1385
-	1	15	1391
-	1	15 1/4	1397
-	1	17 3/4	1461
-	1	19 1/2	1505
-	1	22 1/2	1581
-	1	23 3/4	1612
-	1	24	1619
-	1	26	1669
-	1	30 1/2	1783
-	1	37	1948
-	2	2	2074
-	2	2 1/2	2087



I, Bruce Richard Davies, Registrar General for New South Wales, certify that this negative is a photograph made as a permanent record of a document in my custody this 31st day of May, 1979



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Req:R921151 /Doc:DP 0000585 P /Rev:21-Jul-1992 /Sts:OK.OK /Pgs:ALL /Prt:09-Dec-2016 15:07 /Seq:4 of 7
Ref:13/0524 /Src:M

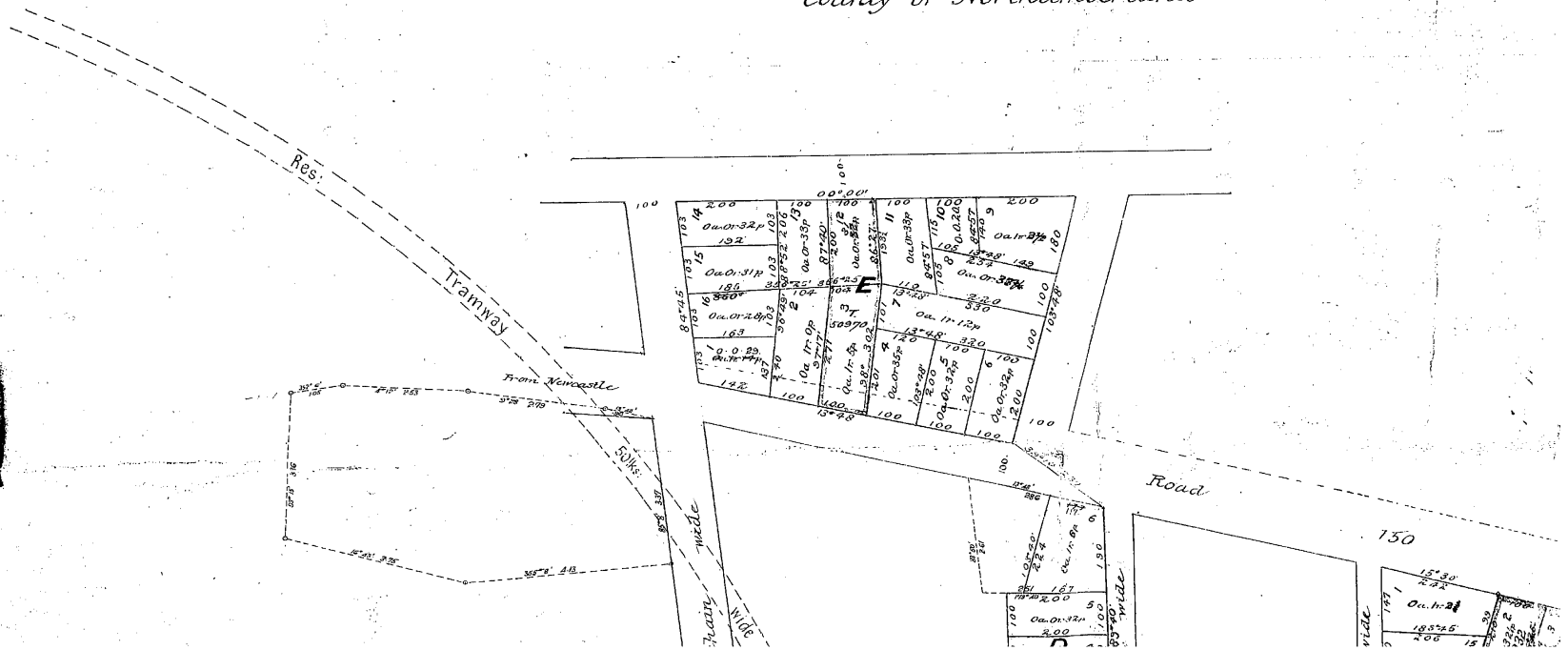
D.P. 585

Faxed 3/11/81

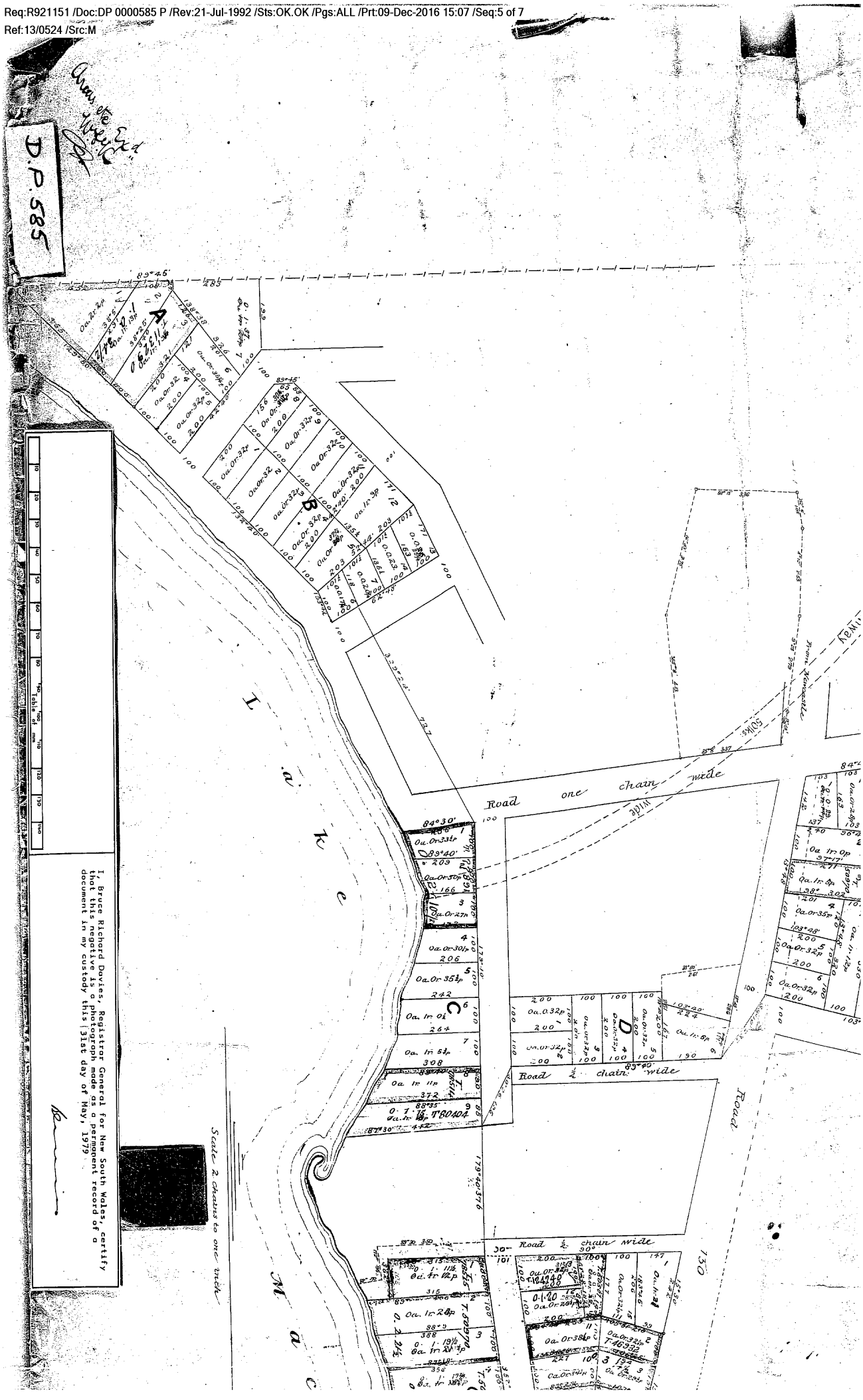
PLAN
OF
85 ALLOTMENTS
BELMONT
LAKE MACQUARIE

This subdivision forms part of portion 60
Parish of Kahibah
County of Northumberland

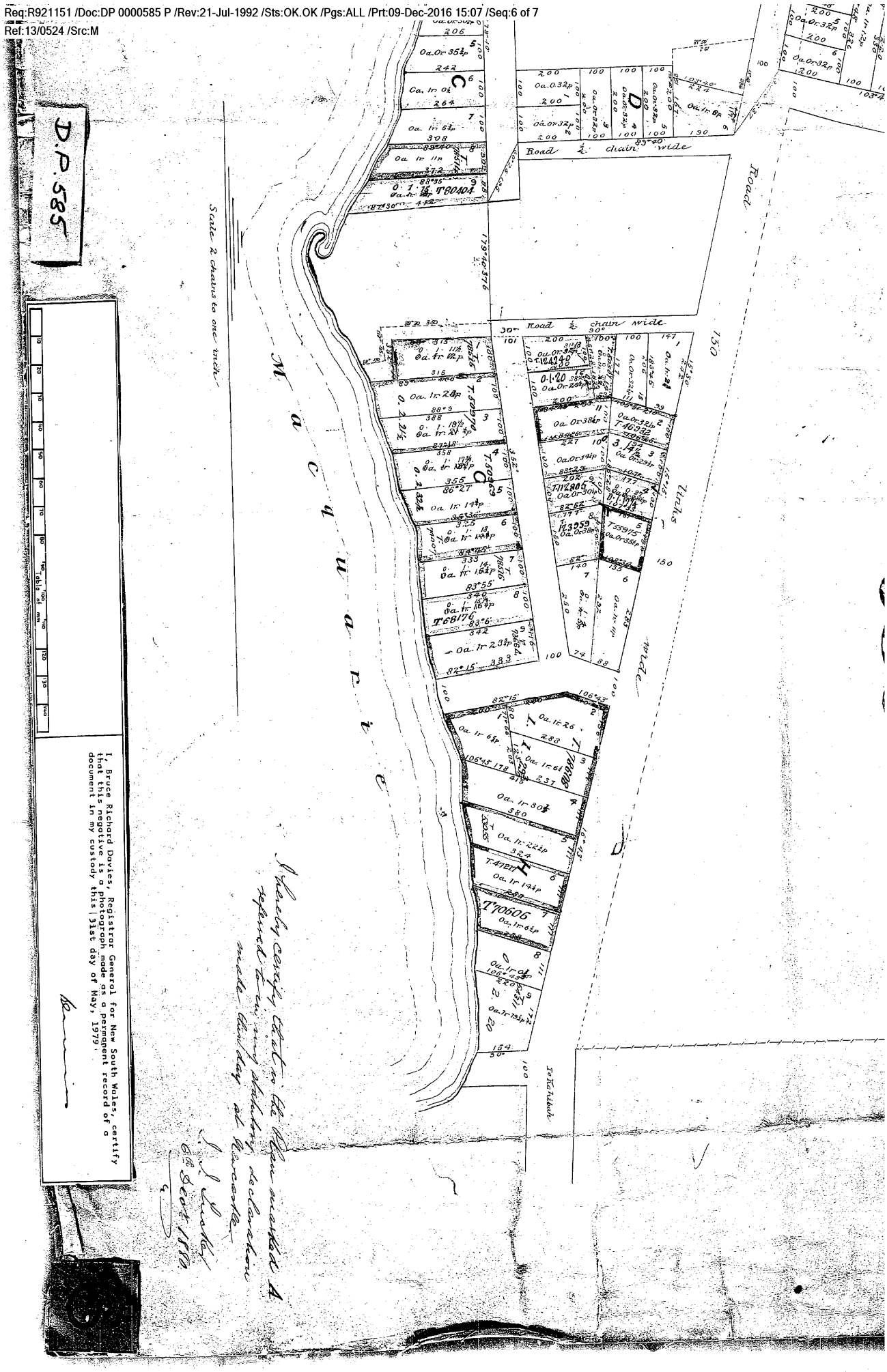
I, Bruce Richard Davies, Registrar General for New South Wales, certify that this negative is a photograph made as a permanent record of a document in my custody this 31st day of May, 1979



Req:R921151 /Doc:DP 0000585 P /Rev:21-Jul-1992 /Sts:OK.OK /Pgs:ALL /Prt:09-Dec-2016 15:07 /Seq:5 of 7
Ref:13/0524 /Src:M



Req:R921151 /Doc:DP 0000585 P /Rev:21-Jul-1992 /Sts:OK.OK /Pgs:ALL /Prt:09-Dec-2016 15:07 /Seq:6 of 7
Ref:13/0524 /Src:M



Req:R921151 /Doc:DP 0000585 P /Rev:21-Jul-1992 /Sts:OK.OK /Pgs:ALL /Prt:09-Dec-2016 15:07 /Seq:7 of 7
Ref:13/0524 /Src:M

PLAN OF 85 ALLOTMENTS OF BELMONT E MACQUARIE

Parish of Kahibah / County of Northumberland

Part of portion 60 of 100 ac. Granted to Thos Williamson and Robert Kirkcaldy 3rd July 1856.

Purchase forms part of portion 60

COPY MADE 9.12.49
EXAMINED 9.12.49

585

DP 585

STANDARD PREPARED

I, Bruce Richard Davies, Registrar General for New South Wales, certify that this negative is a photograph made as a permanent record of a document in my custody this 31st day of May, 1979

D08936521

Lake Macquarie City Council

23 September 2016

FEE ENQUIRY APPLICANT
126-138 Main Rd
SPEERS POINT NSW 2284

Dear Sir/Madam

Fee Estimate - Development Application

Proposal: **Demolition And Mixed Use Development**
Property: **Lot 3 Sec B DP 585, 32 Brooks Parade, BELMONT NSW 2280**

Thank you for your request for an estimate of application fees for the proposed development.

The estimated application fee is $50,584.00 and includes GST to the value of $0.00.

The fee is based on the nominated estimated cost of works of $39,000,000.00.

The estimated cost must be a genuine estimate of the cost for materials and labour for construction and/or demolition. If the estimated cost of works has been understated, the figure will be adjusted and you may incur additional application fees.

A breakdown of individual charges, including GST, is attached.

Please note that this estimate has been calculated using Lake Macquarie City Council's current adopted Fees and Charges which is reviewed each financial year, and the information provided to Council by you at the time of the enquiry.

You are advised that this estimate is subject to change at any time and may vary upon lodgement of a formal application.

For your convenience a record of this Fee Estimate has been kept in Councils records, should you require any further information or advice please do not hesitate to contact Council's Customer Service Centre during normal business on (02) 4921 0333.

Yours faithfully

Customer Service Officer
Customer Service Centre

126-138 Main Road Speers Point NSW 2284 ● Box 1906 Hunter Region Mail Centre NSW 2310
Phone: 02 4921 0333 ● Fax: 02 4958 7257 ● ABN 81 065 027 868
council@lakemac.nsw.gov.au
www.lakemac.com.au

Our Ref: FEE/2199/2016

Estimate Of Fees For

Proposal: **Demolition And Mixed Use Development**

Property: **Lot 3 Sec B DP 585, 32 Brooks Parade, BELMONT NSW 2280**

The fee is based on the nominated estimated cost of works of $39,000,000.00.

Fee Description	GST	TOTAL (inc GST)
Archival Fee	0.00	60.00
DA Assessment Fee	0.00	25,425.00
Planning Reform Fee	0.00	24,954.00
Planning Reform Administration Fee	0.00	5.00
Integrated Application Administration Fee	0.00	140.00
Total	**$0.00**	**$50,584.00**

126-138 Main Road Speers Point NSW 2284 ● Box 1906 Hunter Region Mail Centre NSW 2310
Phone: 02 4921 0333 ● Fax: 02 4958 7257 ● ABN 81 065 027 868
council@lakemac.nsw.gov.au
www.lakemac.com.au

Our Ref: FEE/2199/2016

HUNTER WATER CORPORATION LTD
Newcastle Customer Centre

- ☐ Building clear of Sewermain
- ☑ Building over/adjacent to sewer S65 form submitted
- ☐ Mains and boundaries subject to alterations
- ☐ No sewer available
- ☑ Section 50 Application taken and fee paid
- ☐ Return of the plans to HWC unnecessary
- ☑ If any of the following applications have bee… you will be required to return to HWC and m… relevant application(s) and pay the applicab…

Applications

- ☐ Water/sewer not yet available for connectio…
- ☑ Water connection ☐ Pre-laid
- ☑ Sewer connection (Council approved plans…
- ☐ Sewer Service Access Charge
- ☐ Hydraulic Drawings (plans required)
- ☑ Trade Waste – If required
- ☐ Sewer Connection
- ☐ Connection of Sewer ☑ Return W…
- ☐ Systems Charge Applicable

Customer No:
Checked By: A. Garner Date: 18/12/16

Redacted

Redacted

Redacted

Building Sustainability Assessments bdav
Certificate Number 0000783170
Accreditation Number VIC/BDAV/15/1491
Signature Date 26/09/2016

EDGAR STREET

SUB-STATION

RAISED PLANTER BED OVER CARPARK ENTRY. REFER LANDSCAPE DRGS
RAMP TO BASEMENT
ACCESS STAIRS C/W NON SLIP TILES AND SS HAND RAIL BOTH SIDES
LINE OF SIGHT MAINTAINED AT LOW LEVEL AS PER TRAFFIC REPORT
STREET NUMBER AND PROPRIETARY LETTERBOXES POWDERKOTE FINISH IN BRICK PLINTH RENDER AND PAINT FINISH
DDA COMPLIANT RAMP C/W SS RAILS

EXTERNAL WALL TO 1700 ABOVE FOOTPATH LEVEL RENDER AND PAINT FINISH C/W PICKET ALUMINUM ACCESS GATE AND SIMILAR PICKET PANELS POWDERKOTE FINISH (TYP ALL 3 UNITS THIS ELEVATION)
STAIRS TO UNITS C/W NON SLIP TILES AND HANDRAIL (TYP ALL 3 UNITS THIS ELEVATION)

LEGEND
- RETAIL / COMMERCIAL
- 1-BEDROOM + STUDY APARTMENT
- 2-BEDROOM APARTMENT
- 2-BEDROOM + STUDY APARTMENT
- 3-BEDROOM APARTMENT

ESCAPE STAIRS FROM BASEMENT (TYP)
MOTORISED SECTIONAL OVERHEAD DOOR FULL WIDTH AND HEIGHT OF OPENING
2400 X 2400 ELEVATING PLATFORM C/W SAFETY RAILS SERVICING BASEMENT, STREET LEVEL, AND GROUND FLOOR
GLASS AND ALUMINUM BALUSTRADES. REFER ELEVATIONS FOR EXTENT. (TYP)
DDA COMPLIANT LIFT IN GLASS ENCLOSURE ON E SIDES (TYP SHARP ST AND BROOKS PDE LOCATIONS)
ACCESS STAIRS C/W NON SLIP TILES AND GLASS AND ALUMINUM BALUSTRADE (TYP ALL EXTERNAL STAIRS)
REMOTE CONTROLLED MOTORISED SECTIONAL OVERHEAD DOOR C/W VENTILATION LOUVERS 2300 (H) X 6000 (W)
ALUMINIUM WEATHERPROOF LOUVERS POWDERKOTE FINISH. REFER ELEVATIONS FOR EXTENT (TYP)

RETAIL / COMMERCIAL
58.97 m²
2,360

VISITORS PARKING
19 CAR SPACES
2 MOTORCYCLE SPACES

BUILDING A
21 STORAGE LOCKERS

RETAIL / COMMERCIAL
210.98 m²
2,360

2,360
2,360

GLAZED ALUMINUM SLIDING DOOR OR SIMILAR C/W FINISH (TYP)
LIGHTWEIGHT PRIVACY PARTITION BETWEEN RE CONSISTOR ALL BALCONIES
TILES LAID TO FALLS (TYP ALL UNIT BALCONIES)
ADJUSTABLE ALUMINUM LOUVRES C/W FINISH REFER ELEVATIONS FOR EXTENT (TYP ALL UNIT BALCONIES)
GLASS AND ALUMINUM BALUSTRADES REFER ELEVATIONS FOR EXTENT (TYP ALL UNIT BALCONIES)
EXTENT OF LAND PURCHASED FROM ADJOINING NEIGHBOUR
EXISTING CANAL SECTIONS
TIMBER WALKWAY 2400 WIDE 300 ABOVE NATURAL GROUND LEVEL NOMINAL RAMP DOWN EITHER END TO MEET NATURAL GROUND AT 1:20. PROVIDE POST AND RAIL ALUMINUM BALUSTRADE ALONG SOUTHERN SIDE (CANAL SIDE) WITH HANDRAIL AT 1200 AFFL OF DECK TO BUTOMEX DETAIL
RAISED TIMBER DECK OVER CANAL C/W GLASS AND ALUMINUM BALUSTRADE AROUND ALL 3 SIDES
SOLID BALUSTRADE PAINT FINISH REFER ELEVATIONS FOR EXTENT (TYP)
PAVED AND LANDSCAPED COMMON PDS INCLUDING PLANTER BOXES, AND ARTWORK AREAS REFER LANDSCAPE DRGS FOR DETAILS
EXTERNAL WALL FACE BRICKWORK OR RENDER AND PAINT FINISH REFER ELEVATIONS FOR EXTENT (TYP ALL EXTERNAL WALLS)
ALUCOBOND OR SIMILAR VERTICAL FINS TO PROJECT 750 FROM FACE OF BUILDING REFER ELEVATIONS FOR LOCATIONS (TYP)
RC SUSPENDED SLAB TO ENG'S DETAIL (TYP)
RETURN WALL AND PARTITION BETWEEN BALCONIES RENDER AND PAINT FINISH. REFER ELEVATIONS FOR LOCATIONS (TYP ALL BALCONIES)
SOLID PORTAL FRAME OVER ENTRY RENDER AND PAINT FINISH (TYP ALL 4 ENTRY FRAMING)
GARBAGE CHUTE TO SERVICE ALL RESIDENTIAL FLOORS (TYP ALL 4 BLOCKS)
INTERCOM AND REMOTE CONTROLLED ENTRY DOORS (TYP ALL 4 BLOCKS)
GALVANISED CHC AND CHAIN WIRE STORAGE CAGES C/W GATE TO EACH UNIT (TYP ALL STRAGE CAGES THIS LEVEL)
PARTI WALL BETWEEN UNITS OR COMMERCIAL AREAS TO MEET BCA REQUIREMENTS (TYP)
GLAZED ALUMINUM SHOPFRONT TO COMMERCIAL AREAS REFER ELEVATIONS FOR LOCATIONS (TYP)

STREET NUMBER AND PROPRIETARY LETTERBOXES POWDERKOTE FINISH IN BRICK PLINTH RENDER AND PAINT FINISH

BROOKS PARADE

SHARP STREET

0.0 2.0 4.0 6.0 8.0 10.0 20.0 M

The builder shall check and verify all dimensions and verify all errors and omissions to the Architect. Do not scale the drawings. Drawings shall not be used for construction purposes until issued by the Architect for construction.

coeve design
PO Box 362 Mont Albert Vic 3127
Phone: (03) 9899 6471
Fax: (03) 9899 6515
Email: coeve1@coevedesign.com.au
Web: www.coevedesign.com.au

Project: BROOKS PARADE

Drawing Title: GROUND FLOOR PLAN

Client: ---
Scale: 1:200 AT A1
Date: 04 AUG 2016
Drawn By: CDB
Revision: --
Project No: ---
Drawing No.: DA03-A
Plot Date: 24/09/2016

Monteath & Powys Pty Ltd

SURVEYING, PLANNING, ENGINEERING DESIGN, PROJECT MANAGEMENT



Clause 4.6 Assessment – Building Height

Mixed Use Development

32-44 BROOKS PARADE, 2-10 SHARP STREET & 5-11 EDGAR STREET, BELMONT

Clause 4.6 Assessment – Building Height

Liability limited by a scheme approved under Professional Standards Legislation

Quality ISO 9001 Certified System

This Report was prepared by:-

Monteath & Powys Pty Ltd
Suite 13 Tonella Commercial Centre
125 Bull Street
NEWCASTLE WEST NSW 2302

PO Box 2270
DANGAR NSW 2309

Telephone:(02) 4926 1388
Facsimile: (02) 4929 3475
Web: www.monteathpowys.com.au

PROJECT:	Mixed use, multi storey development comprising 140 residential units, 4 retail/commercial areas, 1 communal multi-purpose area, basement car parking and associated landscaping – 32-44 Brooks Parade, 2-10 Sharp Street and 5-11 Edgar Street, Belmont.
CLIENT:	KML Joint Venture
OUR REFERENCE:	13/0524
VERSION:	Amended – 25 September 2018
AUTHOR:	Konrad Grinlaubs Senior Planner M.P.I.A.
CERTIFICATION:	I hereby certify that this Report has been prepared in accordance with the requirement of the *Environmental Planning and Assessment Act 1979* and its associated Regulations. I certify that to the best of my knowledge the information contained within this Report is neither false nor misleading.
SIGNATURE	
CHECKED BY:	Darren Holloway B.Sci. (Hons), MBEnv Manager Planning and Environment Registered Planner
SIGNATURE:	

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1. INTRODUCTION

This submission seeks a variation to Clause 4.3 of the Lake Macquarie Local Environmental Plan 2014, which relates to the building height.

This submission has been prepared with regards to a development application for mixed use, multi storey development comprising 140 residential units, retail/commercial areas, 1 communal multi-purpose area, basement car parking and associated landscaping at 32-44 Brooks Parade, 2-10 Sharp Street and 5-11 Edgar Street, Belmont.

The proposed development meets the requirements prescribed under Clause 4.6 of the Lake Macquarie LEP 2014, as detailed in this written request for a variation to maximum building height control. Clause 4.6 states the following:

> ***"4.6 Exceptions to development standards***
>
> *(1) The objectives of this clause are as follows:*
> *(a) to provide an appropriate degree of flexibility in applying certain development standards to particular development,*
> *(b) to achieve better outcomes for and from development by allowing flexibility in particular circumstances.*
>
> *(2) Development consent may, subject to this clause, be granted for a development even though the development would contravene a development standard imposed by this or any other environmental planning instrument. However, this clause does not apply to a development standard that is expressly excluded from the operation of this clause.*
>
> *(3) Development consent must not be granted for development that contravenes a development standard unless the consent authority has considered a written request from the applicant that seeks to justify the contravention of the development standard by demonstrating:*
> *(a) that compliance with the development standard is unreasonable or unnecessary in the circumstances of the case, and*
> *(b) that there are sufficient environmental planning grounds to justify contravening the development standard.*
>
> *(4) Development consent must not be granted for development that contravenes a development standard unless:*
> *(a) the consent authority is satisfied that:*
> *i. the applicant's written request has adequately addressed the matters required to be demonstrated by subclause (3), and*
> *ii. the proposed development will be in the public interest because it is consistent with the objectives of the particular standard and the objectives for development within the zone in which the development is proposed to be carried out, and*
> *(b) the concurrence of the Secretary has been obtained.*
>
> *(5) In deciding whether to grant concurrence, the Secretary must consider:*
> *(a) whether contravention of the development standard raises any matter of significance for State or regional environmental planning, and*
> *(b) the public benefit of maintaining the development standard, and*
> *(c) any other matters required to be taken into consideration by the Secretary before granting concurrence.*

(6) *Development consent must not be granted under this clause for a subdivision of land in Zone RU1 Primary Production, Zone RU2 Rural Landscape, Zone RU3 Forestry, Zone RU4 Primary Production Small Lots, Zone RU6 Transition, Zone R5 Large Lot Residential, Zone E2 Environmental Conservation, Zone E3 Environmental Management or Zone E4 Environmental Living if:*

(a) *the subdivision will result in 2 or more lots of less than the minimum area specified for such lots by a development standard, or*

(b) *the subdivision will result in at least one lot that is less than 90% of the minimum area specified for such a lot by a development standard.*

Note. *When this Plan was made it did not include any of these Zones.*

(7) *After determining a development application made pursuant to this clause, the consent authority must keep a record of its assessment of the factors required to be addressed in the applicant's written request referred to in subclause (3).*

(8) *This clause does not allow development consent to be granted for development that would contravene any of the following:*

(a) *a development standard for complying development,*

(b) *a development standard that arises, under the regulations under the Act, in connection with a commitment set out in a BASIX certificate for a building to which State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004 applies or for the land on which such a building is situated,*

(c) *clause 5.4*

(ca) *clause 2.8, 6.1 or 6.2.*

Clause 4.6 – Exceptions to development standards, establishes the framework for varying development standards applying under a LEP. Subclause 4.6(3)(a) and 4.6(3)(b) requires that a consent authority must not grant consent to a development that contravenes a development standard unless a written request has been received from the applicant that seeks to justify the contravention of the standard by demonstrating that:

"*4.6(3)(a) that compliance with the development standard is unreasonable or unnecessary in the circumstances of the case, and*

4.6(3)(b) that there is sufficient environmental planning grounds to justify contravening the development standard."

In addition, 4.6(4)(a)(i) and (ii) requires that development consent must not be granted to a development that contravenes a development standard unless the:

"*(a) the consent authority is satisfied that:*

(i) the applicant's written request has adequately addressed the matters required to be demonstrated by subclause (3), and

(ii) the proposed development will be in the public interest because it is consistent with the objectives of the particular standard and the objectives for development within the zone in which the development is proposed to be carried out, and"

1.1 THE DEVELOPMENT STANDARD

The Environmental Planning Instrument to which these variations relate to is the *Lake Macquarie Local Environmental Plan 2014*. The development standard to which this variation relates to is Clause 4.3 – Height of Buildings, which reads as follows:

> ***"4.3 Height of buildings***
> *(1) The objectives of this clause are as follows:*
> *(a) to ensure the height of buildings are appropriate for their location,*
> *(b) to permit building heights that encourage high quality urban form.*
> *(2) The height of a building on any land is not to exceed the maximum height shown for the land on the Height of Buildings Map."*

Under the *Lake Macquarie Local Environmental Plan 2014* **building height** (or **height of building**) means:

> *(a) in relation to the height of a building in metres—the vertical distance from ground level (existing) to the highest point of the building, or*
> *(b) in relation to the RL of a building—the vertical distance from the Australian Height Datum to the highest point of the building, including plant and lift overruns, but excluding communication devices, antennae, satellite dishes, masts, flagpoles, chimneys, flues and the like.*

1.2 CONTRAVENTION OF THE DEVELOPMENT STANDARD

The proposed development exceeds Clause 4.3 under the *Lake Macquarie Local Environmental Plan 2014.* A written justification is therefore required for the proposed variation to the maximum building height development standard, in accordance with Clause 4.6 of the *Lake Macquarie LEP 2014.*

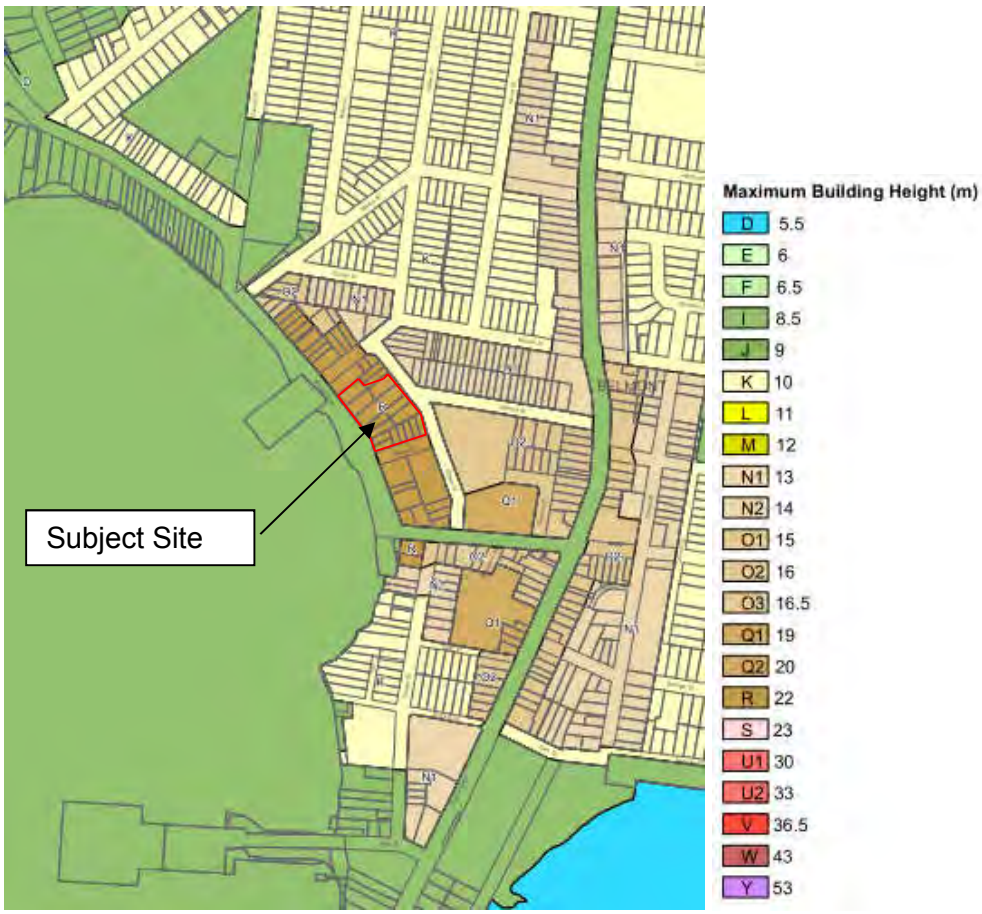
Clause 4.3 of the *Lake Macquarie LEP 2014* states that the maximum building height for the site is 22m (refer to Figure 1).

The current proposal seeks a building height of 28.94 metres and 22.94 metres. The extent of the variation to Clause 4.3 is as follows:

- Building A – Seeks a maximum building height of 28.94 metres. This variation is equivalent to 6.94 metres;
- Building B – Seeks a maximum building height of 22.94 metres. This variation is equivalent to 0.94 metres;
- Building C – Seeks a maximum building height of 22.94 metres. This variation is equivalent to 0.94 metres; and
- Building D – Seeks a maximum building height of 22.94 metres. This variation is equivalent to 0.94 metres.

It is our submission that the breach to the building height control, will not impact on the amenity of the development or adjoining properties, nor will the variation compromise the architecture of the building or the bulk and scale of the development or the character of the area. The proposed additional height is consistent with the objectives of Clause 4.3 of the Lake Macquarie LEP 2014, the zoning objectives the objectives of the Environmental Planning and Assessment Act 1979 (EP&A Act), and justifiable on environmental planning grounds and is in the public interest. In this instance, compliance with the development standard is unreasonable or unnecessary.

Figure 1: Building Height



Source: Lake Macquarie Local Environmental Plan 2014 - Height of Buildings Map - Sheet HOB_010CA

2. PLANNING CONTEXT

2.1 ZONING

The site of the proposed development is zoned B4 Mixed Use under the *Lake Macquarie Local Environmental Plan 2014*. The objectives of the B4 Mixed Use zone are as follows:

- *To provide a mixture of compatible land uses.*
- *To integrate suitable business, office, residential, retail and other development in accessible locations so as to maximise public transport patronage and encourage walking and cycling.*
- *To enable development that complements and enhances the core retail function and trading performance of Zone B2 Local Centre and Zone B3 Commercial Core.*

2.2 RELEVANT PLANNING DOCUMENTS

The subject site is covered by several statutory and strategic planning documents as identified below.

Hunter Regional Plan 2036

Published in 2016 this Plan identifies the site as being with in the Belmont a major sub-regional centre in Lake Macquarie. The Plan identifies Belmont for higher density development and a compact mixed use centre.

Greater Newcastle Metropolitan Plan 2036

Published in 2018 this Plan builds upon the Hunter Regional Plan 2036. Similar to the Hunter Regional Plan the Greater Newcastle Metropolitan Plan identifies significant redevelopment opportunities in Belmont, building upon the significance of the town centre and its well serviced public transport links.

Draft Lake Macquarie 2050 Strategy

The Draft Lake Macquarie 2050 Strategy identifies Belmont as a key strategic town centre and a target for higher density growth.

Lake Macquarie Local Environmental Plan (2014)

As noted the subject site is zoned B4 Mixed Use under the Lake Macquarie LEP. Mixed use development as proposed is permissible with consent.

Belmont Area Plan

The Belmont Area Plan is part of the Lake Macquarie development control plan (DCP). While only a guideline the Area Plan identifies intensification of development for the subject site.

Review of the Town Centres DCP and Belmont Area Plan for 32 Brooks Parade Belmont

This document is an internal working document prepared by Council officers. This document feed into the development of the Belmont Area Plan.

3. IS COMPLIANCE WITH THE DEVELOPMENT STANDARD UNREASONABLE OR UNNECESSARY IN THE CIRCUMSTANCES OF THE CASE?

3.1 PRINCIPLES OF ESTABLISHING WHETHER A DEVELOPMENT STANDARD IS UNREASONABLE OR UNNECESARY

Wehbe vs Pittwater Council 2007

A proposed variation from the development standard is assessed against the accepted "5 Part Test" for the assessment of a development standard variation established by the NSW Land and Environment Court in Wehbe vs Pittwater Council (2007) LEC 827. In the matter, the Commissioner stated within the judgement the following, in reference to a variation:

> "*…the case law developed in relation to the application of SEPP 1 may be of assistance in applying Clause 4.6. While Wehbe concerned an objection under SEPP 1, in my view the analysis is equally applicable to a variation under Clause 4.6 where Clause 4.6 (3)(a) uses the same language as Clause 6 of SEPP 1.*"

It is therefore our submission that the Wehbe test is of relevance in the consideration of a standard to determine whether or not it is unreasonable or unnecessary in the circumstances of the case and it is evident, the above test is relevant.

In the decision of *Wehbe vs Pittwater Council (2007) LEC 827*, Chief Justice Preston expressed the view that there are five (5) different ways in which an objection may be well founded and that approval of the objection may be consistent with the aims of the policy. This attributes to determining whether compliance with the standard is unreasonable or unnecessary in the circumstances of the case as set out below:

First – The most commonly invoked way is to establish that compliance with the development standards is unreasonable or unnecessary because the objectives of the development standard are achieved notwithstanding non-compliance with the standard. The rationale is that development standards are not ends in themselves but means of achieving ends. The ends are environmental or planning objectives. If the proposed development proffers an alternative means of achieving the objective, strict compliance with the standard would be unnecessary and unreasonable.

Second – A second way is to establish that the underlying objective or purpose is not relevant to the development with the consequence that compliance is unnecessary.

Third – A third way is to establish that the underlying objective or purpose would be defeated or thwarted if compliance was required with the consequence that compliance is unreasonable.

Fourth – A fourth way is to establish that the development standard has been virtually abandoned or destroyed by the Council's own actions in granting consents departing from the standard and hence compliance with the standard is unnecessary and unreasonable.

Fifth – A fifth way is to establish that "the zoning of particular land" was "unreasonable or inappropriate" so that "a development standard appropriate for that zoning was also unreasonable or unnecessary as it applied to that land" and that "compliance with the standard in that case would also be unreasonable or unnecessary.

Initial Action Pty Ltd vs Woollahra Municipal Council 2018

More recently the case of Initial Action Pty Ltd v Woollahra Municipal Council [2018] NSWLEC 118 has reinforced the establishment of matters for consideration under Clause 4.6. In Initial Action Pty Ltd v Woollahra Municipal Council an appeal was lodged in relation to the interpretation (or mis-interpretation) of Clause 4.6 of the Woollahra LEP (WLEP). Preston CJ identified that Clause 4.6(2) of the WLEP allows a consent authority to grant development consent for a development that contravenes a development standard subject to conditions. Clause 4.6(4) establishes preconditions that must be satisfied before a consent authority can exercise the power to grant consent for a development that contravenes a development standard.

As Preston CJ notes the consent authority must form two positive opinions of satisfaction under Clause 4.6(4)(a)(i) and (ii). The first opinion of satisfaction, in Clause 4.6(4)(a)(i), is that the applicant's written request seeking to justify the contravention of the development standard has adequately addressed the matters required to be demonstrated by Clause 4.6(3). These matters are twofold: first, that compliance with the development standard is unreasonable or unnecessary in the circumstances of the case (Clause 4.6(3)(a)) and, secondly, that there are sufficient environmental planning grounds to justify contravening the development standard (Clause 4.6(3)(b)). The written request needs to demonstrate both of these matters.

An applicant does not need to establish all of the ways that compliance in unreasonable or unnecessary. It may be sufficient to establish only one way, although if more ways are applicable, an applicant can demonstrate that compliance is unreasonable or unnecessary in more than one way.

As to the second matter required by Clause 4.6(3)(b), the grounds relied on by the applicant in the written request under Clause 4.6 must be "environmental planning grounds" by their nature. The environmental planning grounds relied on in the written request under Clause 4.6 must be "sufficient". There are two respects in which the written request needs to be "sufficient".

First, the environmental planning grounds advanced in the written request must be sufficient "to justify contravening the development standard". The focus of Clause 4.6(3)(b) is on the aspect or element of the development that contravenes the development standard, not on the development as a whole, and why that contravention is justified on environmental planning grounds. The environmental planning grounds advanced in the written request must justify the contravention of the development standard, not simply promote the benefits of carrying out the development as a whole.

Second, the written request must demonstrate that there are sufficient environmental planning grounds to justify contravening the development standard so as to enable the consent authority to be satisfied under Clause 4.6(4)(a)(i) that the written request has adequately addressed this matter. The consent authority must form the positive opinion of satisfaction that the applicant's written request has adequately addressed both of the matters required to be demonstrated by Clause 4.6(3)(a) and (b). As Preston CJ noted in *Randwick City Council v Micaul Holdings Pty Ltd*, the consent authority does not have to directly form the opinion of satisfaction regarding the matters in Clause 4.6(3)(a) and (b), but only indirectly form the

opinion of satisfaction that the applicant's written request has adequately addressed the matters required to be demonstrated by Clause 4.6(3)(a) and (b).

The second opinion of satisfaction, in Clause 4.6(4)(a)(ii), is that the proposed development will be in the public interest because it is consistent with the objectives of the particular development standard that is contravened and the objectives for development for the zone in which the development is proposed to be carried out. The second opinion of satisfaction under Clause 4.6(4)(a)(ii) differs from the first opinion of satisfaction under Clause 4.6(4)(a)(i) in that the consent authority must be directly satisfied about the matter in Clause 4.6(4)(a)(ii), not indirectly satisfied that the applicant's written request has adequately addressed the matter in Clause 4.6(4)(a)(ii).

The matter in Clause 4.6(4)(a)(ii), with which the consent authority must be satisfied, is not merely that the proposed development will be in the public interest but that it will be in the public interest *because* it is consistent with the objectives of the development standard and the objectives for development of the zone in which the development is proposed to be carried out. It is the proposed development's consistency with the objectives of the development standard and the objectives of the zone that make the proposed development in the public interest.

3.2 CONSIDERATION OF WHETHER THE DEVELOPMENT STANDARD IS UNREASONABLE AND/OR UNNECESSARY

i. The objectives of the standard are achieved notwithstanding non-compliance with the standard

The objectives supporting the maximum building height control identified in Clause 4.3 are discussed below, in particular the additional height as proposed. Consistency with the objectives and the absence of any environmental impacts, would demonstrate that strict compliance with the standards would be both unreasonable and unnecessary in this instance.

With respect to the building height objective, we need to acknowledge that the subject site is located at the corner of Brooks Parade, and Sharp and Edgar Streets and part of the Belmont Town Centre. Development within the Belmont Town Centre, located in the immediately vicinity of the subject site, have a height commensurate with the height proposed. With no FSR provisions within the LEP, enabling a better understanding of scale, use intensity and dominance a maximum building height limits consideration to quality of built form and appropriate transition in built form.

The site is currently underutilised and presents an opportunity to fulfil the vision for a sustainable and emerging vibrant commercial precinct. The proposal is supported by a detailed urban design review outlining good urban outcomes including increasing employment, well serviced by public transport and other amenities, increased housing diversity and responding to the desire for activated, vibrant streets and neighbourhoods.

In view of the sites prominent corner location and position, its relationship to the Belmont Town Centre and immediate locality are key considerations. Supplementary considerations are the availability of local infrastructure shading/shadowing and public transport services. The proposed building height would reinforce the position of the subject site creating a landmark/ development to the town centre, reinforcing noted urban design considerations of the Belmont 'bump'. It is therefore considered the proposal is in keeping with the locational attributes, consistent and in keeping with the surrounding established character of the area.

The built form of the development is the outcome of the physical and locational expression considered in the detailed urban design review as attached in the SOEE. The review considers the relationships, shape and size of buildings, structures and spaces and the context and setting of the proposed buildings.

At a finer grain level the development is expressed through clean vertical proportions creating a distinctly modern idiom. The proposal will also increase housing density and diversity; improved streetscape interfaces; and enhanced connectivity and amenity.

In understanding these opportunities, and the reasoning behind the proposed increase in height it is worth noting that the proposal identified a number of limitations with the current provisions, particularly height and block controls. This includes a lack of any technical feasibility relating to the intended outcomes of the built form for the Belmont town centre.

The proposed building envelope ensures that a tower on the south east corner of the site will reflect the current and evolving character of the urban context of this section of Belmont. As noted above, the proposal will complete the Belmont 'bump', consider both in the urban design review, peer reviewed by Peter Annand and Associates and the Council's '*Review of the Town Centres DCP and Belmont Area Plan for 32 Brooks Parade Belmont*', prepared by Lake Macquarie Council's Integrated Planning Department.

The use of a traditional, site responsive materials in contemporary ways is highly supportable. The continuity of the material across the podium is a direct and successful response to the issue of sea level rise. The development, design, character and materiality provides block pattern that has a good balance between providing a cohesive, podium and the need to design for a good level of daylight and natural ventilation and the inclusion of appropriate commercial floor plates.

The proposal is a response to the existing grit, grain and character of Belmont and is a well considered design outcome. The location of a ground floor commercial offerings on the corner provides excellent opportunities for streetscape activation during the day, and opportunities for additional subtle lighting to the pedestrian realm at night and is considered an excellent response.

In response to objective (1)(b), the proposed development is of a high quality urban form and responds to the constraints of the site. The proposed development provides for four free standing buildings to reflect the size and nature of the site. The proposal provides for consistent setbacks to the side and front boundaries enabling a clearly definable, modern form that acts as an exemplar exhibition of built form to the Belmont Town Centre.

As demonstrated in the perspectives provided and the urban design report, the development promotes an attractive and active street frontage, albeit limited due to minimum podium level to address flooding constraints. Large commercial spaces and glazed shopfronts addressing both the Brooks Parade and Sharp Street street frontages. The residential lobbies are clearly defined and the form is reinforced through a strong vertical element which spans across all of the proposed six and eight storeys.

The subject site is within 400 metres of several major bus stop routes bus stops (see map below). Public transport is provided by government and private bus companies. Newcastle Buses provides several routes to various local centres, town centres, north to Newcastle City Centre and south to Swansea, and weekday services to Morisset Rail Station. Private bus companies also service Belmont town centre.

It is considered that this submission provides sufficient environmental planning grounds to justify contravening the development standard. As demonstrated, the objectives of these standards have been achieved.

It is apparent that notwithstanding the proposed variation, the building envelope will not result in any adverse impacts on the amenity of the locality. The proposed building envelope for the south east tower has been assessed for its potential impacts on the desired future character of the area, overshadowing, views, and environment, and has been found to be acceptable in each of these cases.

It sum is considered that this submission provides sufficient environmental planning grounds to justify contravening the development standard, as demonstrated below. In particular the proposed development will meet the objectives of the standard in the following ways:

- The site is in the Belmont Town Centre and is identified in both regional and local planning strategies as a major town centre capable of higher density redevelopment.
- The scale of the development is consistent with approved developments in the area. The Belmont Town Centre has been undergoing redevelopment over the last few years with higher rise mixed use development being constructed.
- The proposed additional height will not affect the urban form. The site is in a town centre and the additional height does not affect the urban form of the town centre.
- The scale of development is consistent with regional strategies and plans for higher densities are key public transport nodes.
- The additional height does not create any significant additional overshadowing impacts. The towers basically overshadow themselves. There is some minor overshadowing on the façade of Belmont Towers to the south but the additional height has negligible impacts.
- The additional height is able to meet relevant design standards in regards to solar access and cross ventilation.
- The additional height does not detract from the sites strategic vision of a major town centre.
- The additional height does not affect any proposed public domain works or proposed road upgrades.

ii. The underlying objective or the purpose of the standard is not relevant to the development and therefore compliance is unnecessary

The underlying objective or purpose of the standard is relevant to the development and is achieved as outlined in (i) above. Therefore, this clause is not applicable.

iii. the underlying object or purpose would be defeated or thwarted if compliance was required and therefore compliance is unreasonable

The underlying objective or purpose would not be defeated or thwarted if compliance was required. However, on balance the proposed development provides a better outcome. The objectives of Clause 4.3 of the Lake Macquarie LEP aim to ensure a scale of development consistent with established centres hierarchy and permit building heights to encourage a high quality urban form. The proposed additional height is consistent with the future desired character of the Belmont City Centre. The additional height does not affect and solar access or other design provisions than the current height limit would. It is also noted that as part of the strategic work that feed into the Belmont Area Plan there has been community engagement that lead to the proposed height limits identified. Council would have also had to

consider the objectives of the LEP including Clause 4.3 when preparing the Belmont Area Plan, and Draft 2050 Strategy to identify the future desired character and form of the area as being able to have higher density developments.

iv. the development standard has been virtually abandoned or destroyed by the Council's own actions in granting consents departing from the standard and hence compliance with the standard is unnecessary and unreasonable; and

While the standard has not been abandoned or destroyed, Lake Macquarie Council has varied LEP standards in the past. As demonstrated in this letter, the proposal will not result in any significant adverse environmental impacts and will result in a high quality mixed use development consistent with the surrounding character and commensurate with the development expectations for the site.

v. the zoning of the land is unreasonable or inappropriate so that a development standard appropriate for that zoning is also unreasonable and unnecessary as it applies to the land and compliance with the standard would be unreasonable or unnecessary. That is, the particular parcel of land should not have been included in the particular zone.

Not applicable as the zoning of the site is appropriate.

4. ARE THERE SUFFICIENT ENVIRONMENTAL PLANNING GROUNDS?

The assessment above and shown throughout the Statement of Environmental Effects demonstrates that the resultant environmental impacts of the proposal will be satisfactory. The proposal addresses the site constraints, streetscape and relevant objectives of both the standards and the zone. The proposal will not result in any unreasonable amenity or environmental impacts as detailed in the submitted specialist studies with the DA.

As detailed within this submission, the subject site is located within the Belmont Town Centre at the corner of Brooks Parade and Sharp and Edgar Streets. Development located in the immediate area and opposite the subject site is of a similar height. The bulk and scale of development within the area will also be of a consistent density although the LEP contains no FSR controls. In fact, the proposed FSR of the site is less than 2:1 which is significantly less than the densities in other major town centres.

We submit that the prominent location of the subject site, its locational context within the Belmont Town Centre, the availability of local infrastructure and its position to public transport services all support the development outcomes sought. The proposed building height would be consistent with development to the south and the north and would reinforce the missing middle noted as the Belmont 'bump'. The bump is referenced in the attached urban design report and previous urban design assessments for the area. The subject site development will create a landmark development which contextually unites and visually integrates into the surrounding built form and character of the locality. Furthermore, the proposal will contribute towards, and espouse, Belmont's reputation as a preeminent precinct.

In this case, strict compliance with the development standard for building height in the Lake Macquarie LEP 2014 is unnecessary and unreasonable. The additional height does not create any additional environmental, social or economic impacts than a building at the current LEP height limit.

Objectives of the EP&A Act

In relation to the objectives of the Environmental Planning and Assessment Act 1979, being:

> (a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,
> (b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,
> (c) to promote the orderly and economic use and development of land,
> (d) to promote the delivery and maintenance of affordable housing,
> (e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,
> (f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),
> (g) to promote good design and amenity of the built environment,
> (h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,
> (i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,

(j) to provide increased opportunity for community participation in environmental planning and assessment.

In regards to (a), (b), and (c) the proposal is in a major town centre area close to a major public transport hub and within walking distance of employment and services in the Belmont town centre. There are regional and local planning policies that have been on exhibition that promote higher density development in the Belmont area. The site is an existing urban area and does not have any significant environmental issues or degrade the natural resources of NSW. The site has positive economic and social benefits through construction jobs, ongoing economic flow on effects from additional residents and allowing increased walking and public transport trips by its location in the Belmont City Centre precinct.

In relation to point (d) the proposal includes the construction of units which will create more affordable housing in the Belmont area, as also identified in the urban design report attached to the DA.

In relation to (e) and (f) there are no significant environmental issues as identified in the statement of environmental effects, and no cultural or historic heritage will be impacted.

In relation to point (g) the proposal has been through the Lake Macquarie urban design panel. Changes were made to the original proposal in regards to the panel's comments. The additional height has been identified to have no additional impacts than what would be interpreted from the design if it met the LEP height limit. That is, relevant design considerations (e.g. solar, ventilation) are still meet by the additional height. The design was also peer reviewed by Annand and Associates.

In relation to (h) there will be a condition of consent ensuring compliance with the Building Code of Australia (BCA). In regard to point (i) the Belmont City Centre is identified for urban renewal and densification under both Regional and Local planning documents. And in regards to point (j) all these regional and local planning documents including the Belmont Area Plan have been through extensive community consultation processes.

Matters for Consideration under Section 4.15 of the EP&A Act

Under Section 4.15 of the EP&A Act, the matters for consideration include:

In determining a development application, a consent authority is to take into consideration such of the following matters as are of relevance to the development the subject of the development application:

(a) the provisions of:
(i) any environmental planning instrument, and
(ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Planning Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and
(iii) any development control plan, and
(iiia) any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4, and
(iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph),
(v) (Repealed)

that apply to the land to which the development application relates,

(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,

(c) the suitability of the site for the development,

(d) any submissions made in accordance with this Act or the regulations,

(e) the public interest.

In relation to part (a) of Section 4.15, the development is permissible on the subject site. The proposal is consistent with the zone objectives being compatible with existing land uses, provides residential/commercial development adjacent to a major public transport node and in walking/cycling distance to employment areas in the Belmont city centre and nearby Belmont hospital, but does not detract from the viability of the town centre precinct. Some additional retail/commercial premises are provided in the development. There are some SEPPs that apply (e.g. SEPP 55) which has been addressed as part of the Statement of Environmental Effects and no inconsistencies were identified with relevant SEPPs.

There are no draft EPI's that apply and there are no Planning Agreements identified at the time of writing. The Statement of Environmental Effects has detailed consistency with the Lake Macquarie DCP, while recognizing the site is an infill site. No inconsistencies with Regulations are identified. The issue relating to the Clause 4.6 variation is height under the LEP.

In relation to the environmental, economic and social outcomes. There has been identified a positive economic outcome through construction jobs and ongoing effects through new residents in purchasing goods and services. Socially, the development proposes a mix of units and sales prices which is considered of significant benefit to the Belmont area given the site location to services and public transport, particularly through the provision of more affordable housing stock. No significant design impacts have been identified from the additional height proposed. There has been no significant environmental impact identified for the site.

Consideration of the Zone Objectives

The proposal is consistent with the zone objectives being compatible with existing land uses, provides residential/commercial development adjacent to a major public transport node and in walking/cycling distance to employment areas in the Belmont city centre, but does not detract from the viability of the City Centre precinct. Some additional retail/commercial premises are provided in the development

Assessment Against the Clause 4.3 Objectives

Clause 4.3 of the Lake Macquarie LEP relates to building heights. The proposals consistency with the objectives is addressed elsewhere in this document. In sum, the objectives of Clause 4.3 of the LEP continue to be met by the additional height as discussed above. The proposed additional height does not provide any additional significant impacts in relation to design impacts such solar access, overshadowing, ventilation, than would be the case if the building met the current LEP height limit. It is also noted that Council would have considered these issues in formulating their strategic planning documents

The proposal allows, and meets, solar access requirements in the Apartment Design Guideline. The public domain is not significantly impact by the proposal. The public streetscape in the vicinity of the site is proposed to be enhanced as a result of the proposal.

Relevant Planning Principles

The relevant principles for proposing a variation to a development standard as identified in Wehbe vs Pittwater Council (2007) LEC 827 are presented earlier in this document. In the matter of Veloshin v Randwick Council [2007] NSWLEC 428 a number of planning principles were considered in assessing height and bulk. These principles include:

- Are the impacts consistent with impacts that may be reasonably expected under the controls?
- How does the proposal's height and bulk relate to the height and bulk desired under the relevant controls?
- Does the area have a predominant existing character and are the planning controls likely to maintain it?
- Does the proposal fit into the existing character of the area?
- Is the proposal consistent with the bulk and character intended by the planning controls?
- Does the proposal look appropriate in its context?

In relation to these principles the development proposes a mixed use building over the current LEP height limit. Higher density buildings are supported in this area, which is part of the Belmont Town Centre. Some developments have already been built of similar size in the area. The building will not be out of character with the area, and will not look out of place in the future character and context of the town centre as outlined in the vision by Council.

5. IS THE VARIATION IN THE PUBLIC INTEREST?

Clause 4.6 states that the development consent must not be granted for development that contravenes a development standard unless the proposed development will be in the public interest because it is consistent with the objectives of the particular standard and the objectives for development within the zone in which the development is to be carried out.

It is considered that this submission in conjunction with the Statement of Environmental Effects provides sufficient environmental planning grounds to justify contravening the development standard under Part 4.

As noted in Section 1 of this report the objective of the Clause 4.3 (1) are as follows:

(a) to ensure the height of buildings are appropriate for their location,
(b) to permit building heights that encourage high quality urban form.

As previously discussed in Section 3 and 4 of this report the proposed development and its supporting documentation demonstrates that the proposed height is appropriate given its locational context within the Belmont Town Centre and its future desired character. It has also been demonstrated that the proposed height of the buildings encourage high quality urban form. As such, the development as proposed will be in the public interest as it is consistent with the objectives of Clause 4.3.

Also noted in Section 1 of this report the objectives of the sites B4 Mixed Use zone are as follows:

- *To provide a mixture of compatible land uses.*
- *To integrate suitable business, office, residential, retail and other development in accessible locations so as to maximise public transport patronage and encourage walking and cycling.*
- *To enable development that complements and enhances the core retail function and trading performance of Zone B2 Local Centre and Zone B3 Commercial Core.*

The proposed development also provides a mixture of compatible land uses and integrated uses by enabling maximisation of public transport. The proposal will furthermore, complement and enhance the core functions of the Belmont Town Centre creating retail function, trading performance, employment opportunities and residential density and precinct activation. As such, the development as proposed will be in the public interest as it is consistent with the objectives of the B4 Mixed Use zone.

The proposal before Council provides for a well-considered development that responds to the context of the site and its surrounds. In terms of ADG provisions, the development is compliant with respect to solar access, ventilation, common open space provisions and deep soil planting requirements.

It is considered that this submission provides sufficient environmental planning grounds to justify contravening the development standards, noting the development will be in the public interest.

In sum, the proposed development will be in the public interest as required by clause 4.6(4)(a)(ii). The proposed development is consistent with the objectives of the development standard in the following ways:

- The site is in the Belmont City Centre and is identified in both regional and local planning strategies as a city centre.
- The scale of the development is consistent with approved developments in the area.
- The scale of development is consistent with the vision outlined in the Council's local planning strategy.
- The scale of development is consistent with regional strategies prepared by the Department of Planning and Environment which identify higher densities around key public transport nodes.
- The additional height does not create any additional design impacts such as overshadowing impacts.
- The additional height is able to meet relevant design standards in regards to solar access and cross ventilation.
- The additional height does not affect any proposed public domain works or proposed road upgrades as identified in Council's plans/policies.
- The proposal is consistent with the objectives of Clause 4.3 of the Lake Macquarie LEP (as discussed above), and the objectives of the zone and EP&A Act.

6. PUBLIC BENEFIT OF MAINTAINING THE STANDARD?

It is considered that there is no benefit to the public or the community in maintaining the development standards. The proposed development, particularly the additional height will allow for the creation of a high quality mixed use development which as stated above meets the desired objectives of the standard and zone objectives.

It is not considered that the variation sought raises any matter of significance for State or regional environmental planning.

The departure from the building height control within the *Like Macquarie LEP 2014* allows for the orderly and economic use of the site in a manner which achieves the outcomes and objectives of the relevant planning controls.

The future urban form in this area of Belmont are higher heights and intensification of land uses. The departure from the building height control within the Lake Macquarie LEP allows for the orderly and economic use of the site in a manner which achieves the outcomes and objectives of the relevant planning controls.

The community have been consulted on the regional strategies applying to Belmont and the Belmont area plan. Any concerns were considered prior to the adoption of these documents, and proposals for higher height limits in Belmont.

There are no heritage or conservation matters that are created from the additional height and the proposal will ensure that taller buildings in the city centre continue to be located near major transport nodes.

7. IS THE VARIATION WELL FOUNDED?

It is considered that this has been adequately addressed in Parts 4 and 5 of this submission. In summary, this Clause 4.6 Variation is well founded as required by Clause 4.6 of the *Lake Macquarie LEP 2014* in that:

- Compliance with the development standards would be unreasonable and unnecessary in the circumstances of the development;
- There are sufficient environmental planning grounds to justify the departure from the standards;
- The development (including the additional height) meets the objectives of the standard to be varied (building height) and objectives of the B4 Mixed Use zoning of the land;
- The proposed additional height of the development is in the public interest and there is no public benefit in maintaining the standard;
- The breach does not raise any matter of State of Regional Significance; and
- The development submitted aligns with the development expectations for the Belmont Town Centre.

Based on the above, the proposed variation is considered well founded.

8. GENERAL

Clause 4.6 also states that:

> "*(6) Development consent must not be granted under this clause for a subdivision of land in Zone RU1 Primary Production, Zone RU2 Rural Landscape, Zone RU3 Forestry, Zone RU4 Primary Production Small Lots, Zone RU6 Transition, Zone R5 Large Lot Residential, Zone E2 Environmental Conservation, Zone E3 Environmental Management or Zone E4 Environmental Living if:*
>
> *(a) the subdivision will result in 2 or more lots of less than the minimum area specified for such lots by a development standard, or*
>
> *(b) the subdivision will result in at least one lot that is less than 90% of the minimum area specified for such a lot by a development standard.*
>
> *Note. When this Plan was made it did not include any of these Zones.*
>
> *(7) After determining a development application made pursuant to this clause, the consent authority must keep a record of its assessment of the factors required to be addressed in the applicant's written request referred to in subclause (3).*
>
> *(8) This clause does not allow development consent to be granted for development that would contravene any of the following:*
>
> *(a) a development standard for complying development,*
>
> *(b) a development standard that arises, under the regulations under the Act, in connection with a commitment set out in a BASIX certificate for a building to which State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004 applies or for the land on which such a building is situated,*
>
> *(c) clause 5.4*
>
> *(ca) clause 2.8, 6.1 or 6.2*"

This variation does not relate to the subdivision of land. The variation sought is thus not contrary to subclause (6). Should the exception to the development standard sought under this submission be supported by Council, the Council must retain a record of the assessment of this submission. A BASIX certificate will be provided for the development.

Clause 2.8, 5.4, 6.1 or 6.2 of the *Lake Macquarie Local Environmental Plan 2014* does not apply to the proposal.

9. CONCLUSION

The proposal does not strictly comply with the maximum building height control as prescribed by Clause 4.3 of the *Lake Macquarie Local Environmental Plan 2014*. Having evaluated the likely affects arising from this non-compliance, we are satisfied that the objectives of Clause 4.6 of the *Lake Macquarie LEP 2014* are satisfied as the breach to the controls does not create any adverse environmental impacts.

Consequently, strict compliance with this development standard is unreasonable and unnecessary in this particular instance, and that the use of Clause 4.6 of the *Lake Macquarie LEP 2014* to vary this development controls is appropriate in this instance.

Based on the above, it is sensible to conclude that strict compliance with the maximum building height is not necessary and that a better planning outcome is achieved for this development by allowing flexibility in the application.

The applicant considers that the consent authority can be satisfied that:

(a) This request adequately addresses the matters required to be demonstrated by clause 4.6(3), being:
   (i) Compliance with the development standard is unreasonable or unnecessary in the circumstances; and
   (ii) There are sufficient environmental planning grounds to justify contravening the development standard.

(b) The proposed development will be in the public interest because it is consistent with the objectives of the development standard and the relevant zone objectives.

In those circumstances, and on the basis of assumed concurrence from the Secretary the consent authority is permitted to grant development consent for the development under clause 4.6, notwithstanding the contravention of the development standard.

D08936533

Review of the Town Centres DCP and Belmont Area Plan for 32 Brooks Parade Belmont



Brooks Parade

Integrated Planning Department

Lake Macquarie City Council

Completed 22 Nov 2013

INTRODUCTION

The purpose of this review is to provide a Council staff strategic land-use perspective on the provisions of the Town Centres DCP and the Belmont Area Plan as it applies to the assembled site known as 32 Brooks Parade, Belmont.

The intention of the review is to determine if the process and provisions outlined in the Council's Town Centres DCP and the Belmont Area Plan (2012) in its current form can support a viable development of this significant site in Belmont, or if the Area Plan requires amendment and re-exhibition.

The view of the SEPP 65 Design Review Panel, Councillors and the community may vary from the Council staff perspective presented in this review.

Background

The Subject Site comprises 13 lots (mostly used for residential purposes) in a high amenity location on the western edge of Lake Macquarie within Belmont town centre. The site is bounded by Brooks Pde, Sharp St, Edgar St and the midblock stormwater channel from Edgar to Brooks Parade (see figure opposite).

Council's Town Centres DCP adopted in 23 July 2012 includes both general town centre provisions and specific block layouts for the Site within the Belmont Area Plan.

Council previously received a proposal from Illawarra Retirement Trust for a Seniors Living development on the site, and the current proposal from Coeve Design is for a mixed use commercial and residential development. It is noted that neither proposal was formally lodged as a development application to Council.

Council's SEPP 65 Design Review Panel has previously provided comment on both the IRT Seniors Living proposal and the current Coeve Design proposal in relation to the 10 design principles in SEPP 65 and the Residential Flat Design Code provisions. The DRP has consistently emphasised the need for an urban design analysis of this significant site to inform the scale, massing and character of a development proposal.

The current proponents maintain that the assembled site is too small and irregular in shape to deliver a viable development that meets the 4 tower concept and the building massing envisaged in the Belmont Area Plan, without a relaxation of one or more of the DCP controls and possibly the RFDC provisions under SEPP65.

Council's Integrated Planning Department has used information and analysis submitted for pre-lodgement meetings about the previous IRT Seniors Living proposal and the current Coeve Design proposal to prepare this review.

SEPP65 Design Quality of Residential Flat Development

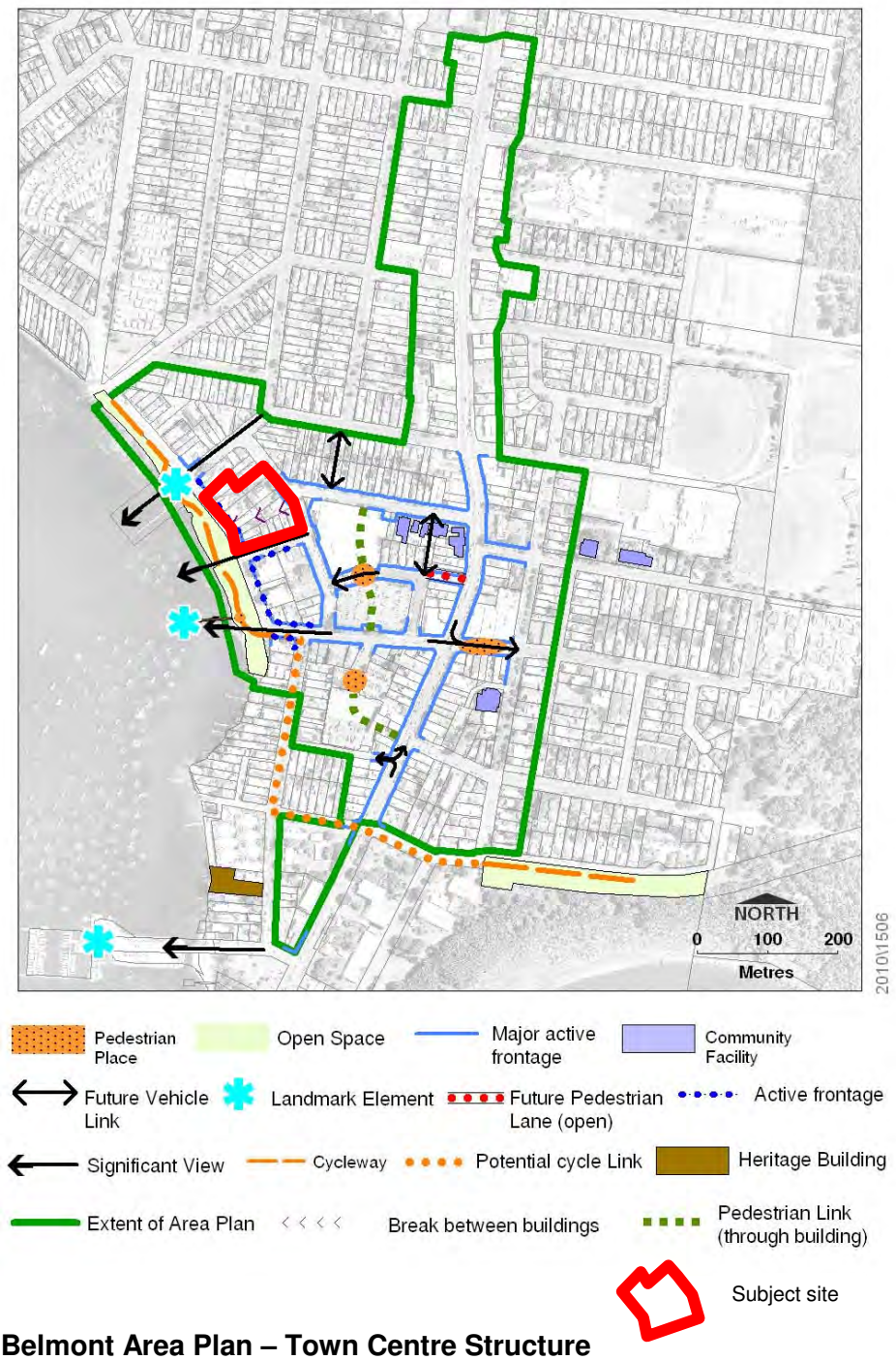
Under State Environmental Planning Policy 65 a residential flat building must address 10 specific design quality elements and the more detailed requirements of the Residential Flat Design Code. The RFDC provisions apply to any residential flat building of 3 or more storeys or any development of 4 or more dwellings excluding villas, townhouses and hostels.

SEPP 65 and RFDC are higher level planning policies that guide Council's DCP. The RFDC was developed as an important resource to be used by Council's for creating plans relating to residential flat buildings.

A Council Plan is required to align with the RFDC requirements rather than override, reduce or negate any RFDC requirements.

Any reduction to the SEPP65 RFDC requirements(including building separation distances) in a Concept Plan proposal may be justified in a Development Application and considered in the merit assessment process.

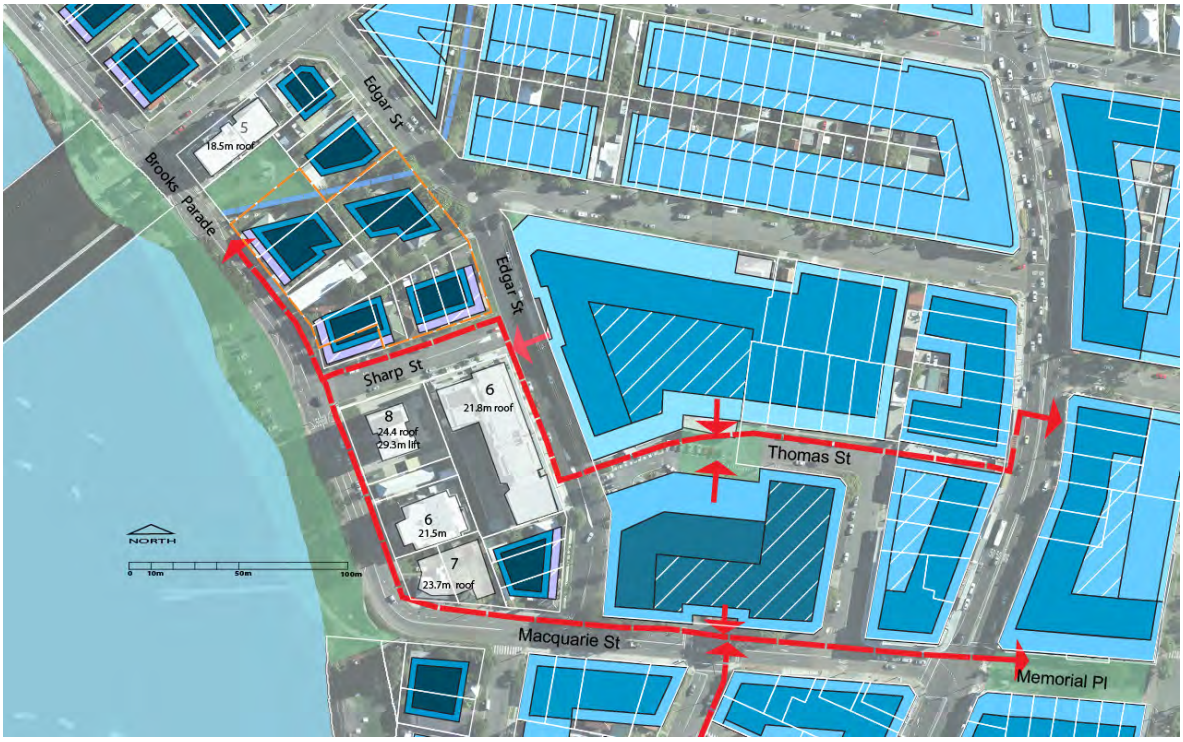
However this document and a DCP cannot fetter the consideration of SEPP 65 and the RFDC by the SEPP 65 Design Review Panel and Council's assessing officers at the DA stage.



Belmont Area Plan – Town Centre Structure

URBAN DESIGN CONSIDERATIONS

The following urban design considerations for the Brooks Pde site are derived from the existing Area Plan, the Residential Flat Design Code and the previous Design Review Panel commentary.



Site Context

Brooks Parade is emerging as precinct of higher commercial-residential mixed use buildings located between the future retail core (Pacific Highway Macquarie Street, Herbert Street and Edgar Street) and the lake and foreshore.

Buildings are generally higher than the remainder of the centre but are separated to maintain a permeable zone between the town core and the foreshore leisure area. The recent Wharf Apartments development on Edgar St is an exception and creates a continuous built mass along Edgar St to the Sharp St corner.

Sharp and Macquarie St are the most direct pedestrian and vehicle connections from the retail core to the Lake foreshore.

Diagrams

1. All diagrams are for illustration purposes and not to scale.
2. Minimum setbacks and building separations are as detailed in following text and these are shown diagrammatically on plan views.



Subject Site

Isolated Lot

The assembled site does not currently include the corner lot at 44 Brooks Parade despite extended efforts of the owners of the assembled Site to acquire this property. This review assumes that agreement cannot be reached regarding purchase of the isolated lot and explores an alternative approach to the Sharp St and Brooks Pde corner.

TOWN CENTRES DCP PROVISIONS

Concept Plan Sites

The Town Centres DCP adopted by Council 23 July 2012 (the DCP) includes both general provisions in Part 2 and locality specific provisions in the Belmont Area Plan section of the document.

The site at 32 Brooks Parade (the Site) is identified as a Concept Plan site in the Belmont Area Plan. The Town Centres DCP specifies a particular process for any Concept Plan site, in recognition of the scale and significance of these larger and strategically located sites.

The intention of this process is to provide more surety for the applicant and Council about the main parameters of the development before proceeding to detailed design stage.

The process involves

1. undertaking a thorough urban design analysis of the site and its context
2. using the outcomes of the analysis to guide the location massing and height of green space, the podium, the buildings and the space between building
3. developing a Concept Plan that indicates extent of deep soil, site access points, extent and height of podium, extent of building footprints, building heights, transition from street to podium and open areas.
4. preparing and lodging the Concept Plan proposal as a Stage1 DA.
5. a merit based assessment of the Stage 1 DA.

The results of urban design analysis may highlight conflicts between controls in the Area Plan. As a result the Concept Plan may present a scheme that includes variations from the current Area Plan controls such as additional height or reduced building separation and setbacks that would meet the objectives of the Area and support a viable development to be assessed on its merits.

DCP and Yield

The current provisions in the DCP have a direct bearing on the development form, height, bulk and therefore potential yield of a proposal.

The previous DCP 1 provisions for the Site included a 3 storey height limit on the lots facing Edgar St and a 4 storey limit on lots facing Brooks Parade with potential for up to 6 storeys for a building of architectural merit. No guidance was provided on building footprints or separations.

The current Belmont Area Plan allows 6 storeys on all lots. At the same time it indicates a significant gap through the site in the east – west direction. Generally it is agreed that the potential yield of the site has increased compared to the provisions in DCP 1.

The calculations provided by Coeve Design demonstrate that an FSR of 2.0 is achievable on the subject site under the current Area Plan and site controls. This is less than that achieved by other recent nearby developments such as the Santorini development (FSR of 3.28) at 24 Brooks Pde and for the Wharf Apartments (FSR of 3.91) in Edgar St.

This may be attributable to a combination of

1. the Area Plan block controls for the subject Site,

2. Different site constraints or characteristics and
3. variations to development controls approved in the merit assessment process for the existing developments.

Only the first issue is addressed in this review.

Social and Economic Factors

Belmont locality includes a TAFE, local hospital, retail services including 2 supermarkets and associated specialties, professional services, the lake and sailing facilities, cycling and the Fernleigh Track, beach and surf attractions, Belmont Sporties Club, Belmont 16 footers, recreation events and more immediately the Brooks Pde foreshore.

The economic and social factors that affect liveability and the demand for residential and commercial floor space in Belmont would have a direct bearing on the target market, the project scheme and its feasibility.

Given demographic change and housing mobility a site of this size has the potential to lead a change in the demographic mix and social fabric of Belmont. An economic analysis could explore where are the emerging markets? would younger singles and couples rent or buy in Belmont given the local attractions and access to employment? is there a demand for serviced apartments?

A justification of the social and economic benefits of the proposal would be considered at the Development Assessment phase and are not specifically part of this review.

Ground Floor Uses

Ground floor uses might include retail or other non-residential uses such as health and lifestyle facilities, offices or professional consultation rooms.The potential commercial operations on the site could include health and recreation facilities, lifestyle services or classes, personal services, café or restaurants,or professional offices and consulting rooms.

Market Demand for Parking

The DCP stipulates parking generation rates. These are considered as the desired quantum of parking for each use currently adopted by Council.

The proponent argues that the vast majority of people that will reside in a multi storey mixed use development in this location will own a car. As such, if insufficient car parking is provided on site, residents will be forced to park in the streets or in the visitors and commercial carparks. Coeve states that additional car parking over and above the minimum standards in the DCP should be encouraged even if it involves a larger basement area than could be constructed if the strict interpretation of the DCP standards were applied. It is also argued that insufficient parking will result in apartments not being desirable or not being able to attract an adequate price to make a viable development.

Dedicated visitors parking spaces could be reduced by allowing dual use of some commercial parking spaces, if those commercial spaces are required primarily for daytime trading.

Any departure *below or above* the DCP parking generation rate has implications for the built form and street amenity and should be justified as part of the DA process.

Scale of Residential Towers

Coeve Design note that a commercially viable building floor plate should accommodate between 5 and 8 units per floor and that any less than 4 units per floor becomes unviable.

When larger floor plates are possible, it is then possible to tier the building and reduce the top 2 floors to a lesser amount. With small floor plates it is necessary to reduce the number of apartments on these upper levels to a point where development viability may be compromised.

BROOKS PARADE CHARACTER

The Area Plan states that future development should reinforce the desired future character of Brooks Pde which includes separate mid-rise apartment buildings that have green landscape areas on the podium, between buildings and in the street setback areas.

The Wharf Apartments development in Edgar St has a ground floor level about 900mm above the footpath and a basement wall hard up against the street boundary with no landscape planting on the site (see photo below).

The Santorini development has a front terrace level built to the boundary and about 600mmm above the footpath, and a main ground floor level approximately 1.1m above footpath level. It includes a narrow landscape treatment to the Maude St boundary (see photo below).

The Deck Apartments has a restaurant area about 900mm above footpath level and some landscape planting within a larger front setback area (see photo below).

The Area Plan objective is to achieve a higher streetscape amenity and improved landscape treatment than in these previous developments.

Coeve design maintain that seeking to achieve the streetscape and landscape objectives of the new area plan significantly impact on potential ldevelopment on the subject site and its viability.



Wharf Apartments basement wall on Sharp Street



Brooks Parade Santorini Apartments with lower front terrace



Deck Apartments on Brooks Pde with ground level café close to street

Gaps through the Site – Building Separation

The Area Plan requires buildings to have an 18m separation at ground level in the E-W direction to achieve the local character objective of greater openess in the block between the future retail centre and the Lake.

The RFDC sets out objectives for building separation including:

- To ensure new development is scaled to support the desired area character
- To provide visual and acoustic privacy for existing and new residents
- To control overshadowing of adjacent properties
- To provide deep soil zones for stormwater management and tree planting

To achieve these objectives the RFDC recommends that building separation increase in proportion to building height so as to ensure appropriate urban form, adequate amenity and privacy for building occupants.

The Area Plan requirement for building separation in the E-W direction exceeds the the RFDC rules of thumb set out below.

A reduced separation that meets the RFDC rule of thumb may be adequate to achieve the local character objective of the DCP subject to further testing with 3D modelling.

RESPONSE

The separation space between buildings should be aligned so that there is an open corridor in both an E-W and a N-S direction between the building masses.

The minimum distances as set out in SEPP65 RFDC rules of thumb have been adopted to ensure residential amenity.

For levels 1-4

- 12m separation between habitable rooms and balconies ,
- 9 metres between habitable balconies and non-habitable rooms
- 6 metres between non-habitable rooms

For levels 5-8

- 18m separation between habitable rooms and balconies ,
- 13 metres between habitable balconies and non-habitable rooms
- 9 metres between non-habitable rooms

For levels 9 and above

- 24m separation between habitable rooms and balconies ,
- 18 metres between habitable balconies and non-habitable rooms
- 12 metres between non-habitable rooms

This implies that levels 2 to 4 of the towers must be at least 12m apart and increased separation is largely achieved by setbacks from the main facades at levels 5 and above.

It is important to note that SEPP 65 and the RFDC are higher level planning policies whose requirements cannot be reduced by Council's Area Plan and DCP.

However a reduction to the SEPP65 RFDC building separation distances may be justified in a Development Application and considered during the merit assessment of a proposal.



Gaps through the Site

Alignment to Street Frontage

Brooks Parade has a broad curving alignment. Sharp St is a pedestrian through street. Edgar Street is characterised by a deflection near Herbert. The Town Centres DCP advocates using built form to reinforce the street boundary alignment.

RESPONSE:

Ground floor building alignment and setback is used to reinforce the curve of Brooks Parade and the alignment of Sharp and Edgar Sts. Upper levels of the residential towers could then be oriented for maximum design efficiency, solar access and views.

The street alignment is reinforced by establishing frontages parallel to the street for the ground floor level. The Area Plan allows for setbacks to be reduced to 2m for 50% of the frontage for commercial trading space only. Towers should be setback a minimum of 6m from the street boundary.

The alignment of buildings along Edgar street is less important than Brooks Pde and Sharp St. The requirement to align the building frontage parallel to Edgar St has been relaxed which provides design flexibility for vehicle access, deep soil landscaping, planting at the visual termination of Herbert St and service areas.

Setback from Street Boundaries

Brooks Pde, Sharp St and Edgar St have different roles in the town centre structure. Accordingly, it is considered appropriate that the building setbacks to Brooks Pde, Sharp St and Edgar St are different.

In Brooks Pde, streetscape and amenity are highly important. It is agreed that a 6m setback on Brooks Parade is reasonable. This setback is measured from the street boundary to the main façade of the tower (as shown in Section C-C of the Area Plan). Balconies may project 3m into the setback area under the provisions of the Area Plan.

The eastern portion of Sharp St and Edgar Street are closer to the shopping area and the street has a more urban character. On this basis a 4m setback to each tower face could be supported if the development design provides suitable deep soil planting along the street edge, suitable access to ground floor non-residential space and if balconies project no more than 2m into the 4m setback area.

Basement wall must be any closer than 2m from the street boundary (as shown in Section C-C of the Area Plan) and should be setback further to meet deep soil requirements. The basement wall should be articulated both vertically and horizontally.



Alignment to Street Frontage

Deep Soil Areas

Deep soil planting is essential for suitable scale planting that reflects the scale of proposed development. It is the means to enhance precinct character and maintain the extension of green vegetation from the lakefront to the built environment.

Town Centres DCP requires 10% of the site for deep soil landscaping.

RESPONSE

It is considered that deep soil planting is suitable at NW and NE corners of the site, along part of the channel, and in the narrower areas between the street boundary and the podium wall.

Setbacks along the section adjoining the Hunter Water owned land are not essential given the adjoining land is unlikely to be developed and it provides a green open space between development at the corner of Maude St and Brooks Pde and the subject Site.

Development of the north-eastern part of the Site adjacent to the drainage channel should provide for building separation to a future building on the north side of the channel. Assuming a minimum 12m separation for the lower 4 levels and a channel width of 2.5m the setback on this section should be 5m. This 5m setback is also an opportunity to achieve deep soil planting.

A reduction in the required deep soil area from 10% to between 7% and 8% would be considered where this is offset by extensive and larger scale podium planting and street planting.



Deep Soil Areas

Level Changes from Footpath to Podium

Natural ground level is 1.0m to 1.4m above lake level. Council's Sea Level Rise policy requires that the ground floor level is 1.0m to 1.4m above the foot path.

The City wide DCP 2013 provides solutions to handle the transition from footpath to podium while still maintaining activation and connection between the footpath and ground floor level.

RESPONSE:

Council's Sea level Rise Policy requires commercial floor levels to be a minimum RL 2.36. An acceptable solution may be to design interim level terraces that that would tolerate short term inundation. This would provide both trading space and access to the commercial floorspace. Council's DCP 2013 contains a provision that allows for variable floor levels to accommodate both sea level rise requirements and street activation. See Part 4 section 4.1 of DCP 2013.

An acceptable solution for managing the level change between the footpath and ground floor would be to use a combination of paved terrace areas and horizontal planting beds. Planting areas could be on low terraces or at street level with low ground cover plants interspersed with taller stemmed tree planting. This would serve to visually break up the impact of the podium wall.

Long continuous wall sections as viewed from the footpath should be avoided.

The development Concept Plan should establish:

- location of pedestrian access and trading areas and the transition of levels
- areas available for deep soil planting adjacent the basement wall
- general design for footpath to ground floor in areas of deep soil planting

A raised walkway parallel to the footpath is not a desirable outcome.



Level Changes from Footpath to Podium

Building Height and Bulk

Belmont Towers is the highest building on Brooks Pde. It also has a moderate frontage length. The elevational area of this building (as perceived from the lake) provides a useful reference point for acceptable visual bulk of new development.

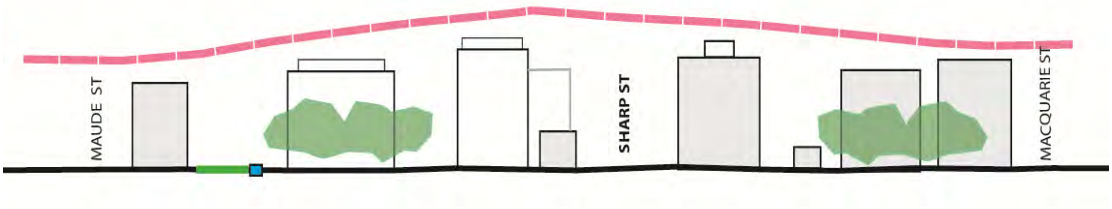
RESPONSE

The highest building on the Site should reflect the height and width of Belmont Towers so it serves to emphasise the Sharp St and Brooks Pde intersection as the key public access point to the lake foreshore. It is not desirable to shift the 'bump' to the north and away from Sharp St but rather to bookend the Sharp St entry.

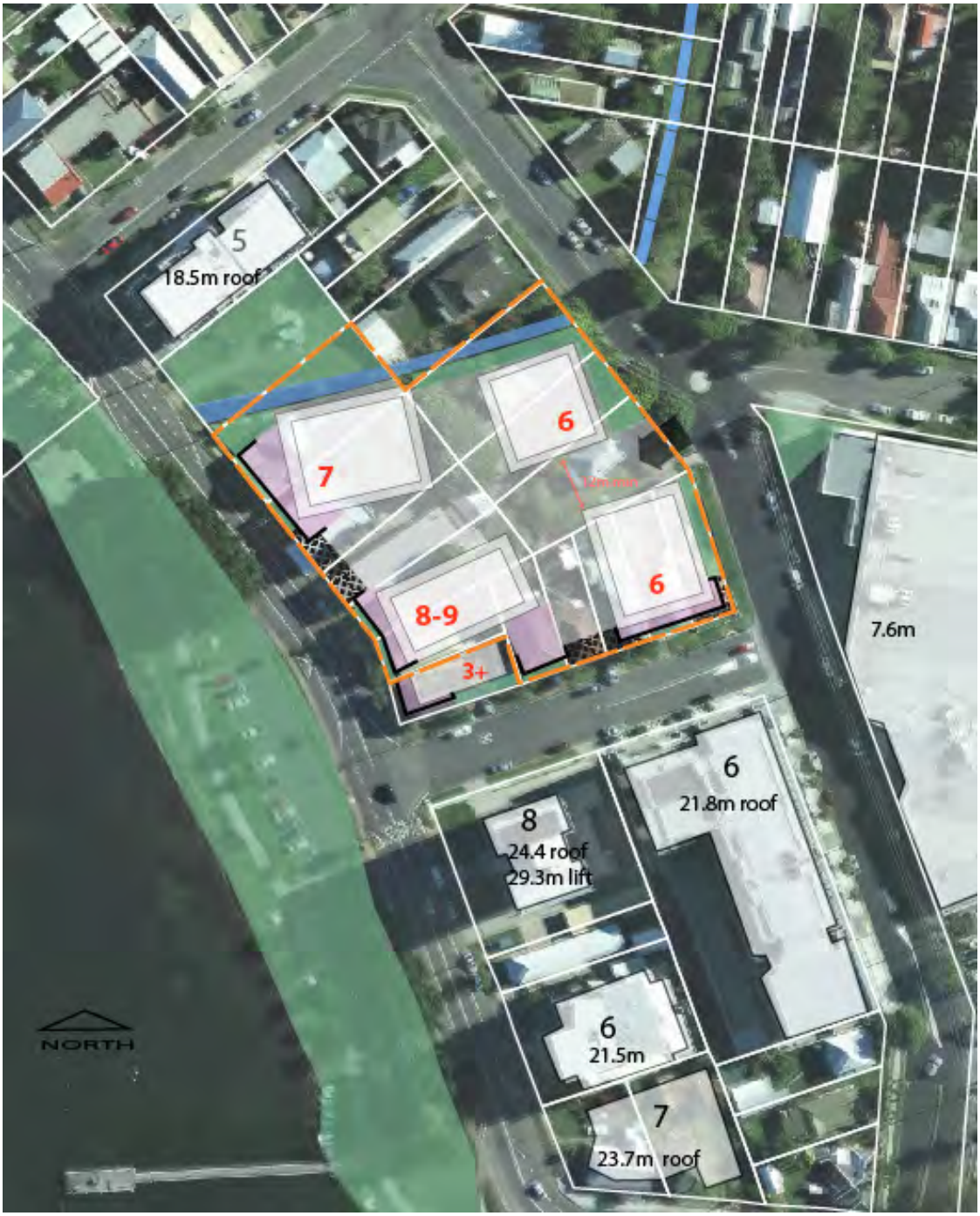
Belmont Towers has a roof height of 24.4m AHD with central lift overrun structure. The lake building frontage is approximately 22m.

The subject Site could reasonably support 8-9 storeys close to Sharp St and height should reduce going north to integrate with the Santorini development on the corner of Brooks Parade and Maude St. This more northern building could have a wider facade.

Whilst new development will not overshadow the adjoining undeveloped sites to the north, shadow analysis at DA stage would be necessary to determine the impacts of the proposed northern towers on the sunlight access of new apartments in the towers along the southern boundary of the Site.



Building Bulk: Belmont Towers as the reference point for visual bulk**.**



Building Height

Note:

Setbacks for upper levels of each tower will be guided by the SEPP65 RFDC requirements under Primary Development Controls for Building Separation.

Provisions for Future Development of the Isolated Lot

It may not be possible to reach an agreement with the owner of the property on the corner of Brooks Parade and Sharp Street to amalgamate this site into the overall site and that this property may become an isolated site.

If this occurs, then it will be unreasonable to meet the 12mbuilding separation between habitable floor space as set out to in RFDC.

However the RFDC stipulates that for levels 1-4 a separation of 6m is adequate between non-habitable rooms. This would serve as a reasonable guide for addressing the boundary between 44 Brooks and the subject Site.

At ground level a potential solution would be to permit both sites to be developed to the EW site boundary and allow for future connection of commercial trading space fronting Brooks Pde.

The design of the current proposal should consider:

- Future basement parking link to 44 Brooks
- Building to boundary on EW boundary with 44 Brooks on the ground level (with no windows or openings to this elevation)
- Setback of 3m for level 2 and above
- Future connection of front terrace level at Brooks Pde

A proposal for the successful future development of the isolated lot would considered as part of the merit assessment of a DA.

Landscape on Podium

The desired character is for separate buildings, with green areas between.

RESPONSE

Use landscape mounding and generous areas of mass planting to establish amenity, and privacy, ameliorate impact of large paved areas, manage pedestrian flows and reinforce character.

The landscape design would need to be justified at the time a design is considered by Council.



Landscape on Podium

3D MODEL OF BUILDING ENVELOPES



Area Plan 2012 Building Envelopes



Envelopes proposed in this review

MATTERS TO BE ADDRESSED AT DA STAGE

Vehicle access

DCP highlights primary active street frontages and vehicle access is not preferred on Sharp St or Brooks Pde.

Pedestrian Access /linkages through site

Prefer pedestrians to use streets and public access is only required for access to commercial areas.

Ground floor uses on Sharp St and Brooks Pde

LEP and DCP require commercial uses on both these frontages.

Apartment size mix

The DCP requires a mix of apartment sizes based on market demand and providing housing mix to meet community needs.

Public transport

A bus stop is located on Brooks Pde and public transport facilities should be integrated with ground floor uses and access.

Proposed building character and materials

RFDC provides adequate guidance on building articulation, modulation, treatment of balconies.

Detail of materials to be considered in Stage 2 of the DA.

CONCLUSIONS

In order to support a reasonable yield on the subject site and maintain the concept and character of 4 towers with separation in an east-west and north-south direction it is necessary to relax the requirements for a larger building gap in an E-W direction.

To deliver a viable development it may also be necessary to consider additional height provided that this is located close to the Brooks Pde and Sharp St corner.

It was agreed that there is a tension between the number of parking spaces (that determines the size of the parking basement) and the area available for deep soil planting and the subsequent impacts on streetscape. Given the high amenity streetscape and the visual sensitivity of the site and the desired future streetscape outcomes, deep soil planting and streetscape issues should take precedence over providing parking that exceeds the DCP requirements.

Coeve Design maintain that in this location the market currently demands parking above the parking rate requirements in the DCP. Coeve design state that if parking was provided at the rate set out in the DCP there would be parking impacts on surrounding streets and other nearby carparks, as residents who do not have a parking spot in the development seek other alternative parking locations.

Notwithstanding the view of Coeve Design, parking provision in excess of the DCP is not advocated in this review where it negatively affects desired deep soil planting and streetscape outcomes. If additional parking is proposed an application would need to address any adverse impacts of basement bulk, basement walls fronting the street and restriction of deep soil planting areas on the desired streetscape.

To allow efficient basement design the quantum of deep soil planting could be reduced to 7-8% of site area, provided this is offset by larger scale planting in available areas, extensive podium planting and larger scale street tree planting.

SUMMARY OF RECOMMENDATIONS

In summary, the conclusions of this review are that Concept Plan could reasonably include the following variations to the Area Plan controls for the purpose of a merit assessment provided that the proposal addressed any adverse impacts identified in this review.:

- Reduced setback to 0m for north western half of site fronting drainage channel.
- Reduced setback to both street elevations for the tower at corner of Sharp and Edgar St and the Edgar St elevation of the NE tower.
- Setback of minimum 2m to basement wall. Greater setback should be provided to meet deep soil requirements.
- Building separation that meets the RFDC recommendations as opposed to the larer Area Plan separation required for the E-W direction. Deep soil area in the vicinity of 7% and 8% of site area that could support larger scale planting combined with larger scale planting on podium.
- Additional height to both towers fronting Brooks Pde.

NEXT STEPS

To proceed to a Concept Plan proposal being considered by Council that takes advantage of the variations detailed in this review, 2 options have been identified each with certain risks and implications.

OPTION 1

Generally a Concept Plan and Stage 1 DA could be considered within the provisions of the existing Belmont Area Plan and Town Centres DCP guidelines for Concept Plan sites with the variations cited above. The proposal would need to demonstrate the social and economic benefits of the development for the town centre of Belmont and the Brooks Pde precinct and how development would align with the desired future streetscape character..

Option 1 carries the risk of adverse community and Councillor response to a development application with additional height and variations that differ from the current Area Plan, even where the proposal demonstrates the social and economic benefits of the development for the town centre of Belmont.

OPTION 2

Prepare an amended Area Plan and seek Council resolution to place a draft Belmont Area Plan on public exhibition.

Option 2 involves more time and associated cost implications. An adverse community and councillor response to extra height is also possible in this option, but allows better opportunity to address these concerns.

KML Joint Venture

Proposed Residential and Retail Mixed Use Development, Belmont

LGA: Lake Macquarie

Aboriginal Heritage Due Diligence Assessment

1 February 2018

McCARDLE CULTURAL HERITAGE PTY LTD

ACN 104 590 141 • ABN 89 104 590 141

PO Box 166, Adamstown, NSW 2289
Mobile: 0412 702 396 • Fax: 4952 5501 • Email: mcheritage@iprimus.com.au

McCARDLE
CULTURAL HERITAGE

Report No: J07022	
Approved by:	Penny McCardle
Position:	Director
Signed:	
Date:	1 February 2018

This report has been prepared in accordance with the scope of services described in the contract or agreement between McCardle Cultural Heritage Pty Ltd (MCH), ACN: 104 590 141, ABN: 89 104 590 141, and KML Joint Venture. The report relies upon data, surveys, measurements and specific times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by and KML Joint Venture. Furthermore, the report has been prepared solely for use by and KML Joint Venture and MCH accepts no responsibility for its use by other parties.

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EXECUTIVE SUMMARY

McCardle Cultural Heritage Pty Ltd (MCH) was commissioned by KML Joint Venture to undertake an Archaeological Due Diligence Assessment for the proposed a residential and retail mixed use development including the demolition of the existing buildings at 32-44 Brooks parade, 2-10 Sharp Street and 5-11 Edgar Street, Belmont. The project entails the proposed a residential and retail mixed use development including the demolition of the existing buildings at 32-42 Brooks parade, 2-10 Sharp Street & 5-11 Edgar Street, Belmont.

The project area is situated on the banks of Lake Macquarie which would have provided a range of subsistence resources for past Aboriginal people and hance camping in the local area. However, land uses include residential development and retail business throughout the entire project area, resulting in a highly disturbed landscape.

A search of the OEH AHIMS register (Annex A) indicate there are has shown that 20 known Aboriginal sites are currently recorded within five kilometres of the project area including 13 artefact sites, three shell/artefact sites and one each of scar tree, shell, PAD, and shell/artefact/stone arrangement.

Due to the significant disturbances across the entire project area for residential development, no sites were predicted to be present within the project area. Sites types that may have occurred prior to development were likely to have included artefact scatters, isolated finds and/or shell middens.

The results of the survey indicated high visibility (50%) and exposures (100%) resulting in an effective coverage of 50%. No sites or PADs were identified and this was likely due to the high levels of disturbances and impacts for past residential development across the project area. The following recommendations were made:

1) The persons responsible for the management of onsite works will ensure that all staff, contractors and others involved in construction and maintenance related activities are made aware of the statutory legislation protecting sites and places of significance. Of particular importance is the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010, under the National Parks and Wildlife Act 1974;

2) If any Aboriginal objects are uncovered during construction works, works must cease in that location immediately and the Environmental Line notified (131 555).

GLOSSARY

Aboriginal Site: an Aboriginal site is the location of one or more Aboriginal archaeological objects, including flaked stone artefacts, midden shell, grinding grooves, archaeological deposits, scarred trees etc.

Artefact: any object that is physically modified by humans.

Artefact scatter: a collection of artefacts scattered across the surface of the ground (also referred to as open camp sites).

Assemblage: a collection of artefacts associated by a particular place or time, assumed generated by a single group of people, and can comprise different artefact types.

Background scatter: a term used to describe low density scatter of isolated finds that are distributed across the landscape without any obvious focal point.

Contact site: a site that displays interaction between early colonists and Aboriginal Australians.

Debitage: small pieces of stone debris that break off during the manufacturing of stone tools. These are usually considered waste and are the by product of production (also referred to as flake piece).

Formation processes: human caused (land uses etc) or natural processes (geological, animal, plant growth etc) by which an archaeological site is modified during or after occupation and abandonment. These processes have a large effect on the provenience of artefacts or features.

Harm: is defined as an act that may destroy, deface or damage an Aboriginal object or place. In relation to an object, this means the movement or removal of an object from the land in which it has been situated

Stratified Archaeological Deposits: layers detected within the soil or sediments that are attributable to separate depositional events in the past, the deposit is said to be stratified. The integrity of sediments and soils are usually affected by 200 years of European settlement and activities such as land clearing, cultivation and construction of industrial, commercial and residential developments.

Taphonomy: the study of processes which have affected organic materials such as bone after death; it also involves the microscopic analysis of tooth-marks or cut marks to assess the effects of butchery or scavenging activities.

Typology: the systematic organization of artefacts into types on the basis of shared attributes.

ACRONYMS

ACHMP	Aboriginal Cultural Heritage Management Plan
AHIMS	Aboriginal Heritage Information Management System. Data base of recorded sites across NSW managed by OEH
OEH	Office of Environment and Heritage

OEH AHIMS SITE ACRONYMS

ACD	Aboriginal ceremonial and dreaming
AFT	Artefact (stone, bone, shell, glass, ceramic and metal)
ARG	Aboriginal resource and gathering
ART	Art (pigment or engraving)
BOM	Non-human bone and organic material
BUR	Burial
CFT	Conflict site
CMR	Ceremonial ring (stone or earth)
ETM	Earth mound
FSH	Fish trap
GDG	Grinding groove
HAB	Habitation structure
HTH	Hearth
OCQ	Ochre quarry
PAD	Potential archaeological deposit.
SHL	Shell
STA	Stone arrangement
STQ	Stone quarry
TRE	Modified tree (carved or scarred)
WTR	Water hole

1 INTRODUCTION

1.1 INTRODUCTION

McCardle Cultural Heritage Pty Ltd (MCH) has been commissioned by KML Joint Venture to undertake an Archaeological Due Diligence Assessment for the proposed a residential and retail mixed use development including the demolition of the existing buildings at 32-44 Brooks parade, 2-10 Sharp Street and 5-11 Edgar Street, Belmont. The assessment has been undertaken to meet the NSW Office of Environment and Heritage (OEH), Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW 2010), the OEH Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH 2011), the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW and the brief.

The purpose of a due diligence assessment is to assist proponents to exercise due diligence when carrying out activities that may harm Aboriginal objects or Aboriginal places and to determine whether that should apply for a consent to harm Aboriginal objects or Places through an Aboriginal Heritage Impact Assessment (AHIP). The purpose of this due diligence report is to demonstrate that all reasonable and practicable measures have been undertaken to prevent harm to any Aboriginal objects and/or place within the project area. This report has met the requirements and considered the relevant environmental and archaeological information, the project land condition, the nature of the proposed development activity and impacts, as well as preparing appropriate recommendations.

1.2 THE PROJECT AREA

The project area (Figures 1.1 to 1.3) is located approximately 800 metres south of Redhead, NSW. Including 32-44 Brooks parade, 2-10 Sharp Street and 5-11 Edgar Street, Belmont, the western boundary backs onto Belmont Bay, the southern onto Sharp St, the eastern onto Edgar Street and the northern residential property.

Figure 1.1 Regional location of the project area

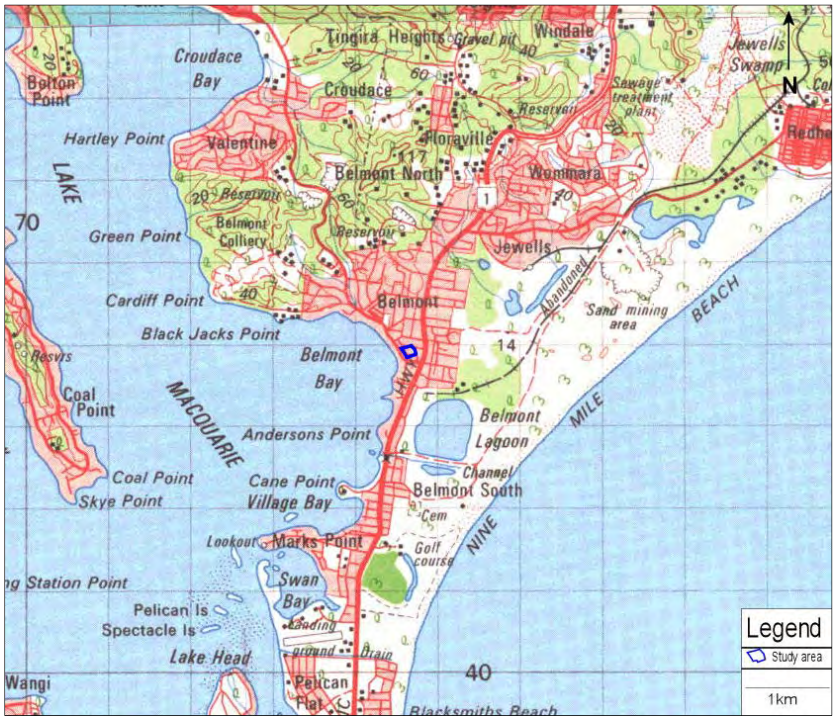


Figure 1.2 Local location of the project area



Figure 1.3 Aerial location of the project area



1.3 DESCRIPTION OF THE PROPOSED DEVELOPMENT

The project entails the proposed a residential and retail mixed use development including the demolition of the existing buildings at 32-44 Brooks parade, 2-10 Sharp Street & 5-11 Edgar Street, Belmont.

1.4 OBJECTIVES OF THE DUE DILIIGENCE ASSESSMENT

The objectives and primary tasks of this due diligence assessment were to:

- Undertake a search of the OEH Aboriginal Heritage Management System (AHIMS) and other relative registers;
- Undertake preliminary research into the environmental and archaeological contexts of the project area;
- Develop a predictive model of site location for the project area;
- Undertake a field survey of the project area;
- Assess the potential impacts of the proposed development on any identified Aboriginal sites or potential archaeological deposits (PADs) identified within the project area;
- Assess the scientific significance of any identified Aboriginal objects or sites identified within the project area;
- Complete and submit site cards to the OEH for any Aboriginal sites identified; and
- Provide appropriate recommendations.

1.5 LEGISLATIVE CONTEXT

The following overview of the legislative framework, is provided solely for information purposes for the client, and should not be interpreted as legal advice. MCH will not be liable for any actions taken by any person, body or group as a result of this general overview and MCH recommends that specific legal advice be obtained from a qualified legal practitioner prior to any action being taken as a result of the general summary below.

Land managers are required to consider the affects of their activities or proposed development on the environment under several pieces of legislation. Although there are a number of Acts and regulations protecting Aboriginal heritage, including places, sites and objects, within NSW, the three main ones include:

- National Parks and Wildlife Act (1974, as amended)
- National Parks and Wildlife Regulation (2009)
- Environmental Planning and Assessment Act (1979)

1.5.1 NATIONAL PARKS AND WILDLIFE ACT (1974, AS AMENDED)

The National Parks and Wildlife Act (1974), Amended 2010, is the primary legislation for the protection of Aboriginal cultural heritage in New South Wales. The NPW Act protects Aboriginal heritage (places, sites and objects) within NSW and the Protection of Aboriginal heritage is outlined in s86 of the Act, as follows:

- "A person must not harm or desecrate an object that the person knows is an Aboriginal object" s86(1)
- "A person must not harm an Aboriginal object" s86(2)

- "A person must not harm or desecrate an Aboriginal place" s86(4)

Penalties apply for harming an Aboriginal object, site or place. The penalty for knowingly harming an Aboriginal object (s86[1]) and/or an Aboriginal place (s86[4]) is up to $550,000 for an individual and/or imprisonment for 2 years; and in the case of a corporation the penalty is up to $1.1 million. The penalty for a strict liability offence (s86[2]) is up to $110,000 for an individual and $220,000 for a corporation.

Harm under the National Parks and Wildlife Act (1974, as amended) is defined as any act that; destroys defaces or damages the object, moves the object from the land on which it has been situated, causes or permits the object to be harmed. However, it is a defence from prosecution if the proponent can demonstrate that;

1) harm was authorised under an Aboriginal Heritage Impact Permit (AHIP) (and the permit was properly followed), or
2) the proponent exercised due diligence in respect to Aboriginal heritage.

The 'due diligence' defence (s87[2]), states that if a person or company has applied due diligence to determine that no Aboriginal object, site or place was likely to be harmed as a result of the activities proposed for the Project Area, then liability from prosecution under the NPW Act 1974 will be removed or mitigated if it later transpires that an Aboriginal object, site or place was harmed. If any Aboriginal objects are identified during the activity, then works should cease in that area and OEH notified (DECCW 2010:13). The due diligence defence does not authorise continuing harm.

The archaeological due diligence assessment and report has been carried out in compliance with the NSW OEH 2010 Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW.

1.5.2 NATIONAL PARKS AND WILDLIFE REGULATION (2009)

The National Parks and Wildlife Regulation 2009 provides a framework for undertaking activities and exercising due diligence in respect to Aboriginal heritage. The Regulation (2009) recognises various due diligence codes of practice, including the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW which is pertinent to this report, but it also outlines procedures for Aboriginal Heritage Impact Permit (AHIP) applications and Aboriginal Cultural Heritage Consultation Requirements (ACHCRs); amongst other regulatory processes.

1.5.3 ENVIRONMENTAL PLANNING & ASSESSMENT ACT 1979 (EP&A ACT)

EP&A Act establishes the statutory framework for planning and environmental assessment in NSW and the implementation of the EP&A Act is the responsibility of the Minister for Planning, statutory authorities and local councils. The EP&A Act contains three parts which impose requirements for planning approval:

- Part 3 of the EP&A Act relates to the preparation and making of Environmental Planning Instruments (EPIs), State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs).
- Part 4 of the EP&A Act establishes the framework for assessing development under an environmental planning instrument (EPI). The consent authority for Part 4 development is generally the local council, however the consent authority may by the Minister, the Planning Assessment Commission or a joint regional planning panel depending upon the nature of the development.

- Part 4, Division 4.1 of the EP&A Act establishes the assessment pathway for State significant development (SSD) declared by the State Environmental Planning Policy (State and Regional Development) 2011 (NSW). Once a development is declared as SSD, the Director-General will issue Director-General Requirements (DGRs) outlining what issues must be considered in the EIS.
- Part 5 of the EP&A Act provides for the control of 'activities' that do not require development consent and are undertaken or approved by a determining authority. Development under Part 5 that are likely to significantly affect the environment is required to have an EIS prepared for the proposed activity.
- Part 5.1 of the EP&A Act establishes the assessment pathways for State significant infrastructure (SSI). Development applications made for SSI can only be approved by the Minister. Once a development is declared as SSI, the Director-General will issue DGRs outlining what issues must be addressed in the Environmental Impact Statement (EIS).

The applicable approval process is determined by reference to the relevant environmental planning instruments and other controls, LEPs and State Environmental Planning Policies (SEPPs). This project falls under Part 4.

1.6 ABORIGINAL COMMUNITY CONSULTATION

A due diligence assessment relates to the physical identification of Aboriginal objects, sites and places. Community consultation is only required once Aboriginal objects, sites or places have been identified and an Aboriginal Heritage Impact Permit (AHIP) is deemed necessary. Section 5.2 of the 2010 Due Diligence Code of Practice for the protection of Aboriginal Objects in NSW specifically states that;

> *'consultation with the Aboriginal community is not a formal requirement of the due diligence process' (2010:8).*

1.7 QUALIFICATIONS OF THE INVESTIGATOR

Penny McCardle: Principal Archaeologist/Forensic Anthropologist has 15 years experience in Indigenous archaeological assessments, excavation, research, reporting, analysis and consultation. Twelve years in skeletal identification, biological profiling and skeletal trauma identification.

- BA (Archaeology and Palaeoanthropology, University of New England 1999
- Hons (Archaeology and Palaeoanthropology): Physical Anthropology), University of New England 2001
- Forensic Anthropology Course, University of New England 2003
- Armed Forces Institute of Pathology Forensic Anthropology Course, Ashburn, VA 2008
- Analysis of Bone trauma and Pseudo-Trauma in Suspected Violent Death Course, Erie College, Pennsylvania, 2009
- Currently completing a PhD, University of Newcastle, 2018

1.8 REPORT STRUCTURE

The report includes Section 1 which outlines the project, Section 2 presents the environmental and archaeological context, Section 3 provides the results and discussion, Section 4 presents the Impact Assessment, Section 5 discusses the mitigation measures and Section 6 provides the management recommendations.

2 ENVIROMNEMATLAND ARCHAEOLOGICAL CONTEXT

The archaeological due diligence process and assessment requires that the available knowledge and information in relation to the environmental and archaeological contexts is considered. The purpose of this is to assist in identifying whether Aboriginal objects, sites or places are likely to be present within the project area based on archaeological predictive modelling and in what condition they may be found in given the environmental impacts.

2.1 LOCAL ENVIRONMENT

Past site location and land use are closely linked to the environment including the landform, geology, geomorphology, soils, waterways and associated resources. The environmental context is important to identify potential factors relating to past Aboriginal land use patterns. The project area is situated on the banks of Lake Macquarie, specifically Belmont Bay and its available subsistence resources.

European settlers extensively cleared the original native vegetation in the 1800's and since then the investigation area has been subject to significant works associated with residential development, drainage works, road works and associated utilities and infrastructure which would have significantly impacted on any cultural materials that may have been present. Additional disturbances would have derived from natural processes including flooding and erosion. Additionally, bioturbation processes such as the redistribution and mixing of cultural deposits occurs as a result of burrowing and mounding by earthworms, ants and other species of burrowing animals. Artefacts can move downwards through root holes as well as through sorting and settling due to gravity, and translocation can also occur as a result of tree falls (Balek 2002; Peacock and Fant 2002:92).

The project area is located within an environment that provided subsistence resources, including sea food, fauna, flora and water that would have allowed for sustainable occupation of the area. However, in relation to modern alterations to the landscape, the use of the project area for residential development can be expected to have had significantly high impacts upon the archaeological record.

2.2 ARCHAEOLOGICAL CONTEXT

A review of the archaeological literature of the region, and more specifically the Lake Macquarie area and the results of a OEH AHIMS search provide essential contextual information for the current assessment.

2.2.1 OEH ABORIGINAL HERITAGE INFORMATION MANAGEMENT SYSTEM (AHIMS)

It must be noted that there are many limitation with an AHIMS search including incorrect site coordinates due to errors and changing of computer systems at OEH over the years that failed to correctly translate old coordinate systems to new systems. Secondly, OEH will only provide up to 110 sites per search, thus limiting the search area surrounding the project area and enabling a more comprehensive analysis and finally, few sites have been updated on the OEH AHIMS register to notify if they have been subject to a s87 or s90 and as such what sites remain in the local area and what sites have been destroyed, to assist in determining the cumulative impacts, is unknown. In addition to this, other limitations include the number of studies in the local area, high levels of erosion have proven to disturb sites, site contents, and the extent of those disturbances is unknown. Thus the OEH AHIMS search is limited and provides a basis only that aids in predictive modelling.

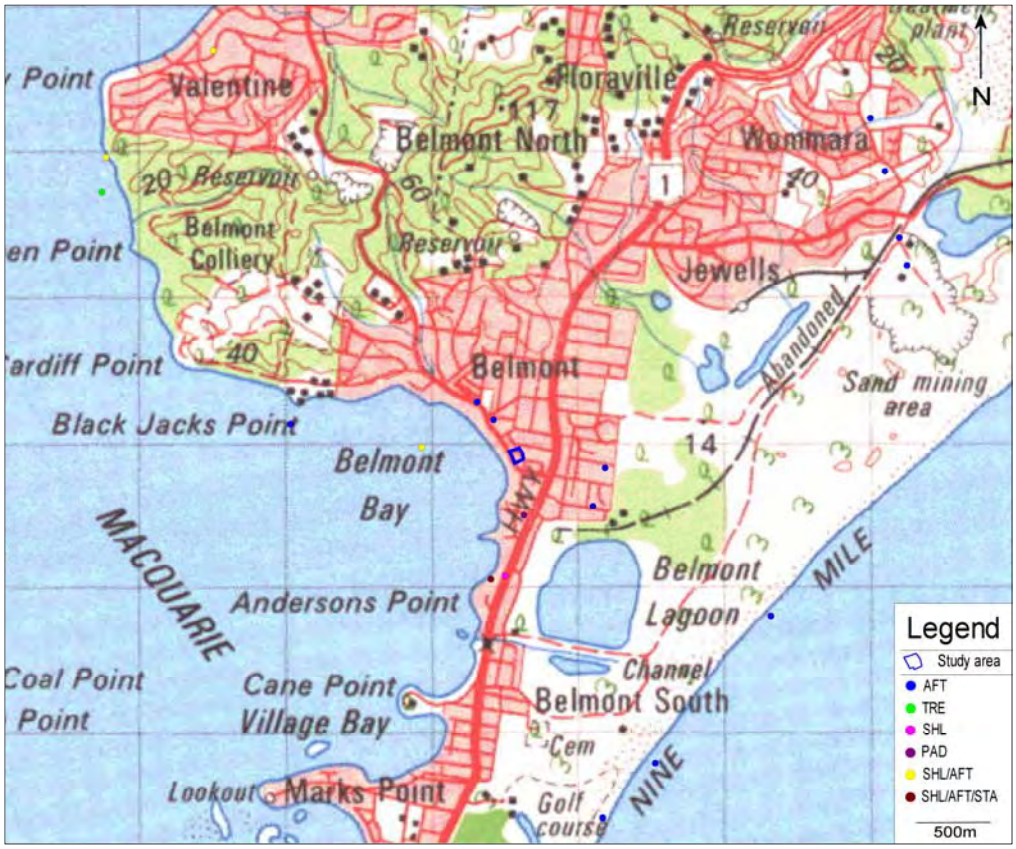
A search of the OEH AHIMS register (Annex A) indicate there are has shown that 20 known Aboriginal sites are currently recorded within five kilometres of the project area (Table 2.1 and

Figure 2.1). There are no Aboriginal Places that have been declared within the 3km radius search area and there are no sites registered within the project area.

Table 2.1 Summary of AHIMS results

Site Type	Frequency	Percent
AFT	13	65%
TRE	1	.5%
SHL	1	.5%
PAD	1	.5%
SHL/AFT	3	15%
SHL/AFT/STA	1	.5%
Total	**20**	**100%**

Figure 2.1 Known sites



2.2.2 HERITAGE REGISTER LISTINGS

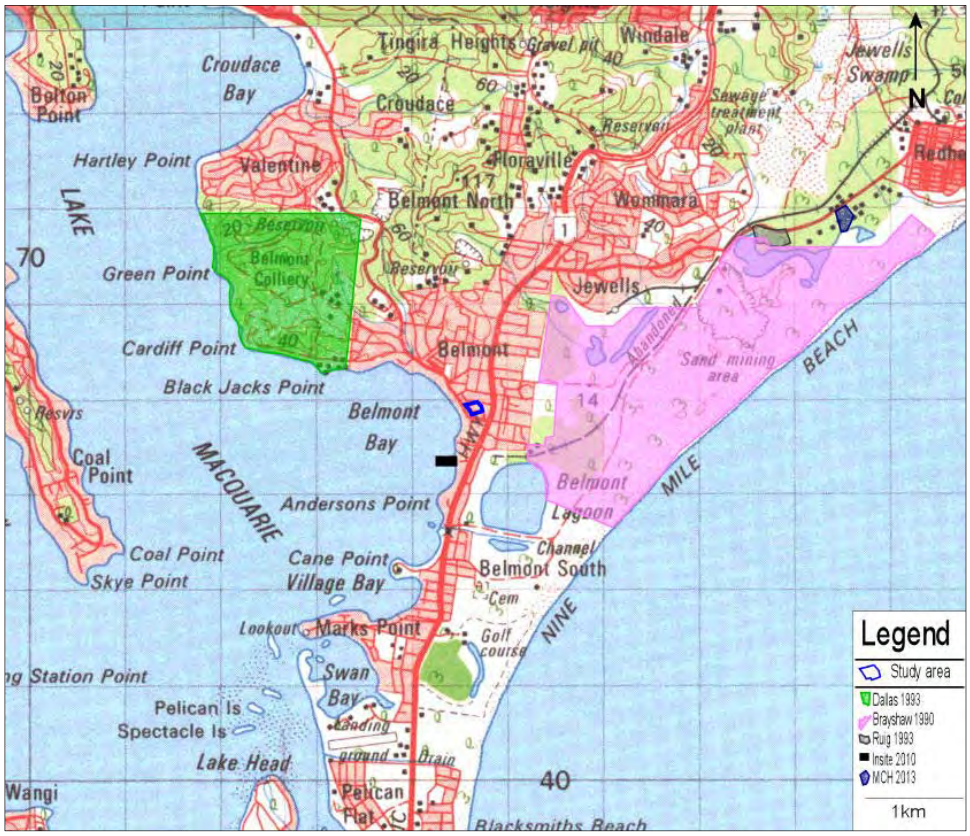
The State Heritage Register and Inventory, the national heritage List, The National Trust Register, the Commonwealth Heritage List and the Lake Macquarie Local Environmental Plan have no Aboriginal objects, sites or places listed.

2.2.3 SUMMARY OF THE ARCHAEOLOGICAL CONTEXT

The most relevant investigations from across the Lake Macquarie area indicate differing results and observations based on surface visibility and exposure, alterations to the landscape (including

mining, industrial and residential development), proximity to water sources and geomorphology. The following summary, is derived from a review of the investigations available from OEH and provides the archaeological context in terms of site location and distribution. These investigations were identified trough the AHIMS search and include Dallas (1993), Brayshaw (1990), Ruig (1993), Insite (2010) and MCH (2013). A detailed summary of these assessments is provided in Annex B and their location in Figure 2.2.

Figure 2.2 Previous studies



By far, the highest numbers of sites are located within 50 metres of a water source, in particular Lake Macquarie. These sites, shell middens, indicate a wide use of the Lake. The surrounding area includes sites such as artefact scatters, isolated finds, grinding grooves and art and a number of sites in reduced numbers and densities. Raw materials are predominantly chert, tuff (also called indurated mudstone by some), silcrete and quarts. Stone artefacts are predominantly flake pieces, broken flakes, flakes, cores and reduced numbers of tools. Shell types typically identified in shell middens include cockle and oyster with reduced numbers of other species. The vast majority of artefactual material in the region was observed on exposures with good to excellent ground surface visibility. The likelihood of finding artefacts surrounding these exposures is reduced due to poor visibility. The Lake Macquarie regional archaeology of the area can be summarised as follows:

- the likelihood of locating sites increases with proximity to water;
- the likelihood of finding large sites increases markedly with proximity to water;

- a variety of raw materials will be represented though the majority of sites will include tuff/mudstone, chert, silcrete and quartz;
- a variety of artefact types will be located though the majority will be flakes, flaked pieces and debitage;
- grinding grooves will be located along or near water sources;
- shell middens will be present along the fore shore;
- the likelihood of finding scarred trees is dependent on the level of clearing in an area' and
- the majority of sites will be subject to disturbances including human and natural.

2.3 SYNTHESIS OF ENVIRONMENTAL AND ARCHAEOLOGICAL CONTEXTS

The site types identified throughout the area appear to be either low density/small occupation activities or sites that were associated with more secular activities. The broader landform assessment also suggests that larger sites indicative of larger camping groups may be located along Lake Macquarie fore shore due to available room and proximity to readily available resources of the lake. Other unsuitable locations, such as steep slopes, would have been limited in space and have uneven surfaces where by large scale habitation is not possible, but may have been utilised as activity areas away from the main camp. Based on information gained from previous studies, both regionally and locally, within a five kilometre radius of the project area, it can be expected that:

- the likelihood of locating sites increases with proximity to available water; either creeks/rivers or Lake Macquarie;
- the likelihood of finding large sites increases markedly with proximity to reliable water;
- grinding grooves will be located along or near water sources;
- a variety of stone artefact types will be located though the majority will be flakes, flaked pieces and debitage;
- a variety of raw materials utilised in stone tool manufacture will be represented, though the majority of sites will be predominated by tuff/mudstone, chert and silcrete;
- the likelihood of finding scarred trees is dependent on the level of clearing in an area; and
- the majority of sites will be subject to disturbances including human and natural.

Relating specifically to the project are, the level of clearing and historic use of the area limits the potential for Aboriginal sites to be located within the project area.

2.4 PREDICTIVE MODEL FOR THE PROJECT AREA

An archaeological predictive model is established to identify areas of archaeological sensitivity so it can be used as a basis for the planning and management of Aboriginal heritage. It involves reviewing existing literature to identify basic site distribution patters. These patterns are then modified according to the specific environment of the project area to form a predictive model for site location within the specific project area. A sampling strategy is then used to test the model and the results of the survey used to confirm, refute or modify the model.

Land systems and environmental factors are commonly used factors in predictive modelling based on the assumption that they provide distinctive sets of constraints and opportunities that influenced past Aboriginal land use patterns. As land use patterns may differ between zones (due to different

environmental conditions), this may result in the physical manifestation of different spatial distributions and forms of archaeological evidence. The predictive model presented here is based on the following information;

- Landform units;
- Previous archaeological assessments conducted within the region;
- Distribution of known sites and site densities; and
- Traditional Aboriginal land use patterns.

Also taken into consideration are land use impacts (both natural and anthropomorphic) that may have resulted in a disturbed landscape and associated archaeological record. However, these assumptions may only be clarified during survey and the model updated accordingly if needed.

No sites are predicted to be present within the project area due to the high impacts form previous land uses.

Brief descriptions of the site types that may have occurred occur in the project prior to land uses are presented below.

- **Artefact scatters**

Also described as open campsites, artefact scatters and open sites, these deposits have been defined at two or more stone artefacts within 50 metres of each other and will include archaeological remains such as stone artefacts and may be found in association with camping where other evidence may be present such as shell, hearths, stone lined fire places and/or heat treatment pits. These sites are usually identified as surface scatters of artefacts in areas where ground surface visibility is increased due to lack of vegetation. Erosion, agricultural activities (such as ploughing, grazing) and access ways can also expose surface campsites. Artefact scatters may represent evidence of;

- Large camp sites, where everyday activities such as habitation, maintenance of stone or wooden tools, manufacturing of such tools, management of raw materials, preparation and consumption of food and storage of tools has occurred;
- Medium/small camp sites, where activities such as minimal tool manufacturing occurred;
- Hunting and/or gathering events;
- Other events spatially separated from a camp site, or
- Transitory movement through the landscape.

Artefact scatters are a common site type in the local locality and the broader region. However, due to the significant landuses and associated impacts across the project area from development and infrastructure, there is low to no potential for artefact scatters to occur within the project area.

- **Isolated finds**

Isolated artefacts are usually identified in areas where ground surface visibility is increased due to lack of vegetation. Erosion, agricultural activities and access ways can also expose surface artefacts. Isolated finds may represent evidence of;

- Hunting and/or gathering events; or
- Transitory movement through the landscape.

Isolated finds are a common site type in the local locality and the broader region. However, due to the significant landuses and associated impacts across the project area from development and infrastructure, there is low to no potential for artefact scatters to occur within the project area.

- **Shell middens**

Middens result from seasonal camping and exploitation of oysters and freshwater mussels. Extended camping results in the deposition of a feature that is distinguishable from a natural shell layer. This includes the inclusion of burnt or blackened shell, non-molluscan fauna, dis-articulated bivalves, charcoal, burnt wood, hearth stones, stone artefacts and stratification. Middens are usually found on the coast and on the shorelines of estuaries, lakes and inland rivers. Although sometimes identified on ridges, these middens tend to be less extensive than those close to the resource base. Smaller lenses of shell deposition also occur close to water. Shell middens may represent evidence of;

- Large camp sites, where everyday activities such as habitation, maintenance of stone or wooden tools, manufacturing of such tools, management of raw materials, preparation and consumption of food and storage of tools has occurred;
- Medium/small camp sites, where activities such as a small meal was cooked and/or consumed;
- Hunting and/or gathering events;
- Other events spatially separated from a camp site, or
- Transitory movement through the landscape.

Shell middens are a common site type in the local locality and the broader region. However, due to the significant landuses and associated impacts across the project area from development and infrastructure, there is low to no potential for artefact scatters to occur within the project area.

3 RESULTS AND DISCUSSION

To comply with the due diligence requirement that a visual inspection of the project area was undertaken, an archaeological survey across the project area was undertaken by MCH archaeologist Penny McCardle on 17 March 2017. The survey focused on areas of high ground surface visibility and exposures (erosional features and cleared areas).

The project, surveyed in its entirety, included one survey unit (SU) that was based on the disturbed landform that encompassed the entire project area. The project area is currently residential and retail (coffee shop). Being highly disturbed through construction works associated with such developments, the project area consisted of numerous buildings, driveways and associated infrastructure. Exposures were high (100%) due to the residential development across the entire project area and visibility was also high (40%) due to erosion and gardening throughout the residential front and back yards. The effective coverage for the project area was 50% with grass being the limiting factor. Figures 3.1 and 3.2 provide examples of the survey unit.

Figure 3.1 8 Sharp St, backyard facing north



Figure 3.2 9 Edgar St, yard



The level and nature of the effective survey coverage is considered satisfactory to provide an effective assessment of the Aboriginal sites identified and those potentially present within the investigation area. The coverage was comprehensive for obtrusive site types (e.g. grinding grooves and scarred trees) and less obtrusive surface stone artefact sites.

No archaeological sites or Potential Archaeological Deposits (PADs) were identified. This is likely due to the high levels of impacts from previous excavation/fill construction works associated with residential building and associated infrastructure.

As no sites were identified it is not possible to discuss the local and regional archaeological patterning, not reassess the predictive model.

3.1 CONCLUSION

Sites provide valuable information about past occupation, use of the environment and its specific resources including diet, raw material transportation, stone tool manufacture, and movement of groups throughout the landscape.

Proximity to water was an important factor in past occupation of the area, with sites reducing in number significantly away from water with most sites located within 50 metres of water. The surrounding area contains no raw materials that are typically used in the manufacture of stone tools, and as such it can be assumed that any artefacts identified would be of materials traded and/or transported from other locations. The access to water close by would have provided the necessary resources for sustained occupation of the area.

Whilst the project area is located within an environment that provided resources, including fauna, flora and water, that would have allowed for sustainable occupation of the area, construction works across the entire project area would have displaced and/or destroyed any cultural materials that may have been present.

4 ASSESSMENT OF IMPACTS

The archaeological record is a non-renewable resource that is affected by many processes and activities. As outlined in Section 2 and Section 3, the various natural processes and human activities have impacted on archaeological deposits through both site formation and taphonomic processes.

4.1 IMPACTS

The OEH Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales (2010:21) describes impacts to be rated as follows:

1) Type of harm: is either direct, indirect or none
2) Degree of harm is defined as either total, partial or none
3) Consequence of harm is defined as either total loss, partial loss, or no loss of value

As no sites or PADs were identified due to the highly disturbed nature of the project area there are no impacts to the archaeological record.

4.2 CUMULATIVE IMPACTS

The cumulative impact to Aboriginal heritage in the area is nil given that:

- The net development footprint (i.e. the area of direct impact) is small and does not affect a high proportion of any particular landform present within the region;
- A comparable suite of landforms that are expected to, and do contain a similar archaeological resource occur in multiple contexts both within the local area and throughout the Lake Macquarie area;
- The high density deposits identified to date occur outside the development footprint;
- The placement of the development within this area, in particular within the disturbed context, ensures the cumulative impacts are focused in the areas of no archaeological potential and therefore are kept to a minimum.

Mitigation measures to minimise these impacts are outlined in the following chapter.

5 MITIGATION AND MANAGEMENT STRATEGIES

Specific strategies, as outlined through the DECCW (2010b) Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW 2010b), the Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH 2011), and the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (DECCW 2010c), are considered below for the management of the identified site within the project area.

5.1 CONSERVATION/PROTECTION

Conservation is the first avenue and is suitable for all sites, especially those considered high archaeological significance and/or cultural significance. Conservation includes the processes of looking after an indigenous site or place so as to retain its significance and are managed in a way that is consistent with the nature of peoples' attachment to them.

No sites or PADs were identified and as such conservation/protection is not required.

5.2 FURTHER INVESTIGATION

An Aboriginal Heritage Impact Permit (AHIP) is no longer required to undertake test excavations (providing the excavations are in accordance with the Code of Practice for Archaeological Investigations in NSW). Subsurface testing is appropriate when a PAD has been identified, and it can be demonstrated that sub-surface Aboriginal objects with potential conservation value have a high probability of being present, and that the area cannot be substantially avoided by the proposed activity.

No sites or PADs were identified and the project is highly disturbed with low to no potential for in situ archaeological deposits and as such further investigations are not justified.

5.3 AHIP

If harm will occur to an Aboriginal object or Place, then an AHIP is required form the OEH. If a systematic excavation of the known site could provide benefits and information for the Aboriginal community and/or archaeological study of past Aboriginal occupation, a salvage program may be an appropriate strategy to enable the salvage of cultural objects. The AHIP may also include surface collection of artefacts.

No sites or PADs were identified and as such an AHIP is not required.

6 RECOMMENDATIONS

1) The persons responsible for the management of onsite works will ensure that all staff, contractors and others involved in construction and maintenance related activities are made aware of the statutory legislation protecting sites and places of significance. Of particular importance is the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010, under the National Parks and Wildlife Act 1974;

2) If any Aboriginal objects are uncovered during construction works, works must cease in that location immediately and the Environmental Line notified (131 555).

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APPENDIX A

AHIMS Search Results

D08936540

AHIMS Web Services (AWS)
Search Result

Purchase Order/Reference : Belmont 2

Client Service ID : 266969

Penny Mccardle

Po Box 166
Adamstown New South Wales 2289
Attention: Penny Mccardle

Email: mcheritage@iprimus.com.au

Date: 16 February 2017

Dear Sir or Madam:

AHIMS Web Service search for the following area at Datum :GDA, Zone : 56, Eastings : 371500 - 377500, Northings : 6341100 - 6347100 with a Buffer of 50 meters. Additional Info : assessment, conducted by Penny Mccardle on 16 February 2017.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

20	Aboriginal sites are recorded in or near the above location.
0	Aboriginal places have been declared in or near the above location. *

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

3 Marist Place, Parramatta NSW 2150
Locked Bag 5020 Parramatta NSW 2220
Tel: (02) 9585 6380 Fax: (02) 9873 8599

ABN 30 841 387 271
Email: ahims@environment.nsw.gov.au
Web: www.environment.nsw.gov.au

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Belmont 2

Client Service ID : 266969

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-7-0130	Belmont STW Camp Site;	AGD	56	376400	6343000	Open site	Valid	Artefact : -	Open Camp Site	224
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists					**Permits**	156	
45-7-0148	Canoe tree;CT;	AGD	56	371830	6345900	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	2592
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists					**Permits**		
45-7-0041	Mark's Point Nine Mile Beach	AGD	56	375251	6341618	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Unknown Author					**Permits**		
45-7-0042	Nine Mile Beach;	AGD	56	375610	6341991	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Len Dyall					**Permits**		
45-7-0204	BSAS-2	AGD	56	377330	6345400	Open site	Valid	Artefact : -	Open Camp Site	3203
	Contact	**Recorders**	Mr.Kelvin Officer					**Permits**		
45-7-0092	Lake Macquarie (Hartley Point)	AGD	56	372591	6346871	Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	**Recorders**	Len Dyall					**Permits**		
45-7-0096	Belmont;Eleebana;	AGD	56	374014	6344155	Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	**Recorders**	Glen Morris					**Permits**		
45-7-0100	Black Jack's Site;Belmont;	AGD	56	373120	6344310	Closed site	Valid	Artefact : -	Shelter with Deposit	255
	Contact	**Recorders**	Ms.Mary Dallas					**Permits**	488	
45-7-0284	Anderson Pde	GDA	56	374585	6343273	Open site	Valid	Shell : -		101911
	Contact	**Recorders**	Mrs.Angela Besant					**Permits**		
45-7-0030	Belmont;	AGD	56	374488	6343249	Open site	Valid	Shell : -, Artefact : -, Stone Arrangement : 1	Midden	
	Contact	**Recorders**	Unknown Author,Mrs.Angela Besant					**Permits**		
45-7-0046	Dudley-Jewells Swamp Area;Redhead South;	AGD	56	377080	6346408	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Len Dyall					**Permits**		
45-7-0047	Dudley-Jewells Swamp (Redhead South)	AGD	56	377178	6346044	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Len Dyall					**Permits**		
45-7-0048	Dudley-Jewells Swamp Area;Site 2;	AGD	56	377278	6345588	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Len Dyall					**Permits**		
45-7-0049	Dudley-Jewells Swamp Area;	AGD	56	377278	6345588	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Len Dyall					**Permits**		
45-7-0011	Belmont Midden;Green Point Estate;	AGD	56	371860	6346140	Open site	Valid	Shell : -, Artefact : -	Midden	255
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists					**Permits**	2186	
45-7-0345	BHW01	GDA	56	374393	6344461	Open site	Destroyed	Artefact : -		

Report generated by AHIMS Web Service on 16/02/2017 for Penny Mccardle for the following area at Datum :GDA, Zone : 56, Eastings : 371500 - 377500, Northings : 6341100 - 6347100 with a Buffer of 50 meters. Additional Info : assessment. Number of Aboriginal sites and Aboriginal objects found is 20

This information is not guaranteed to be free from error omission. Office of Environment and Heritage (NSW) and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Belmont 2

Client Service ID : 266969

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact Mr.Shane Frost	**Recorders**	Mrs.Angela Besant,Miss.Nicola Roche					**Permits**	3730	
45-7-0346	BHW02	GDA	56	374506	6344341	Open site	Destroyed	Artefact : -		
	Contact	**Recorders**	Mrs.Angela Besant,Miss.Nicola Roche					**Permits**	3730	
45-7-0347	BHW03	GDA	56	375267	6344012	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Mrs.Angela Besant					**Permits**		
45-7-0348	BHW04	GDA	56	375185	6343750	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Mrs.Angela Besant					**Permits**		
45-7-0364	Bahtabah Mission Site PAD	GDA	56	374714	6343688	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Ms.Mary-Jean Sutton					**Permits**	4030	

Report generated by AHIMS Web Service on 16/02/2017 for Penny Mccardle for the following area at Datum :GDA, Zone : 56, Eastings : 371500 - 377500, Northings : 6341100 - 6347100 with a Buffer of 50 meters. Additional Info : assessment. Number of Aboriginal sites and Aboriginal objects found is 20

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APPENDIX B

Archaeological Summary

Dallas (1983) undertook an archaeological survey of Green Point Estate at Belmont, NSW. The study area included part of the foreshore at Green Point on Lake Macquarie that was proposed for development. The development works proposed to conserve the remaining foreshore as a nature reserve, while developing the rest of the study area into a hotel-marina complex. The proposed works would involve surface and subsurface disturbance within the study area. Previous disturbance within the study area was extensive, including such activities as vegetation clearance, logging, dirt tracks, bike trails, 4WD tracks, gravel and sand quarries, sand mining, coal mining, washing, preparing, garbage dumping, boat building/repair, as well as house, road and boat ramp construction and use. The study area was situated in parts of the hinterland area between Hartley Point and Black Jack's Point as well as the adjacent foreshore. Creeks in the area were mostly seasonal, with some now draining into areas disturbed by quarrying. The topography of the area included rolling hills in the hinterland and sand dunes along the foreshore. Vegetation included mature trees suitable for scarred trees, as well as noxious species such as lantana and creeper. A review of past surveys and site recordings noted that shell middens and open campsites occurred in the vicinity, but nothing was specifically identified as within the bounds of the study area. It was noted that none of the sites previously recorded along the foreshore of Lake Macquarie had been recorded or assessed in detail and that no systematic site survey work had been undertaken for the Lake Macquarie foreshore. However, Dallas noted that estuarine shell middens were expected to occur within the study area and axe grinding groove sites were not common in the area, but could occur where suitable sandstone was exposed adjacent to creeks. Also, occupation sites were likely to occur on dry, flat landforms, burials may be found in soft sediments such as sand or sandy loam and scarred trees were possible where vegetation clearance had not destroyed all mature trees in the area. The survey across the entire study area revealed that surface visibility was limited in some areas by ground cover vegetation.

Two sites were located within the study area, both along the foreshore. Shell midden site 45-3A-11 was a relocated site that had been recorded previously, included both shell and stone artefacts (cockle and oyster shell, flake/core artefacts of chert and quartz), was moderately disturbed with subsurface potential. The second site, Black Jack's Point Site was also a shell midden with stone artefacts (shell, siltstone and quartzite cores) and was highly disturbed with no potential for subsurface cultural materials. The sites were consistent with the site types and locations discussed based on past surveys of the area, making the predictive model accurate in its assessment. It was recommended that site 45-3A-11 be preserved with appropriate conservation methods, but no signs or indicators be erected to draw attention to the midden's location. The proposed location for development did not impact on either of the sites, but it was recommended that test excavations be carried out in the proposed area prior to works commencing. It was also recommended that a Permit to Collect be applied for to allow for the salvage of the Black Jack's Point Site and consultation with the Aboriginal stakeholders continue.

Dyall (1972) undertook a study of Aboriginal occupation in the Dudley-Jewells Swamp Area in the Hunter region of NSW. Dyall described the area as having geographic unity, with the landscape consisting of hills, sandy heaths, dunes and creeks. Water sources in the area included Freshwater Creek, Dudley-Redhead Creek and Dudley Lagoon with the creek system draining into the swamp. The creeks generally flowed over clay, gravels and coarse conglomerates, with fine grained sandstone also noted in some areas. Dense prickly scrub was noted covering the sandy slopes near the sea cliffs. Past impacts in the area included heavy weathering and rutile mining at the dunes at Redhead. Dyall hypothesised that the large camp areas identified in his study were located in this landscape as they allowed for foraging across a wide variety of habitats. This was noted with coastal heath camps, which had access to the marshes to the south, the lagoon to the west and the rocky ocean shore at the bottom of the cliff. He identified minor camp sites along the margins of the swamp, one having a thin scatter of artefacts spread across a one acre area. Chert was the predominant raw

material type, with others including tuff, quartzite and quartz. Flaked glass implements were also noted in the Redhead Dunes. Dyall noted that he was only aware of two edge-ground stone implements from the area. Artefact types identified in the area included cores, flakes, Bondi points, geometrics and waste flakes. Shell evidence suggested that turban and whelk shellfish were a food resource in this area. Dyall also argued that an identified lump of quartz demonstrating lustrous crystals may have been of ceremonial value as a "magic stone" imported to the area by Aboriginal people, arguing that its provenance was at least 30 miles away. Dyall's report does not contain detailed information about the individual sites that he identified during this survey. He notes that further data on the individual sites was lodged with the Australian Museum.

Brayshaw (1990) completed an archaeological assessment of approximately 500 ha for a proposed resort at Belmont, NSW. The investigation area had previously been utilised as the location for the John Darling Colliery and disturbed by sand extraction activity. Proposed works included the development of a golf course and club, hotels, conference and retail centres, condominiums and boardwalks along with associated infrastructure.

Landforms included an extensive dune and wetland system and the deposits were of Quaternary coastal sand and silt with underlying deposits of Permian Newcastle Coal Measures including shale, sandstone, conglomerate, tuff, chert and coal. The closest major water source was Nine Mile Creek and vegetation included melaleuca, acacia, banksia, bittou bush and lantana. A search of the NPWS database identified two previously recorded sites within the study area. These included a midden site 45-7-0051 and artefact scatter site 45-7-0130. Previously recorded sites located outside the study area were of the same site types (midden and artefact scatter). No additional sites were identified during an inspection of the study area, which confirmed that the location was highly disturbed. It was recommended that further investigation be undertaken in areas not covered by this assessment and that the proposed works proceed in the disturbed areas, stopping if any new finds were located. It was further recommended that the two previously recorded sites be preserved and that interpretative signs and artefact displays be incorporated into the development design.

Ruig (1993) undertook an archaeological assessment of Lots 57, 58 and 59 (DP10262) in the City of Lake Macquarie in the Parish of Kahibah, approximately 17 kilometres to the south of Newcastle. The proposed development was for a golfing facility for the use of park residents on three lots adjacent to the southern boundary of an existing mobile home village. The study area was approximately eight hectares in size. Past impacts included vegetation clearance, mining and rubbish dumping. Landforms of the investigation area included dunes and swamp. The deposits were Quarternary coastal sands and silts underlain by the Permian system of the Newcastle Coal Measures group. The closest water source was Jewells Swamp. Vegetation in the study area included Melaleuca quinquenervia, Melaleuca ericifolia, Casuarina glauca, Persoonia spp., Banksia serata, pteridium esculentum, lantana and Bittou bush. A search of the NPWS database did not identify any sites within the investigation area and previously identified sites in the surrounding area included middens, artefact scatters and isolated artefacts. It was predicted that any of these three sites types could occur in the study area. The study area was found to be highly disturbed and the one identified artefact scatter identified on a sand dune and included two artefacts in a highly disturbed area (vehicle track) and was assessed as having low archaeological significance. Ruig recommended that the developer apply to the Director of National Parks and Wildlife Service for a Consent to Destroy and that the application be granted. No further archaeological investigation work was recommended for the study area.

Insite Heritage (2010) undertook a heritage and archaeological assessment of an area proposed for development as part of an upgrade to the Lake Macquarie Yacht Club. The proposed works included upgrading the building and extending the marina. Landforms of the investigation area consisted of slopes, headland and foreshore on a small lens of the Norah Head Soil Landscape. The area had been

cleared of vegetation, which was originally heathland and the nearest water sources were Cockle Creek and Jewells Swamp. A search of the AHIMS database identified one previously recorded site within the study area. This was a midden site located in Cullen Park. It was identified that the proposed works would not impact on this site. Site types predicted as possible to occur in the study area included artefact scatters, isolated artefacts, middens, burials, scarred trees and grinding grooves. Of these types, only middens were located during survey. Shell fragments and a section of fragmented shell midden were identified outside the proposed upgrade area (see below in Table 1.1). It was recommended that the proposed works proceed without constraint.

Table 6.1 Summary of sites (Insite Heritage 2010)

Site	Site type	Landform	Distance to water	Stream order	Artefacts /features	Disturbance	Subsurface potential
45-7-0284	midden	dune	not provided	Jewells Swamp	not provided	clearance & development	not provided
Transect 2 site	midden	not provided	not provided	Jewells Swamp	not provided	clearance & development	not provided

McCardle Cultural Heritage Pty Ltd (2013) undertook an Aboriginal Heritage Impact Assessment for the proposed manufactured home estate (11 Staged Development) at Redhead. The proposed development involved the staged construction of a one hundred and thirty seven (137) site manufactured home estate (MHE) on the land, inclusive of a two storey community facilities building, pool, landscaping, communal open space, stormwater quality facilities and rehabilitation of the degraded section of Crokers Creek which forms the southern boundary of the site. The study area was located approximately 800 metres south of Redhead, including Lot 36 DP10262 and Lot 62 DP 102626, the southern boundary backed onto Crockers Creek which flows into Jewells Swamp. The study area had no remaining original topography remaining as the site had been filled. The specific study area has been cleared and primarily used for pastoral purposes (grazing), involving the wholesale clearance of native vegetation, the introduction of pasture grass, , housing, fencing, numerous tracks and associated infrastructure (water, electricity, telephone). The study area was filled and also used as a transport facility. Crockers Creek is vary badly degraded for the majority of its length, eroded and blocked or constriced in some locations by large concrete blocks and other debris (including the remains of disused crosssing previoulsy used for sand mining on Crown Land to the south). The elevated slope above Crockers Creek in the south of the study area may be considred ideal for past occupation. The area is considered suitable for hunting and/or gatheirng as the swamp would have provided resourses for occupation and evidince of such occupation is expected to be located on elevated landforms overlooking the swamp. It was predicted that there is potential for evidence of past occupation in particular stone artefacts as these are typically identified in areas more suitable for occupation such as elevated landforms. However, due to past and present landuses and impacts, the sites are expected to be under the fill material and the upper sections disturbed and not in situ.

The results of the assessment showed that no sites were identified and as such no sites will be impacted upon by the development. In relation to the potential original landform under the existing fill materials and any poissible sites being present, with the exception of some possible intrusion below the fill where the fill is shallow at the front of the site, the development will not be excavating below the fill materials and as such there are no imopacts expected to any of the origoinal landform remaining under the existing fill. MCH recommended that the persons responsible for the management of an onsite will ensure that all staff, contractors and others involved in construction and maintenance related activities are made aware of the statutory legislation protecting sites and

places of significance. Of particular importance is the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010, under the National Parks and Wildlife Act 1974; and if the development will impact below the existing fill materials further archaeological investigations will be required to determine if the original landform is present and if any sites are present within that landform prior to work.

Monteath & Powys Pty Ltd

SURVEYING, PLANNING, ENGINEERING DESIGN, PROJECT MANAGEMENT






WASTE MANAGEMENT PLAN

MIXED USE DEVELOPMENT
(BEING A RESIDENTIAL FLAT BUILDING AND COMMERCIAL PREMISES)

32-44 BROOKS PARADE, 2-10 SHARP STREET AND 5-11 EDGAR STREET, BELMONT

Waste Management Plan

Liability limited by a scheme approved under Professional Standards Legislation

Quality ISO 9001 Certified System

This Report was prepared by:-

Monteath & Powys Pty Ltd
Suite 13 Tonella Commercial Centre
125 Bull Street
NEWCASTLE WEST NSW 2302

PO Box 2270
DANGAR NSW 2309

Telephone: (02) 4926 1388
Facsimile: (02) 4929 3475
Web: www.monteathpowys.com.au

PROJECT:	Mixed use, multi storey development (being a ***Commercial premises*** and ***Residential flat building***) comprising 140 residential units, 4 retail/commercial areas, 1 communal multi-purpose room, basement car parking and associated landscaping
CLIENT:	KML Joint Venture
OUR REFERENCE:	13/0524
VERSION:	**Draft – 22 January 2018** **Final Draft – 30 January 2018** **Amended – 25 June 2018**
AUTHOR:	Konrad Grinlaubs Senior Planner M.P.I.A.
CERTIFICATION:	I certify that to the best of my knowledge the information contained within this Report is neither false nor misleading.
SIGNATURE	
CHECKED BY:	Darren Holloway B.Sci. (Hons), MBEnv Manager Planning and Environment Registered Planner
SIGNATURE:	

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GLOSSARY OF TERMS

TERM	DESCRIPTION
Baler	A device that compresses waste into a mould to form bales which may be self-supporting or retained in shape by wire ties and strapping
Chute	A ventilated, essentially vertical pipe passing from floor to floor of a building with openings as required to connect with hoppers and normally terminating at its lower end at the roof of the central waste room(s)
Collection Area/Point	The position or area where waste or recyclables are actually loaded onto the collection vehicle
Compactor	A Machine for compressing waste into disposable or reusable containers
Composter	A container/machine used for composting specific food scraps
Crate	A plastic box used for the collection of recyclable materials
Garbage	All domestic waste (Except recyclables and green waste)
Hopper	A fitting into which waste is placed and from which it passes into a chute or directly into a waste container. It consists of a fixed frame and hood unit (the frame) and a hinged or pivoted combined door and receiving unit
Recycling	Glass bottles and jars – PET, HDPE and PVC plastics; aluminium aerosol and steel cans; milk and juice cartons; soft drink, milk and shampoo containers; paper, cardboard, junk mail, newspapers and magazines
Green	Garden organics such as small branches, leaves and grass clippings, tree and shrub pruning, plants and flowers, and weeds
L	Litre(s)
Liquid Waste	Non-hazardous liquid waste generated by commercial premises that is supposed to be connected to sewer or collected for treatment and disposal by a liquid waste contractor (including grease trap waste)
Mobile Garbage Bin(s) (MGB)	A waste container generally constructed of plastic with wheels with a capacity in litres of 120, 240, 660, 1000 or 1100
Putrescible Waste	Component of the waste stream liable to become putrid. Usually breaks down in a landfill to create landfill gases and leachate. Typically applies to food, animal and organic products.

1. INTRODUCTION

This waste management plan covers the demolition and associated works on the site and the ongoing management of waste generated by the mixed use development located at 32-44 Brooks Parade, 2-10 Sharp Street and 5-11 Edgar Street, Belmont.

Waste audit and management strategies are recommended for new developments to provide support for the building design and promote strong sustainability outcomes for the building. All recommended waste management plans will comply with council codes and any statutory requirements. The waste management plan has three key objectives:

i. Ensure waste is managed to reduce the amount of waste and recyclables to land fill by assisting residents to segregate appropriate materials that can be recycled; displaying signage to remind and encourage recycling practices; and through placement of recycling and waste bins in the retail precinct to reinforce these messages.
ii. Recover, reuse and recycle generated waste wherever possible.
iii. Compliance with all relevant codes and policies.

To assist in providing clean and well-segregated waste material, it is essential that this waste management plan is integral to the overall management of the building and clearly communicated to residents and tenants. For the purpose of this report the proposed development will consist of:

- 4 residential towers with a total of 140 units (see Table 1), and
- 4 commercial premises areas, total GFA of 699.88m^2.

Table 1: Unit Breakdown Matrix

Building (A)				**Building (B)**		
Bed No	**Unit No**	**% Mix**		**Bed No**	**Unit No**	**% Mix**
1	**-**	**-**		**1**	**3**	**9.7**
2	**16**	**43.2**		**2**	**21**	**67.7**
3	**21**	**56.8**		**3**	**7**	**22.6**
Commercial	**2**	**301.5m²**		**Commercial**	**1**	**234.4m²**
Total	**36**	**100**		**Total**	**31**	**100**

Building (C)		
Bed No	**Unit No**	**% Mix**
1	**10**	**26.3**
2	**25**	**65.8**
3	**3**	**7.9**
Commercial	**-**	**-**
Total	**38**	**100**

Building (D)		
Bed No	**Unit No**	**% Mix**
1	**10**	**29.4**
2	**16**	**47.1**
3	**8**	**23.5**
Commercial	**2**	**179.3m²**
Total	**33**	**100**

All figures and calculations are based on area schedules as shown on architectural drawings.

2. LAKE MACQUARIE CITY COUNCIL

The residential and retail/commercial waste and recycling will be collected by a private contractor. The demolition waste will also be collected by private contractor however separate to the operational waste contract.

All waste facilities and equipment are to be designed and constructed to comply with Council's Policy for Waste Minimisation, Australian Standards and relevant statutory requirements.

COUNCIL OBJECTIVES

- Ensure that each dwelling/unit has adequate space to manage waste.
- Ensure that buildings provide appropriate facilities to manage waste.
- Ensure that residential amenity is not impacted by waste systems and collection services.

REQUIREMENTS

Access – Ensure waste systems are easy to use and collection vehicles are able to access buildings to safely remove waste and recycling;

Safety – Ensure safe practises for storage, handling and collection of waste and recycling;

Pollution Prevention – Prevent stormwater pollution that may occur as a result of poor waste storage and management practises;

Noise Minimisation – Provide acoustic insulation to the waste service facilities or residential units adjacent to or above chute, waste storage facilities, chute discharge, waste compaction equipment and waste collection vehicle access points;

Ecologically Sustainable Development (ESD) – Promote the principles of ESD through resource recovery and recycling leading to a reduction in the consumption of finite natural resources; and

Hygiene – Ensure health and amenity for residents, visitors and workers.

3. GENERATED WASTE AND VOLUMES

The assessment of projected waste volumes is a calculated estimate only and will be influenced by the development's management and occupant's waste disposal and recycling practices.

CONSTRUCTION AND DEVELOPMENT WASTE

The head contractor will be responsible for removing all construction-related waste off-site in a manner that meets all authority requirements. Please refer to the relevant section of the waste management plan for construction waste as part of the Development Application.

BUILDING MANAGER/WASTE CARETAKER

All waste equipment movements are to be managed by the building manager/cleaners at all times. No tenants or residents will be allowed to transport waste or recyclables from the waste room; tenants and residents will only transport their waste to the allocated bin room.

The building manager/cleaner duties include, but are not limited to, the following:

- general maintenance and cleaning of the chute doors on each level (Frequency dependent on waste generation and will be determined based upon building operation);
- organising, maintaining and cleaning the general and recycled waste holding areas (Frequency will depend on waste generation and based upon building operation);
- transporting of bins as required;
- organising both garbage and recycled waste pick-ups as required;
- cleaning and exchanging all bins;
- ensure site safety for residents, children, visitors, staff and contractors;
- abide by all relevant OH&S legislation, regulations, and guidelines;
- assess any manual handling risks and prepare a manual handling control plan for waste and bin transfers; and
- provide to staff/contractors equipment manuals, training, health and safety procedures, risk assessments, and PPE to control hazards associated with all waste management activities

NOTE: It is the responsibility of the building manager to monitor the number of bins required for the development. As waste volumes may change according to the development's waste disposal and recycling, bin numbers and sizes may need to be altered to suit the building operation.

4. REPORTING

It is recommended that building management ensure that all waste service providers submit monthly reports on all equipment movements and weights of any waste and recycling products removed from the development. Regular reviews of servicing should take place to ensure operational and economic best practise and to assist with sustainability reporting.

5. EDUCATION

Building management is responsible for creating and managing the waste management education process. Educational material encouraging correct separation of garbage and recycling items must be provided to each resident to ensure correct use of the waste chute. This should include the correct disposal process for bulky goods (old furniture, large discarded items, etc.). It is recommended that information is provided in multiple languages to support correct practises and minimise the possibility of chute blockages as well as contamination in the collective waste bins.

It is also recommended that the owners' corporation website contain information for residents to refer to regarding waste and recycling management and use of the chute. Information should include:

- directions on using the chute doors;
- recycling and garbage descriptions (Council provides comprehensive information);
- how to dispose of bulky goods and any other items that are not garbage or recycling;
- residents' obligations to WHS and building management; and
- how to prevent damage or blockages to the chute (example below).

To prevent damage or blockage to rubbish chute DO NOT *dispose of any newspapers, umbrellas, bedding, cigarettes, cartons, coat hangers, brooms, mops, large plastic wrappings from furniture, white goods, any sharp objects, hot liquid or ashes, oil, unwrapped vacuum dust, syringes, paint and solvents, car parts, bike parts, chemicals, corrosive and flammable items, soil, timber, bricks or other building materials, furniture, etc. down the chute. It is expected that leasing arrangements with retail/commercial operations contain direction on waste management services and expectations.*

6. DEMOLITION AND CONSTRUCTION WASTE

The proposed demolition works do not include any heritage items as defined in any draft or adopted Environmental Planning Instrument or any property identified individually by reference to DCP. The demolition works will comply with AS2601 – The Demolition of Structures. There will be no use of explosives and there will be compliance with 'Workcover' Authority requirements.

All services will be sealed off, asbestos disposal will be to 'Workcover' requirements and the proposed Sediment and Erosion control measures will be installed prior to the commencement of any work.

Effluent from the amenities for which the contractor is responsible shall be discharged into the local sewer system, where available. Otherwise, a portable self-contained toilet of suitable capacity will be used subject to acceptable arrangement for disposal of the effluent.

Littering or dumping of unwanted waste or disposal of surplus construction materials including bitumen, asphalt or concrete on any land around the site is not permitted. Appropriate receptacles will be provided for depositing litter and other waste materials, and their contents disposed of off-site to a suitable waste disposal station on a regular basis. The disposal of chemical, fuel and lubricant containers, solid and liquid wastes shall be in accordance with the requirements of the Principal or the EPA.

Key outcomes are to ensure that recycle and divert from landfill surplus soil, rock and other excavated or demolition materials, wherever this is practical. Also, separately collect and stream quantities of waste concrete, bricks, blocks, timber, metals, plasterboard, paper and packaging, glass and plastics and offer them for recycling where practical. All wastes to be contained on site within a designated area of 10.0m x 10.0m.

If asbestos is encountered during construction or demolition work, measures must be in place in accordance with WorkCover NSW guidelines. Work must not commence until all the necessary safeguards required by WorkCover NSW are fully in place. Contractors who are licensed for asbestos disposal by WorkCover NSW must only carry out the removal and disposal of asbestos from demolition and construction sites.

Prior to commencing work on demolition sites where buildings containing asbestos are to be demolished, a commercially manufactured sign containing the words “DANGER ASBESTOS REMOVAL IN PROGRESS” measuring 400mm x 300mm (see below) is to be erected in a prominent visible position on the site in accordance with AS1319 “Safety Signs for the Occupational Environment”.

The applicant shall notify adjoining residents in writing five (5) working days prior to the demolition of asbestos buildings. Asbestos waste must only be disposed of at a landfill authorised to receive such waste. At least 24 hours prior notice must be given to allow an area to be prepared for disposal.

Waste management measures have been prepared to understand the details regarding site waste generated during the demolition phase of the development. Waste storage will be provided to meet the predicted requirements of the development calculated in accordance with Council policy.

Demolition/Construction Stage		
Type of material	**On-site**	**Off-site**
Building Fittings	Removed, sorted and stored.	To salvage yard.
Green Waste	Mulched and re-used where possible.	To landscape suppliers.
Excavation Material (soils)	Sorted and stored on site, re-used where possible.	To approved recycling refuse facility. If unable to be recycled, to an approved landfill.
Glass	Sorted and stored on site.	To approved recycling refuse facility for re-use or crushing.
Bricks	Sorted and stored on site, re-used where possible.	To approved recycling refuse facility for re-use or crushing.
Concrete/Cement Fibre Board	Sorted and stored on site, re-used where possible.	To approved recycling refuse facility for crushing and/or re-use.
Timber	Separated and sortd. Mulched/crushed/cit and re-used where possible.	Where appropriate to an approved salvage yard for weatherboards flooring etc. To approved recycling refuse facility. Where possible clean timber pallets sawust etc to be recycled for broiler chicken bedding in

		accordance with relevant requirements.
Plasterboard	Sorted and stored, broken-down and re-used where possible in accordance with the NSW Resource Recovery Exemption (RRE) for Plasterboard.	To approved recycling facility for crushing or re-use.
Metals	Sorted and stored.	To approved recycling refuse facility.
Asbestos (if any)	Treated and wrapped (if any)	To an approved refuse facility.
Plactics/packaging	Sorted and stored.	To approved recycling refuse facility or where unable to the recycled to approved landfill.

As it is premature to outline and source or location of particular providers for waste during the demolition and construction phases, mainly as a contractor is yet to be appointed.

A Construction Environmental Management Plan (CEMP) will be prepared. The CEMP is to provide transparency and demonstrate a commitment to environmental conservation during the demolition and construction phases, and provide a management framework to address potential waste streams associated with the demolition and construction of the project.

The CEMP will include a range of environmental control measures and procedures to address the requirements in relevant Management Plans. The CEMP will include the following Management Plans: -

- Erosion & Sediment Control Plan
- Incident / Emergency Management Plan; and
- Demolition and Construction Waste Management Plan.

The waste management plan shall include the following critera;

WASTE MANAGEMENT PLAN		
Ensure waste is disposed of in compliance with the requirements of *Waste Avoidance and Resource Recovery Act, 2001* at a waste facility licensed to accept the type of waste presented.	Site Manager	Ongoing during operations
All wastes will be properly classified and appropriately stored in accordance with	Site Manager	Ongoing during operations

guidelines and regulations. Incompatible materials will be stored separately from one another.		
Ensure that wastes are contained and isolated from ground and surface water surrounds and treatment or collection does not result in long term impacts on the natural environment.	Site Manager	Ongoing during operations
Ensure that the person transporting the waste is licensed if the waste is of such an amount as to require the person transporting the waste to be licensed. The project will ensure that: - • Vehicles carrying waste will be kept clean and be constructed and maintained as to prevent spillage of waste. • Loads which may spill or emit odours are covered so that spillage and/or emission is prevented. • Any contained waste is safely secured. • Incompatible waste will not be mixed or transported together. • Any hazardous waste is not mixed with any other type of waste. • Any waste containing asbestos is to be handled and stored in accordance with approved methods and disposed of at a licenced facility. • Material segregated for recycling is not mixed with other wastes. • Any waste is transported only to controlled facilities or other facilities that can lawfully receive	Site Manager	Ongoing during operations

the waste. • The occupier of the waste facility is advised of the type of waste involved before the waste is unloaded.		

7. RESIDENTIAL WASTE PLAN

The *Better Practice Guide for Waste Management and Recycling in Multi-unit Dwellings* has been referenced to calculate the total number of bins required for the residential units. Please note that calculations are based on generic figures; waste generation rates may differ according to the residents' waste management practice.

Table 2: *Calculated Waste Generation – Residential*

Building	Units	Waste Calculation (L/unit/week)	Waste Generated (L/week)	Recycling Calculation (L/unit/week)	Recycling Generated (L/week)
A	**37**	**80**	**2,960**	**40**	**1,480**
(240L)			**(13)**		**(7)**
(1100L)			**(3)**		**(2)**
B	**31**	**80**	**2,480**	**40**	**1,240**
(240L)			**(11)**		**(6)**
(1100L)			**(3)**		**(2)**
C	**38**	**80**	**3,040**	**40**	**1,520**
(240L)			**(13)**		**(7)**
(1100L)			**(3)**		**(2)**
D	**34**	**80**	**2,720**	**40**	**1,360**
(240L)			**(12)**		**(6)**
(1100L)			**(3)**		**(2)**
Total	**140**	**80**	**11,200**	**40**	**5,600**
(240L)			**(49)**		**(26)**
(1100L)			**(12)**		**(8)**

BIN SUMMARY

The following assumptions have been taken into consideration:

- garbage is not compacted at the base of each chute;
- recycling bins are located in the waste compartment on each level; and
- number of bins have been rounded up for best operational outcome.

Using the assumptions stated, the required capacity and quantity of garbage and recycling bins have been calculated and tabulated respectively in the following table:

Garbage

- MGBs collected
  - 13 x 240L MGBs for Building (A) **once weekly**; or
  - 3 x 1100L MGBs for Building (A) **once a week**; and
  - 11 x 240L MGBs for Building (B) **once weekly**; or
  - 6 x 1100L MGBs for Building (B) **once a week**; and
  - 13 x 240L MGBs for Building (C) **once weekly**; or
  - 3 x 1100L MGBs for Building (C) **once a week**; and
  - 12 x 240L MGBs for Building (D) **once weekly**; or
  - 3 x 1100L MGBs for Building (D) **once a week**.

Total site

- 49 x 240L MGBs **once a weekly**; or
- 12 x 1100L MGBs **once a week**.

Recycling

- MGBs collected
  - 12 x 240L MGBs for Building (A) **once fortnightly**; or
  - 4 x 1100L MGBs for Building (A) **once fortnightly**; and
  - 12 x 240L MGBs for Building (B) **once fortnightly**; or
  - 4 x 1100L MGBs for Building (B) **once fortnightly**; and
  - 14 x 240L MGBs for Building (C) **once fortnightly**; or
  - 4 x 1100L MGBs for Building (C) **once fortnightly**; and
  - 12 x 240L MGBs for Building (D) **once fortnightly**; or
  - 4 x 1100L MGBs for Building (D) **once fortnightly**.

Total site

- 26 x 240L MGBs **once a week**; or
- 52 x 240L MGBs **once fortnightly**; or
- 8 x 1100L MGBs **once a week**; or
- 16 x 1100L MGBs **once fortnightly**.

WASTE MANAGEMENT

Waste chutes will be installed with access provided on all residential levels of each building. The chutes are to be used for the disposal of garbage only. Garbage and recycling will located in the waste room located at ground level. This garbage is not compacted. Full waste and recycling bins will be positioned closer to the exit before being transferred for collection.

WASTE HANDLING

WASTE

Residents will be supplied with a collection area in each unit (generally in the kitchen, under bench or similar alternate area) to deposit garbage and collect recyclable material suitable for one day of storage. Residents should wrap or bag their waste. Bagged waste should not exceed 3kg in weight or 35cm x 35cm x 35cm in dimension.

The caretaker/cleaner will be required to check the bins in any upper floor waste compartment and rotate full bins to the storage and collection area, and replace with empty bins. The caretaker/cleaner will be required to check the bins collecting waste from each chute, rotate full bins to the storage and collection area, and replace empty bins under each chute.

RECYCLING

Recycling must not be bagged. It is recommended that residents use a crate or dedicated bin for collecting recyclables within the allocated residential space provided to ensure correct separation.

Cardboard furniture boxes or large cardboard containers should not be included in the waste chute – a cardboard collection bin will be made available to residents to deposit flattened cardboard and will be managed by the waste caretaker. Bins will be located in the garbage and bulky goods area.

The caretaker/cleaner will exchange/empty recycling bins and store full bins in the bin holding room located on the ground level for collection.

TEMPORARY STORAGE OF BULKY GOODS

A caged area of 8m^2 must be allocated for the storage of discarded residential bulky items. This area should be made available close to the collection area. It is envisaged that bulky goods will be managed by the appointed waste caretaker/s. Residents will be required to liaise with building management regarding all bulky goods movements.

It is recommended that donations to charitable organisations be encouraged for all re-usable waste streams. Clean, sound furniture and household goods etc. are highly sought after to provide for the disadvantaged. Donations will be arranged with the assistance of the

building manager/caretaker.

OTHER WASTE STREAMS

Disposal or recycling of electronic, liquid waste and home detox (paint/chemicals etc.) will be organised with the assistance of the building caretaker. These items must not be placed in waste or recycling bins due to safety and environmental factors. Residents should be directed to Council's website for further information:

COMPOSTING

It is suggested that a space for composting is to be available for all residents in a communal facility. Composting facilities are to be sited on an unpaved area with soil depth of at least 300mm. Residents may also choose to purchase and install apartment style compost bin where practical and self-manage these systems (*see **Section 11** for Typical Compost Bins)*. Two systems have been included for consideration however there are a variety of compost systems available at hardware stores.

COMMON AREAS

The ground floor lobbies, retail tenncies and circulation areas will not be supplied with individual waste and recycling bins. Building management will monitor these areas and ensure any waste is removed and area cleaned as appropriate.

WASHROOM FACILITIES

Washroom facilities for staff should be supplied with collection bins for paper towels (if used). Sanitary bins for female restroom facilities must also be arranged with an appropriate contractor.

GREEN WASTE

Any green waste will be collected and removed from site by the maintenance contractor during scheduled or arranged servicing of these areas.

EQUIPMENT SUMMARY

***Table 3:** Equipment Summary*

Component	Part	Quantity	Notes
Chutes	Galvanised Steel or LLDPE Polyethylene Plastic	**1**	*See Section 11 for Typical Chute Section.*
Equipement	Suitable Bin Moving	**N/a**	*See Section 11 for Typical Bin Mover.*

	Equipment		

8. RETAIL/COMMERCIAL WASTE PLAN

The *Better Practice Guide for Waste Management and Recycling in Multi-unit Dwellings* has been referenced to calculate the total number of bins required for the retail areas. Please note that calculations are based on generic figures; waste generation rates may differ according to the tenants' waste management practice. Please note that if food tenants are placed, the waste generation rates will require adjustment. A seven day operating week has been assumed.

Table 4: *Calculated Waste Generation – Retail/Commercial*

Type (Tenancy)	Floor Area	Waste Calculation (50L/100²/day)	Waste Generated (L/week)	Recycling Calculation (25L/100²/day)	Recycling Generated (L/week)
Building (A)	301.3	50	1,055	25	528
			(5)		(3)
Building (B)	234.4	50	820	25	410
			(4)		(2)
Building (C)	-	50	-	25	-
Building (D)	164.2	50	575	25	288
			(3)		(2)
Total			**2,450**		**1,226**
(240L)			**(11)**		**(6)**

BIN SUMMARY

Garbage

- 11 x 240L MGBs collected **weekly**; or
- 3 x 1100L MGBs collected **weekly**.

Recycling

- 6 x 240L MGBs collected **weekly**.

WASTE MANAGEMENT

Retail tenants will be required to be responsible for their own storage of waste and recycling back of house (BOH).

Cardboard is a major component of the waste generated by cafes/restaurants. All cardboard should be flattened (to save bin space), placed in and collected from bulk bins. Whilst cardboard is bulky, it is generally lightweight however it can be contaminated with food or liquid which makes it unsuitable for recycling.

For the food based tenancies, food handling for food cooked or prepared, served and consumed on site will produce a typical waste composition of food scraps from plates, packaging waste and some plastics. Café or restaurant staff will be responsible for their waste management.

On completion of each trading day or as required, nominated retail staff/cleaners will transport their waste and recycling, using the access corridor, to the retail waste room on the ground level and place waste and recycling into the appropriate collection bins.

It is recommended that:

- all waste should be bagged and waste bins should be plastic lined;
- bagging of recyclables is not permitted;
- all waste collections located BOH during operations;
- individual recycling programs are recommended for retailers to ensure commingled
- recycling is separated correctly;
- a suitable storage area needs to be provided and affectively bunded for chemicals,
- pesticides and cleaning products;
- dry basket arresters need to be provided to the floor wastes in the food preparation
- and waste storage areas;
- washroom facilities should be supplied with collection bins for paper towels (if used);
- and
- all flattened cardboard will be collected and removed to the waste room recycling MGB

WASHROOM FACILITIES

Washroom facilities in retail and staff areas should be supplied with collection bins for paper towels (if used). Sanitary bins for female restroom facilities must also be arranged with an appropriate contractor.

9. COLLECTION OF WASTE

RESIDENTIAL

Residential waste and recycling will be collected by a private contractor twice weekly. Prior to collections, the building manager will be responsible for transferring all full bins from their respective discharge rooms to the residential waste holding room.

Waste vehicles will access the bins from Sharp Street where the bins are to be serviced. Once servicing is complete, it will be the building manager's responsibility to return all bins to their respective locations to resume operational use.

RETAIL

Retail waste will be collected by private contractor to an agreed schedule. This report assumes that collections for both waste streams will collected on a weekly basis or twice a week.

Prior to collections, the building manager will be responsible for ensuring all bins are stored neatly within the waste room for ease of servicing.

The private contractor's waste vehicles will access the bins from the street where the bins are to be serviced. Once servicing is complete, it will be the building manager's responsibility to return all bins to their respective locations to resume operational use.

COLLECTION AREA

It is our understanding that the collection areas have been reviewed by a traffic consultant to confirm the waste collections, access and egress for loading and to exit, load requirements as well as collection vehicle. The final number of truck movements will depend on management of waste contract; final configuration of waste and recycling arrangements therefore number of bin lifts and additional irregular truck movements for hard waste.

10. GARBAGE ROOM

CONSTRUCTION REQUIREMENTS

The garbage room will be required to contain the following facilities to minimise odours, deter vermin, protect surrounding areas, and make it a user-friendly and safe area:

- waste room floor to be sealed with a two pack epoxy;
- waste room walls and floor surface is flat and even;
- all corners coved and sealed 100mm up, this is to eliminate build-up of dirt;
- cold water facility and hose cock must be provided for washing the bins;
- any waste water discharge from bin washing must be drained to sewer in accordance with the relevant requirements (Hunter Water);
- tap height of 1.6m;
- storm water access preventatives (grate);
- all walls painted with light colour and washable paint;
- equipment electric outlets to be installed 1700mm above floor levels;
- the room must be mechanically ventilated;
- light switch installed at height of 1.6m;
- waste rooms must be well lit (sensor lighting recommended);
- optional automatic odour and pest control system installed to eliminate all pest types and assist with odour reduction – this process generally takes place at building handover – building management make the decision to install;
- all personnel doors are hinged and self-closing;
- waste collection area must hold all bins – bin movements should be with ease of access;
- conform to the Building Code of Australia, Australian Standards and local laws; and
- childproofing and public/operator safety shall be assessed and ensured

SIGNAGE

The building manager/caretaker is responsible for waste room signage including safety signage (*see* ***Section 11***). Appropriate signage must be prominently displayed on walls and above all bins, clearly stating what type of waste or recyclables is to be placed in the bin underneath. All chute doors on all residential levels will be labelled with signs directing chute operations and use of chute door.

VENTILATION

Waste and recycling rooms must have their own exhaust ventilation system either;

- Mechanically - exhausting at a rate of 5L/m² floor area, with a minimum rate of 100L/s minimum; or
- Naturally - permanent, unobstructed, and opening direct to the external air, not less than one-twentieth (1/20) of the floor area

Mechanical exhaust systems shall comply with AS1668 and not cause any inconvenience, noise or odour problem.

STORM WATER PREVENTION & LITTER REDUCTION

Building management shall be responsible for the following to minimise dispersion of site litter and prevent stormwater pollution to avoid impact to the environment and local amenity:

- promote adequate waste disposal into the bins;
- secure all bin rooms (whilst affording access to staff/contractors);
- prevent overfilling of bins, keep all bin lids closed and bungs leak-free;
- take action to prevent dumping or unauthorised use of waste areas; and
- ensure collection contractors clean-up any spillage that may occur when clearing bins.

AREA REQUIREMENTS

The garbage rooms will be required to contain the following bins in addition to the facilities noted above to minimise odours, deter vermin, protect surrounding areas, and make it a user-friendly and safe area:

240L MGB's (0.45m²)	**Residential**			**Retail/Commercial**			Area m²
	Garbage	Recycling	Area m²	Garbage	Recycling	Area m²	
Builidng (A)	13	7	9	5	3	3.6	**12.6 (28)**
Builidng (B)	11	6	7.6	4	2	2.7	**10.3 (23)**
Builidng (C)	13	7	9	-	-	-	**9.0 (20)**
Builidng (D)	12	6	8.1	3	2	2.2	**10.3 (23)**
Total	**49**	**26**	**33.7**	**12**	**7**	**8.5**	**41.3 (92)**
	75 = 33.7m² (Weekly)			**19 = 8.5m² (Weekly)**			

Note: the areas are bin storage only and do not include access or areas for other facilities.

1100L MGB's (1.70m²)	Residential			Retail/Commercial			Area m²
	Garbage	Recycling	Area m²	Garbage	Recycling	Area m²	
Builidng (A)	3	2	8.5	1	1	3.4	**11.9 (7)**
Builidng (B)	3	2	8.5	1	1	3.4	**11.9 (7)**
Builidng (C)	3	2	8.5	-	-	-	**8.5 (5)**
Builidng (D)	3	2	8.5	1	1	3.4	**11.9 (7)**
Total	**12**	**8**	**34**	**3**	**3**	**10.2**	**44.2 (26)**
	20 = 32.0m² (Weekly)			**6 = 10.2m² (Weekly)**			

Note: the areas are bin storage only and do not include access or areas for other facilities.

Section 10 identifies the areas of the bins to be accommodated. Area will also need to accommodate movement of the bins and abovementioned facilities. In addition an area shall contain a caged area of 8m^2 allocated for the storage of discarded residential bulky items.

11. WASTE MANAGEMENT PRODUCTS

Crates



Crate size	50L Crate	70L Crate	90L Crate
Height	320 mm	395 mm	420 mm
Length	575 mm	575 mm	450 mm
Width	445 mm	445 mm	450 mm

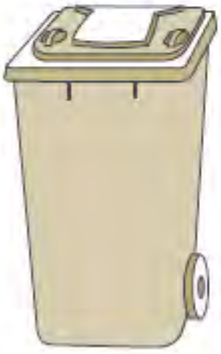
The above dimensions are indicative only of common crate sizes

Mobile garbage bins (MGBs)

MGBs with capacities up to 1700L should comply with the Australian Standard for Mobile Waste Containers (AS 4123). AS 4123 specifies standard sizes and sets out the colour designations for bodies and lids of mobile waste containers that relate to the type of materials they will be used for.

Indicative sizes only for common MGB sizes are provided below. Note that not all MGB sizes are shown; the dimensions are only a guide and differ slightly according to manufacturer, if bins have flat or dome lids and are used with different lifting devices. Refer to AS 4123 for further detail.

Mobile containers with a capacity from 80L to 360L with two wheels



Bin Type	80 Litre MGB	120 Litre MGB	140 Litre MGB	240 Litre MGB	360 Litre MGB
Height	870 mm	940 mm	1065 mm	1080 mm	1100 mm
Depth	530 mm	560 mm	540 mm	735 mm	885 mm
Width	450 mm	485 mm	500 mm	580 mm	600 mm

Mobile containers with a capacity from 500L to 1700L with four wheels



Dome or flat lid containers

Bin Type	660 Litre MGB	770 Litre MGB	1100 Litre MGB	1300 Litre MGB	1700 Litre MGB
Height	1250	1425	1470	1480	1470
Depth	850	1100	1245	1250	1250
Width	1370	1370	1370	1770	1770

WASTE SIGNS

Signs for garbage, recycling and organics bins should comply with the standard signs promoted by the Department of Environment and Heritage.



SAFETY SIGNS

The design and use of safety signs for waste rooms and enclosures should comply with AS1319 Safety Signs for Occupational Environment. Safety signs should be used to regulate and control safety behaviour, warn of hazards and provide emergency information, including fire protection information. Below are some examples. Each development will need to decide which signs are relevant for its set of circumstances and service provided.



Australian Standards are available from the SAI Global Limited website (www.saiglobal.com)

Source: Better Practice Guide to Waste Management in Multi-Unit Dwellings, 2009, DECC

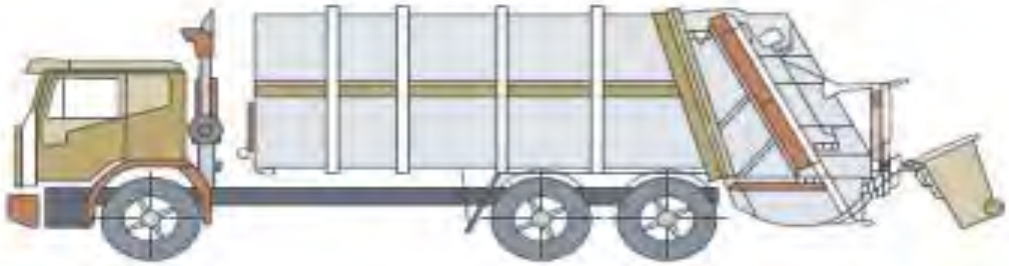
TYPICAL COLLECTION VEHICLE INFORMATION

Collection vehicles

Waste collection vehicles may be side loading, rear-end loading, front-end loading or crane trucks. The size of vehicle varies according to the collection service. Thus it is impossible to specify what constitutes the definitive garbage vehicle. Developers should consult the local council and/or relevant contractors regarding the type of vehicle used in that area.

The following characteristics represent the typical collection vehicle, however, these are only for guidance.

It may be possible to engage a collection service provider to use smaller collection vehicles to service developments with narrow roadways and laneways, or for on-site collections. However, as the availability of smaller vehicles to make services varies between councils and private contractors, wherever possible the development should be designed to accommodate vehicles of a similar size to that reported below.



Rear loading collection vehicle

This is commonly used for domestic garbage and recycling collections from MUDs. It can be used to collect waste stored in MGBs or bulk bins, particularly where bins are not presented on the kerbside.

Rear loading collection vehicle	
Length overall	10.24m
Width overall	2.5m
Operational height	3.5m
Travel height	3.5m
Weight (vehicle only)	12.4 tonnes
Weight (payload)	9.5 tonnes
Turning circle	18.0m

TYPICAL BIN MOVER



ELECTRIC ORGANIC COMPOST BIN

CLOSED LOOP
LOVE WHAT YOU DO
CLO'ey



Product Specifications

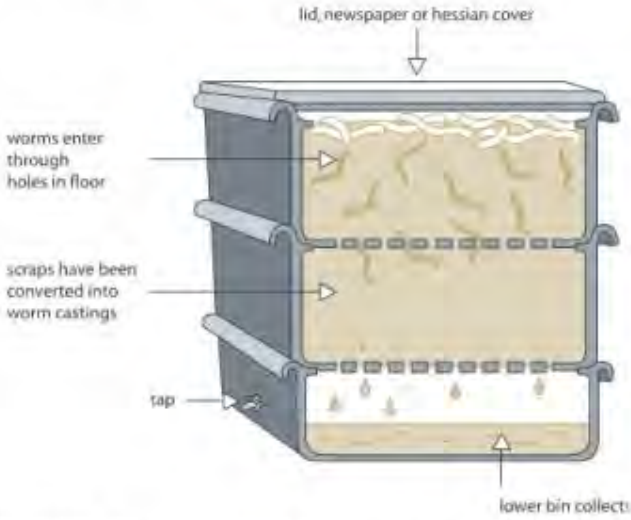
Decomposition Method	Fermentation by microorganisms
Decomposition Capacity	2 metric tonnes per year* (4 kg per day*)
Rating	220–240 V 50/60 Hz – 1.1 A
Decomposition Time	24 hrs
Operating Temperature	0C and 40C **
Deodorisation Method	Nano-Filter system
Maximum Power	210 W
Power Usage	Average 1 kwh per day
Weight	21 kgs
External Dimensions	w 400 mm d 400 mm h 780 mm

* Food Waste Handling Capacity – based on an optimal operating environment
** Ambient temperature range of area where unit may be installed.

SOURCE: *Closed Loop Domestic Composter – See Useful Contacts*

TYPICAL WORM FARM SPECIFICATIONS

Worm farms



Space requirements for a typical worm farm for an average household:

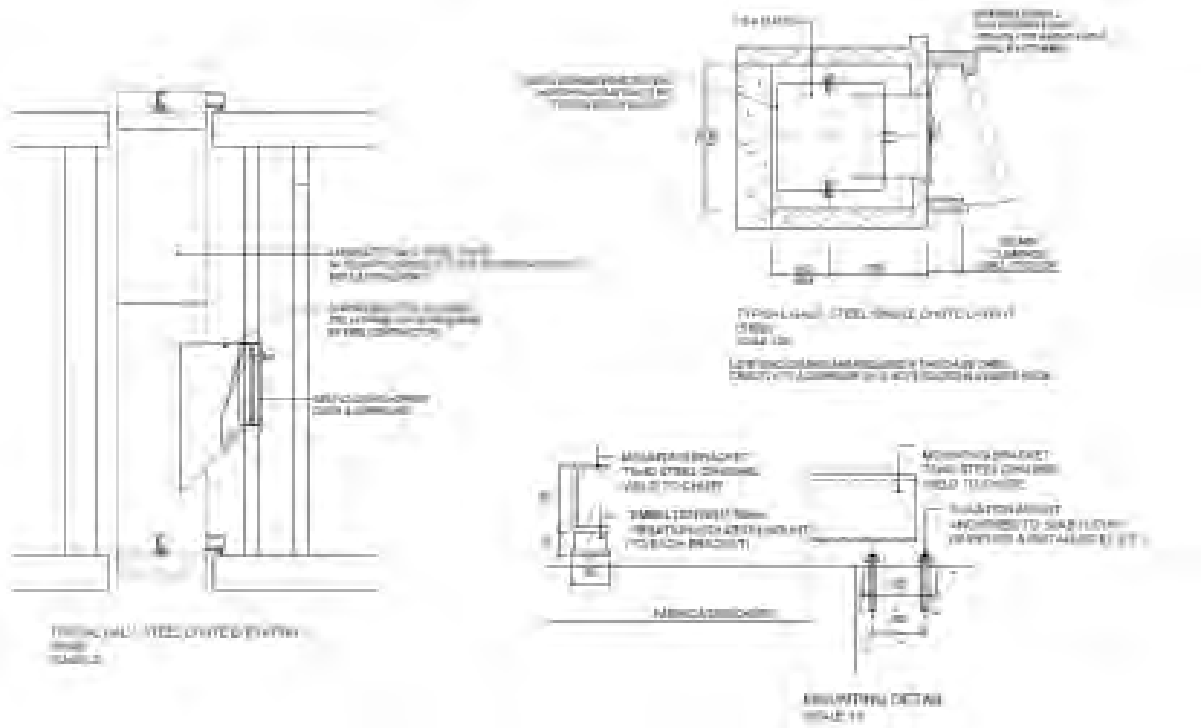
Height – 300mm per level

Width – 600mm

Length – 900mm

There are many worm farm arrangements. The above dimensions are indicative only.

SOURCE: *Department of Environment and Climate Change NSW 2008, Better Practice Guide for Waste Management in Multi-Unit Dwellings*



Waste chutes are supplied per the following specifications:

- either 510mm galvanised steel or 510mm recycled LLDPE polyethylene plastic;
- galvanised steel chute hoppers are wrapped with 50mm poly-wool R1.3 noise insulation foil to assist in noise reduction;
- penetrations on each building level at vertically perpendicular points with minimum penetration dimensions of 600mm x 600mm (square or round) are required to accommodate the chute installation;
- a wash down system and vent should also be included as part of the chute system;
- council and supplier require that all chutes are installed without offsets to achieve best practise operationally for the building; and
- two hour fire-rated (AS1530.4-2005) stainless steel refuse chute doors at each service level. All doors are to be fitted with a self-closing mechanism to meet BSA fire standards.

NOTE: Chute doors are installed after walls rendered, painted or when required. Information stickers will be placed on each chute door at each residential level.



SCALE 1:500 @ A1
SCALE 1:1000 @ A3

0 5 10 20 30 40 50 metres

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EROSION AND SEDIMENT CONTROL NOTES

1. PROVIDE EROSION AND SEDIMENT CONTROL MEASURES DURING CONSTRUCTION TO LMCC COUNCIL STANDARDS AND CONFORMING TO LANDCOM SOILS & CONSTRUCTION Vol 1, 4th EDITION, MARCH 2004.
2. PREPARE EROSION AND SEDIMENT CONTROL PLAN AND OBTAIN COUNCIL APPROVAL PRIOR TO WORKS.
3. ALL PERIMETER CONTROL DEVICES ARE TO BE INSTALLED PRIOR TO WORK COMMENCING AND BE MAINTAINED DURING CONSTRUCTION. LOCATE SEDIMENT FENCE WITHIN WORKS BOUNDARY.
4. CONTRACTOR TO DEFINE ACCESS, STOCKPILE AND OTHER AREAS PRIOR TO WORK COMMENCING.
5. PROVIDE A SINGLE POINT OF ACCESS TO THE SITE.
6. MINIMISE SITE DISTURBANCE AND REDUCE STOCKPILING TO A LEVEL NECESSARY TO CONSTRUCT THE WORKS. STOCKPILE AREAS, CONSTRUCTION ACCESSES AND NO GO AREAS TO BE DEFINED AND CONFIRMED PRIOR TO COMMENCEMENT OF WORK. FENCE NO GO AREAS.
7. CONTROL DUST BY WINDBREAKS, WATERING ETC.
8. EROSION AND SILT PROTECTION MEASURES ARE TO BE MAINTAINED AT ALL TIMES. ADJUST TO SUIT STAGING AND PROGRESS.
9. HIGH EROSION AREAS, INCLUDING BATTERS TO BE STABILISED WITHIN 7 DAYS OF COMPLETING OF WORKS AND EARLIER IF DIRECTED BY SUPERINTENDENT.
10. ALL STABILISED WORKS ARE TO BE MAINTAINED UNTIL COMPLETION OF WORKS.
11. REMOVE TEMPORARY MEASURES AFTER COMPLETION OF CONSTRUCTION AND STABILISATION OF WORKS.
12. MATERIALS, WHETHER LIQUID OR SOLID, REMOVED FROM ANY ESC MEASURE, INCLUDING DE WATERING OF ANY EXCAVATION, DURING MAINTENANCE OR DECOMMISSIONING SHALL BE BE DISPOSED OF IN A MANNER THAT DOES NOT CAUSE ONGOING SOIL EROSION OR WATER POLLUTION. THIS MAY INCLUDE HYDROCARBONS OR HEAVY METALS.

LEGEND

- SEDIMENT FENCE TO SD 6-8
- STABILISED SITE ACCESS TO SD 6-14
- BUILDING TO BE DEMOLISHED

FOR BASEMENT EXCAVATION

1. IF THE WATER IS REQUIRED TO BE PUMPED FROM EXCAVATION THE FOLLOWING WATER QUALITY CRITERIA ARE TO BE MET PRIOR TO DISCHARGE.
   - PH BETWEEN 6.5 - 8.5.
   - TSS < 50mg/L.
   - TURBIDITY < 60 NTU.
   - ELECTRICAL CONDUCTIVITY OF 200µs/cm OR LESS THAN OR EQUAL TO BACKGROUND LEVELS.
2. DISCHARGE OF WATER TO CONCRETE CHANNEL, NOT STREET SYSTEM.

NOT FOR CONSTRUCTION

This drawing has been assigned an electronic code that signifies the drawing has been checked and approved by:

Issue	Description	Date	Drawn	Approved
C	RE - ISSUE FOR APPROVAL	01.02.18	JER	JPR
B	RE - ISSUE FOR APPROVAL	28.02.17	JER	JPR
A	ISSUE FOR APPROVAL	22.02.17	JER	JPR

1cm at full size

North

Client
KML JOINT VENTURE

Planner
MONTEATH AND POWYS PTY LTD
PO BOX 726
NEWCASTLE NSW 2300
PHONE : (02) 4926 1388 FAX : (02) 4929 3475

ACOR Consultants (NNSW) Pty Ltd
Level 1, 54 Union Street
Cooks Hill, Newcastle NSW 2300
T +61 2 4926 4811
ACOR CONSULTANTS ENGINEERS | MANAGERS | INFRASTRUCTURE PLANNERS | DEVELOPMENT CONSULTANTS

Project
PROPOSED RESIDENTIAL AND RETAIL MIXED USE DEVELOPMENT
32 - 42 BROOKES PARADE, BELMONT NSW 2280

Drawing Title
BELMONT DEVELOPMENT
EROSION AND SEDIMENT CONTROL PLAN

Drawn	Date	Scale	A1	Q.A. Check	Date
JER	FEB 2017	1:500			
Designed	Project No.			Dwg. No.	Issue
JPR	NE170025			SCK01	C

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Feb 01, 2018 - 4:48pm

KML Joint venture

Proposed Multi-storey Development

Belmont NSW

Environmental Site Assessment

Report No. RGS01385.1-AD

13 February 2018

REGIONAL
GEOTECHNICAL SOLUTIONS

Manning-Great Lakes

Port Macquarie

Coffs Harbour

RGS01385.1-AD

13 February 2018

KML Joint venture
Suite 1
20 Smart Street
CHARLESTOWN NSW 2290

Attention: Tony Brown

Dear Tony

RE: Proposed Multi-storey Development – Belmont NSW

Environmental Site Assessment

Regional Geotechnical Solutions Pty Ltd (RGS) has completed geotechnical and environmental site assessments at the site of the proposed multi-storey development to be constructed on the block encompassed by Brooks Parade, Sharp Street and Edgar Streets Belmont NSW. This report presents the results of the investigations.

The geotechnical and environmental assessments are presented in separate reports. This report presents the results of the environmental site assessment. The geotechnical assessment is presented separately, in report number RGS01385.1–AC.

If you have any questions regarding this project, or require any further assistance with this project, please do not hesitate to contact the undersigned.

For and on behalf of

Regional Geotechnical Solutions Pty Ltd

Steven Morton

Principal

Regional Geotechnical Solutions Pty Ltd
ABN 51141848820

44 Bent Street
Wingham NSW 2450
Ph. (02) 6553 5641

Email steve.m@regionalgeotech.com.au
Web: www.regionalgeotech.com.au

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Figure 101 Test Location Plan

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Appendix A Results of Field Investigations

Appendix B Laboratory Test Results

1 INTRODUCTION

Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken an Environmental Site Assessment for the proposed multi-storey development to be constructed on the block encompassed by Brooks Parade, Sharp Street and Edgar Streets Belmont NSW.

The proposed development is comprised of three, six storey towers and one, eight storey tower with basement parking level parking and landscaped gardens. The towers will be comprised of commercial premises and one, two and three bedroom residential apartments.

The development site is generally level and is situated on the north eastern shore of Lake Macquarie at Belmont, in an area underlain by interbedded sands and estuarine sediments with a high groundwater table.

The scope of the work was to conduct a Phase 1 site contamination assessment, as well as to provide a Waste Classification for excavated soil materials that may require removal from the site during development.

The assessment involved a brief review of site history to assess evidence of potentially contaminating past land uses, followed by observation of site conditions and sampling and analysis of site soils for a broad suite of common contaminants.

2 METHODOLOGY

The assessment was undertaken in accordance with the relevant sections of the NSW EPA, *Guidelines for Consultants Reporting on Contaminated Sites* and involved the following process:

- A brief study of site history, with the aim of identifying past activities on or near the site that might have the potential to cause contamination;
- Site walkover to assess visible surface conditions and identify any evidence of contamination, or past activities that may cause contamination;
- Review of selected aerial photographs for to identify visible evidence of potential contamination or potentially contaminating activities;
- Search of government records of groundwater use in the area;
- Search of Environmental Protection Authority (EPA) website for any Contamination Notices for the site
- Discussion with current landowners to assess possible past land uses or activities that may present potential sources of contamination or contaminating activities.

The results of the site history study are presented in Appendix A.

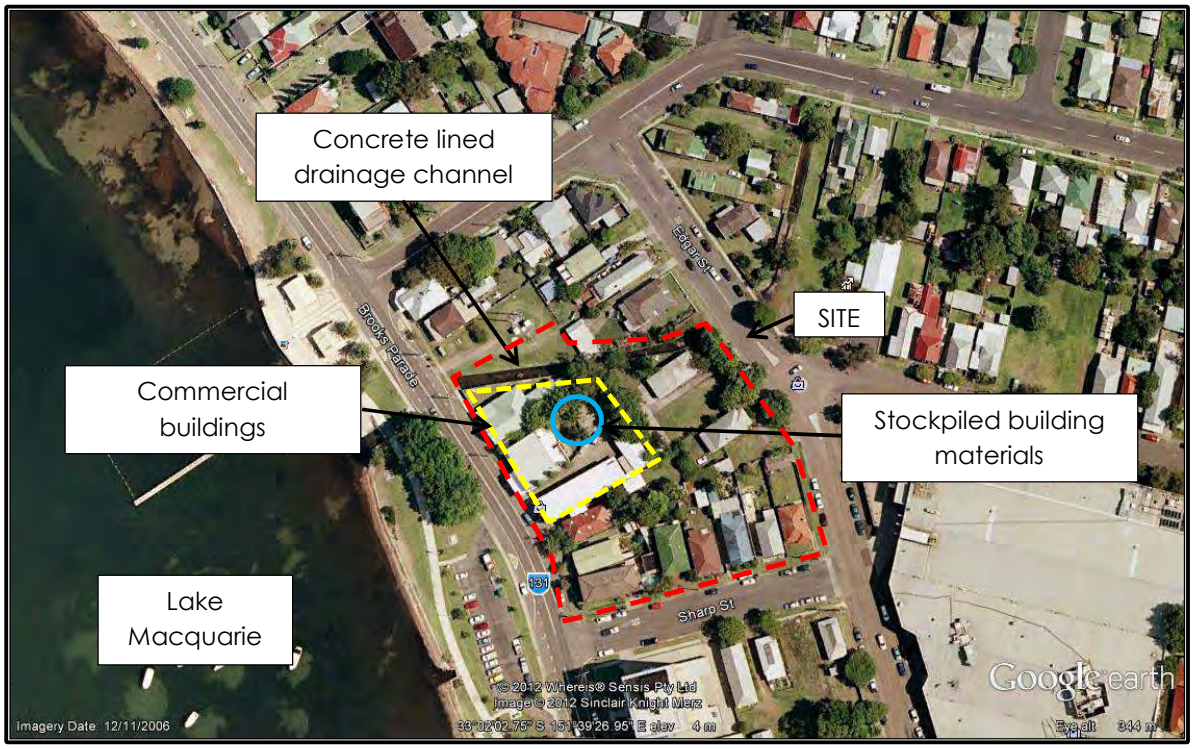
Sampling and testing was undertaken from the boreholes drilled as part of the geotechnical investigations and from additional hand augered boreholes drilled at targeted areas across the site. The samples collected were analysed for a suite of potential contaminants associated with past land use activities. The results have been evaluated against industry accepted criteria for the proposed development.

3 SITE SETTING AND HISTORY

3.1 Site Description

The site is located within a coastal environment on the eastern shore of Lake Macquarie approximately 2 km from the coast. The Google earth image below illustrates the site setting and site features.

Diagram 1: Site Setting and Features



The site is generally level and located within a low lying aeolian sand plain at the base of a broad depression within the surrounding gently undulating topography. Beyond the site residual hill-slopes rise gradually to the north and south. Coastal dune systems are situated to the east.

Lake Macquarie is located approximately 50m to the west beyond Brooks Parade and a park reserve. The mean tide level of the lake is approximately 1 to 1.5m below site level.

A concrete lined stormwater drain flows from east to west through the northern end of the site.

Existing structures generally comprise single storey houses of timber and brick construction. Three commercial buildings of brick and timber construction occupy the north western corner of the site (refer to Diagram 1) which front Brooks Parade. The existing developments are surrounded by yards comprising grassed lawns, border gardens, localised concrete pavements and numerous scattered trees and shrubs. The area behind the central commercial building is concrete paved and contains a number of stockpiles of building materials, including timber and steel.

A pump station is located to the north of the stormwater drain at the north western corner of the site. A five storey residential complex with basement car park is located at the corner of Brooks

Parade and Maude Street. A similar development is located to the south of the site. The remainder of the site is surrounded by one and two storey residential development. A single level precast panel shopping centre is located to the south east on the opposite side of Edgar Street.

3.2 NSW EPA Records

A search of the NSW EPA website (www.environment.nsw.gov.au) revealed that no notices have been issued on the site under the Contaminated Land Management Act (1997).

4 GEOLOGY

The 1:250,000 Geology sheet for Sydney indicates the site is underlain by Quaternary alluvial deposits comprising sand, silts clays and gravel. To the north and south of the site the underlying geology comprise the Newcastle Coal Measures comprising shale, sandstone, conglomerate, chert, tuff and coal seams.

In summary the boreholes encountered a subsurface profile generally comprising aeolian and alluvial sand overlying alluvial and residual clays which grade into siltstone which intern overly moderately weathered to fresh sandstone.

Further details of the profile encountered are provided below with detailed descriptions in the engineering logs which are presented in Appendix A.

Unit 1 - Topsoil / Fill: comprising predominately sand was encountered in all boreholes to depths of between 0.1m to 0.7m; overlying,

Unit 2 - Alluvial / Aeolian Sand: comprising very loose to loose sand and gravelly sand, encountered below the topsoil and fill in all boreholes to depths of between 2.4m to 2.8m.

Unit 3 - Alluvial Clay: gravelly clay and sandy clay, medium to high plasticity varying from firm to very stiff strength was encountered below the alluvial sands and extended to depths between 3.1m and 4.5m. A layer of peat approximately 0.6m thick was encountered in in BH3 from a depth of 1.8m.

Unit 4 - Residual Clay: clay and silty clay of medium to high plasticity, very stiff to hard strength was encountered below the alluvial clays in all boreholes to depths of between 6.8m and 10m. The residual clays graded into extremely weathered siltstone.

Unit 5 - Weathered Siltstone: The siltstone was initially extremely weathered (hard residual clay) generally improving with depth to highly to moderately weathered and very low to low strength. The siltstone was interbedded with sandstone in BH2, BH6, BH7 and BH8 near the siltstone / sandstone interface.

Unit 6 - Weathered sandstone: The sandstone was generally moderately weathered and low to medium strength improving to slightly weathered to fresh and of medium to high strength.

Groundwater was encountered during the drilling of all eight drill rig boreholes. A summary of the groundwater observations is presented in Table 1.

Table 1: Summary of Groundwater Observations

Borehole	Inflow Depth During Drilling (m)	Depth to Water After Completion of Drilling (m)
BH1	Not recorded (1)	Not recorded (2)
BH2	1.5	1.1
BH3	1.5	Not recorded(2)
BH4	1.6	1.1
BH5	1.3	Not recorded(2)
BH6	1.0	0.6
BH7	1.2	Not recorded(2)
BH8	1.0	1.0

NOTES:

1. *Borehole advanced by wash boring methods from 0.6m therefore no meaningful groundwater observations possible.*
2. *No meaningful groundwater observations possible due to water introduced during core drilling.*

It should be noted that groundwater levels may fluctuate seasonally and in response to rainfall and tidal variations.

A groundwater bore search on the NSW Water Information website, http://waterinfo.nsw.gov.au/gw/ indicated that there are no licensed groundwater bores within the property boundary, however, several are located to the south. The closest bore is located near the intersection of The Pacific Highway and Robert Street approximately 1.5km to the south. The bore is for domestic use.

5 SITE CONTAMINATION ASSESSMENT

5.1 Areas of Environmental Concern and Chemicals of Concern

Based on the site observations and knowledge obtained about site activities as outlined above, the areas of environmental concern and chemicals of concern outlined in Table 2 were identified for the assessment.

Table 2: Areas of Concern and Chemicals of Concern

Area of Environmental Concern	Mode of potential contamination	Chemicals of Concern
General site area subjected to herbicide and pesticide use for gardening purposes	Spraying, spillage or storage of pesticides and herbicides.	Heavy Metals, OC/OPP
Commercial buildings and yards along Brooks parade frontage	Potential spillage or leakage of chemicals and fuels from containers.	Heavy Metals, TPH, BTEX, PAH,
Localised areas around workshops, garages etc	Potential spillage or leakage of chemicals and fuels from containers.	Heavy Metals, TPH, BTEX, PAH,
General site area containing refuse or fragments from older buildings	Possible asbestos fragments, or remnants of leaded paint	Asbestos, lead, other heavy metals
General site contaminants	Fuel and oils, lead containing paints, asbestos containing building materials, general contamination and spillage	Heavy Metals, Asbestos, TPH, BTEX, PAH, OC/OPP

Heavy Metals - Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc
BTEX - Benzene, Toluene, Ethylbenzene and Xylene
TPH - Total Petroleum Hydrocarbons
PAH – Polycyclic Aromatic Hydrocarbons
OC/OPP – Organochlorine and Organophophorus Pesticides

5.2 Guidelines and Assessment Criteria

The NSW DEC *Guidelines for the NSW Site Auditor Scheme (2006 2nd Edition)* present health based investigation guidelines for different land uses (e.g. industrial/commercial, residential, recreational etc.) as well as provisional phytotoxicity based investigation levels.

The future land use on the site is intended to be primarily residential with some commercial space. Therefore the investigation levels for "residential with limited soil access" land use have been adopted as the primary investigation criteria.

The NSW DEC (2006) Guidelines for the NSW Site Auditor Scheme does not provide investigation criteria for Total Petroleum Hydrocarbons (TPH). The NSW EPA (1994) Guidelines for Assessing Service Station Sites provides acceptable threshold concentrations for petroleum hydrocarbons compounds at service station sites to be reused for sensitive land uses such as residential.

On the basis of the above, the guidelines presented in Table 3 below have been adopted for this assessment.

Table 3 Adopted Soil Investigation Criteria (mg/kg)

Analyte	Adopted Soil Investigation Criteria	Analyte	Adopted Soil Investigation Criteria
Benzene	1	Copper	4,000
Toluene	1.4	Lead	1,200
Ethyl-benzene	3.1	Zinc	28,000
Xylene	14	Cadmium	80
TRH $C_6 – C_9$	65	Chromium (III)	48%
TRH $C_{10} – C_{35}$	1000	Arsenic	400
Total PAH	80	Nickel	2,400
Benzo-a-pyrene	4	Mercury	60
Aldrin + Dieldrin	40	DDT + DDD + DDE	800
Chlordane	200	Heptachlor	40

5.3 Sampling Plan and Field Work

NSW EPA 1995 Sampling Design Guidelines indicate that sampling can be undertaken on a targeted basis, ie targeting identified areas of potential contamination. Where no such specific areas of concern exist, sampling can be undertaken on a systematic grid basis, with samples evenly spaced over the subject area. The site occupies an area of 0.6 hectares, for which the guidelines indicate a systematic sampling grid would require a minimum of 15 sample locations.

Fieldwork was carried out in April 2012 and comprised a site walkover assessment and the logging and sampling of site soils at 26 locations. Soil samples were collected at various depths across the site. Samples were then selected for analysis based on a combination of sample location and field observations (i.e. material type and proximity to areas of environmental concern). Test locations are shown in Figure 101.

The samples were collected from the split tube sampler and from the auger. The samples were collected in acid-rinsed 250mL glass jars and placed in an ice-chilled cooler while on site and during transit to the laboratory where the samples were refrigerated.

5.4 Laboratory testing

Samples were transported under chain-of-custody conditions to ALS Laboratory Group, a NATA accredited specialist chemical testing laboratory. Samples were tested for the following suite of contaminants:

- Polycyclic Aromatic Hydrocarbons (PAH)
- Total Petroleum Hydrocarbons (TPH)
- Benzene, Toluene, Ethyl-benzene, Xylenes (BTEX)
- Organochlorine Pesticides (OCPs)
- Polychlorinated Biphenyls (PCB)
- Heavy metals (arsenic, cadmium, chromium, cobalt, copper, lead, mercury, and zinc)
- Asbestos.

The results are presented in Appendix B.

5.5 Quality Control

Samples were obtained using industry accepted protocols for sample treatment, preservation, and equipment decontamination. Four duplicate samples were submitted to the laboratory for analysis, as outlined below:

1. Primary BH5 - 0.1 to 0.2, duplicate BH5 – 0.2 to 0.3;
2. Primary BH7 - 0.15 to 0.25, duplicate BH7 – 0.35 to 0.45;
3. Primary 106, Duplicate 126;
4. Primary 117, Duplicate 127.

Comparison of the test results on the primary and duplicate samples show good correlation.

In addition to the field QC procedures, the laboratory conducted internal quality control testing including surrogates, blanks, and laboratory duplicate samples. The results are presented with the laboratory test results in Appendix B.

All laboratory quality control data is within acceptable limits for the tests carried out. Therefore on the basis of the results of the field and laboratory quality control procedures and testing the data is considered to reasonably represent the concentrations of contaminants in the soils at the sample locations at the time of sampling and the results can be adopted for this assessment.

5.6 Results

Laboratory test results are presented in Appendix B. An evaluation of the laboratory test results against the adopted soil assessment criteria is provided below:

- Results of heavy metal analysis revealed concentrations were below the adopted soil investigation criteria in all samples analysed;

- Results of BTEX analysis revealed concentrations below the level of reporting in all but one sample (113, which recorded low concentrations of Toluene). All results were below the adopted assessment criteria for all BTEX compounds analysed.
- Results of TRH C6-C9 analysis revealed concentrations below the laboratory detection limits for all samples and therefore well below the adopted assessment criteria for all TRH C6-C9 compounds analysed.
- Results of TRH C10-C36 analysis in all samples revealed some detectable concentrations in a number of samples tested however concentrations were below the adopted assessment criteria for all samples analysed.
- Results of organochlorine and organophosphorus pesticide analysis revealed some detectable concentrations in a number of samples tested from the northeastern corner of the site, however, all levels were below the adopted assessment criteria.
- Asbestos was detected in a soil sample from location BH1 at 0.1 to 0.2m. No asbestos was detected in any of the other soil samples analysed.

6 ASSESSMENT AND CONCLUSIONS REGARDING SITE CONTAMINATION

The majority of the site has been used for residential purposes since at least the last 50 years. Some commercial activities have taken place in several properties along the Brooks Parade frontage. No specific evidence of potentially contaminating sources or activities was identified.

Analysis of soil samples found heavy metals, TPH, BTEX, PAH, PCB and OC/OPP were either at concentrations below the laboratory detection limits or at concentrations below the adopted criteria for residential land use *'with minimal access to soil including high rise apartments and flats'*.

The slightly elevated levels of organochlorine pesticides encountered in samples recovered from BH5, 104, and 105, are likely to be associated with the use of pesticides in the lawns and gardens present in the vicinity of BH5. Discussions with the property owner at the time of the assessment support this. The concentrations encountered were below the adopted soil investigation criteria.

One soil sample from location BH1 revealed some asbestos fibres. This borehole was within a residential property and the soil or surrounding area did not reveal visible asbestos materials. It is likely that the asbestos encountered was an isolated occurrence resulting from past construction or refurbishment of the ageing dwelling on the property. It is recommended that prior to excavation of materials from this area, some additional sampling and analysis for the presence of asbestos should be undertaken to assess the extent of asbestos within the soil. Once identified, the affected area of the soil should be specifically excavated and removed as asbestos waste.

On the basis of the investigations and assessment undertaken it is considered that the site is appropriate for the proposed development with regards to contamination resulting from past or current land use.

7 WASTE CLASSIFICATION

7.1 Background and Classification Guidelines

The proposed development will incorporate basement level parking, and as such will require excavation to depths of the order of 3m across a large proportion of the site. This will involve excavation and removal of three general soil units:

- An upper soil profile comprising fill, topsoil and minor surface rubble;
- Aeolian sands to depths of the order of 2.5m;
- Alluvial clay soils below 2.5m.

Materials likely to be excavated have been classified in accordance with the NSW EPA 2014 Waste Classification Guidelines. The guidelines provide a process of waste classification that allows comparison of soil concentration test results against a range of Contaminant Threshold values for a broad range of contaminants. Where the test results exceed these thresholds the guidelines allow further evaluation based on evaluation of leachate test results, using the Toxicity Characteristics Leach Procedure (TCLP) test to simulate low pH conditions likely to be encountered in a waste landfill situation.

7.2 Evaluation against Contaminant Threshold Values

The results of all soil samples analysed were compared to the Contaminant Threshold criteria for General Solid Waste (CT1). The following samples exceeded these criteria:

- BH1 0.1 to 0.2m – exceeds CT1for lead. This sample also revealed some detectable PAH for which the guidelines indicate leachate testing to be required for classification;
- BH5 0.1 to 0.2m – exceeds CT1for lead. This sample also revealed some detectable PAH for which the guidelines indicate leachate testing to be required for classification;
- Samples 101,103, 109,110, 112 and 113 exceed CT1for lead;
- Samples 104, 108 revealed some detectable PAH for which the guidelines indicate leachate testing to be required for classification

7.3 Leachate Testing

In accordance with the Waste Classification Guidelines, further evaluation was required for these samples to be classified as General Solid Waste, involving leachate testing which then allows results to be evaluated against TCLP1 criteria and Specific Contaminant Concentration (SCC1) values. Results of leachate testing are provided in Appendix B. The results indicated TCLP values within the TCLP1 concentrations for all samples analysed. Specific Contaminant Concentrations were below SCC1 concentrations. On this basis the material can be classified as General Solid Waste.

7.4 Waste Classification

Based on the results of the testing undertaken, the following waste classifications apply to the materials to be excavated from the site:

- The upper profile of fill, topsoil and the like would be classified as General Solid Waste, and would require disposal to an appropriately licensed landfill if it is to be removed from the site;
- Aeolian sands to depths of the order of 2.5m are classified as Virgin Excavated Natural Material (VENM);
- Alluvial clay soils below 2.5m would also classify as VENM, however, testing presented and discussed in the Geotechnical Report (Ref REGS00372.1-AC) indicates the clay soils to be Potential Acid Sulfate Soils (ASS). Treatment and disposal of these soils should therefore be undertaken in accordance with the ASS Management Plan provided in the geotechnical report.

8 WATER

Water samples were recovered from three monitoring wells installed within the sand aquifer in the upper profile. A fourth well was sealed into the underlying clay layers to assess whether different groundwater characteristics were present at depth, but due to the very low permeability of the clay horizons it was not possible to obtain a sample from that well.

Some dewatering is likely to be required to allow construction of the basement. The water samples obtained were analysed to assess background water quality, to assist with assessing options for discharge of the extracted groundwater. The test results are presented in Appendix B and summarised in Table 4. Table 4 compares the results to criteria derived from ANZECC 2000 Water Quality Guidelines. The guidelines present criteria for evaluation of waters to be discharged to a range of environmental scenarios. Criteria relevant to this project are presented in Table to allow comparison of results obtained, assuming the site and nearby receiving waters would constitute at least a moderately disturbed environment.

Table 4. Results of groundwater sampling and analysis

Analyte	Evaluation Criteria		BH6	BH4	BH2
	Fresh Water	Marine			
pH	6.5 - 8	7 – 8.5*	7.53	7.31	6.75
Conductivity(uS/cm)	20 - 30	N/A	4080	1350	3680
Chloride (ug/L)	3	N/A	1160	524	1090
Ammonia (ug/L)	900	910	540	<10	230
Nitrate (ug/L)	700	N/A	70	<10	120
Total N (ug/L)	350	300*	70	<10	120
Total P (ug/L)	10	30*	950	5930	1450

Note * denotes guideline for estuary waters

The results indicate the water would generally be suitable for discharge to marine or estuarine receiving water, however, further assessment of phosphorus concentrations should be undertaken.

Also, sampling and analysis of receiving waters should be undertaken to provide background data for assessment of other parameters tested including Dissolved Oxygen and BOD.

9 LIMITATIONS

The findings of this assessment are the result of sampling and analysis at specific locations using methodologies adopted in accordance with accepted industry practices and standards. It is considered that the results represent a reasonable interpretation of the conditions at the site in relation to contamination resulting from past site activities. Under no circumstances, however, can it be considered that these findings represent the actual state of the site at all points. The potential exists for 'hot spots' of soil contamination between sampling locations. Should conditions that differ from those described in this report be encountered during future site usage, further advice should be sought.

For and on behalf of

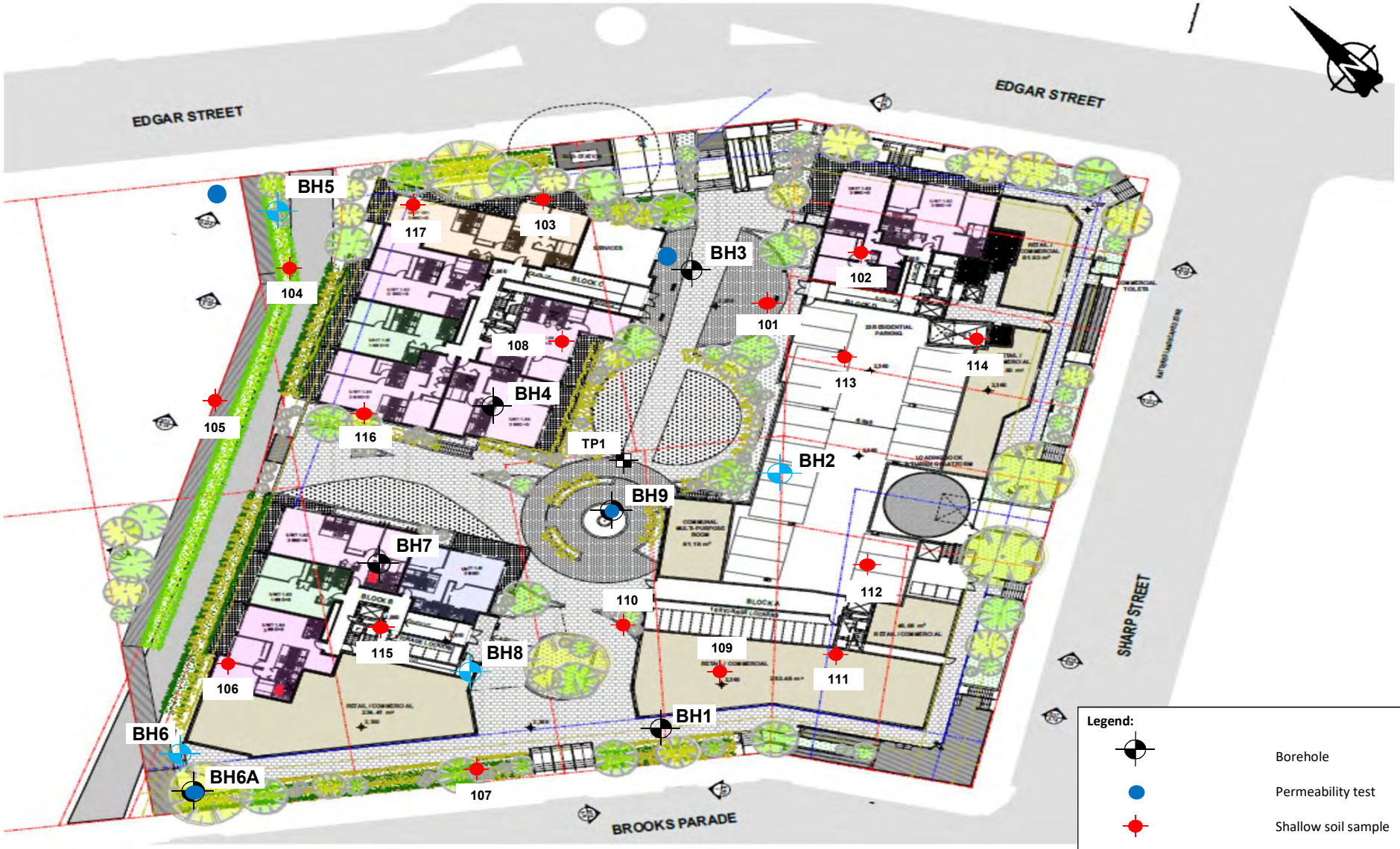
Regional Geotechnical Solutions Pty Ltd



Steven Morton

Principal

Figure



NOT TO SCALE

REGIONAL GEOTECHNICAL SOLUTIONS	Client	KML Joint Venture	Job No. RGS01385.1
	Project:	Proposed Multi-storey Development	Drawn By: AH
		Environmental Site Assessment	Date: 13-Feb-18
	Title:	Test Location Plan	Drawing No. **FIGURE 1**

Appendix A

Results of Field Investigations

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH1

CLIENT: KML Joint Venture
PAGE: 1 OF 3

PROJECT NAME: Proposed Multi-Storey Development
JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1
DATE: 11/4/12

DRILL TYPE: XC Track Mounted
SURFACE RL:

BOREHOLE DIAMETER: 100 mm
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
ADTC							Topsoil/Fill: Silty SAND, fine grained, brown, contains fine to medium rounded gravel and rootlets	M				0.00: TOPSOIL: FILL: Grassed
							0.30m					0.30: ALLUVIAL
						SP	SAND, medium to coarse grained, orange, brown, contains medium to coarse subrounded gravel					
				1.0			1.00m					
CB		1.50m SPT 2,2,1 N=3 1.95m				SP	Gravelly SAND, medium to coarse subrounded, grey, gravel is fine to medium grained, subrounded	W	L			
				2.0			2.60m					
		3.00m SPT 2,3,3 N=6 3.45m		3.0		CL	Gravelly CLAY, medium plasticity, grey, gravel is medium to coarse grained, subrounded, claystone, contains medium to coarse grained Sand	M ~ w_P	St - VSt			
				4.0			4.00m					
RR		4.50m SPT 3,5,8 N=13 4.95m				CH	Silty CLAY, high plasticity, pale grey, contains coal bands	M ~ w_P				4.00: RESIDUAL
							4.50m					
				5.0			Clayey SILT, medium to high plasticity, pale grey					
		6.00m SPT 3,4,6 N=10 6.45m		6.0		MH		W	VSt			
				7.0								

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH1**

CLIENT: KML Joint Venture

PAGE: 2 OF 3

PROJECT NAME: Proposed Multi-Storey Development

JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1

DATE: 11/4/12

DRILL TYPE: XC Track Mounted

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
RR						MH	Clayey SILT, medium to high plasticity, pale grey *(continued)*	W	VSt			
							8.60m					
				9.0		MH	SILTSTONE, fine to medium grained, grey-brown and orange-brown, very low strength					8.60: Reduction in Drilling Resistence
							9.00m					
							Continued as Cored Drill Hole					
				10.0								
				11.0								
				12.0								
				13.0								
				14.0								
				15.0								

LEGEND:

Water

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes

- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: BH1

CLIENT: KML Joint Venture

PAGE: 3 OF 3

PROJECT NAME: Proposed Multi-Storey Development

JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1

DATE: 11/4/12

DRILL TYPE: XC Track Mounted

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

DATUM: AHD

Drilling and Sampling					Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	CORE LIFT / TEST	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
				9.0		START CORING AT 9.00m						
NMLC						Start Coring at 9.0m, No Core 0.4m						
				10.0		SILTSTONE, fine grained, grey with orange-brown bands	EW	VL				PT 0° SN PT 0° SN PT 0° SN PT 0° SN PT 0° SN PT 0° SN
							HW	L		0	50	CS PT 0° SN PT 0° SN PT 0° SN
		10.5							A=0.45		300	PT 0° SN PT 0° SN PT 0° SN
				11.0			HW - MW	VL - L		13	50	CZ 30mm thick
		11.7									100	PT 0°
				12.0		SANDSTONE, fine to medium grained, grey, instinctly bedded	SW	L - M		60	300	PT 5° PT 0° SZ 0° PT 5° SZ 5° PT 0° PT 5° JT 10° CN UN RO PT 5° PT 10°
				13.0				M	A=1.42			
		13.2				Hole Terminated at 13.20 m						
				14.0								
				15.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Method

AS	Auger Screwing
AD	Auger Drilling
RR	Roller/tricone
CB	Claw or Blade bit
NMLC	NMLC Core

Field Tests

HP	Hand Penetrometer

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength

		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
SS	Sheared Surface
CS	Crushed Seam

Roughness

VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating

CN	Clean
SN	Stained
VN	Veneer
CO	Coating

Planarity

PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

RG LIB 1.02.GLB Log RG CORED BOREHOLE RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:27 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH2

CLIENT: KML Joint Venture
PAGE: 1 OF 3

PROJECT NAME: Proposed Multi-Storey Development
JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1
DATE: 11/4/12

DRILL TYPE: XC Track Mounted
SURFACE RL:

BOREHOLE DIAMETER: 100 mm
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
NMLC							0.20m TOPSOIL, Silty SAND, fine grained, orange-brown, contains rootlets	D				0.00: TOPSOIL: GRASSED
						SM	Silty SAND, fine grained, dark grey	D	VL			0.20: AEOLIAN
				1.0		SP	0.80m Gravelly SAND, medium to coarse grained, grey, gravel is medium to coarse grained, rounded	M				0.80: ALUVIAL
		1.30m SPT 3,1,1 N=2 1.75m				SP	1.50m SAND, fine to medium grained, grey, contains a trace of fine to medium rounded gravel	W	VL			
				2.0			2.60m					
							2.80m Sandy Clay, medium plasticity dark Grey		St			
		2.90m SPT 2,4,6 N=10 3.35m		3.0		CH	Gravely Clay, medium to high plasticity dark grey, Gravel is medium to coarse grained subrounded Siltstone ironstone contains some fine to medium grained Sand		VSt			3.00: ALLUVIAL CLAY
				4.0			4.00m Silty Clay, medium to high plasticity, pale grey contains trace of thin coal seams		VSt			4.00: RESIDUAL NO SAMPLE RECOVERY
		4.20m SPT 2,3,3 N=6 4.65m		5.0		CH						
				6.0								
		7.00m SPT 3,12,7 N=19 7.45m		7.0		CH	6.95m Silty Clay medium to high plasticity, pale grey mottled Orange brown with some highly weathered Siltstone Sands		VSt - H			6.80: EXTREMELY WEATHERED SILTSTONE

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH2

CLIENT: KML Joint Venture

PAGE: 2 OF 3

PROJECT NAME: Proposed Multi-Storey Development

JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1

DATE: 11/4/12

DRILL TYPE: XC Track Mounted

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
						CH	Silty Clay medium to high plasticity, pale grey mottled Orange brown with some highly weathered Siltstone Sands *(continued)*		VSt - H			
							8.75m Continued as Cored Drill Hole					
				9.0								
				10.0								
				11.0								
				12.0								
				13.0								
				14.0								
				15.0								

LEGEND:

Water

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes

- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: BH2

CLIENT: KML Joint Venture

PAGE: 3 OF 3

PROJECT NAME: Proposed Multi-Storey Development

JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1

DATE: 11/4/12

DRILL TYPE: XC Track Mounted

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

DATUM: AHD

Drilling and Sampling					Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	CORE LIFT / TEST	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
						START CORING AT 8.75m						
NMLC				9.0		Siltstone fine grey with Orange brown bands indistinctly bedded	EW	EL				SM 0°
							HW	VL				JT 5 - 10°
												SZ
												SM 0°
												SZ
												SM 0°
						Siltstone fine dark grey mottled pale grey, distinctly bedded at 5° - 20°	HW - MW	VL - L				SZ 0°
												JT 15°
				10.0								SM 5°
												SM
												PT 0° SN
												PT 0° SN
									A=0.38			PT 0° SN
							MW - SW	L - M				PT 0°
						Interbedded Sandstone and Siltstone, fine Sandstone is pale grey, Siltstone dark grey, distinctly bedded at 0° - 5°						CS 5°
				11.0								SM 0°
						Sandstone, fine to medium grained grey indistinctly bedded						SZ
												PT 5° VN
												PT 5° VN
				12.0			SW - FR	M	A=1.00			
												PT 0° CN
				13.0		Hole Terminated at 12.90 m						
				14.0								
				15.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Method

AS	Auger Screwing
AD	Auger Drilling
RR	Roller/tricone
CB	Claw or Blade bit
NMLC	NMLC Core

Field Tests

HP	Hand Penetrometer

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength

		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
SS	Sheared Surface
CS	Crushed Seam

Roughness

VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating

CN	Clean
SN	Stained
VN	Veneer
CO	Coating

Planarity

PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

RG LIB 1.02.GLB Log RG CORED BOREHOLE RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:27 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH3

CLIENT: KML Joint Venture
PAGE: 1 OF 3
PROJECT NAME: Proposed Multi-Storey Development
JOB NO: RGS1385.1
LOGGED BY: AH
LOCATION: Refer to Figure 1
DATE: 11/4/12

DRILL TYPE: XC Track Mounted
SURFACE RL:
BOREHOLE DIAMETER:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
NMLC		1.50m SPT 1,1,1 N=2 1.95m		1.0		SP	0.10m TOPSOIL: Silty Sand, fine dark grey, contains rootlets 0.50m Silty Sand, fine grey SAND, medium to coarse grey contains trace of Fine rounded gravel	M M	VL			0.00: TOPSOIL: GRASSED 0.10: AEOLIAN 0.50: ALLUVIAL
				2.0			1.60m Peat Brown	W				
				3.0		CH	2.50m Gravelly Clay, high plasticity, pale grey - Gravel is fine to medium grained contains fine to medium grained sand	M > w_P	St - VSt			2.50: RESIDUAL
		4.00m SPT 3,4,6 N=10 4.45m		4.0		CH	3.60m Clay, high plasticity, pale grey, contains trace of fine Sand and fine angular Siltstone gravel with some Orange brown mottle					
				5.0			5.00m Clay, high plasticity, pale grey, with some Orange brown mottle	W	VSt			
				6.0		CH						
		7.00m SPT 3,4,5 N=9 7.45m		7.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH3**

CLIENT: KML Joint Venture

PAGE: 2 OF 3

PROJECT NAME: Proposed Multi-Storey Development

JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1

DATE: 11/4/12

DRILL TYPE: XC Track Mounted

SURFACE RL:

BOREHOLE DIAMETER:

DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
						CH	8.20m Silty Clay, medium plasticity pale grey mottled orange browny	W M < w_P	VSt H			
				9.0			9.20m Continued as Cored Drill Hole					
				10.0								
				11.0								
				12.0								
				13.0								
				14.0								
				15.0								

LEGEND:

Water

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes

- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: BH3

CLIENT: KML Joint Venture

PAGE: 3 OF 3

PROJECT NAME: Proposed Multi-Storey Development

JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1

DATE: 11/4/12

DRILL TYPE: XC Track Mounted

SURFACE RL:

BOREHOLE DIAMETER:

DATUM: AHD

Drilling and Sampling					Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	CORE LIFT / TEST	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
				9.0		START CORING AT 9.20m						
NMLC				10.0		Siltstone fine pale grey with occasional orange brown mottle, indistinctly bedded	EW	EL				CS 95° JT 60° SN JT 10° VN CS 30°
				11.0		Siltstone: Fine pale grey mottled orange brown, bedded at 10° to 20°	EW - HW	EL - VL				SM 30° JT 20° VN PT 10° SN JT 45° CN JT 45° VN PT 5° PT 10°
				12.0		Sandstone: Fine pale grey mottled orange brown bedded at 5° to 20° with thin Siltstone bands	MW SW	VL - L M	A=1.02			PT 0°
				13.0		Sandstone: Fine to medium grey, indistinctly bedded	SW - FR	M - H	A=1.36			
				14.0		Hole Terminated at 13.40 m						
				15.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Method

AS	Auger Screwing
AD	Auger Drilling
RR	Roller/tricone
CB	Claw or Blade bit
NMLC	NMLC Core

Field Tests

HP	Hand Penetrometer

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength

		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
SS	Sheared Surface
CS	Crushed Seam

Roughness

VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating

CN	Clean
SN	Stained
VN	Veneer
CO	Coating

Planarity

PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

RG LIB 1.02.GLB Log RG CORED BOREHOLE RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:27 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH5

CLIENT: KML Joint Venture

PAGE: 1 OF 3

PROJECT NAME: Proposed Multi-Storey Development

JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1

DATE: 11/4/12

DRILL TYPE: XC Track Mounted

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
NMLC	▶	3.00m SPT 2,4,5 N=9 3.45m		1.0		SM	0.30m TOPSOIL: Silty Sand, medium to coarse dark grey with fine to medium grained subrounded Gravel and rootlets	M				0.00: TOPSOIL CROSSED
				2.0			Silty Sand, medium to coarse grey with medium to coarse subrounded Gravel	M				0.30: ALLUVIAL
				3.0				W	VL			
				4.0		CH	2.50m Sandy Clay, medium to high plasticity, Grey, Sand fine to medium grained	$M > w_P$	VSt			2.50: ALLUVIAL
		6.00m SPT 5,5,5 N=10 6.45m		5.0			4.00m Clay, medium to high plasticity, pale Grey					4.00: RESIDUAL
				6.0		CH			VSt			
				7.0								

LEGEND:

Water

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes

- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH5**

CLIENT: KML Joint Venture | **PAGE:** 2 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 11/4/12

DRILL TYPE: XC Track Mounted | **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm | **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
NMLC		9.00m SPT 5,13,14 N=27 9.45m		9.0		CH	Clay, medium to high plasticity, pale Grey *(continued)*		VSt			
							8.50m					
							Clay, medium to high plasticity, pale Grey mottled Orange Brown	$M > w_P$				8.50: EXTREMELY WEATHERED SILTSTONE
				10.0		CH			H			
				11.0			11.00m					
							Siltstone, fine dark grey with pale grey bands, very low strength	M				11.00: EXTREMELY WEATHERED TO HIGHLY WEATHERED SILTSTONE
				12.0			12.50m					
							Continued as Cored Drill Hole					
				13.0								
				14.0								
				15.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

ENGINEERING LOG - CORED BOREHOLE

REGIONAL GEOTECHNICAL SOLUTIONS

BOREHOLE NO: BH5
CLIENT: KML Joint Venture
PAGE: 3 OF 3
PROJECT NAME: Proposed Multi-Storey Development
JOB NO: RGS1385.1
LOGGED BY: AH
LOCATION: Refer to Figure 1
DATE: 11/4/12

DRILL TYPE: XC Track Mounted
SURFACE RL:
BOREHOLE DIAMETER: 100 mm
DATUM: AHD

Drilling and Sampling					Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	CORE LIFT / TEST	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}D/A$	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
				9.0								
				10.0								
				11.0								
				12.0		START CORING AT 12.50m						
NMLC				13.0		Sandstone, fine to medium pale grey with re brown staining, indistinctly bedded	HW	VL				PT 5° SN PT 0° SN PT 0° SN
							SW	M - H				PT 5° CN
				14.0								SM 50° SM 20° SM 20°
						NO CORE 0.25M	EW	VL				
						Sandstone, fine to medium grey, Indistinctly bedded	HW	VL				
							MW	L - M				
				15.0		NO CORE 0.28M						
						Sandstone, fine to medium grey indistinctly bedded	SW	M	A=5.80			SM 0° SM 0° SM 0° 40°
							EW	VL				
						Hole Terminated at 15.85 m						

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Method

AS	Auger Screwing
AD	Auger Drilling
RR	Roller/tricone
CB	Claw or Blade bit
NMLC	NMLC Core

Field Tests

HP	Hand Penetrometer

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength

		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
SS	Sheared Surface
CS	Crushed Seam

Roughness

VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating

CN	Clean
SN	Stained
VN	Veneer
CO	Coating

Planarity

PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

RG LIB 1.02.GLB Log RG CORED BOREHOLE RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:28 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH6**

CLIENT: KML Joint Venture | **PAGE:** 1 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 18/4/12

DRILL TYPE: Truck Mounted | **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm | **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
NMLC		1.20m SPT 3,1,2 N=3 1.65m		1.0		SP	0.02m TOPSOIL/FILL: Gravelly SAND, fine to medium grained dark grey, Gravel is fine to medium grained, subangular SAND, medium to coarse grained, grey with fine to medium grained subrounded gravel	W				0.00: TOPSOIL/FILL: GRASSED 0.02: ALLUVIAL
				2.0				W	VL			
				3.0		CL	2.80m Sandy CLAY, medium plasticity, grey, Sand fine to medium grained	M > w_P	St			2.80: ALLUVIAL
		4.50m SPT 5,8,13 N=21 4.95m		4.0			4.00m CLAY, medium-high plasticity, grey mottled orange brown					4.00: RESIDUAL
				5.0								
				6.0		CH		M > w_P	H			
		7.10m SPT 5,10,14 N=24 7.55m		7.0								

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH6**

CLIENT: KML Joint Venture | **PAGE:** 2 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 18/4/12

DRILL TYPE: Truck Mounted | **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm | **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
NMLC		10.70m SPT 10,20,150 N=170 11.15m		9.0		CH	CLAY, medium-high plasticity, grey mottled orange brown *(continued)*	M > w_P				
							9.00m					9.00: EXTREMELY WEATHERED SILTSTONE
				10.0		CH	CLAY, medium plasticity, grey mottled orange, brown	M > w_P	H			
							10.80m					10.80: EXTREMELY WEATHERED TO HIGHLY WEATHERED SILTSTONE
				11.0			SILTSTONE, fine grained, grey mottled orange brown, very low strength with occasional low strength bands					
							11.70m					
							Continued as Cored Drill Hole					
				12.0								
				13.0								
				14.0								
				15.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

RG LIB 1.02 GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: BH6

CLIENT: KML Joint Venture

PAGE: 3 OF 3

PROJECT NAME: Proposed Multi-Storey Development

JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1

DATE: 18/4/12

DRILL TYPE: Truck Mounted

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

DATUM: AHD

Drilling and Sampling					Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	CORE LIFT / TEST	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
				9.0								
				10.0								
				11.0		START CORING AT 11.70m						
NMLC				12.0		Start Coring at 11.70m No Core 0.2m Interbedded SILTSTONE and SANDSTONE, fine grained, Siltstone is dark grey, Sandstone is pale grey, bedded at 5° to 10°	HW	M	A=0.49			SM 0° SM 0° PT 0° CN PT 0° SM 15° PT 0° CN PT 5° SN PT 5 - 10° CN PT 5° CN SM 5 - 10° SN PT 0 - 5° CN PT 15° SN JT 75° VN PT 0° SN PT 0° SN PT 0° CN PT 20° CN PT 20° CN PT 0° CN PT 0° CN PT 5 - 10° CN PT 5 - 20° CN PT 10° CN PT 5° CN PT 5° CN
				13.0			SW	M				
				14.0		SANDSTONE, fine grained, pale grey, indistinctly bedded	SW	M	A=1.09			
						SANDSTONE, fine to medium grained, pale grey, indistinctly bedded		L	A=0.12			
				15.0		Hole Terminated at 14.45 m						

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Method

AS	Auger Screwing
AD	Auger Drilling
RR	Roller/tricone
CB	Claw or Blade bit
NMLC	NMLC Core

Field Tests

HP	Hand Penetrometer

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength

		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
SS	Sheared Surface
CS	Crushed Seam

Roughness

VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating

CN	Clean
SN	Stained
VN	Veneer
CO	Coating

Planarity

PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

RG LIB 1.02.GLB Log RG CORED BOREHOLE RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:28 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH6A

CLIENT: KML Joint Venture
PAGE: 1 OF 1
PROJECT NAME: Proposed Multi-Storey Development
JOB NO: RGS1385.1
LOGGED BY: AH
LOCATION: Refer to Figure 1
DATE: 18/4/12

DRILL TYPE: Hand Excavator
SURFACE RL:
BOREHOLE DIAMETER: 100 mm
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
HA				0.00			FILL: Sandy Gravel medium to coarse angular orange brown	W				0.00: FILL: GRASSED
				0.20m								
				0.35m			FILL: Gravely Sand, fine to medium grained dark grey mottled pale grey gravel is fine to medium grained subangular contains charcoal					0.45: ALLUVIAL
				0.45m		SM	FILL SAND: fine to medium grained orange brown		VL			
	▶			1.00m			Silty SAND: medium coarsed dark grey with some fine to medium subrounded gravel					
				1.0								
				2.0								
				3.0								
				4.0			Hole Terminated at 4.00 m					
				5.0								
				6.0								
				7.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH7

CLIENT: KML Joint Venture | **PAGE:** 1 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 19/4/12

DRILL TYPE: Truck Mounted | **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm | **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
NMLC		3.00m SPT 0,1,2 N=3 3.45m		1.0		SM	0.13m Concrete, 10mm 0.23m Fill: Sandy Gravel medium to coarse angular with some Clay 0.40m Fill: Silty Sand, fine to medium grained dark grey, with some fine to medium grained subrounded Gravel Silty Sand: medium to coarse dark grey	M M $M > w_P$	VL			0.00: CONCRETE 130MM THICK 0.13: FILL 0.40: ALLUVIAL
				2.0								
				3.0			2.95m Sandy Clay, medium to high plasticity, grey with some medium to coarse subrounded gravel					2.95: ALLUVIAL CLAY
				4.0		CH		$M > w_P$	F			
		6.00m SPT 4,4,6 N=10 6.45m		5.0			4.20m Clay, high plasticity, grey with occasional Orange Brown mottle					4.20: RESIDUAL
				6.0		CH		$M > w_P$	St			
				7.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

RG LIB 1.02 GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 G/NT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH7**

CLIENT: KML Joint Venture | **PAGE:** 2 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 19/4/12

DRILL TYPE: Truck Mounted | **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm | **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
NMLC		9.00m SPT 3,8,12 N=20 9.45m		9.0		CH	Clay, high plasticity, grey with occasional Orange Brown mottle *(continued)*	$M > w_P$				
				10.0			10.00m					
						CH	Clay, medium plasticity, grey mottled Orange brown contains bands of highly weathered siltstone		St			10.00: EXTREMELY WEATHERED SILTSTONE
				11.0			11.30m	$M > w_P$				11.20: HIGHLY WEATHERED SILTSTONE
		12.00m SPT 10,0,0 N=R 12.45m		12.0			Siltstone, fine grey banded pale grey, very low strength with low strength bands					
							12.30m 12.35m Interbedded Siltstone and Sandstone, fine Siltstone is dark grey and Sandstone is pale grey bedded @ 0° to 10°					
				13.0			Sandstone fine to medium pale grey bedded @ 10° to 20° Continued as Cored Drill Hole					
				14.0								
				15.0								

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: **BH7**

CLIENT: KML Joint Venture

PAGE: 3 OF 3

PROJECT NAME: Proposed Multi-Storey Development

JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1

DATE: 19/4/12

DRILL TYPE: Truck Mounted

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

DATUM: AHD

Drilling and Sampling					Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	CORE LIFT / TEST	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}D/A$	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
				9.0								
				10.0								
				11.0								
				12.0								
NMLC				13.0			SW	M	A=0.41			PT 0° CN PT 10° CN PT 0° CN JT 30° VN PT 0° CN
				14.0			SW	VL - H M	A=0.90			PT 10° CN PT 10° CN PT 15° CN PT 10° CN
				15.0								JT 30° CN PT 15° CN

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Method

AS	Auger Screwing
AD	Auger Drilling
RR	Roller/tricone
CB	Claw or Blade bit
NMLC	NMLC Core

Field Tests

HP	Hand Penetrometer

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength

		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
SS	Sheared Surface
CS	Crushed Seam

Roughness

VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating

CN	Clean
SN	Stained
VN	Veneer
CO	Coating

Planarity

PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

RG LIB 1.02.GLB Log RG CORED BOREHOLE RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:28 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH8**

CLIENT: KML Joint Venture | **PAGE:** 1 OF 3

PROJECT NAME: Proposed Multi-Storey Development | **JOB NO:** RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1 | **DATE:** 19/4/12

DRILL TYPE: | **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm | **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
NMLC	▶	3.00m SPT 0,1,1 N=2 3.45m		1.0		SP	0.13m Concrete 130mm thick Fill: Sandy Gravel medium to coarse sub angular Orange Brown with Clay 0.50m Fill: Gravelly Sand, fine to medium grained, dark grey Gravel is medium to coarse subrounded 0.70m Sand: medium to coarse grey	M D W	VS			0.00: CONCRETE 130MM THICK F72 REO 50MM COVER 0.13: FILL 0.50: ALLUVIAL
				2.0								
				3.0		CH	2.80m Sandy Clay high plasticity, pale grey, Sand fine to medium grained	M > W_P	F			2.80: ALLUVIAL
				4.0			4.25m Clay high plasticity pale grey with some orange brown mottle					4.25: RESIDUAL
		6.00m SPT 3,9,10 N=19 6.45m		5.0								
				6.0		CH		M > W_P	VSt			
				7.0			8.00m					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density			
	V	Very Loose	Density Index <15%
	L	Loose	Density Index 15 - 35%
	MD	Medium Dense	Density Index 35 - 65%
	D	Dense	Density Index 65 - 85%
	VD	Very Dense	Density Index 85 - 100%

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REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH8**

CLIENT: KML Joint Venture

PAGE: 2 OF 3

PROJECT NAME: Proposed Multi-Storey Development

JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1

DATE: 19/4/12

DRILL TYPE:

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
NMLC		9.00m SPT 10,12,16 N=28 9.45m		9.0		CH	CLAY, high plasticity pale grey with some orange-brown mottle	$M > w_P$				
				10.0			10.00m					10.00: EXTREMELY WEATHERED SILTSTONE
						CL	Clay medium plasticity grey, mottled orange brown					10.35: HIGHLY WEATHERED SILTSTONE
							10.80m					
				11.0			Siltstone fine, dark grey mottled pale grey very low strength with medium strength (sandstone bands)		H			
				12.0			12.00m					
							Continued as Cored Drill Hole					
				13.0								
				14.0								
				15.0								

LEGEND:

Water

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes

- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

RG LIB 1.02.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

ENGINEERING LOG - CORED BOREHOLE

REGIONAL GEOTECHNICAL SOLUTIONS

BOREHOLE NO: BH8
CLIENT: KML Joint Venture
PAGE: 3 OF 3
PROJECT NAME: Proposed Multi-Storey Development
JOB NO: RGS1385.1
LOGGED BY: AH
LOCATION: Refer to Figure 1
DATE: 19/4/12

DRILL TYPE:
SURFACE RL:
BOREHOLE DIAMETER: 100 mm
DATUM: AHD

Drilling and Sampling					Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	CORE LIFT / TEST	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
				9.0								
				10.0								
				11.0								
				12.0		START CORING AT 12.00m						
NMLC				13.0		Interbedded siltstone and sandstone fine Siltstone is dark grey, Sandstone is pale grey, bedded at 0° to 10°	SW	L - M				PT 0° CN SM 5° PT 5° CN PT 0° CN
						Sandstone fine to medium grey indistinctly bedded		VL L M L				SM 0° SM 0° SM 0° PT 5° CN
				14.0		AS ABOVE with thin coal seams then than 1mm			A=0.37			
				15.0		Sandstone fine to medium grey indistinctly bedded		M	A=1.35			
						Hole Terminated at 15.00 m						

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Method

AS	Auger Screwing
AD	Auger Drilling
RR	Roller/tricone
CB	Claw or Blade bit
NMLC	NMLC Core

Field Tests

HP	Hand Penetrometer

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength

		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
SS	Sheared Surface
CS	Crushed Seam

Roughness

VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating

CN	Clean
SN	Stained
VN	Veneer
CO	Coating

Planarity

PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

RG LIB 1.02.GLB Log RG CORED BOREHOLE RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:28 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH9

CLIENT: KML Joint Venture

PAGE: 1 OF 1

PROJECT NAME: Proposed Multi-Storey Development

JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1

DATE: 19/4/12

DRILL TYPE: Hand AUGER

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
HA	▶			0.10m			Topsoil: Silty Sand, fine to medium dark grey contains rootlets	M				0.00: TOPSOIL: GRASSED 0.10: ALLUVIAL
						SP	Silty Sand: Fine to medium dark grey	M	VL			
				0.70m		SP	Sand: medium to coarse grey	W	L			
				1.00m								
				1.0								
				2.0								
				3.0								
				4.0								
							Hole Terminated at 4.00 m					
				5.0								
				6.0								
				7.0								

LEGEND:

Water

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes

- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

RG LIB 1.02 GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS01385.1 GINT FILE.GPJ <<DrawingFile>> 26/08/2016 11:26 8.30.004 Datgel Lab and In Situ Tool

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP1

CLIENT: KML Joint Venture

PAGE: 1 OF 1

PROJECT NAME: Proposed Multi-Storey Development

JOB NO: RGS1385.1

LOGGED BY: AH

LOCATION: Refer to Figure 1

DATE: 19/4/12

EQUIPMENT TYPE: Hand Excavator

SURFACE RL:

TEST PIT LENGTH: 0.5 m **WIDTH:** 0.5 m

DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
SHOVEL	(None encountered)						TOPSOIL: Silty Sand, fine to medium grained, dark grey contains rootlets	M				0.00: TOPSOIL: GRASSED
							0.30m Silty Sand: Fine to medium grained dark grey	M	VL - L			0.30: ALLUVIAL
				1.0			0.80m Hole Terminated at 0.80 m					
				2.0								
				3.0								
				4.0								
				5.0								
				6.0								
				7.0								

LEGEND:

Water

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes

- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

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Appendix B

Laboratory Test results

***Note**: Project number on laboratory results is based on a previous internal RGS project number.*

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **ES1209295**	Page	: 1 of 18
Client	: **REGIONAL GEOTECHNICAL SOLUTION**	Laboratory	: Environmental Division Sydney
Contact	: MR STEVE MORTON	Contact	: Client Services
Address	: 5/97 ISABELLA STREET WINGHAM NSW, AUSTRALIA 2429	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: steve.m@regionalgeotech.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 6553 5641	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: RGS00372 1	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 19-APR-2012
Sampler	: ----	Issue Date	: 30-APR-2012
Site	: ----		
		No. of samples received	: 24
Quote number	: SY/395/10	No. of samples analysed	: 16

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Descriptive Results
- Surrogate Control Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Evie.Sidarta	Inorganic Chemist	Sydney Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Organics
Peter Rennie	Team Leader - Asbestos	Newcastle
Raymond Commodor	Instrument Chemist	Sydney Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **EA200 Legend for Asbestos Type:**
- **EA200 'Am' Amosite (brown asbestos)**
- **EA200 'Ch' Chrysotile (white asbestos)**
- **EA200 'Cr' Crocidolite (blue asbestos)**
- **EA200 't' Trace levels**
- **EA200 'UMF' Unknown mineral fibres**
- **EA200: Asbestos Identification Samples were analysed by Polarised Light Microscopy including dispersion staining.**
- **EA200: Confirmation by alternative techniques is recommended for samples where unknown mineral fibres are detected. Negative results for vinyl tiles should be confirmed by an independent analytical technique.**

Page : 3 of 18
Work Order : ES1209295
Client : REGIONAL GEOTECHNICAL SOLUTION
Project : RGS00372 1

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH1 0.1-0.2	BH2 0.1-0.2	BH2 0.5-0.6	BH3 0.4-0.5	BH4 0.1-0.2
				Client sampling date / time: 19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00
				ES1209295-001	ES1209295-002	ES1209295-003	ES1209295-004	ES1209295-005
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**11.0**	**5.4**	**8.2**	**13.4**	**12.6**
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples								
Asbestos Detected	1332-21-4	0.1	g/kg	**Yes**	----	----	----	**No**
Asbestos Type	1332-21-4	0.1	--	**Am**	----	----	----	**-**
Sample weight (dry)	----	0.01	g	**82.7**	----	----	----	**77.5**
APPROVED IDENTIFIER:	----	-	--	**P.RENNIE**	----	----	----	**P.RENNIE**
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	**13**
Cadmium	7440-43-9	1	mg/kg	**1**	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	**8**	**2**	<2	<2	**15**
Copper	7440-50-8	5	mg/kg	**21**	**8**	**9**	<5	**20**
Lead	7439-92-1	5	mg/kg	**309**	**82**	**31**	**18**	**15**
Nickel	7440-02-0	2	mg/kg	**3**	<2	<2	<2	**17**
Zinc	7440-66-6	5	mg/kg	**395**	**111**	**96**	**28**	**59**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.10	mg/kg	----	<0.10	----	<0.10	<0.10
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg	----	**0.68**	----	<0.05	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	----	<0.05	----	<0.05	<0.05

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Work Order : ES1209295
Client : REGIONAL GEOTECHNICAL SOLUTION
Project : RGS00372 1

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH1 0.1-0.2	BH2 0.1-0.2	BH2 0.5-0.6	BH3 0.4-0.5	BH4 0.1-0.2
				Client sampling date / time: 19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00
				ES1209295-001	ES1209295-002	ES1209295-003	ES1209295-004	ES1209295-005
EP068A: Organochlorine Pesticides (OC) - Continued								
Endosulfan sulfate	1031-07-8	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg	----	<0.2	----	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg	----	<0.2	----	<0.2	<0.2
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg	----	<0.2	----	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg	----	<0.2	----	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg	----	<0.2	----	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg	----	<0.05	----	<0.05	<0.05
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	**0.8**	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	**4.3**	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	**0.9**	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	**8.5**	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	**8.0**	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	**2.3**	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	**2.5**	<0.5	<0.5	<0.5	<0.5
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	**3.3**	<0.5	<0.5	<0.5	<0.5

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Work Order : ES1209295
Client : REGIONAL GEOTECHNICAL SOLUTION
Project : RGS00372 1

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH1 0.1-0.2	BH2 0.1-0.2	BH2 0.5-0.6	BH3 0.4-0.5	BH4 0.1-0.2
				Client sampling date / time: 19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00
				ES1209295-001	ES1209295-002	ES1209295-003	ES1209295-004	ES1209295-005
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	**1.4**	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	**2.3**	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	**1.4**	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	**1.9**	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	**37.6**	<0.5	<0.5	<0.5	<0.5
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	**290**	**220**	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	**170**	**130**	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	**460**	**350**	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	----	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	**360**	**270**	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	**210**	**150**	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	**570**	**420**	<50	<50	<50
EP080: BTEX								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP080: BTEXN								
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	1330-20-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	**88.8**	----	**98.1**	**102**
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	----	**92.7**	----	**86.2**	**82.8**
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	----	**80.6**	----	**75.7**	**83.1**
EP075(SIM)S: Phenolic Compound Surrogates								

Analytical Results

Sub-Matrix: SOIL				Client sample ID	BH1 0.1-0.2	BH2 0.1-0.2	BH2 0.5-0.6	BH3 0.4-0.5	BH4 0.1-0.2
				Client sampling date / time	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00
Compound	CAS Number	LOR	Unit		ES1209295-001	ES1209295-002	ES1209295-003	ES1209295-004	ES1209295-005
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
Phenol-d6	13127-88-3	0.1	%		85.8	81.2	76.3	78.3	74.7
2-Chlorophenol-D4	93951-73-6	0.1	%		89.4	81.0	78.6	79.6	77.3
2.4.6-Tribromophenol	118-79-6	0.1	%		84.7	78.5	76.0	81.6	66.9
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		85.8	80.6	77.2	78.2	76.6
Anthracene-d10	1719-06-8	0.1	%		88.1	82.0	79.9	83.6	80.0
4-Terphenyl-d14	1718-51-0	0.1	%		86.8	81.0	78.2	82.2	78.5
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		81.5	85.4	85.8	89.5	78.5
Toluene-D8	2037-26-5	0.1	%		97.6	107	113	103	91.1
4-Bromofluorobenzene	460-00-4	0.1	%		87.5	94.9	98.6	94.1	83.9

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Work Order : ES1209295
Client : REGIONAL GEOTECHNICAL SOLUTION
Project : RGS00372 1

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH4 0.4-0.5	BH5 0.1-0.2	BH5 0.2-0.3	BH5 1.1-1.2	BH6A 0.1-0.2
				Client sampling date / time: 19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00
				ES1209295-006	ES1209295-007	ES1209295-008	ES1209295-009	ES1209295-010
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**10.8**	**19.0**	**19.6**	**23.0**	**18.0**
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples								
Asbestos Detected	1332-21-4	0.1	g/kg	----	----	----	----	**No**
Asbestos Type	1332-21-4	0.1	--	----	----	----	----	**-**
Sample weight (dry)	----	0.01	g	----	----	----	----	**80.4**
APPROVED IDENTIFIER:	----	-	--	----	----	----	----	**P.RENNIE**
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	**10**
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	<2	**4**	**4**	<2	**9**
Copper	7440-50-8	5	mg/kg	**7**	**6**	**7**	<5	**18**
Lead	7439-92-1	5	mg/kg	**22**	**268**	**233**	<5	**31**
Nickel	7440-02-0	2	mg/kg	<2	<2	<2	<2	**8**
Zinc	7440-66-6	5	mg/kg	**177**	**127**	**112**	<5	**94**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.10	mg/kg	----	<0.10	<0.10	----	<0.10
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
beta-BHC	319-85-7	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
delta-BHC	319-86-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Heptachlor	76-44-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Aldrin	309-00-2	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	----	**0.19**	**0.21**	----	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	----	**0.13**	**0.23**	----	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	----	**0.14**	**0.22**	----	<0.05
Dieldrin	60-57-1	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Endrin	72-20-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	----	<0.05	<0.05	----	<0.05

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH4 0.4-0.5	BH5 0.1-0.2	BH5 0.2-0.3	BH5 1.1-1.2	BH6A 0.1-0.2
				Client sampling date / time: 19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00
				ES1209295-006	ES1209295-007	ES1209295-008	ES1209295-009	ES1209295-010
EP068A: Organochlorine Pesticides (OC) - Continued								
Endosulfan sulfate	1031-07-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg	----	<0.2	<0.2	----	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Methoxychlor	72-43-5	0.2	mg/kg	----	<0.2	<0.2	----	<0.2
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg	----	<0.2	<0.2	----	<0.2
Dimethoate	60-51-5	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Diazinon	333-41-5	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg	----	<0.2	<0.2	----	<0.2
Malathion	121-75-5	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Fenthion	55-38-9	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Parathion	56-38-2	0.2	mg/kg	----	<0.2	<0.2	----	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Prothiofos	34643-46-4	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Ethion	563-12-2	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Carbophenothion	786-19-6	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg	----	<0.05	<0.05	----	<0.05
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	**0.6**	**0.5**	<0.5	**0.6**
Pyrene	129-00-0	0.5	mg/kg	<0.5	**0.5**	**0.5**	<0.5	**0.6**
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

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Work Order : ES1209295
Client : REGIONAL GEOTECHNICAL SOLUTION
Project : RGS00372 1

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH4 0.4-0.5	BH5 0.1-0.2	BH5 0.2-0.3	BH5 1.1-1.2	BH6A 0.1-0.2
				Client sampling date / time: 19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00
				ES1209295-006	ES1209295-007	ES1209295-008	ES1209295-009	ES1209295-010
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	**1.1**	**1.0**	<0.5	**1.2**
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	<100	**110**	**270**	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	**110**	**270**	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	----	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	**120**	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	**160**	**430**	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	**160**	**550**	<50	<50
EP080: BTEX								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP080: BTEXN								
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	1330-20-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	**95.6**	**101**	----	**92.2**
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	----	**89.7**	**91.9**	----	**87.9**
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	----	**67.2**	**71.9**	----	**61.6**
EP075(SIM)S: Phenolic Compound Surrogates								

Analytical Results

Sub-Matrix: SOIL				Client sample ID	BH4 0.4-0.5	BH5 0.1-0.2	BH5 0.2-0.3	BH5 1.1-1.2	BH6A 0.1-0.2
				Client sampling date / time	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00
Compound	CAS Number	LOR	Unit		ES1209295-006	ES1209295-007	ES1209295-008	ES1209295-009	ES1209295-010
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
Phenol-d6	13127-88-3	0.1	%		78.6	100	103	96.6	95.1
2-Chlorophenol-D4	93951-73-6	0.1	%		79.6	97.3	100	92.5	90.3
2.4.6-Tribromophenol	118-79-6	0.1	%		76.1	93.4	96.3	77.6	73.6
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		79.1	98.4	108	91.7	93.2
Anthracene-d10	1719-06-8	0.1	%		82.3	101	111	104	98.7
4-Terphenyl-d14	1718-51-0	0.1	%		80.6	100	106	93.9	93.5
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		83.1	80.5	86.3	79.9	80.0
Toluene-D8	2037-26-5	0.1	%		100	105	95.3	91.8	100
4-Bromofluorobenzene	460-00-4	0.1	%		90.8	85.5	93.2	81.6	86.8

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Work Order : ES1209295
Client : REGIONAL GEOTECHNICAL SOLUTION
Project : RGS00372 1

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH6A 0.2-0.3	BH7 0.15-0.25	BH7 0.35-0.45	BH7 0.25-0.35	BH8 0.15-0.25
				Client sampling date / time: 19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00
				ES1209295-011	ES1209295-012	ES1209295-013	ES1209295-014	ES1209295-015
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	----	17.8	17.1	15.1	9.6
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples								
Asbestos Detected	1332-21-4	0.1	g/kg	No	No	----	----	No
Asbestos Type	1332-21-4	0.1	--	-	-	----	----	-
Sample weight (dry)	----	0.01	g	33.3	98.1	----	----	119
APPROVED IDENTIFIER:	----	-	--	P.RENNIE	P.RENNIE	----	----	P.RENNIE
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	----	8	11	8	12
Cadmium	7440-43-9	1	mg/kg	----	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	----	6	9	7	11
Copper	7440-50-8	5	mg/kg	----	10	16	25	18
Lead	7439-92-1	5	mg/kg	----	7	8	103	26
Nickel	7440-02-0	2	mg/kg	----	8	12	8	25
Zinc	7440-66-6	5	mg/kg	----	27	41	144	50
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	----	<0.1	<0.1	<0.1	<0.1
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.10	mg/kg	----	----	<0.10	<0.10	<0.10
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	----	----	<0.05	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	----	----	<0.05	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg	----	----	<0.05	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	----	----	<0.05	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg	----	----	<0.05	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg	----	----	<0.05	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg	----	----	<0.05	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	----	----	<0.05	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	----	----	<0.05	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	----	----	<0.05	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	----	----	<0.05	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg	----	----	<0.05	<0.05	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg	----	----	<0.05	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg	----	----	<0.05	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	----	----	<0.05	<0.05	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	----	----	<0.05	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	----	----	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: SOIL				Client sample ID	BH6A 0.2-0.3	BH7 0.15-0.25	BH7 0.35-0.45	BH7 0.25-0.35	BH8 0.15-0.25
				Client sampling date / time	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00
Compound	CAS Number	LOR	Unit		ES1209295-011	ES1209295-012	ES1209295-013	ES1209295-014	ES1209295-015
EP068A: Organochlorine Pesticides (OC) - Continued									
Endosulfan sulfate	1031-07-8	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg		----	----	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg		----	----	<0.2	<0.2	<0.2
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg		----	----	<0.2	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg		----	----	<0.2	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg		----	----	<0.2	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		----	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		----	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		----	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg		----	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		----	<0.5	<0.5	**0.9**	<0.5
Anthracene	120-12-7	0.5	mg/kg		----	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		----	<0.5	<0.5	**2.1**	<0.5
Pyrene	129-00-0	0.5	mg/kg		----	<0.5	<0.5	**2.4**	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg		----	<0.5	<0.5	**0.6**	<0.5
Chrysene	218-01-9	0.5	mg/kg		----	<0.5	<0.5	**0.6**	<0.5
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg		----	<0.5	<0.5	**0.8**	<0.5

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Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH6A 0.2-0.3	BH7 0.15-0.25	BH7 0.35-0.45	BH7 0.25-0.35	BH8 0.15-0.25
				Client sampling date / time: 19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00
				ES1209295-011	ES1209295-012	ES1209295-013	ES1209295-014	ES1209295-015
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	----	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	----	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	----	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	----	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	----	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	----	<0.5	<0.5	**7.4**	<0.5
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	----	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	----	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	----	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	----	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	----	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	10	mg/kg	----	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	----	10	mg/kg	----	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	----	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	----	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	----	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	----	<50	<50	<50	<50
EP080: BTEX								
Benzene	71-43-2	0.2	mg/kg	----	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	----	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	----	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	----	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	----	<0.5	<0.5	<0.5	<0.5
EP080: BTEXN								
^ Sum of BTEX	----	0.2	mg/kg	----	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	1330-20-7	0.5	mg/kg	----	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	----	<1	<1	<1	<1
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	----	**99.1**	**124**	**89.7**
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	----	----	**83.1**	**124**	**81.0**
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	----	----	**66.6**	**60.8**	**56.2**
EP075(SIM)S: Phenolic Compound Surrogates								

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: BH6A 0.2-0.3	BH7 0.15-0.25	BH7 0.35-0.45	BH7 0.25-0.35	BH8 0.15-0.25
				Client sampling date / time: 19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00	19-APR-2012 15:00
				ES1209295-011	ES1209295-012	ES1209295-013	ES1209295-014	ES1209295-015
EP075(SIM)S: Phenolic Compound Surrogates - Continued								
Phenol-d6	13127-88-3	0.1	%	----	**98.2**	**95.4**	**84.1**	**94.7**
2-Chlorophenol-D4	93951-73-6	0.1	%	----	**92.7**	**90.2**	**93.0**	**89.9**
2.4.6-Tribromophenol	118-79-6	0.1	%	----	**76.0**	**72.2**	**53.1**	**65.1**
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	----	**95.9**	**95.0**	**101**	**93.4**
Anthracene-d10	1719-06-8	0.1	%	----	**98.0**	**99.2**	**111**	**97.3**
4-Terphenyl-d14	1718-51-0	0.1	%	----	**97.0**	**93.9**	**114**	**91.9**
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	----	**88.0**	**87.2**	**90.0**	**82.9**
Toluene-D8	2037-26-5	0.1	%	----	**96.7**	**94.2**	**99.3**	**103**
4-Bromofluorobenzene	460-00-4	0.1	%	----	**91.1**	**88.9**	**105**	**92.2**

Analytical Results

Sub-Matrix: SOIL				Client sample ID	BH8 0.5-0.6	----	----	----	----
				Client sampling date / time	19-APR-2012 15:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1209295-016	----	----	----	----
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1.0	%		6.9	----	----	----	----
EG005T: Total Metals by ICP-AES									
Arsenic	7440-38-2	5	mg/kg		<5	----	----	----	----
Cadmium	7440-43-9	1	mg/kg		<1	----	----	----	----
Chromium	7440-47-3	2	mg/kg		3	----	----	----	----
Copper	7440-50-8	5	mg/kg		<5	----	----	----	----
Lead	7439-92-1	5	mg/kg		15	----	----	----	----
Nickel	7440-02-0	2	mg/kg		3	----	----	----	----
Zinc	7440-66-6	5	mg/kg		24	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	----	----	----	----
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	----	----	----	----
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	----	----	----	----
Fluorene	86-73-7	0.5	mg/kg		<0.5	----	----	----	----
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	----	----	----	----
Anthracene	120-12-7	0.5	mg/kg		<0.5	----	----	----	----
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	----	----	----	----
Pyrene	129-00-0	0.5	mg/kg		<0.5	----	----	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	----	----	----	----
Chrysene	218-01-9	0.5	mg/kg		<0.5	----	----	----	----
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg		<0.5	----	----	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	----	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	----	----	----	----
C10 - C14 Fraction	----	50	mg/kg		<50	----	----	----	----
C15 - C28 Fraction	----	100	mg/kg		<100	----	----	----	----
C29 - C36 Fraction	----	100	mg/kg		<100	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft									

Analytical Results

Sub-Matrix: SOIL				Client sample ID	BH8 0.5-0.6	----	----	----	----
				Client sampling date / time	19-APR-2012 15:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1209295-016	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft - Continued									
C6 - C10 Fraction	----	10	mg/kg		<10	----	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	----	10	mg/kg		<10	----	----	----	----
>C10 - C16 Fraction	----	50	mg/kg		<50	----	----	----	----
>C16 - C34 Fraction	----	100	mg/kg		<100	----	----	----	----
>C34 - C40 Fraction	----	100	mg/kg		<100	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	----	----	----	----
EP080: BTEX									
Benzene	71-43-2	0.2	mg/kg		<0.2	----	----	----	----
Toluene	108-88-3	0.5	mg/kg		<0.5	----	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	----	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	----	----	----	----
EP080: BTEXN									
^ Sum of BTEX	----	0.2	mg/kg		<0.2	----	----	----	----
^ Total Xylenes	1330-20-7	0.5	mg/kg		<0.5	----	----	----	----
Naphthalene	91-20-3	1	mg/kg		<1	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		96.3	----	----	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%		90.7	----	----	----	----
2.4.6-Tribromophenol	118-79-6	0.1	%		62.6	----	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		95.8	----	----	----	----
Anthracene-d10	1719-06-8	0.1	%		99.3	----	----	----	----
4-Terphenyl-d14	1718-51-0	0.1	%		93.2	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		111	----	----	----	----
Toluene-D8	2037-26-5	0.1	%		114	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%		103	----	----	----	----

Analytical Results

Descriptive Results

Sub-Matrix: **SOIL**

Method: Compound	Client sample ID - Client sampling date / time	Analytical Results
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples		
EA200: Description	BH1 0.1-0.2 - 19-APR-2012 15:00	Dark brown sandy soil with some coal grains plus some vegetation and one small friable asbestos fibre bundle
EA200: Description	BH4 0.1-0.2 - 19-APR-2012 15:00	Mid brown clay soil with some small red rocks plus some quartz and coal grains and a trace of vegetation
EA200: Description	BH6A 0.1-0.2 - 19-APR-2012 15:00	Mid brown clay soil with some small grey rocks plus some quartz grains and a trace of vegetation
EA200: Description	BH6A 0.2-0.3 - 19-APR-2012 15:00	Pale grey soil with some small grey rocks and a trace of vegetation
EA200: Description	BH7 0.15-0.25 - 19-APR-2012 15:00	Pale brown clay soil with some small grey rocks and some vegetation
EA200: Description	BH8 0.15-0.25 - 19-APR-2012 15:00	Pale brown clay soil with some small grey rocks and some vegetation

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	30.8	155.7
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	19.5	167.0
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	22.7	163.5
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	56.3	133.3
2-Chlorophenol-D4	93951-73-6	53.8	133.8
2.4.6-Tribromophenol	118-79-6	23.1	134.9
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	58.9	132.7
Anthracene-d10	1719-06-8	55.0	137.6
4-Terphenyl-d14	1718-51-0	54.0	147.8
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	72.8	133.2
Toluene-D8	2037-26-5	73.9	132.1
4-Bromofluorobenzene	460-00-4	71.6	130.0

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1209295**	Page	: 1 of 7
Client	: REGIONAL GEOTECHNICAL SOLUTION	Laboratory	: Environmental Division Sydney
Contact	: MR STEVE MORTON	Contact	: Client Services
Address	: 5/97 ISABELLA STREET WINGHAM NSW, AUSTRALIA 2429	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: steve.m@regionalgeotech.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 6553 5641	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: RGS00372 1	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 19-APR-2012
Sampler	: ----	Issue Date	: 30-APR-2012
Order number	: ----		
		No. of samples received	: 24
Quote number	: SY/395/10	No. of samples analysed	: 16

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Page	: 2 of 7
Work Order	: ES1209295
Client	: REGIONAL GEOTECHNICAL SOLUTION
Project	: RGS00372 1

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non-volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content							
Soil Glass Jar - Unpreserved (EA055-103)							
BH1 0.1-0.2, BH2 0.1-0.2, BH2 0.5-0.6, BH3 0.4-0.5, BH4 0.1-0.2, BH4 0.4-0.5, BH5 0.1-0.2, BH5 0.2-0.3, BH5 1.1-1.2, BH6A 0.1-0.2, BH7 0.15-0.25, BH7 0.35-0.45, BH8 0.15-0.25, BH8 0.5-0.6	**19-APR-2012**	**----**	----	----	**24-APR-2012**	03-MAY-2012	✓
Soil Glass Jar - Unpreserved (EA055-103)							
BH7 0.25-0.35	**19-APR-2012**	**----**	----	----	**27-APR-2012**	03-MAY-2012	✓
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples							
Snap Lock Bag (EA200)							
BH1 0.1-0.2, BH4 0.1-0.2, BH6A 0.1-0.2, BH6A 0.2-0.3, BH7 0.15-0.25, BH8 0.15-0.25	**19-APR-2012**	**---**	16-OCT-2012	----	**27-APR-2012**	24-OCT-2012	✓
EG005T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
BH1 0.1-0.2, BH2 0.1-0.2, BH2 0.5-0.6, BH3 0.4-0.5, BH4 0.1-0.2, BH4 0.4-0.5, BH5 0.1-0.2, BH5 0.2-0.3, BH5 1.1-1.2, BH6A 0.1-0.2, BH7 0.15-0.25, BH7 0.35-0.45, BH8 0.15-0.25, BH8 0.5-0.6	**19-APR-2012**	**24-APR-2012**	16-OCT-2012	✓	**26-APR-2012**	16-OCT-2012	✓
Soil Glass Jar - Unpreserved (EG005T)							
BH7 0.25-0.35	**19-APR-2012**	**30-APR-2012**	16-OCT-2012	✓	**30-APR-2012**	16-OCT-2012	✓

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Client : REGIONAL GEOTECHNICAL SOLUTION
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Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
BH1 0.1-0.2, BH2 0.1-0.2, BH2 0.5-0.6, BH3 0.4-0.5, BH4 0.1-0.2, BH4 0.4-0.5, BH5 0.1-0.2, BH5 0.2-0.3, BH5 1.1-1.2, BH6A 0.1-0.2, BH7 0.15-0.25, BH7 0.35-0.45, BH8 0.15-0.25, BH8 0.5-0.6	**19-APR-2012**	**24-APR-2012**	17-MAY-2012	✓	**26-APR-2012**	17-MAY-2012	✓
Soil Glass Jar - Unpreserved (EG035T)							
BH7 0.25-0.35	**19-APR-2012**	**30-APR-2012**	17-MAY-2012	✓	**30-APR-2012**	17-MAY-2012	✓
EP066: Polychlorinated Biphenyls (PCB)							
Soil Glass Jar - Unpreserved (EP066)							
BH2 0.1-0.2, BH3 0.4-0.5, BH4 0.1-0.2, BH5 0.1-0.2, BH5 0.2-0.3, BH6A 0.1-0.2, BH7 0.35-0.45, BH8 0.15-0.25	**19-APR-2012**	**24-APR-2012**	03-MAY-2012	✓	**27-APR-2012**	03-JUN-2012	✓
Soil Glass Jar - Unpreserved (EP066)							
BH7 0.25-0.35	**19-APR-2012**	**27-APR-2012**	03-MAY-2012	✓	**27-APR-2012**	06-JUN-2012	✓
EP068A: Organochlorine Pesticides (OC)							
Soil Glass Jar - Unpreserved (EP068)							
BH2 0.1-0.2, BH3 0.4-0.5, BH4 0.1-0.2, BH5 0.1-0.2, BH5 0.2-0.3, BH6A 0.1-0.2, BH7 0.35-0.45, BH8 0.15-0.25	**19-APR-2012**	**24-APR-2012**	03-MAY-2012	✓	**27-APR-2012**	03-JUN-2012	✓
Soil Glass Jar - Unpreserved (EP068)							
BH7 0.25-0.35	**19-APR-2012**	**27-APR-2012**	03-MAY-2012	✓	**27-APR-2012**	06-JUN-2012	✓
EP068B: Organophosphorus Pesticides (OP)							
Soil Glass Jar - Unpreserved (EP068)							
BH2 0.1-0.2, BH3 0.4-0.5, BH4 0.1-0.2, BH5 0.1-0.2, BH5 0.2-0.3, BH6A 0.1-0.2, BH7 0.35-0.45, BH8 0.15-0.25	**19-APR-2012**	**24-APR-2012**	03-MAY-2012	✓	**27-APR-2012**	03-JUN-2012	✓
Soil Glass Jar - Unpreserved (EP068)							
BH7 0.25-0.35	**19-APR-2012**	**27-APR-2012**	03-MAY-2012	✓	**27-APR-2012**	06-JUN-2012	✓
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP071)							
BH1 0.1-0.2, BH2 0.1-0.2, BH2 0.5-0.6, BH3 0.4-0.5, BH4 0.1-0.2, BH4 0.4-0.5	**19-APR-2012**	**24-APR-2012**	03-MAY-2012	✓	**26-APR-2012**	03-JUN-2012	✓
Soil Glass Jar - Unpreserved (EP071)							
BH5 0.1-0.2, BH5 0.2-0.3, BH5 1.1-1.2, BH6A 0.1-0.2, BH7 0.15-0.25, BH7 0.35-0.45, BH8 0.15-0.25, BH8 0.5-0.6	**19-APR-2012**	**26-APR-2012**	03-MAY-2012	✓	**26-APR-2012**	05-JUN-2012	✓
Soil Glass Jar - Unpreserved (EP071)							
BH7 0.25-0.35	**19-APR-2012**	**27-APR-2012**	03-MAY-2012	✓	**28-APR-2012**	06-JUN-2012	✓

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Client : REGIONAL GEOTECHNICAL SOLUTION
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Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))							
BH1 0.1-0.2, BH2 0.1-0.2, BH2 0.5-0.6, BH3 0.4-0.5, BH4 0.1-0.2, BH4 0.4-0.5	**19-APR-2012**	**24-APR-2012**	03-MAY-2012	✓	**26-APR-2012**	03-JUN-2012	✓
Soil Glass Jar - Unpreserved (EP075(SIM))							
BH5 0.1-0.2, BH5 0.2-0.3, BH5 1.1-1.2, BH6A 0.1-0.2, BH7 0.15-0.25, BH7 0.35-0.45, BH8 0.15-0.25, BH8 0.5-0.6	**19-APR-2012**	**26-APR-2012**	03-MAY-2012	✓	**26-APR-2012**	05-JUN-2012	✓
Soil Glass Jar - Unpreserved (EP075(SIM))							
BH7 0.25-0.35	**19-APR-2012**	**27-APR-2012**	03-MAY-2012	✓	**27-APR-2012**	06-JUN-2012	✓
EP080: BTEX							
Soil Glass Jar - Unpreserved (EP080)							
BH1 0.1-0.2, BH2 0.1-0.2, BH2 0.5-0.6, BH3 0.4-0.5, BH4 0.1-0.2, BH4 0.4-0.5, BH5 0.1-0.2, BH5 0.2-0.3, BH5 1.1-1.2, BH6A 0.1-0.2, BH7 0.15-0.25, BH7 0.35-0.45, BH8 0.15-0.25, BH8 0.5-0.6	**19-APR-2012**	**24-APR-2012**	03-MAY-2012	✓	**26-APR-2012**	03-MAY-2012	✓
Soil Glass Jar - Unpreserved (EP080)							
BH7 0.25-0.35	**19-APR-2012**	**27-APR-2012**	03-MAY-2012	✓	**27-APR-2012**	03-MAY-2012	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080)							
BH1 0.1-0.2, BH2 0.1-0.2, BH2 0.5-0.6, BH3 0.4-0.5, BH4 0.1-0.2, BH4 0.4-0.5, BH5 0.1-0.2, BH5 0.2-0.3, BH5 1.1-1.2, BH6A 0.1-0.2, BH7 0.15-0.25, BH7 0.35-0.45, BH8 0.15-0.25, BH8 0.5-0.6	**19-APR-2012**	**24-APR-2012**	03-MAY-2012	✓	**26-APR-2012**	03-MAY-2012	✓
Soil Glass Jar - Unpreserved (EP080)							
BH7 0.25-0.35	**19-APR-2012**	**27-APR-2012**	03-MAY-2012	✓	**27-APR-2012**	03-MAY-2012	✓
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080)							
BH1 0.1-0.2, BH2 0.1-0.2, BH2 0.5-0.6, BH3 0.4-0.5, BH4 0.1-0.2, BH4 0.4-0.5, BH5 0.1-0.2, BH5 0.2-0.3, BH5 1.1-1.2, BH6A 0.1-0.2, BH7 0.15-0.25, BH7 0.35-0.45, BH8 0.15-0.25, BH8 0.5-0.6	**19-APR-2012**	**24-APR-2012**	03-MAY-2012	✓	**26-APR-2012**	03-MAY-2012	✓
Soil Glass Jar - Unpreserved (EP080)							
BH7 0.25-0.35	**19-APR-2012**	**27-APR-2012**	03-MAY-2012	✓	**27-APR-2012**	03-MAY-2012	✓

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Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	2	16	**12.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (SIM)	EP075(SIM)	5	34	**14.7**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	2	9	**22.2**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	2	9	**22.2**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	3	22	**13.6**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	3	22	**13.6**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	5	34	**14.7**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	3	15	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	3	34	**8.8**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	2	9	**22.2**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	2	9	**22.2**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	2	22	**9.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	22	**9.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	3	34	**8.8**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	15	**13.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	3	34	**8.8**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	2	9	**22.2**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	2	9	**22.2**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	2	22	**9.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	22	**9.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	3	34	**8.8**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	15	**13.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	3	34	**8.8**	**5.0**	✓	ALS QCS3 requirement
Pesticides by GCMS	EP068	2	9	**22.2**	**5.0**	✓	ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	2	9	**22.2**	**5.0**	✓	ALS QCS3 requirement
Total Mercury by FIMS	EG035T	2	22	**9.1**	**5.0**	✓	ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	22	**9.1**	**5.0**	✓	ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	3	34	**8.8**	**5.0**	✓	ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	15	**13.3**	**5.0**	✓	ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2010 Draft) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Asbestos Identification in bulk solids	EA200	SOIL	AS 4964 - 2004 Method for the qualitative identification of asbestos in bulk samples
Total Metals by ICP-AES	EG005T	SOIL	(APHA 21st ed., 3120; USEPA SW 846 - 6010) (ICPAES) Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (1999) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	AS 3550, APHA 21st ed., 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (1999) Schedule B(3)
Polychlorinated Biphenyls (PCB)	EP066	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 504)
Pesticides by GCMS	EP068	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM (1999) Schedule B(3) (Method 504,505)
TPH - Semivolatile Fraction	EP071	SOIL	(USEPA SW 846 - 8015A) Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C36. This method is compliant with NEPM (1999) Schedule B(3) (Method 506.1)
PAH/Phenols (SIM)	EP075(SIM)	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 502 and 507)
TPH Volatiles/BTEX	EP080	SOIL	(USEPA SW 846 - 8260B) Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 501)

Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	USEPA 200.2 Mod. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (1999) Schedule B(3) (Method 202)
Methanolic Extraction of Soils for Purge and Trap	* ORG16	SOIL	(USEPA SW 846 - 5030A) 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids (Option A - Concentrating)	ORG17A	SOIL	In-house, Mechanical agitation (tumbler). 20g of sample, Na2SO4 and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Tumbler Extraction of Solids (Option B - Non-concentrating)	ORG17B	SOIL	In-house, Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 20mL 1:1 DCM/Acetone by end over end tumble. The solvent is transferred directly to a GC vial for analysis.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons	ES1209295-001	BH1 0.1-0.2	**Sum of polycyclic aromatic hydrocarbons**	----	34.3 %	0-20%	**RPD exceeds LOR based limits**

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**
- **For all matrices, no Matrix Spike outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

- **No Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**



ALS Group
Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: **ES1209295**		
Client	: **REGIONAL GEOTECHNICAL SOLUTION**	Laboratory	: Environmental Division Sydney
Contact	: MR STEVE MORTON	Contact	: Client Services
Address	: 5/97 ISABELLA STREET WINGHAM NSW, AUSTRALIA 2429	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: steve.m@regionalgeotech.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 6553 5641	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: RGS00372 1	Page	: 1 of 3
Order number	: ----		
C-O-C number	: ----	Quote number	: ES2010REGGEO0001 (SY/395/10)
Site	: ----		
Sampler	: ----	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 19-APR-2012	Issue Date	: 25-APR-2012 14:21
Client Requested Due Date	: 30-APR-2012	Scheduled Reporting Date	: **30-APR-2012**

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 14'C - Ice present
No. of coolers/boxes	: 1 HARD	No. of samples received	: 25
Security Seal	: Intact.	No. of samples analysed	: 16

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Samples received in appropriately pretreated and preserved containers.**
- **Asbestos analysis will be conducted by ALS Newcastle.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- **7 additional samples were received and placed on hold.**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (60 days) from date of completion of work order.

Issue Date	: 25-APR-2012 14:21
Page	: 2 of 3
Work Order	: ES1209295
Client	: REGIONAL GEOTECHNICAL SOLUTION

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exist.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default to 15:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory for processing purposes and will be shown bracketed without a time component.

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	(On Hold) SOIL No analysis requested	SOIL - EA200 Asbestos Identification in Soils	SOIL - S-16 TPH/BTEX/PAH/OC/OP/PCB/8Metals	SOIL - S-26 8 metals/TPH/BTEX/PAH
ES1209295-001	19-APR-2012 15:00	BH1 0.1-0.2		✓		✓
ES1209295-002	19-APR-2012 15:00	BH2 0.1-0.2			✓	
ES1209295-003	19-APR-2012 15:00	BH2 0.5-0.6				✓
ES1209295-004	19-APR-2012 15:00	BH3 0.4-0.5			✓	
ES1209295-005	19-APR-2012 15:00	BH4 0.1-0.2		✓	✓	
ES1209295-006	19-APR-2012 15:00	BH4 0.4-0.5				✓
ES1209295-007	19-APR-2012 15:00	BH5 0.1-0.2			✓	
ES1209295-008	19-APR-2012 15:00	BH5 0.2-0.3			✓	
ES1209295-009	19-APR-2012 15:00	BH5 1.1-1.2				✓
ES1209295-010	19-APR-2012 15:00	BH6A 0.1-0.2		✓	✓	
ES1209295-011	19-APR-2012 15:00	BH6A 0.2-0.3		✓		
ES1209295-012	19-APR-2012 15:00	BH7 0.15-0.25		✓		✓
ES1209295-013	19-APR-2012 15:00	BH7 0.35-0.45			✓	
ES1209295-014	19-APR-2012 15:00	BH7 0.25-0.35			✓	
ES1209295-015	19-APR-2012 15:00	BH8 0.15-0.25		✓	✓	
ES1209295-016	19-APR-2012 15:00	BH8 0.5-0.6				✓
ES1209295-017	12-APR-2012 15:00	BH2 1.0-1.1	✓			
ES1209295-018	12-APR-2012 15:00	BH2 1.5-1.6	✓			
ES1209295-019	13-APR-2012 15:00	BH3 0.1-0.2	✓			
ES1209295-020	13-APR-2012 15:00	BH3 1.5-1.6	✓			
ES1209295-021	15-APR-2012 15:00	BH4 1.0-1.1	✓			
ES1209295-022	16-APR-2012 15:00	BH5 3.0-3.1	✓			
ES1209295-023	16-APR-2012 15:00	BH5 0.4-0.5	✓			
ES1209295-024	19-APR-2012 15:00	BH7 0.25-0.35	✓			
ES1209295-025	19-APR-2012 15:00	BH7 3.0-3.1	✓			

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Issue Date	:	25-APR-2012 14:21
Page	:	3 of 3
Work Order	:	ES1209295
Client	:	REGIONAL GEOTECHNICAL SOLUTION

Requested Deliverables

MR ADAM HOLZHAUSER

- *AU Certificate of Analysis - NATA (COA)	Email	adam.h@regionalgeotech.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	adam.h@regionalgeotech.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	adam.h@regionalgeotech.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	adam.h@regionalgeotech.com.au
- A4 - AU Tax Invoice (INV)	Email	adam.h@regionalgeotech.com.au
- Chain of Custody (CoC) (COC)	Email	adam.h@regionalgeotech.com.au
- EDI Format - ENMRG (ENMRG)	Email	adam.h@regionalgeotech.com.au

MR STEVE MORTON

- *AU Certificate of Analysis - NATA (COA)	Email	steve.m@regionalgeotech.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	steve.m@regionalgeotech.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	steve.m@regionalgeotech.com.au
- A4 - AU Tax Invoice (INV)	Email	steve.m@regionalgeotech.com.au
- Chain of Custody (CoC) (COC)	Email	steve.m@regionalgeotech.com.au

MR TIM MORRIS

- *AU Certificate of Analysis - NATA (COA)	Email	tim.morris@regionalgeotech.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	tim.morris@regionalgeotech.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	tim.morris@regionalgeotech.com.au
- A4 - AU Tax Invoice (INV)	Email	tim.morris@regionalgeotech.com.au
- Chain of Custody (CoC) (COC)	Email	tim.morris@regionalgeotech.com.au

1 of 2

CHAIN OF CUSTODY

ALS Laboratory: please tick →

Sydney 277 Woodpark Rd Smithfield NSW 2176 Ph 02 8784 8555 E samples.sydney@alsenviro.com
Brisbane 32 Shand St, Stafford QLD 4053 Ph 07 3243 7222 E samples.brisbane@alsenviro.com
Melbourne 2-4 Westall Rd Springvale VIC 3171 Ph 03 8549 9600 E samples.melbourne@alsenviro.com
Perth 10 Hod Way, Malaga WA 6090 Ph 08 9209 7655 E samples.perth@alsenviro.com
Newcastle 5 Rosegum Rd Warabrook NSW 2304 Ph 02 4968 9433 E samples.newcastle@alsenviro.com
Townsville 14-15 Desma Ct, Bohle QLD 4818 Ph 07 4796 0600 E samples.townsville@alsenviro.com
Adelaide 2-1 Burma Rd Pooraka SA 5095 Ph 08 8359 0890 E adelaide@alsenviro.com
Launceston 27 Wellington St, Launceston TAS 7250 Ph 03 6331 2158 E launceston@alsenviro.com

CLIENT: Regional Geotechnical Solutions	TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☒ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle): Custody Seal Intact? Yes No N/A
OFFICE:		☐ Non Standard or urgent TAT (List due date):	Free ice / frozen ice bricks present upon receipt? Yes No N/A
PROJECT: PROJECT NO.:	SITE NO.:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C
ORDER NUMBER: PURCHASE ORDER NO.:	COUNTRY OF ORIGIN:	OF: 1 2 3 4 5 6 7	Other comment:
PROJECT MANAGER: Steve Morton	CONTACT PH: 0432258578		
SAMPLER: Adam Holzhauser	SAMPLER MOBILE: 0423057278	RELINQUISHED BY:	RECEIVED BY:
COC Emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME: 19-4-12 5:45pm	DATE/TIME: 19/4/12 17.15
Email Reports to (will default to PM if no other addresses are listed): adam.h@regionalgeotech.com		RELINQUISHED BY:	RECEIVED BY: HP
Email Invoice to (will default to PM if no other addresses are listed): ~~adam~~ as above		DATE/TIME: 20/4/12 17-00	DATE/TIME: 20/4 19:00

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).				Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Asbestos	Suite S-16	TPH, BTEX, PAH & metals		Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	BH1 0.1-0.2					✓		✓		
2	BH2 0.1-0.2						✓			
3	BH2 0.5-0.6					✓		✓		
4	BH3 0.4-0.5						✓			
5	BH4 0.1-0.2					✓	✓			
6	BH4 0.4-0.5							✓		
7	BH5 0.1-0.2						✓			
8	BH5 0.2-0.3						✓			
9	BH5 1.1-1.2							✓		
10	BH6A 0.1-0.2					✓	✓			
11	BH6A 0.2-0.3					✓				
12	BH7 0.15-0.25					✓		✓		
					TOTAL					

Subcon / Forward Lab / Split WO
Lab / Analysis: New Castle Asbestos
Organised By / Date: 1-5-10-11-12-15
Relinquished By / Date:
Connote / Courier:
WO No:
Attach By PO / Internal Sheet:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Fo
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

Environmental Division
Sydney
Work Order
ES1209295

Telephone : +61-2-8784 8555

D08936555

2 of 2

CHAIN OF CUSTODY

ALS Laboratory: please tick →

[ ] Sydney 277 Woodpark Rd Smithfield NSW 2176 Ph 02 8784 8555 E samples.sydney@alsenviro.com
[ ] Brisbane 32 Shand St Stafford QLD 4053 Ph 07 3243 7222 E samples.brisbane@alsenviro.com
[ ] Melbourne 2-4 Westall Rd Springvale VIC 3171 Ph 03 8549 9600 E samples.melbourne@alsenviro.com
[ ] Perth 10 Hod Way, Malaga WA 6090 Ph 08 9209 7655 E samples.perth@alsenviro.com
[ ] Newcastle: 5 Rosegum Rd Warabrook NSW 2304 Ph 02 4968 9433 E samples.newcastle@alsenviro.com
[ ] Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph 07 4796 0600 E samples.townsville@alsenviro.com
[ ] Adelaide: 2-1 Burma Rd Pooraka SA 5095 Ph 08 8359 0890 E adelaide@alsenviro.com
[ ] Launceston: 27 Wellington St, Launceston TAS 7250 Ph 03 6331 2158 E launceston@alsenviro.com

CLIENT: Regional Geotechnical Solutions	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)
OFFICE:		☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact? Yes No N/A
PROJECT: PROJECT NO.:	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle)	Free ice / frozen ice bricks present upon receipt? Yes No N/A
ORDER NUMBER: PURCHASE ORDER NO.:	COUNTRY OF ORIGIN:	COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt °C
PROJECT MANAGER: Steve Morton CONTACT PH: 0432258578		OF: 1 2 3 4 5 6 7	Other comment:

SAMPLER: Adam Holzhauser	SAMPLER MOBILE: 0423057270	RELINQUISHED BY:	RECEIVED BY: CR	RELINQUISHED BY:
COC Emailed to ALS? (YES / NO)	EDD FORMAT (or default):			
Email Reports to (will default to PM if no other addresses are listed): adam.h@regionalgeotech.com		DATE/TIME: 19-4-12 5:15pm	DATE/TIME: 19/4/12 17.15	DATE/TIME:
Email Invoice to (will default to PM if no other addresses are listed): as above				

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED Including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Asbestos	Suite S-16	TPH, BTEX, PAH 8 metals						Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
13	BH7 0.35-0.45						✓							
14	BH7 0.25-0.35						✓							
15	BH8 0.15-0.25					✓	✓							
16	BH8 0.5-0.6							✓						
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

D08936555

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Newcastle: 5 Rosegum Rd Warabrook NSW 2304 Ph 02 4968 9433 E samples.newcastle@alsenviro.com
Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph 07 4796 0600 E townsville.environmental@alsenviro.com
Adelaide: 2-1 Burma Rd Pooraka SA 5095 Ph 08 8359 0890 E adelaide@alsenviro.com
Launceston: 27 Wellington St, Launceston TAS 7250 Ph 03 6331 2158 E launceston@alsenviro.com

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OFFICE:		☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact? Yes No N/A
PROJECT:	PROJECT NO.: ES1209295	ALS QUOTE NO.:	Free ice / frozen ice bricks present upon receipt? Yes No N/A
ORDER NUMBER:	PURCHASE ORDER NO.:	COUNTRY OF ORIGIN:	Random Sample Temperature on Receipt: °C
PROJECT MANAGER: Steve Morton	CONTACT PH: 0413258578	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	Other comment:
SAMPLER: Adam Holzhauser	SAMPLER MOBILE: 0423057278	RELINQUISHED BY:	RECEIVED BY:
COC Emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME: 19-4-12. 5:45pm	DATE/TIME: 19/4/12 17.15
Email Reports to (will default to PM if no other addresses are listed): adam.h@regionalgeotech.com		RELINQUISHED BY:	RECEIVED BY:
Email Invoice to (will default to PM if no other addresses are listed): as above		DATE/TIME: 20/4/12 17-00	DATE/TIME: 20/4 19:00

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

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LAB ID		SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Asbestos	S-16	TPH, BTEX, PAH & metals	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	BH1	0.1-0.2					✓		✓	Subcon / Forward Lab / Split WO
2	BH2	0.1-0.2						✓		Lab / Analysis: New Castle / Asbestos
3	BH2	0.5-0.6					✓		✓	Organised By / Date: 1-5-10-11-12-15
4	BH3	0.4-0.5						✓		Relinquished By / Date:
5	BH4	0.1-0.2					✓	✓		Connote / Courier:
6	BH4	0.4-0.5							✓	WO No:
7	BH5	0.1-0.2						✓		Attach By PO / Internal Sheet:
8	BH5	0.2-0.3						✓		
9	BH5	1.1-1.2							✓	
10	BH6A	0.1-0.2					✓	✓		
11	BH6A	0.2-0.3					✓			
12	BH7	0.15-0.25					✓		✓	
						TOTAL				

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
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Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

Environmental Division
Sydney
Work Order
ES1209295

Telephone : +61-2-8784 8555

D08936555

CHAIN OF CUSTODY

ALS Laboratory: please tick →

Sydney 277 Woodpark Rd Smithfield NSW 2176 Ph 02 8784 8555 E samples.sydney@alsenviro.com
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Perth 10 Hod Way, Malaga WA 6090 Ph 08 9209 7655 E samples.perth@alsenviro.com
Newcastle: 5 Rosegum Rd Wrinabrook NSW 2304 Ph 02 4968 9433 E samples.newcastle@alsenviro.com
Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph 07 4796 0600 E townsville.environmental@alsenviro.com
Adelaide: 2-1 Burma Rd Pooraka SA 5095 Ph 08 8359 0890 E adelaide@alsenviro.com
Launceston: 27 Wellington St, Launceston TAS 7250 Ph 03 6331 2548 E launceston@alsenviro.com

CLIENT: Regional Geotechnical Solutions	TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):	FOR LABORATORY USE ONLY (Circle): Custody Seal Intact? Yes No N/A; Free ice / frozen ice bricks present upon receipt? Yes No N/A; Random Sample Temperature on Receipt: °C; Other comment:
OFFICE:			
PROJECT: PROJECT NO.:	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	
ORDER NUMBER: PURCHASE ORDER NO.:	COUNTRY OF ORIGIN:		
PROJECT MANAGER: Steve Morton CONTACT PH: 0432 258 578			
SAMPLER: Adam Holzhauser SAMPLER MOBILE: 0423057270	RELINQUISHED BY:	RECEIVED BY: CC	RELINQUISHED BY: / RECEIVED BY:
COC Emailed to ALS? (YES / NO) EDD FORMAT (or default):			
Email Reports to (will default to PM if no other addresses are listed): adam.h@regionalgeotech.com	DATE/TIME: 19-4-12 5:15pm	DATE/TIME: 19/4/12 17:15	DATE/TIME: / DATE/TIME:
Email Invoice to (will default to PM if no other addresses are listed): as above			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Asbestos	Suite S-16	TPH, BTEX, PAH 8 metals						Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
13	BH7 0.35-0.45						✓							
14	BH7 0.25-0.35						✓							
15	BH8 0.15-0.25					✓	✓							
16	BH8 0.5-0.6							✓						
	Received Extra sample													
17	BH2 1.0-1.1	12-4-19	24	BH7 0.25-0.35 19-4-12										
18	BH2 1.5-1.6	12-4-19	25	BH7 3.0-3.1 19/4/12										
19	BH3 0.1-0.2	13-4-12												
20	BH3 1.5-1.6	13-4-12												
21	BH4 1.0-1.1	15-4-12												
22	BH5 3.0-3.1	16-4-12												
23	BH5 0.4-0.5	16-4-12												
					TOTAL									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

D08936555

CHAIN OF CUSTODY

ALS Laboratory: please tick →

Sydney 277 Woodpark Rd Smithfield NSW 2176 Ph 02 8784 8555 E samples.sydney@alsenviro.com
Brisbane 32 Shand St, Stafford QLD 4053 Ph 07 3243 7222 E samples.brisbane@alsenviro.com
Melbourne 2-4 Westall Rd Springvale VIC 3171 Ph 03 8549 9600 E samples.melbourne@alsenviro.com
Perth 10 Hod Way, Malaga WA 6090 Ph 08 9209 7655 E samples.perth@alsenviro.com
Newcastle 5 Rosegum Rd Warabrook NSW 2304 Ph 02 4968 9433 E samples.newcastle@alsenviro.com
Townsville 14-15 Desma Ct, Bohle QLD 4818 Ph 07 4796 0600 E samples.townsville@alsenviro.com
Adelaide 2-1 Burma Rd Pooraka SA 5095 Ph 08 8359 0890 E adelaide@alsenviro.com
Launceston 27 Wellington St, Launceston TAS 7250 Ph 03 6331 2158 E launceston@alsenviro.com

CLIENT: Regional Geotechnical Solutions	TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)	☒ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)
OFFICE:		☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact? Yes No N/A
PROJECT: PROJECT NO.: ES1209295	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle)	Free ice / frozen ice bricks present upon receipt? Yes No N/A
ORDER NUMBER: PURCHASE ORDER NO.:	COUNTRY OF ORIGIN:	COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C
PROJECT MANAGER: Steve Morton	CONTACT PH: 0432258578	OF: 1 2 3 4 5 6 7	Other comment:
SAMPLER: Adam Holzhauser	SAMPLER MOBILE: 0423057278	RELINQUISHED BY:	RECEIVED BY:
COC Emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME: 19-4-12. 5:15pm	DATE/TIME: 19/4/12 17.15.
Email Reports to (will default to PM if no other addresses are listed): adam.h@regionalgeotech.com		RELINQUISHED BY:	RECEIVED BY: HP
Email Invoice to (will default to PM if no other addresses are listed): as above.		DATE/TIME:	DATE/TIME: 20/4 19:00

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).				Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Asbestos	Suite S-16	TPH, BTEX, PAH & metals		Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	BH1 0.1-0.2					/		/		Subcon / Forward Lab / Split WO
2	BH2 0.1-0.2						/			Lab / Analysis: New Castle - Asbestos
3	BH2 0.5-0.6					[illegible]		/		Organised By / Date: 15-16-11-12-15
4	BH3 0.4-0.5						/	/		Relinquished By / Date:
5	BH4 0.1-0.2					/	/			Connote / Courier:
6	BH4 0.4-0.5							/		WO No:
7	BH5 0.1-0.2						/			Attach By PO / Internal Sheet:
8	BH5 0.2-0.3						/			
9	BH5 1.1-1.2							/		
10	BH6A 0.1-0.2					/	/			
11	BH6A 0.2-0.3					/				
12	BH7 0.15-0.25					/		/		
					TOTAL					

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Fo
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

D08936555

Environmental Division
Sydney
Work Order
ES1209295

Telephone : +61-2-8784 8555

2 of 2

CHAIN OF CUSTODY

ALS Laboratory: please tick →

[ ] Sydney 277 Woodpark Rd, Smithfield NSW 2176 Ph 02 8784 8555 E samples.sydney@alsenviro.com
[ ] Newcastle: 5 Rosegum Rd Warabrook NSW 2304 Ph 02 4968 9433 E samples.newcastle@alsenviro.com
[ ] Brisbane 32 Shand St, Stafford QLD 4053 Ph 07 3243 7222 E samples.brisbane@alsenviro.com
[ ] Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph 07 4796 0600 E townsville.environmental@alsenviro.com
[ ] Melbourne 2-4 Westall Rd Springvale VIC 3171 Ph 03 8549 9600 E samples.melbourne@alsenviro.com
[ ] Adelaide: 2-1 Burma Rd Pooraka SA 5095 Ph 08 8359 0890 E adelaide@alsenviro.com
[ ] Perth 10 Hod Way, Malaga WA 6090 Ph 08 9209 7655 E samples.perth@alsenviro.com
[ ] Launceston: 27 Wellington St, Launceston TAS 7250 Ph 03 6331 2158 E launceston@alsenviro.com

CLIENT: Regional Geotechnical Solutions	TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):	FOR LABORATORY USE ONLY (Circle): Custody Seal Intact? Yes No N/A; Free ice / frozen ice bricks present upon receipt? Yes No N/A; Random Sample Temperature on Receipt °C; Other comment:
OFFICE:			
PROJECT: PROJECT NO.:	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	
ORDER NUMBER: PURCHASE ORDER NO.:	COUNTRY OF ORIGIN:		
PROJECT MANAGER: Steve Morton	CONTACT PH: 0432258578		
SAMPLER: Adam Holzhauser	SAMPLER MOBILE: 0423057270	RELINQUISHED BY:	RECEIVED BY: CR
COC Emailed to ALS? (YES / NO)	EDD FORMAT (or default):		
Email Reports to (will default to PM if no other addresses are listed): adam.h@regionalgeotech.com.au		DATE/TIME: 19-4-12 5:15pm	DATE/TIME: 19/4/12 17:15
Email Invoice to (will default to PM if no other addresses are listed): as above			

RELINQUISHED BY:	RECEIVED BY:
DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Asbestos	Suite S-16	TPH, BTEX, PAH, 8 metals						Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
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14	BH7 0.25-0.35						✓							
15	BH8 0.15-0.25					✓	✓							
16	BH8 0.5-0.6							✓						
	Received Extra sample													
17	BH2 1.0-1-1.1	12-4-19		~~24~~ BH7 0.25-035 19/4/12										
18	BH2 1-5-1-6	12-4-19		25 BH7 3.0-3.1 19/4/12										
19	BH3-0-1-0-2	13-4-12												
20	BH3 1-5-1.6	13-4-12												
21	BH4 1-0-1-1	15-4-12												
22	BH5 3-0-3-1	16-4-12												
23	BH5 0-4-0-5	16-4-12												
					TOTAL									

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Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

D08936555

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **ES1210665**	Page	: 1 of 22
Client	: **REGIONAL GEOTECHNICAL SOLUTION**	Laboratory	: Environmental Division Sydney
Contact	: MR STEVE MORTON	Contact	: Client Services
Address	: 5/97 ISABELLA STREET WINGHAM NSW, AUSTRALIA 2429	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: steve.m@regionalgeotech.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 6553 5641	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: RGS00372	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 02-MAY-2012
Sampler	: ----	Issue Date	: 11-MAY-2012
Site	: ----		
		No. of samples received	: 22
Quote number	: SY/395/10	No. of samples analysed	: 22

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Descriptive Results
- Surrogate Control Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Evie.Sidarta	Inorganic Chemist	Sydney Inorganics
Hoa Nguyen	Inorganic Chemist	Sydney Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Organics
Peter Keyte	Newcastle Manager	Newcastle
Peter Rennie	Team Leader - Asbestos	Newcastle
Phalak Inthaksone	Laboratory Manager - Organics	Sydney Organics
Raymond Commodor	Instrument Chemist	Sydney Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **EA200 Legend for Asbestos Type:**
- **EA200 'Am' Amosite (brown asbestos)**
- **EA200 'Ch' Chrysotile (white asbestos)**
- **EA200 'Cr' Crocidolite (blue asbestos)**
- **EA200 't' Trace levels**
- **EA200 'UMF' Unknown mineral fibres**
- **EA200: Asbestos Identification Samples were analysed by Polarised Light Microscopy including dispersion staining.**
- **EA200: Confirmation by alternative techniques is recommended for samples where unknown mineral fibres are detected. Negative results for vinyl tiles should be confirmed by an independent analytical technique.**
- **ED041G LOR raised for SO4 on the sample ID (BH4) due to sample matrix.**
- **EG-005T:LCS recovery for Chromium falls outside ALS Dynamic Control Limit. However, it is within the acceptance criteria based on ALS DQO. No further action is required.**
- **EK055G LOR raised for NH3 on the sample ID (BH4) due to sample matrix.**
- **EK057G LOR raised for NO2 on the sample ID (BH4) due to sample matrix.**
- **EK059G LOR raised for NOx on the sample ID (BH4) due to sample matrix.**
- **EK071G LOR raised for RP on the sample ID (BH4) due to sample matrix.**
- **EK085: LOR raised for Sulphide on sample ID BH4 due to sample matrix.**
- **EK085: Poor matrix spike recovery for sample ID BH6 due to sample matrix. Confirmed by re-analysis.**
- **EP071: Poor duplicate precision for sample 111 due to sample heterogeneity. Confirmed by re-extraction and re-analysis.**
- **MW017 - VIC is ALS's internal code and is equivalent to in-house method MW055.**

Page : 4 of 22
Work Order : ES1210665
Client : REGIONAL GEOTECHNICAL SOLUTION
Project : RGS00372

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: 101	102	103	104	105
				Client sampling date / time: 02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00
				ES1210665-001	ES1210665-002	ES1210665-003	ES1210665-004	ES1210665-005
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**4.2**	**11.2**	**12.3**	**8.5**	**24.5**
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples								
Asbestos Detected	1332-21-4	0.1	g/kg	**No**	----	----	**No**	----
Asbestos Type	1332-21-4	0.1	--	**-**	----	----	**-**	----
Sample weight (dry)	----	0.01	g	**37.8**	----	----	**26.8**	----
APPROVED IDENTIFIER:	----	-	--	**P.RENNIE**	----	----	**P.RENNIE**	----
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	**15**	<5	**10**	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	**5**	**8**	**6**	**2**	**2**
Copper	7440-50-8	5	mg/kg	**22**	**18**	**28**	**15**	**7**
Lead	7439-92-1	5	mg/kg	**107**	**69**	**101**	**91**	**58**
Nickel	7440-02-0	2	mg/kg	**11**	**3**	**5**	<2	<2
Zinc	7440-66-6	5	mg/kg	**262**	**67**	**452**	**114**	**20**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	**0.1**	<0.1	<0.1	<0.1	<0.1
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.10	mg/kg	----	----	----	<0.10	<0.10
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	----	----	----	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	----	----	----	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg	----	----	----	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	----	----	----	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg	----	----	----	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg	----	----	----	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg	----	----	----	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	----	----	----	**0.20**	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	----	----	----	**0.96**	**0.40**
alpha-Endosulfan	959-98-8	0.05	mg/kg	----	----	----	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	----	----	----	**0.75**	**0.32**
Dieldrin	60-57-1	0.05	mg/kg	----	----	----	<0.05	**0.96**
4.4`-DDE	72-55-9	0.05	mg/kg	----	----	----	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg	----	----	----	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	----	----	----	<0.05	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	----	----	----	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	----	----	----	<0.05	<0.05

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: 101	102	103	104	105
				Client sampling date / time: 02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00
				ES1210665-001	ES1210665-002	ES1210665-003	ES1210665-004	ES1210665-005
EP068A: Organochlorine Pesticides (OC) - Continued								
Endosulfan sulfate	1031-07-8	0.05	mg/kg	----	----	----	<0.05	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg	----	----	----	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	----	----	----	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg	----	----	----	<0.2	<0.2
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	----	----	----	<0.05	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg	----	----	----	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg	----	----	----	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg	----	----	----	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg	----	----	----	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	----	----	----	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg	----	----	----	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg	----	----	----	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg	----	----	----	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg	----	----	----	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg	----	----	----	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	----	----	----	<0.05	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg	----	----	----	<0.05	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg	----	----	----	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg	----	----	----	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg	----	----	----	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg	----	----	----	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg	----	----	----	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg	----	----	----	<0.05	<0.05
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: 101	102	103	104	105
				Client sampling date / time: 02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00
				ES1210665-001	ES1210665-002	ES1210665-003	ES1210665-004	ES1210665-005
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	**180**	<100	<100	**190**	<100
C29 - C36 Fraction	----	100	mg/kg	<100	<100	**130**	**380**	<100
^ **C10 - C36 Fraction (sum)**	----	50	mg/kg	**180**	<50	**130**	**570**	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
^ **C6 - C10 Fraction minus BTEX (F1)**	----	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	**230**	<100	**160**	**260**	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	**120**	**530**	<100
^ **>C10 - C40 Fraction (sum)**	----	50	mg/kg	**230**	<50	**280**	**790**	<50
EP080: BTEX								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP080: BTEXN								
^ **Sum of BTEX**	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ **Total Xylenes**	1330-20-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	----	----	----	**78.3**	**76.3**
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	----	----	----	**126**	**128**
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	----	----	----	**88.4**	**91.5**
EP075(SIM)S: Phenolic Compound Surrogates								

Analytical Results

Sub-Matrix: SOIL				Client sample ID	101	102	103	104	105
				Client sampling date / time	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00
Compound	CAS Number	LOR	Unit		ES1210665-001	ES1210665-002	ES1210665-003	ES1210665-004	ES1210665-005
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
Phenol-d6	13127-88-3	0.1	%		112	106	110	100	88.0
2-Chlorophenol-D4	93951-73-6	0.1	%		97.7	96.8	112	95.1	97.6
2.4.6-Tribromophenol	118-79-6	0.1	%		94.8	98.4	97.5	102	104
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		101	110	107	95.5	105
Anthracene-d10	1719-06-8	0.1	%		109	112	112	103	114
4-Terphenyl-d14	1718-51-0	0.1	%		111	114	119	103	106
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		108	106	107	116	95.3
Toluene-D8	2037-26-5	0.1	%		97.6	98.4	104	109	83.0
4-Bromofluorobenzene	460-00-4	0.1	%		85.8	86.8	91.2	96.2	73.7

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Project : RGS00372

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: 106	107	108	109	110
				Client sampling date / time: 02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00
				ES1210665-006	ES1210665-007	ES1210665-008	ES1210665-009	ES1210665-010
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**2.8**	**11.9**	**10.3**	**8.1**	**13.8**
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples								
Asbestos Detected	1332-21-4	0.1	g/kg	**No**	**No**	----	**No**	----
Asbestos Type	1332-21-4	0.1	--	**-**	**-**	----	**-**	----
Sample weight (dry)	----	0.01	g	**35.2**	**29.4**	----	**29.0**	----
APPROVED IDENTIFIER:	----	-	--	**P.RENNIE**	**P.RENNIE**	----	**P.RENNIE**	----
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	**7**	<5	<5	**7**
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	**1**
Chromium	7440-47-3	2	mg/kg	**17**	**5**	**5**	**7**	**12**
Copper	7440-50-8	5	mg/kg	**7**	**7**	**19**	**30**	**131**
Lead	7439-92-1	5	mg/kg	**21**	**37**	**56**	**404**	**328**
Nickel	7440-02-0	2	mg/kg	**13**	<2	**4**	**4**	**6**
Zinc	7440-66-6	5	mg/kg	**67**	**80**	**236**	**349**	**624**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.10	mg/kg	<0.10	----	<0.10	<0.10	<0.10
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	----	<0.05	<0.05	**0.20**
Endrin	72-20-8	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: SOIL				Client sample ID	106	107	108	109	110
				Client sampling date / time	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00
Compound	CAS Number	LOR	Unit		ES1210665-006	ES1210665-007	ES1210665-008	ES1210665-009	ES1210665-010
EP068A: Organochlorine Pesticides (OC) - Continued									
Endosulfan sulfate	1031-07-8	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg		<0.2	----	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg		<0.2	----	<0.2	<0.2	<0.2
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg		<0.2	----	<0.2	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg		<0.2	----	<0.2	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg		<0.2	----	<0.2	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	**1.0**	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	**2.3**	**1.1**	**1.1**
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	**2.3**	**1.1**	**1.1**
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	**0.7**	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	**0.7**	<0.5	<0.5
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg		<0.5	<0.5	**1.2**	**0.6**	**0.5**

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Work Order	:	ES1210665
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Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: 106	107	108	109	110
				Client sampling date / time: 02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00
				ES1210665-006	ES1210665-007	ES1210665-008	ES1210665-009	ES1210665-010
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	**0.8**	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	**0.7**	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	**9.7**	**2.8**	**2.7**
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	**230**	<100	<100	**110**
C29 - C36 Fraction	----	100	mg/kg	<100	**150**	<100	**100**	**110**
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	**380**	<50	**100**	**220**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	----	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	**330**	**130**	**150**	**180**
>C34 - C40 Fraction	----	100	mg/kg	<100	**110**	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	**440**	**130**	**150**	**180**
EP080: BTEX								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP080: BTEXN								
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	1330-20-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	**90.2**	----	**81.2**	**79.1**	**81.7**
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	**125**	----	**112**	**121**	**93.4**
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	**95.1**	----	**87.9**	**90.0**	**85.2**
EP075(SIM)S: Phenolic Compound Surrogates								

Analytical Results

Sub-Matrix: SOIL				Client sample ID	106	107	108	109	110
				Client sampling date / time	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00
Compound	CAS Number	LOR	Unit		ES1210665-006	ES1210665-007	ES1210665-008	ES1210665-009	ES1210665-010
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
Phenol-d6	13127-88-3	0.1	%		107	91.0	88.8	94.1	97.5
2-Chlorophenol-D4	93951-73-6	0.1	%		102	103	95.4	100	93.7
2.4.6-Tribromophenol	118-79-6	0.1	%		94.6	105	100	100	74.9
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		106	113	90.3	106	100
Anthracene-d10	1719-06-8	0.1	%		98.8	111	108	111	106
4-Terphenyl-d14	1718-51-0	0.1	%		114	118	114	113	95.7
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		113	107	102	116	103
Toluene-D8	2037-26-5	0.1	%		99.9	94.5	95.4	105	93.9
4-Bromofluorobenzene	460-00-4	0.1	%		83.3	85.1	84.4	90.4	78.0

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Client : REGIONAL GEOTECHNICAL SOLUTION
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Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: 111	112	113	114	115
				Client sampling date / time: 02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00
				ES1210665-011	ES1210665-012	ES1210665-013	ES1210665-014	ES1210665-015
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	5.2	6.7	14.4	14.8	3.5
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples								
Asbestos Detected	1332-21-4	0.1	g/kg	----	No	No	No	No
Asbestos Type	1332-21-4	0.1	--	----	-	-	-	-
Sample weight (dry)	----	0.01	g	----	42.4	30.5	46.8	45.4
APPROVED IDENTIFIER:	----	-	--	----	P.RENNIE	P.RENNIE	P.RENNIE	P.RENNIE
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	9	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	5	5	9	4	<2
Copper	7440-50-8	5	mg/kg	12	18	41	12	<5
Lead	7439-92-1	5	mg/kg	76	224	521	80	9
Nickel	7440-02-0	2	mg/kg	3	3	4	<2	<2
Zinc	7440-66-6	5	mg/kg	126	286	759	238	35
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.10	mg/kg	<0.10	----	----	----	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	----	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	----	----	----	----
beta-BHC	319-85-7	0.05	mg/kg	<0.05	----	----	----	----
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	----	----	----	----
delta-BHC	319-86-8	0.05	mg/kg	<0.05	----	----	----	----
Heptachlor	76-44-8	0.05	mg/kg	<0.05	----	----	----	----
Aldrin	309-00-2	0.05	mg/kg	<0.05	----	----	----	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	----	----	----	----
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	----	----	----	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	----	----	----	----
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	----	----	----	----
Dieldrin	60-57-1	0.05	mg/kg	<0.05	----	----	----	----
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	----	----	----	----
Endrin	72-20-8	0.05	mg/kg	<0.05	----	----	----	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	----	----	----	----
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	----	----	----	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	----	----	----	----

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: 111	112	113	114	115
				Client sampling date / time: 02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00
				ES1210665-011	ES1210665-012	ES1210665-013	ES1210665-014	ES1210665-015
EP068A: Organochlorine Pesticides (OC) - Continued								
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	----	----	----	----
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	----	----	----	----
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	----	----	----	----
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	----	----	----	----
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	----	----	----	----
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	----	----	----	----
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	----	----	----	----
Dimethoate	60-51-5	0.05	mg/kg	<0.05	----	----	----	----
Diazinon	333-41-5	0.05	mg/kg	<0.05	----	----	----	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	----	----	----	----
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	----	----	----	----
Malathion	121-75-5	0.05	mg/kg	<0.05	----	----	----	----
Fenthion	55-38-9	0.05	mg/kg	<0.05	----	----	----	----
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	----	----	----	----
Parathion	56-38-2	0.2	mg/kg	<0.2	----	----	----	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	----	----	----	----
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	----	----	----	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	----	----	----	----
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	----	----	----	----
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	----	----	----	----
Ethion	563-12-2	0.05	mg/kg	<0.05	----	----	----	----
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	----	----	----	----
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	**0.6**	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	**0.5**	**1.6**	<0.5	**0.6**	<0.5
Pyrene	129-00-0	0.5	mg/kg	<0.5	**1.6**	<0.5	**0.6**	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	**0.5**	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	**0.6**	<0.5	<0.5	<0.5
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	**0.8**	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: 111	112	113	114	115
				Client sampling date / time: 02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00
				ES1210665-011	ES1210665-012	ES1210665-013	ES1210665-014	ES1210665-015
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	**0.5**	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	**0.5**	**6.2**	<0.5	**1.2**	<0.5
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	**220**	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	**250**	<100	**170**	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	**470**	<50	**170**	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	----	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	**410**	**140**	**190**	**130**	<100
>C34 - C40 Fraction	----	100	mg/kg	**200**	**120**	**170**	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	**610**	**260**	**360**	**130**	<50
EP080: BTEX								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	**0.9**	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP080: BTEXN								
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	**0.9**	<0.2	<0.2
^ Total Xylenes	1330-20-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	**78.6**	----	----	----	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	**118**	----	----	----	----
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	**81.1**	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates								

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: 111	112	113	114	115
				Client sampling date / time: 02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00
				ES1210665-011	ES1210665-012	ES1210665-013	ES1210665-014	ES1210665-015
EP075(SIM)S: Phenolic Compound Surrogates - Continued								
Phenol-d6	13127-88-3	0.1	%	**91.0**	**98.2**	**91.6**	**114**	**88.5**
2-Chlorophenol-D4	93951-73-6	0.1	%	**96.0**	**101**	**94.3**	**108**	**98.8**
2.4.6-Tribromophenol	118-79-6	0.1	%	**101**	**111**	**106**	**108**	**110**
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	**113**	**101**	**100**	**115**	**97.4**
Anthracene-d10	1719-06-8	0.1	%	**116**	**107**	**116**	**106**	**113**
4-Terphenyl-d14	1718-51-0	0.1	%	**116**	**96.2**	**100**	**115**	**117**
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	**123**	**118**	**113**	**109**	**116**
Toluene-D8	2037-26-5	0.1	%	**110**	**106**	**101**	**96.8**	**101**
4-Bromofluorobenzene	460-00-4	0.1	%	**94.9**	**90.8**	**88.3**	**84.5**	**85.7**

Analytical Results

Sub-Matrix: SOIL			Client sample ID	116	117	126	127	----
			Client sampling date / time	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	----
Compound	CAS Number	LOR	Unit	ES1210665-016	ES1210665-017	ES1210665-018	ES1210665-019	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	21.6	8.8	2.8	7.5	----
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	----
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	----
Chromium	7440-47-3	2	mg/kg	3	3	10	4	----
Copper	7440-50-8	5	mg/kg	6	13	10	15	----
Lead	7439-92-1	5	mg/kg	24	32	25	43	----
Nickel	7440-02-0	2	mg/kg	<2	2	7	2	----
Zinc	7440-66-6	5	mg/kg	115	110	67	119	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	----
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.10	mg/kg	----	----	<0.10	----	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	----	----	<0.05	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	----	----	<0.05	----	----
beta-BHC	319-85-7	0.05	mg/kg	----	----	<0.05	----	----
gamma-BHC	58-89-9	0.05	mg/kg	----	----	<0.05	----	----
delta-BHC	319-86-8	0.05	mg/kg	----	----	<0.05	----	----
Heptachlor	76-44-8	0.05	mg/kg	----	----	<0.05	----	----
Aldrin	309-00-2	0.05	mg/kg	----	----	<0.05	----	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	----	----	<0.05	----	----
trans-Chlordane	5103-74-2	0.05	mg/kg	----	----	<0.05	----	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	----	----	<0.05	----	----
cis-Chlordane	5103-71-9	0.05	mg/kg	----	----	<0.05	----	----
Dieldrin	60-57-1	0.05	mg/kg	----	----	<0.05	----	----
4.4`-DDE	72-55-9	0.05	mg/kg	----	----	<0.05	----	----
Endrin	72-20-8	0.05	mg/kg	----	----	<0.05	----	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	----	----	<0.05	----	----
4.4`-DDD	72-54-8	0.05	mg/kg	----	----	<0.05	----	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	----	----	<0.05	----	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	----	----	<0.05	----	----
4.4`-DDT	50-29-3	0.2	mg/kg	----	----	<0.2	----	----
Endrin ketone	53494-70-5	0.05	mg/kg	----	----	<0.05	----	----
Methoxychlor	72-43-5	0.2	mg/kg	----	----	<0.2	----	----
EP068B: Organophosphorus Pesticides (OP)								

Analytical Results

Sub-Matrix: SOIL				Client sample ID	116	117	126	127	----
				Client sampling date / time	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	----
Compound	CAS Number	LOR	Unit		ES1210665-016	ES1210665-017	ES1210665-018	ES1210665-019	----
EP068B: Organophosphorus Pesticides (OP) - Continued									
Dichlorvos	62-73-7	0.05	mg/kg		----	----	<0.05	----	----
Demeton-S-methyl	919-86-8	0.05	mg/kg		----	----	<0.05	----	----
Monocrotophos	6923-22-4	0.2	mg/kg		----	----	<0.2	----	----
Dimethoate	60-51-5	0.05	mg/kg		----	----	<0.05	----	----
Diazinon	333-41-5	0.05	mg/kg		----	----	<0.05	----	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		----	----	<0.05	----	----
Parathion-methyl	298-00-0	0.2	mg/kg		----	----	<0.2	----	----
Malathion	121-75-5	0.05	mg/kg		----	----	<0.05	----	----
Fenthion	55-38-9	0.05	mg/kg		----	----	<0.05	----	----
Chlorpyrifos	2921-88-2	0.05	mg/kg		----	----	<0.05	----	----
Parathion	56-38-2	0.2	mg/kg		----	----	<0.2	----	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		----	----	<0.05	----	----
Chlorfenvinphos	470-90-6	0.05	mg/kg		----	----	<0.05	----	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg		----	----	<0.05	----	----
Fenamiphos	22224-92-6	0.05	mg/kg		----	----	<0.05	----	----
Prothiofos	34643-46-4	0.05	mg/kg		----	----	<0.05	----	----
Ethion	563-12-2	0.05	mg/kg		----	----	<0.05	----	----
Carbophenothion	786-19-6	0.05	mg/kg		----	----	<0.05	----	----
Azinphos Methyl	86-50-0	0.05	mg/kg		----	----	<0.05	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----

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Work Order : ES1210665
Client : REGIONAL GEOTECHNICAL SOLUTION
Project : RGS00372

Analytical Results

Sub-Matrix: SOIL				Client sample ID	116	117	126	127	----
				Client sampling date / time	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	----
Compound	CAS Number	LOR	Unit		ES1210665-016	ES1210665-017	ES1210665-018	ES1210665-019	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	----
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	----
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	<100	----
C29 - C36 Fraction	----	100	mg/kg		**160**	<100	<100	<100	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg		**160**	<50	<50	<50	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft									
C6 - C10 Fraction	----	10	mg/kg		<10	<10	<10	<10	----
^ C6 - C10 Fraction minus BTEX (F1)	----	10	mg/kg		<10	<10	<10	<10	----
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	<50	<50	----
>C16 - C34 Fraction	----	100	mg/kg		**200**	<100	<100	<100	----
>C34 - C40 Fraction	----	100	mg/kg		**130**	<100	<100	<100	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		**330**	<50	<50	<50	----
EP080: BTEX									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	----
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
EP080: BTEXN									
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	----
^ Total Xylenes	1330-20-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	----
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	----
EP066S: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.1	%		----	----	**91.4**	----	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.1	%		----	----	**127**	----	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.1	%		----	----	**86.9**	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		**96.8**	**90.8**	**96.0**	**97.9**	----
2-Chlorophenol-D4	93951-73-6	0.1	%		**99.2**	**91.9**	**101**	**100**	----
2.4.6-Tribromophenol	118-79-6	0.1	%		**83.4**	**89.7**	**114**	**114**	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		**105**	**96.3**	**112**	**110**	----

Analytical Results

Sub-Matrix: SOIL				Client sample ID	116	117	126	127	----
				Client sampling date / time	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	----
Compound	CAS Number	LOR	Unit		ES1210665-016	ES1210665-017	ES1210665-018	ES1210665-019	----
EP075(SIM)T: PAH Surrogates - Continued									
Anthracene-d10	1719-06-8	0.1	%		115	117	118	112	----
4-Terphenyl-d14	1718-51-0	0.1	%		120	116	118	117	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		102	115	121	119	----
Toluene-D8	2037-26-5	0.1	%		104	99.6	108	102	----
4-Bromofluorobenzene	460-00-4	0.1	%		93.7	78.8	86.7	81.8	----

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Work Order : ES1210665
Client : REGIONAL GEOTECHNICAL SOLUTION
Project : RGS00372

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: BH6	BH4	BH2	----	----
				Client sampling date / time: 02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	----	----
				ES1210665-020	ES1210665-021	ES1210665-022	----	----
EA005: pH								
pH Value	----	0.01	pH Unit	7.52	7.31	6.75	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	4080	1350	3680	----	----
EA020EC: Salinity								
Salinity	----	0.01	g/kg	2.16	0.67	1.94	----	----
EA075: Redox Potential								
Redox Potential	----	0.1	mV	177	-118	123	----	----
pH Redox	----	0.01	pH Unit	7.6	6.9	6.6	----	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	15	100	60	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	140	<10	41	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	1160	524	1090	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.54	<0.10	0.23	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	<0.01	<0.10	<0.01	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	0.07	<0.10	0.12	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	0.07	<0.10	0.12	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.95	59.3	1.45	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	----	0.01	mg/L	<0.01	<0.10	<0.01	----	----
EK085M: Sulfide as S2-								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<1.0	<0.1	----	----
EP025: Oxygen - Dissolved (DO)								
Dissolved Oxygen	----	0.1	mg/L	4.5	0.2	2.9	----	----
EP030: Biochemical Oxygen Demand (BOD)								
Biochemical Oxygen Demand	----	2	mg/L	12	96	<2	----	----

Analytical Results

Descriptive Results

Sub-Matrix: **SOIL**

Method: Compound	Client sample ID - Client sampling date / time	Analytical Results
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples		
EA200: Description	101 - 02-MAY-2012 15:00	Grey-brown sandy soil with some vegetation and small grey rocks and large quantity coal pieces
EA200: Description	104 - 02-MAY-2012 15:00	Grey-brown sandy soil with some vegetation and small white rocks and coal pieces
EA200: Description	106 - 02-MAY-2012 15:00	Light brown sandy soil with some vegetation and small white rocks
EA200: Description	107 - 02-MAY-2012 15:00	Light grey soil with some vegetation and small white and dark grey rocks
EA200: Description	109 - 02-MAY-2012 15:00	Dark brown sandy soil with some vegetation and small white and red-brown rocks and coal pieces
EA200: Description	112 - 02-MAY-2012 15:00	Grey-brown sandy soil with some vegetation and small red-brown, grey and white rocks and coal pieces
EA200: Description	113 - 02-MAY-2012 15:00	Dark brown sandy soil with some vegetation and small white and red-brown rocks and coal pieces
EA200: Description	114 - 02-MAY-2012 15:00	Grey-brown sandy soil with some vegetation and small red-brown and white rocks and coal pieces
EA200: Description	115 - 02-MAY-2012 15:00	Light brown sandy soil with some vegetation and small white, grey and red-brown rocks and coal pieces

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	30.8	155.7
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	19.5	167.0
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	22.7	163.5
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	56.3	133.3
2-Chlorophenol-D4	93951-73-6	53.8	133.8
2.4.6-Tribromophenol	118-79-6	23.1	134.9
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	58.9	132.7
Anthracene-d10	1719-06-8	55.0	137.6
4-Terphenyl-d14	1718-51-0	54.0	147.8
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	72.8	133.2
Toluene-D8	2037-26-5	73.9	132.1
4-Bromofluorobenzene	460-00-4	71.6	130.0

Environmental Division

QUALITY CONTROL REPORT

Work Order	: **ES1210665**	Page	: 1 of 15
Client	: **REGIONAL GEOTECHNICAL SOLUTION**	Laboratory	: Environmental Division Sydney
Contact	: MR STEVE MORTON	Contact	: Client Services
Address	: 5/97 ISABELLA STREET WINGHAM NSW, AUSTRALIA 2429	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: steve.m@regionalgeotech.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 6553 5641	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: RGS00372	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 02-MAY-2012
Sampler	: ----	Issue Date	: 11-MAY-2012
Order number	: ----		
		No. of samples received	: 22
Quote number	: SY/395/10	No. of samples analysed	: 22

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Evie.Sidarta	Inorganic Chemist	Sydney Inorganics
Hoa Nguyen	Inorganic Chemist	Sydney Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Organics
Peter Keyte	Newcastle Manager	Newcastle
Peter Rennie	Team Leader - Asbestos	Newcastle
Phalak Inthaksone	Laboratory Manager - Organics	Sydney Organics
Raymond Commodor	Instrument Chemist	Sydney Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC

Page : 3 of 15
Work Order : ES1210665
Client : REGIONAL GEOTECHNICAL SOLUTION
Project : RGS00372

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (QC Lot: 2287678)									
ES1210344-025	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	51.9	51.3	1.2	0% - 20%
ES1210665-011	111	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	5.2	5.0	4.6	No Limit
EA055: Moisture Content (QC Lot: 2287679)									
ES1210734-001	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	10.9	11.4	4.3	0% - 50%
EG005T: Total Metals by ICP-AES (QC Lot: 2287608)									
ES1210277-001	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	13	13	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	8	8	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	8	8	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	10	11	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	36	38	3.5	No Limit
ES1210665-004	104	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	2	2	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	15	15	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	91	94	3.0	0% - 50%
		EG005T: Zinc	7440-66-6	5	mg/kg	114	116	2.2	0% - 20%
EG005T: Total Metals by ICP-AES (QC Lot: 2287610)									
ES1210665-014	114	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	4	4	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	12	12	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	80	81	1.5	0% - 50%
		EG005T: Zinc	7440-66-6	5	mg/kg	238	242	1.8	0% - 20%
ES1210734-005	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	10	8	25.4	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	28	18	46.2	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	7	6	15.6	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	<5	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2287609)									

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Work Order : ES1210665
Client : REGIONAL GEOTECHNICAL SOLUTION
Project : RGS00372

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2287609) - continued									
ES1210277-001	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
ES1210665-004	104	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP066: Polychlorinated Biphenyls (PCB) (QC Lot: 2287803)									
ES1210665-004	104	EP066: Total Polychlorinated biphenyls	----	0.10	mg/kg	<0.10	<0.10	0.0	No Limit
ES1210665-011	111	EP066: Total Polychlorinated biphenyls	----	0.10	mg/kg	<0.10	<0.10	0.0	No Limit
EP068A: Organochlorine Pesticides (OC) (QC Lot: 2287802)									
ES1210665-004	104	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	0.20	0.19	0.0	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	0.96	0.97	0.0	0% - 50%
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	0.75	0.73	1.8	0% - 50%
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
ES1210665-011	111	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP068A: Organochlorine Pesticides (OC) (QC Lot: 2287802) - continued									
ES1210665-011	111	EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP068B: Organophosphorus Pesticides (OP) (QC Lot: 2287802)									
ES1210665-004	104	EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
ES1210665-011	111	EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP068B: Organophosphorus Pesticides (OP) (QC Lot: 2287802) - continued									
ES1210665-011	111	EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 2287863)									
ES1210665-002	102	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
ES1210665-011	111	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

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Work Order : ES1210665
Client : REGIONAL GEOTECHNICAL SOLUTION
Project : RGS00372

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 2287863) - continued									
ES1210665-011	111	EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	0.5	<0.5	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 2287639)									
ES1210544-001	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
ES1210665-010	110	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 2287862)									
ES1210665-002	102	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
ES1210665-011	111	EP071: C15 - C28 Fraction	----	100	mg/kg	220	390	57.4	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	250	460	59.5	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QC Lot: 2287639)									
ES1210544-001	Anonymous	EP080: C6 - C10 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
ES1210665-010	110	EP080: C6 - C10 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QC Lot: 2287862)									
ES1210665-002	102	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
ES1210665-011	111	EP071: >C16 - C34 Fraction	----	100	mg/kg	410	720	55.4	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	200	360	56.1	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080: BTEXN (QC Lot: 2287639)									
ES1210544-001	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
ES1210665-010	110	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit

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Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA005: pH (QC Lot: 2288906)									
EN1201658-001	Anonymous	EA005: pH Value	----	0.01	pH Unit	8.12	8.15	0.4	0% - 20%
ES1210668-005	Anonymous	EA005: pH Value	----	0.01	pH Unit	6.88	6.87	0.1	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 2287578)									
ES1210665-020	BH6	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	4080	4080	0.0	0% - 20%
EA075: Redox Potential (QC Lot: 2289854)									
ES1210338-001	Anonymous	EA075: Redox Potential	----	0.1	mV	161	161	0.0	0% - 20%
		EA075: pH Redox	----	0.01	pH Unit	8.6	8.6	0.0	0% - 20%
ES1210649-009	Anonymous	EA075: Redox Potential	----	0.1	mV	204	204	0.0	0% - 20%
		EA075: pH Redox	----	0.01	pH Unit	6.9	6.9	0.0	0% - 20%
ED038A: Acidity (QC Lot: 2288197)									
ES1210665-020	BH6	ED038: Acidity as CaCO3	----	1	mg/L	15	20	28.6	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2287459)									
ES1210555-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.0	No Limit
ED045G: Chloride Discrete analyser (QC Lot: 2287458)									
ES1210555-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	4	5	0.0	No Limit
ES1210726-002	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	1460	1480	1.7	0% - 20%
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2287576)									
ES1210665-020	BH6	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.54	0.52	4.9	0% - 20%
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2287456)									
ES1210555-001	Anonymous	EK057G: Nitrite as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
ES1210723-001	Anonymous	EK057G: Nitrite as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2287575)									
ES1210665-020	BH6	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.07	0.07	0.0	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 2287590)									
ES1210028-004	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.40	0.40	0.0	0% - 20%
ES1210059-002	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.22	0.20	8.4	0% - 20%
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 2287457)									
ES1210555-001	Anonymous	EK071G: Reactive Phosphorus as P	----	0.01	mg/L	<0.01	0.01	0.0	No Limit
ES1210726-002	Anonymous	EK071G: Reactive Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK085M: Sulfide as S2- (QC Lot: 2287797)									
ES1210665-020	BH6	EK085: Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	0.0	No Limit
EP030: Biochemical Oxygen Demand (BOD) (QC Lot: 2288873)									
ES1210665-021	BH4	EP030: Biochemical Oxygen Demand	----	2	mg/L	96	115	18.0	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005T: Total Metals by ICP-AES (QCLot: 2287608)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	13.11 mg/kg	109	70	130
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	2.76 mg/kg	94.0	83.3	111
EG005T: Chromium	7440-47-3	2	mg/kg	<2	60.93 mg/kg	97.7	89.2	117
EG005T: Copper	7440-50-8	5	mg/kg	<5	54.68 mg/kg	98.0	90.1	114
EG005T: Lead	7439-92-1	5	mg/kg	<5	54.76 mg/kg	95.5	85.2	111
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.23 mg/kg	96.8	88.3	116
EG005T: Zinc	7440-66-6	5	mg/kg	<5	103.88 mg/kg	94.8	88.9	112
EG005T: Total Metals by ICP-AES (QCLot: 2287610)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	101	70	130
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	93.0	83.3	111
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	# 82.6	89.2	117
EG005T: Copper	7440-50-8	5	mg/kg	<5	32.0 mg/kg	96.8	90.1	114
EG005T: Lead	7439-92-1	5	mg/kg	<5	40.0 mg/kg	95.1	85.2	111
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.23 mg/kg	92.0	88.3	116
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	91.2	88.9	112
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2287609)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	1.4 mg/kg	81.7	67	118
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 2287803)								
EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.10	1 mg/kg	77.0	57.4	117
EP068A: Organochlorine Pesticides (OC) (QCLot: 2287802)								
EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	0.5 mg/kg	103	60.8	116
EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	0.5 mg/kg	104	59.4	115
EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	0.5 mg/kg	97.6	59.8	117
EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	0.5 mg/kg	102	59.8	118
EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	97.2	65.8	114
EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	0.5 mg/kg	99.5	65.6	115
EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	0.5 mg/kg	105	67	113
EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	0.5 mg/kg	107	65.6	113
EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	0.5 mg/kg	107	60.7	113
EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	0.5 mg/kg	100	65.8	116
EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	0.5 mg/kg	107	57.3	120
EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	0.5 mg/kg	101	67.4	116
EP068: 4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	0.5 mg/kg	92.5	67.5	114
EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	0.5 mg/kg	98.9	63	121

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Client : REGIONAL GEOTECHNICAL SOLUTION
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Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP068A: Organochlorine Pesticides (OC) (QCLot: 2287802) - continued								
EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	0.5 mg/kg	88.8	66.1	117
EP068: 4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	0.5 mg/kg	81.6	65.3	116
EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	0.5 mg/kg	107	57.3	115
EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	0.5 mg/kg	111	63.6	119
EP068: 4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	0.5 mg/kg	105	58.4	127
EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	0.5 mg/kg	98.7	63.6	117
EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	0.5 mg/kg	88.9	50.4	132
EP068B: Organophosphorus Pesticides (OP) (QCLot: 2287802)								
EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	0.5 mg/kg	94.3	25.5	124
EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	89.1	10.1	159
EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	0.5 mg/kg	88.0	2.88	149
EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	0.5 mg/kg	88.2	48.6	126
EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	0.5 mg/kg	109	64.9	111
EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	0.5 mg/kg	102	65.1	111
EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	0.5 mg/kg	94.2	61.4	113
EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	0.5 mg/kg	106	60.4	127
EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	0.5 mg/kg	97.8	64.7	110
EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	0.5 mg/kg	104	64.2	111
EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	0.5 mg/kg	99.3	60	116
EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	0.5 mg/kg	# 112	64.8	111
EP068: Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	0.5 mg/kg	106	61.4	123
EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	0.5 mg/kg	105	64.3	114
EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	0.5 mg/kg	77.3	45.5	128
EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	0.5 mg/kg	97.5	65.4	111
EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	0.5 mg/kg	92.1	62	116
EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	0.5 mg/kg	103	59.5	119
EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	0.5 mg/kg	70.8	29.8	137
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 2287863)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	4 mg/kg	103	81.9	113
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	4 mg/kg	105	79.6	113
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	4 mg/kg	107	81.5	112
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	4 mg/kg	105	79.9	112
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	4 mg/kg	110	79.4	114
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	4 mg/kg	110	81.1	112
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	4 mg/kg	98.4	78.8	113
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	4 mg/kg	105	78.9	113
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	4 mg/kg	110	77.2	112
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	4 mg/kg	102	79.8	114
EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	4 mg/kg	100	71.8	118

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Work Order : ES1210665
Client : REGIONAL GEOTECHNICAL SOLUTION
Project : RGS00372

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 2287863) - continued								
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	4 mg/kg	97.0	74.2	117
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	4 mg/kg	95.4	76.4	113
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	4 mg/kg	85.4	71	113
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	4 mg/kg	88.4	71.7	113
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	4 mg/kg	91.1	72.4	114
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2287639)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	82.2	68.4	128
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2287862)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	200 mg/kg	88.0	59	131
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	300 mg/kg	114	74	138
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	200 mg/kg	92.0	63	131
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2287639)								
EP080: C6 - C10 Fraction	----	10	mg/kg	<10	31 mg/kg	84.1	68.4	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2287862)								
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	250 mg/kg	89.6	59	131
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	350 mg/kg	108	74	138
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	----	----	----	----
		50	mg/kg	----	150 mg/kg	93.3	63	131
EP080: BTEXN (QCLot: 2287639)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	83.8	62	120
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	83.9	62	128
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	78.2	58	118
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	75.4	60	120
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	74.8	60	120
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	74.6	62	138

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EA010P: Conductivity by PC Titrator (QCLot: 2287578)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	2000 µS/cm	102	92	116
EA075: Redox Potential (QCLot: 2289854)								
EA075: Redox Potential	----	0.1	mV	----	86 mV	102	96	120
ED038A: Acidity (QCLot: 2288197)								
ED038: Acidity as CaCO3	----	1	mg/L	<1	20 mg/L	100	89.8	103
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2287459)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	98.4	77	121

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
ED045G: Chloride Discrete analyser (QCLot: 2287458)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	1000 mg/L	97.8	79	123
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2287576)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1.00 mg/L	102	86	116
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2287456)								
EK057G: Nitrite as N	----	0.01	mg/L	<0.01	0.5 mg/L	85.2	78	128
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2287575)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	118	80	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2287590)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	90.8	67	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 2287457)								
EK071G: Reactive Phosphorus as P	----	0.01	mg/L	<0.01	0.50 mg/L	105	85	115
EK085M: Sulfide as S2- (QCLot: 2287797)								
EK085: Sulfide as S2-	18496-25-8	0.10	mg/L	<0.1	0.50 mg/L	115	70.2	121
EP030: Biochemical Oxygen Demand (BOD) (QCLot: 2288873)								
EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	200 mg/L	88.5	76	108

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005T: Total Metals by ICP-AES (QCLot: 2287608)							
ES1210277-001	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	98.7	70	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	95.0	70	130
		EG005T: Chromium	7440-47-3	50 mg/kg	101	70	130
		EG005T: Copper	7440-50-8	250 mg/kg	105	70	130
		EG005T: Lead	7439-92-1	250 mg/kg	97.3	70	130
		EG005T: Nickel	7440-02-0	50 mg/kg	98.0	70	130
		EG005T: Zinc	7440-66-6	250 mg/kg	95.2	70	130
EG005T: Total Metals by ICP-AES (QCLot: 2287610)							
ES1210665-014	114	EG005T: Arsenic	7440-38-2	50 mg/kg	99.1	70	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	92.8	70	130
		EG005T: Chromium	7440-47-3	50 mg/kg	96.0	70	130
		EG005T: Copper	7440-50-8	250 mg/kg	104	70	130
		EG005T: Lead	7439-92-1	250 mg/kg	92.6	70	130
		EG005T: Nickel	7440-02-0	50 mg/kg	98.8	70	130
		EG005T: Zinc	7440-66-6	250 mg/kg	89.6	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2287609)							
ES1210277-001	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	82.8	70	130
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 2287803)							
ES1210665-004	104	EP066: Total Polychlorinated biphenyls	----	1 mg/kg	85.0	70	130
EP068A: Organochlorine Pesticides (OC) (QCLot: 2287802)							
ES1210665-004	104	EP068: gamma-BHC	58-89-9	0.5 mg/kg	97.0	70	130
		EP068: Heptachlor	76-44-8	0.5 mg/kg	97.6	70	130
		EP068: Aldrin	309-00-2	0.5 mg/kg	77.0	70	130
		EP068: Dieldrin	60-57-1	0.5 mg/kg	82.3	70	130
		EP068: Endrin	72-20-8	2 mg/kg	82.6	70	130
		EP068: 4.4`-DDT	50-29-3	2 mg/kg	80.2	70	130
EP068B: Organophosphorus Pesticides (OP) (QCLot: 2287802)							
ES1210665-004	104	EP068: Diazinon	333-41-5	0.5 mg/kg	104	70	130
		EP068: Chlorpyrifos-methyl	5598-13-0	0.5 mg/kg	98.2	70	130
		EP068: Pirimphos-ethyl	23505-41-1	0.5 mg/kg	91.8	70	130
		EP068: Bromophos-ethyl	4824-78-6	0.5 mg/kg	84.3	70	130
		EP068: Prothiofos	34643-46-4	0.5 mg/kg	80.9	70	130
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 2287863)							
ES1210665-002	102	EP075(SIM): Acenaphthene	83-32-9	10 mg/kg	85.1	70	130
		EP075(SIM): Pyrene	129-00-0	10 mg/kg	88.0	70	130

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Work Order : ES1210665
Client : REGIONAL GEOTECHNICAL SOLUTION
Project : RGS00372

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Spike Recovery (%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2287639)							
ES1210544-001	Anonymous	EP080: C6 - C9 Fraction	----	32.5 mg/kg	94.9	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2287862)							
ES1210665-002	102	EP071: C10 - C14 Fraction	----	640 mg/kg	101	73	137
		EP071: C15 - C28 Fraction	----	3140 mg/kg	120	53	131
		EP071: C29 - C36 Fraction	----	2860 mg/kg	101	52	132
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2287639)							
ES1210544-001	Anonymous	EP080: C6 - C10 Fraction	----	37.5 mg/kg	100	70	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2287862)							
ES1210665-002	102	EP071: >C10 - C16 Fraction	----	850 mg/kg	114	73	137
		EP071: >C16 - C34 Fraction	----	4800 mg/kg	110	53	131
		EP071: >C34 - C40 Fraction	----	2400 mg/kg	111	52	132
EP080: BTEXN (QCLot: 2287639)							
ES1210544-001	Anonymous	EP080: Benzene	71-43-2	2.5 mg/kg	83.0	70	130
		EP080: Toluene	108-88-3	2.5 mg/kg	85.1	70	130
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	79.5	70	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2.5 mg/kg	80.8	70	130
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	81.2	70	130
		EP080: Naphthalene	91-20-3	2.5 mg/kg	70.7	70	130

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Spike Recovery (%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2287459)							
ES1210555-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	106	70	130
ED045G: Chloride Discrete analyser (QCLot: 2287458)							
ES1210555-001	Anonymous	ED045G: Chloride	16887-00-6	250 mg/L	113	70	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2287576)							
ES1210665-020	BH6	EK055G: Ammonia as N	7664-41-7	1.00 mg/L	106	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2287456)							
ES1210555-001	Anonymous	EK057G: Nitrite as N	----	0.5 mg/L	87.0	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2287575)							
ES1210665-020	BH6	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	125	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2287590)							
ES1210028-004	Anonymous	EK067G: Total Phosphorus as P	----	1.00 mg/L	99.4	70	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 2287457)							
ES1210555-001	Anonymous	EK071G: Reactive Phosphorus as P	----	0.50 mg/L	104	70	130

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Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EK085M: Sulfide as S2- (QCLot: 2287797)							
ES1210665-020	BH6	EK085: Sulfide as S2-	18496-25-8	0.33 mg/L	# 30.3	70	130

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1210665**	Page	: 1 of 13
Client	: REGIONAL GEOTECHNICAL SOLUTION	Laboratory	: Environmental Division Sydney
Contact	: MR STEVE MORTON	Contact	: Client Services
Address	: 5/97 ISABELLA STREET WINGHAM NSW, AUSTRALIA 2429	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: steve.m@regionalgeotech.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 6553 5641	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: RGS00372	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 02-MAY-2012
Sampler	: ----	Issue Date	: 11-MAY-2012
Order number	: ----		
		No. of samples received	: 22
Quote number	: SY/395/10	No. of samples analysed	: 22

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

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Work Order	: ES1210665
Client	: REGIONAL GEOTECHNICAL SOLUTION
Project	: RGS00372

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non-volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content							
Soil Glass Jar - Unpreserved (EA055-103)							
101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 126, 127	**02-MAY-2012**	**----**	----	----	**04-MAY-2012**	16-MAY-2012	✓
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples							
Snap Lock Bag (EA200)							
101, 104, 106, 107, 109, 112, 113, 114, 115	**02-MAY-2012**	**---**	29-OCT-2012	----	**07-MAY-2012**	03-NOV-2012	✓
EG005T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 126, 127	**02-MAY-2012**	**04-MAY-2012**	29-OCT-2012	✓	**04-MAY-2012**	29-OCT-2012	✓

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Client : REGIONAL GEOTECHNICAL SOLUTION
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Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 126, 127	**02-MAY-2012**	**04-MAY-2012**	30-MAY-2012	✓	**07-MAY-2012**	30-MAY-2012	✓
EP066: Polychlorinated Biphenyls (PCB)							
Soil Glass Jar - Unpreserved (EP066)							
104, 105, 106, 108, 109, 110, 111, 126	**02-MAY-2012**	**04-MAY-2012**	16-MAY-2012	✓	**06-MAY-2012**	13-JUN-2012	✓
EP068A: Organochlorine Pesticides (OC)							
Soil Glass Jar - Unpreserved (EP068)							
104, 105, 106, 108, 109, 110, 111, 126	**02-MAY-2012**	**04-MAY-2012**	16-MAY-2012	✓	**06-MAY-2012**	13-JUN-2012	✓
EP068B: Organophosphorus Pesticides (OP)							
Soil Glass Jar - Unpreserved (EP068)							
104, 105, 106, 108, 109, 110, 111, 126	**02-MAY-2012**	**04-MAY-2012**	16-MAY-2012	✓	**06-MAY-2012**	13-JUN-2012	✓
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP071)							
101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 126, 127	**02-MAY-2012**	**04-MAY-2012**	16-MAY-2012	✓	**04-MAY-2012**	13-JUN-2012	✓

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Client : REGIONAL GEOTECHNICAL SOLUTION
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Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))							
101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 126, 127	**02-MAY-2012**	**04-MAY-2012**	16-MAY-2012	✓	**04-MAY-2012**	13-JUN-2012	✓
EP080: BTEX							
Soil Glass Jar - Unpreserved (EP080)							
101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 126, 127	**02-MAY-2012**	**04-MAY-2012**	16-MAY-2012	✓	**04-MAY-2012**	16-MAY-2012	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080)							
101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 126, 127	**02-MAY-2012**	**04-MAY-2012**	16-MAY-2012	✓	**04-MAY-2012**	16-MAY-2012	✓

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Client : REGIONAL GEOTECHNICAL SOLUTION
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Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080)							
101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 126, 127	**02-MAY-2012**	**04-MAY-2012**	16-MAY-2012	✓	**04-MAY-2012**	16-MAY-2012	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA005: pH							
Clear Plastic Bottle - Natural (EA005)							
BH6, BH4, BH2	**02-MAY-2012**	**----**	----	----	**02-MAY-2012**	02-MAY-2012	✓
EA010P: Conductivity by PC Titrator							
Clear Plastic Bottle - Natural (EA010-P)							
BH6, BH4, BH2	**02-MAY-2012**	**---**	30-MAY-2012	----	**04-MAY-2012**	30-MAY-2012	✓
EA075: Redox Potential							
Clear Plastic Bottle - Natural (EA075)							
BH6, BH4, BH2	**02-MAY-2012**	**----**	----	----	**04-MAY-2012**	02-MAY-2012	×
ED038A: Acidity							
Clear Plastic Bottle - Natural (ED038)							
BH6, BH4, BH2	**02-MAY-2012**	**----**	----	----	**04-MAY-2012**	16-MAY-2012	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
BH6, BH4, BH2	**02-MAY-2012**	**---**	30-MAY-2012	----	**04-MAY-2012**	30-MAY-2012	✓
ED045G: Chloride Discrete analyser							
Clear Plastic Bottle - Natural (ED045G)							
BH6, BH4, BH2	**02-MAY-2012**	**---**	30-MAY-2012	----	**04-MAY-2012**	30-MAY-2012	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
BH6, BH4, BH2	**02-MAY-2012**	**---**	30-MAY-2012	----	**04-MAY-2012**	30-MAY-2012	✓

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Work Order : ES1210665
Client : REGIONAL GEOTECHNICAL SOLUTION
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Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
BH6, BH4, BH2	**02-MAY-2012**	**---**	04-MAY-2012	----	**04-MAY-2012**	04-MAY-2012	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G)							
BH6, BH4, BH2	**02-MAY-2012**	**---**	30-MAY-2012	----	**04-MAY-2012**	30-MAY-2012	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
BH6, BH4, BH2	**02-MAY-2012**	**04-MAY-2012**	30-MAY-2012	✓	**04-MAY-2012**	30-MAY-2012	✓
EK071G: Reactive Phosphorus as P by discrete analyser							
Clear Plastic Bottle - Natural (EK071G)							
BH6, BH4, BH2	**02-MAY-2012**	**---**	04-MAY-2012	----	**04-MAY-2012**	04-MAY-2012	✓
EK085M: Sulfide as S2-							
Clear Plastic Bottle - Zinc Acetate/NaOH (EK085)							
BH6, BH4, BH2	**02-MAY-2012**	**----**	----	----	**04-MAY-2012**	09-MAY-2012	✓
EP025: Oxygen - Dissolved (DO)							
Clear Plastic Bottle - Natural (EP025)							
BH6, BH4, BH2	**02-MAY-2012**	**----**	----	----	**02-MAY-2012**	02-MAY-2012	✓
EP030: Biochemical Oxygen Demand (BOD)							
Clear Plastic Bottle - Natural (EP030)							
BH6, BH4, BH2	**02-MAY-2012**	**----**	----	----	**03-MAY-2012**	04-MAY-2012	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	3	33	9.1	10.0	×	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (SIM)	EP075(SIM)	2	19	10.5	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	2	20	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	2	16	12.5	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	2	20	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	4	37	10.8	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	2	20	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	20	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	1	19	5.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	16	6.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	37	5.4	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	1	19	5.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	16	6.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	37	5.4	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	1	19	5.3	5.0	✓	ALS QCS3 requirement
Pesticides by GCMS	EP068	1	20	5.0	5.0	✓	ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	16	6.3	5.0	✓	ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	20	5.0	5.0	✓	ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	37	5.4	5.0	✓	ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	20	5.0	5.0	✓	ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	20	5.0	5.0	✓	ALS QCS3 requirement

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Acidity as Calcium Carbonate	ED038	1	3	33.3	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Ammonia as N by Discrete analyser	EK055G	1	3	33.3	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Biochemical Oxygen Demand (BOD)	EP030	1	6	16.7	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

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Work Order : ES1210665
Client : REGIONAL GEOTECHNICAL SOLUTION
Project : RGS00372

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP) - Continued							
Chloride by Discrete Analyser	ED045G	2	11	**18.2**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	1	3	**33.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	3	**33.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	2	19	**10.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH	EA005	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Reactive Phosphorus as P-By Discrete Analyser	EK071G	2	12	**16.7**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Redox Potential	EA075	2	13	**15.4**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	7	**14.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfide as S2-	EK085	1	3	**33.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	2	16	**12.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Acidity as Calcium Carbonate	ED038	1	3	**33.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Ammonia as N by Discrete analyser	EK055G	1	3	**33.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Biochemical Oxygen Demand (BOD)	EP030	1	6	**16.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	11	**18.2**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	1	3	**33.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	3	**33.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	19	**5.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	12	**8.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Redox Potential	EA075	3	13	**23.1**	**15.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	7	**14.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfide as S2-	EK085	1	3	**33.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	1	16	**6.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Acidity as Calcium Carbonate	ED038	1	3	**33.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Ammonia as N by Discrete analyser	EK055G	1	3	**33.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Biochemical Oxygen Demand (BOD)	EP030	1	6	**16.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	1	11	**9.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	1	3	**33.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	3	**33.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	19	**5.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	12	**8.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	7	**14.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfide as S2-	EK085	1	3	**33.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	1	16	**6.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	3	**33.3**	**5.0**	✓	ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	1	11	**9.1**	**5.0**	✓	ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	3	**33.3**	**5.0**	✓	ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	19	**5.3**	**5.0**	✓	ALS QCS3 requirement
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	12	**8.3**	**5.0**	✓	ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	7	**14.3**	**5.0**	✓	ALS QCS3 requirement
Sulfide as S2-	EK085	1	3	**33.3**	**5.0**	✓	ALS QCS3 requirement

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Matrix Spikes (MS) - Continued							
Total Phosphorus as P By Discrete Analyser	EK067G	1	16	**6.3**	**5.0**	✓	ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2010 Draft) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Asbestos Identification in bulk solids	EA200	SOIL	AS 4964 - 2004 Method for the qualitative identification of asbestos in bulk samples
Total Metals by ICP-AES	EG005T	SOIL	(APHA 21st ed., 3120; USEPA SW 846 - 6010) (ICPAES) Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (1999) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	AS 3550, APHA 21st ed., 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (1999) Schedule B(3)
Polychlorinated Biphenyls (PCB)	EP066	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 504)
Pesticides by GCMS	EP068	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM (1999) Schedule B(3) (Method 504,505)
TPH - Semivolatile Fraction	EP071	SOIL	(USEPA SW 846 - 8015A) Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C36. This method is compliant with NEPM (1999) Schedule B(3) (Method 506.1)
PAH/Phenols (SIM)	EP075(SIM)	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 502 and 507)
TPH Volatiles/BTEX	EP080	SOIL	(USEPA SW 846 - 8260B) Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 501)
pH	EA005	WATER	APHA 21st ed. 4500 H+ B. pH of water samples is determined by ISE either manually or by automated pH meter. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Conductivity by PC Titrator	EA010-P	WATER	APHA 21st ed., 2510 B This procedure determines conductivity by automated ISE. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Salinity	EA020-EC-P	WATER	APHA 21st ed. 2520B Calculation from Electrical conductivity. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Redox Potential	EA075	WATER	In House (Ion selective electrode)
Acidity as Calcium Carbonate	ED038	WATER	APHA 21st ed., 2310 B Acidity is determined by titration with a standardised alkali to an end-point pH of 8.3. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	APHA 21st ed., 4500-SO4 Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)

Analytical Methods	Method	Matrix	Method Descriptions
Chloride by Discrete Analyser	ED045G	WATER	APHA 21st ed., 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Ammonia as N by Discrete analyser	EK055G	WATER	APHA 21st ed., 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Nitrite as N by Discrete Analyser	EK057G	WATER	APHA 21st ed., 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Nitrate as N by Discrete Analyser	EK058G	WATER	APHA 21st ed., 4500-NO3- F. Nitrate is reduced to nitrite by way of a cadmium reduction column followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	APHA 21st ed., 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Cadmium Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	APHA 21st ed., 4500-P B&F This procedure involves sulphuric acid digestion of a 100mL sample to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Reactive Phosphorus as P-By Discrete Analyser	EK071G	WATER	APHA 21st ed., 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Sulfide as S2-	EK085	WATER	APHA 21st ed., 4500-S2- D Sulfide species present in water samples are immediately precipitated when collected in pretreated caustic/zinc acetate preserved sample containers. After the supernatant is discarded, the resultant precipitate is then coloured using methylene blue indicator and measured using UV-VIS detection at 664nm. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Oxygen - Dissolved	EP025	WATER	APHA 21st ed., 4500-O G. Dissolved Oxygen Probe. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Biochemical Oxygen Demand (BOD)	EP030	WATER	APHA 21st ed., 5210 B The 5-Day BOD test provides an empirical measure of the oxygen consumption capacity of a given water. A portion of the sample is diluted into oxygenated, nutrient rich water, and a seed added to begin biological decay. The initial dissolved oxygen content is measured, then the bottle is sealed and incubated for five days. The remaining dissolved oxygen is measured, and from the difference, the demand for oxygen, by biological decay, is determined. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)

Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	USEPA 200.2 Mod. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (1999) Schedule B(3) (Method 202)
Methanolic Extraction of Soils for Purge and Trap	* ORG16	SOIL	(USEPA SW 846 - 5030A) 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids (Option A - Concentrating)	ORG17A	SOIL	In-house, Mechanical agitation (tumbler). 20g of sample, Na2SO4 and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Tumbler Extraction of Solids (Option B - Non-concentrating)	ORG17B	SOIL	In-house, Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 20mL 1:1 DCM/Acetone by end over end tumble. The solvent is transferred directly to a GC vial for analysis.

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	APHA 21st ed., 4500 Norg - D; APHA 21st ed., 4500 P - H. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Laboratory Control Spike (LCS) Recoveries							
EG005T: Total Metals by ICP-AES	2709382-032	----	**Chromium**	7440-47-3	82.6 %	89.2-117%	**Recovery less than lower control limit**
EP068B: Organophosphorus Pesticides (OP)	2709557-002	----	**Pirimphos-ethyl**	23505-41-1	112 %	64.8-111%	**Recovery greater than upper control limit**

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EK085M: Sulfide as S2-	ES1210665-020	BH6	**Sulfide as S2-**	18496-25-8	30.3 %	70-130%	**Recovery less than lower data quality objective**

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

Matrix: **WATER**

Method / **Container** / Client Sample ID(s)	*Extraction / Preparation*			*Analysis*		
	Date extracted	*Due for extraction*	***Days overdue***	*Date analysed*	*Due for analysis*	***Days overdue***
EA075: Redox Potential						
Clear Plastic Bottle - Natural						
BH6, BH4, BH2	----	----	----	04-MAY-2012	02-MAY-2012	**2**

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

Matrix: **SOIL**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Moisture Content	3	33	9.1	10.0	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ Sydney: 277 Woodpark Rd, Smithfield NSW 2176 Ph: 02 8784 8555 E:samples.sydney@alsenviro.com
☐ Newcastle: 5 Rosegum Rd, Warabrook NSW 2304 Ph:02 4968 9433 E:samples.newcastle@alsenviro.com
☐ Brisbane: 32 Shand St, Stafford QLD 4053 Ph:07 3243 7222 E:samples.brisbane@alsenviro.com
☐ Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph:07 4796 0600 E: townsville.environmental@alsenviro.com
☐ Melbourne: 2-4 Westall Rd, Springvale VIC 3171 Ph:03 8549 9600 E: samples.melbourne@alsenviro.com
☐ Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E:adelaide@alsenviro.com
☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT: Regional Geotechnical Solutions	TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):	FOR LABORATORY USE ONLY (Circle): Custody Seal Intact? Yes No N/A; Free ice / frozen ice bricks present upon receipt? Yes No N/A; Random Sample Temperature on Receipt: °C; Other comments:
OFFICE:			
PROJECT: RG300372 PROJECT NO.:	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7; OF: 1 2 3 4 5 6 7	
ORDER NUMBER: PURCHASE ORDER NO.:	COUNTRY OF ORIGIN:		
PROJECT MANAGER: STEVE NORTON CONTACT PH:			

SAMPLER: SAMPLER MOBILE:	RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
COC Emailed to ALS? (YES / NO) EDD FORMAT (or default):				
Email Reports to (will default to PM if no other addresses are listed): steve.no@regionalgeotech.com.au	DATE/TIME: 2/5/12	DATE/TIME: 2/5 16:20	DATE/TIME: 2/5 17:00	DATE/TIME: Frank 2-5-12 1900
Email Invoice to (will default to PM if no other addresses are listed):				

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Sulfate S-16			TPH, BTEX, PAH, 8 metals		Asbestos in soil			Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	(4) (5)			HT	Bottle									Please subsample for Asbestos and return to Newcastle.
(6)	104, 105, (7)	2/5/12	Soil			✓								
(8)	106, 126, (9) 108 (10)		"			✓								
(11)	109, (12) 110, 111		"			✓								
	(1) (2) (3)													
	101, 102, 103		"						✓					
	107, (12) 112, 113		"						✓					
	114, 115, 116, 117 + 127		"						✓					
	(14) (15) (16) (17) (19)													
	101, 104, 106	(1) (4) (6)									✓			
	107, 109, 112	(7) (9) (12)									✓			
	113, 114, 115	(13) (14) (15)									✓			
					TOTAL									

Environmental Division
Sydney
Work Order
ES1210665

Telephone : +61-2-8784 8555

P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
d; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; TU = Thiosulfate Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

Sulfate S-16 for Split WO
Forward Lab / Split WO
Lab / Date:
Original Sample Condition
Released By / Date:
Container Condition
WO / Internal Sheets
Attached By

Approved Date: 17/08/2010

D08936555

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ Sydney: 277 Woodpark Rd, Smithfield NSW 2176 Ph: 02 8784 8555 E:samples.sydney@alsenviro.com
☐ Brisbane: 32 Shand St, Stafford QLD 4053 Ph:07 3243 7222 E:samples.brisbane@alsenviro.com
☐ Melbourne: 2-4 Westall Rd, Springvale VIC 3171 Ph:03 8549 9600 E: samples.melbourne@alsenviro.com
☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ Newcastle: 5 Rosegum Rd, Warabrook NSW 2304 Ph:02 4968 9433 E:samples.newcastle@alsenviro.com
☐ Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph:07 4796 0600 E: townsville.environmental@alsenviro.com
☐ Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E:adelaide@alsenviro.com
☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT: REGIONAL GEOTECHNICAL SOLUTIONS	TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)
OFFICE:		☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact? Yes No N/A
PROJECT: RG300372 PROJECT NO.:	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle)	Free ice / frozen ice bricks present upon receipt? Yes No N/A
ORDER NUMBER: PURCHASE ORDER NO.:	COUNTRY OF ORIGIN:	COC: 1 (2) 3 4 5 6 7	Random Sample Temperature on Receipt °C
PROJECT MANAGER: STEVE MORTON CONTACT PH:		OF: 1 (2) 3 4 5 6 7	Other comments:

SAMPLER: SAMPLER MOBILE:	RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
COC Emailed to ALS? (YES / NO) EDD FORMAT (or default):				Frank
Email Reports to (will default to PM if no other addresses are listed): steve.mo@regionalgeotech.com.au	DATE/TIME:	DATE/TIME: 2/5 16:20	DATE/TIME: 2/5 17.00	DATE/TIME: 2-5-12 (900
Email Invoice to (will default to PM if no other addresses are listed): as above				

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED Including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Sulfate reducing bacteria	Sulphide Total P	Sulphide Sol phase	Salinity Ortho P, pH Redox	Nitrate Nitrite	Conductivity DO	Chloride BOD 5	Acidity Ammonia	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
19	BH6	2/5/12	Water			✓	✓	✓	✓	✓	✓	✓	✓	
28	BH4	"	Water			✓	✓	✓	✓	✓	✓	✓	✓	
29	BH2	"	Water			✓	✓	✓	✓	✓	✓	✓	✓	
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

D08936555

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **ES1212943**	Page	: 1 of 7
Client	: **REGIONAL GEOTECHNICAL SOLUTION**	Laboratory	: Environmental Division Sydney
Contact	: MR STEVE MORTON	Contact	: Client Services
Address	: 5/97 ISABELLA STREET WINGHAM NSW, AUSTRALIA 2429	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: steve.m@regionalgeotech.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 6553 5641	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: RGS00372	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: This is a rebatch of ES1209295		
C-O-C number	: ----	Date Samples Received	: 24-MAY-2012
Sampler	: AH	Issue Date	: 04-JUN-2012
Site	: ----		
		No. of samples received	: 10
Quote number	: SY/395/10	No. of samples analysed	: 10

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Organics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID	BH1 0.1-0.2	BH5 0.1-0.2	BH5 0.2-0.3	BH7 0.25-0.35	101
				Client sampling date / time	11-APR-2012 15:00	12-APR-2012 15:00	16-APR-2012 15:00	19-APR-2012 15:00	02-MAY-2012 15:00
					ES1212943-001	ES1212943-002	ES1212943-003	ES1212943-004	ES1212943-005
EN33: TCLP Leach									
Initial pH	----	0.1	pH Unit		**8.6**	**8.0**	**7.6**	**7.6**	**7.2**
After HCl pH	----	0.1	pH Unit		**1.6**	**1.7**	**1.6**	**1.7**	**1.7**
Extraction Fluid Number	----	1	-		**1**	**1**	**1**	**1**	**1**
Final pH	----	0.1	pH Unit		**4.9**	**4.9**	**4.9**	**5.0**	**5.0**

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID: 103	109	110	112	113
				Client sampling date / time: 02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00	02-MAY-2012 15:00
				ES1212943-006	ES1212943-007	ES1212943-008	ES1212943-009	ES1212943-010
EN33: TCLP Leach								
Initial pH	----	0.1	pH Unit	**6.4**	**6.3**	**7.3**	**6.2**	**5.6**
After HCl pH	----	0.1	pH Unit	**1.7**	**1.7**	**1.9**	**1.7**	**1.7**
Extraction Fluid Number	----	1	-	**1**	**1**	**1**	**1**	**1**
Final pH	----	0.1	pH Unit	**5.0**	**5.0**	**5.1**	**4.9**	**4.9**

Page : 5 of 7
Work Order : ES1212943
Client : REGIONAL GEOTECHNICAL SOLUTION
Project : RGS00372

Analytical Results

Sub-Matrix: **TCLP LEACHATE**

Compound	CAS Number	LOR	Unit	Client sample ID: BH1 0.1-0.2	BH5 0.1-0.2	BH5 0.2-0.3	BH7 0.25-0.35	101
				Client sampling date / time: 28-MAY-2012 12:00	28-MAY-2012 12:00	28-MAY-2012 12:00	28-MAY-2012 12:00	29-MAY-2012 12:00
				ES1212943-001	ES1212943-002	ES1212943-003	ES1212943-004	ES1212943-005
EG005C: Leachable Metals by ICPAES								
Lead	7439-92-1	0.1	mg/L	**0.2**	**0.2**	**0.1**	----	<0.1
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1.0	µg/L	<1.0	----	----	<1.0	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	----	----	<1.0	----
Acenaphthene	83-32-9	1.0	µg/L	<1.0	----	----	<1.0	----
Fluorene	86-73-7	1.0	µg/L	<1.0	----	----	<1.0	----
Phenanthrene	85-01-8	1.0	µg/L	<1.0	----	----	<1.0	----
Anthracene	120-12-7	1.0	µg/L	<1.0	----	----	<1.0	----
Fluoranthene	206-44-0	1.0	µg/L	<1.0	----	----	<1.0	----
Pyrene	129-00-0	1.0	µg/L	<1.0	----	----	<1.0	----
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	----	----	<1.0	----
Chrysene	218-01-9	1.0	µg/L	<1.0	----	----	<1.0	----
Benzo(b)fluoranthene	205-99-2	1.0	µg/L	<1.0	----	----	<1.0	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	----	----	<1.0	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	----	----	<0.5	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	----	----	<1.0	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	----	----	<1.0	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	----	----	<1.0	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L	<0.5	----	----	<0.5	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.1	%	**32.4**	----	----	**31.4**	----
2-Chlorophenol-D4	93951-73-6	0.1	%	**77.2**	----	----	**76.2**	----
2.4.6-Tribromophenol	118-79-6	0.1	%	**95.8**	----	----	**95.2**	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	**66.3**	----	----	**65.7**	----
Anthracene-d10	1719-06-8	0.1	%	**83.8**	----	----	**81.4**	----
4-Terphenyl-d14	1718-51-0	0.1	%	**96.2**	----	----	**90.6**	----

Page	:	6 of 7
Work Order	:	ES1212943
Client	:	REGIONAL GEOTECHNICAL SOLUTION
Project	:	RGS00372

Analytical Results

Sub-Matrix: **TCLP LEACHATE**				Client sample ID	103	109	110	112	113
				Client sampling date / time	29-MAY-2012 12:00	29-MAY-2012 12:00	29-MAY-2012 12:00	29-MAY-2012 12:00	29-MAY-2012 12:00
Compound	*CAS Number*	*LOR*	*Unit*		**ES1212943-006**	**ES1212943-007**	**ES1212943-008**	**ES1212943-009**	**ES1212943-010**
EG005C: Leachable Metals by ICPAES									
Lead	7439-92-1	0.1	mg/L		<0.1	**2.8**	<0.1	**0.2**	**0.2**

Surrogate Control Limits

Sub-Matrix: **TCLP LEACHATE**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10.0	64.1
2-Chlorophenol-D4	93951-73-6	11.3	122.9
2.4.6-Tribromophenol	118-79-6	11.7	144.0
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	19.9	122.8
Anthracene-d10	1719-06-8	23.3	125.8
4-Terphenyl-d14	1718-51-0	20.3	134.5

Environmental Division

QUALITY CONTROL REPORT

Work Order	: **ES1212943**	Page	: 1 of 5
Client	: **REGIONAL GEOTECHNICAL SOLUTION**	Laboratory	: Environmental Division Sydney
Contact	: MR STEVE MORTON	Contact	: Client Services
Address	: 5/97 ISABELLA STREET WINGHAM NSW, AUSTRALIA 2429	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: steve.m@regionalgeotech.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 6553 5641	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: RGS00372	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 24-MAY-2012
Sampler	: AH	Issue Date	: 04-JUN-2012
Order number	: This is a rebatch of ES1209295		
		No. of samples received	: 10
Quote number	: SY/395/10	No. of samples analysed	: 10

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Organics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG005C: Leachable Metals by ICPAES (QC Lot: 2325453)									
ES1212943-001	BH1 0.1-0.2	EG005C: Lead	7439-92-1	0.1	mg/L	0.2	0.2	0.0	No Limit
EG005C: Leachable Metals by ICPAES (QC Lot: 2332733)									
ES1212943-005	101	EG005C: Lead	7439-92-1	0.1	mg/L	<0.1	<0.1	0.0	No Limit
ES1213190-004	Anonymous	EG005C: Lead	7439-92-1	0.1	mg/L	<0.1	<0.1	0.0	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005C: Leachable Metals by ICPAES (QCLot: 2325453)								
EG005C: Lead	7439-92-1	0.1	mg/L	<0.1	0.1 mg/L	92.9	70	130
EG005C: Leachable Metals by ICPAES (QCLot: 2332733)								
EG005C: Lead	7439-92-1	0.1	mg/L	<0.1	0.1 mg/L	111	70	130
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 2332378)								
EP075(SIM): Naphthalene	91-20-3	0.2	µg/L	----	5 µg/L	77.1	58.6	119
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Acenaphthylene	208-96-8	0.2	µg/L	----	5 µg/L	81.6	63.6	114
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Acenaphthene	83-32-9	0.2	µg/L	----	5 µg/L	83.2	62.2	113
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Fluorene	86-73-7	0.2	µg/L	----	5 µg/L	85.4	63.9	115
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Phenanthrene	85-01-8	0.2	µg/L	----	5 µg/L	91.8	62.6	116
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Anthracene	120-12-7	0.2	µg/L	----	5 µg/L	91.6	64.3	116
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Fluoranthene	206-44-0	0.2	µg/L	----	5 µg/L	95.0	63.6	118
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Pyrene	129-00-0	0.2	µg/L	----	5 µg/L	96.0	63.1	118
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Benz(a)anthracene	56-55-3	0.2	µg/L	----	5 µg/L	96.2	64.1	117
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Chrysene	218-01-9	0.2	µg/L	----	5 µg/L	96.9	62.5	116
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.2	µg/L	----	5 µg/L	95.6	61.7	119
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.2	µg/L	----	5 µg/L	98.1	61.7	117
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Benzo(a)pyrene	50-32-8	0.2	µg/L	----	5 µg/L	95.5	63.3	117
		0.5	µg/L	<0.5	----	----	----	----
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.2	µg/L	----	5 µg/L	92.4	59.9	118
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.2	µg/L	----	5 µg/L	93.2	61.2	117
		1	µg/L	<1.0	----	----	----	----

Page : 5 of 5
Work Order : ES1212943
Client : REGIONAL GEOTECHNICAL SOLUTION
Project : RGS00372

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	LCS: Spike Recovery (%)	Recovery Limits (%): Low	Recovery Limits (%): High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 2332378) - continued								
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.2	µg/L	----	5 µg/L	93.4	59.1	118
		1	µg/L	<1.0	----	----	----	----
EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	1	µg/L	<1.0	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Spike Recovery (%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EG005C: Leachable Metals by ICPAES (QCLot: 2325453)							
ES1212943-002	BH5 0.1-0.2	EG005C: Lead	7439-92-1	1 mg/L	105	70	130
EG005C: Leachable Metals by ICPAES (QCLot: 2332733)							
ES1212943-006	103	EG005C: Lead	7439-92-1	1 mg/L	116	70	130

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

The quality control term Matrix Spike (MS) and Matrix Spike Duplicate (MSD) refers to intralaboratory split samples spiked with a representative set of target analytes. The purpose of these QC parameters are to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report: Spike Concentration	Spike Recovery (%): MS	Spike Recovery (%): MSD	Recovery Limits (%): Low	Recovery Limits (%): High	RPDs (%): Value	RPDs (%): Control Limit
EG005C: Leachable Metals by ICPAES (QCLot: 2325453)										
ES1212943-002	BH5 0.1-0.2	EG005C: Lead	7439-92-1	1 mg/L	105	----	70	130	----	----
EG005C: Leachable Metals by ICPAES (QCLot: 2332733)										
ES1212943-006	103	EG005C: Lead	7439-92-1	1 mg/L	116	----	70	130	----	----

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1212943**	Page	: 1 of 5
Client	: REGIONAL GEOTECHNICAL SOLUTION	Laboratory	: Environmental Division Sydney
Contact	: MR STEVE MORTON	Contact	: Client Services
Address	: 5/97 ISABELLA STREET WINGHAM NSW, AUSTRALIA 2429	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: steve.m@regionalgeotech.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 6553 5641	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: RGS00372	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 24-MAY-2012
Sampler	: AH	Issue Date	: 04-JUN-2012
Order number	: This is a rebatch of ES1209295		
		No. of samples received	: 10
Quote number	: SY/395/10	No. of samples analysed	: 10

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Page	: 2 of 5
Work Order	: ES1212943
Client	: REGIONAL GEOTECHNICAL SOLUTION
Project	: RGS00372

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non-volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG005C: Leachable Metals by ICPAES							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG005C) BH1 0.1-0.2, BH5 0.1-0.2, BH5 0.2-0.3	**28-MAY-2012**	**28-MAY-2012**	24-NOV-2012	✓	**28-MAY-2012**	24-NOV-2012	✓
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG005C) 101, 103, 109, 110, 112, 113	**29-MAY-2012**	**31-MAY-2012**	25-NOV-2012	✓	**31-MAY-2012**	25-NOV-2012	✓
EN33: TCLP Leach							
Lab Split: Leach for metals excl. Hg (EN33a) 101, 103, 109, 110, 112, 113	**02-MAY-2012**	**---**	29-OCT-2012	----	**29-MAY-2012**	29-OCT-2012	✓
Lab Split: Leach for metals excl. Hg (EN33a) BH5 0.1-0.2	**12-APR-2012**	**---**	09-OCT-2012	----	**28-MAY-2012**	09-OCT-2012	✓
Lab Split: Leach for metals excl. Hg (EN33a) BH5 0.2-0.3	**16-APR-2012**	**---**	13-OCT-2012	----	**28-MAY-2012**	13-OCT-2012	✓
LabSplit: Leach for organics and other tests (EN33a) BH1 0.1-0.2	**11-APR-2012**	**---**	25-APR-2012	----	**28-MAY-2012**	25-APR-2012	×
LabSplit: Leach for organics and other tests (EN33a) BH7 0.25-0.35	**19-APR-2012**	**---**	03-MAY-2012	----	**28-MAY-2012**	03-MAY-2012	×
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075(SIM)) BH1 0.1-0.2, BH7 0.25-0.35	**28-MAY-2012**	**31-MAY-2012**	04-JUN-2012	✓	**01-JUN-2012**	10-JUL-2012	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Leachable Metals by ICPAES	EG005C	3	15	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Leachable Metals by ICPAES	EG005C	2	15	**13.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Leachable Metals by ICPAES	EG005C	2	15	**13.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Leachable Metals by ICPAES	EG005C	2	15	**13.3**	**5.0**	✓	ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Leachable Metals by ICPAES	EG005C	SOIL	APHA 21st ed., 3120; USEPA SW 846 - 6010 The ICPAES technique ionises leachate sample atoms emitting a characteristic spectrum. This spectrum is then compared against matrix matched standards for quantification. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	SOIL	USEPA SW 846 - 8270D Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Digestion for Total Recoverable Metals in TCLP Leachate	EN25C	SOIL	USEPA SW846-3005 Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
TCLP for Non & Semivolatile Analytes	EN33a	SOIL	(USEPA SW846-1311, ALS QWI-EN/33) The TCLP procedure is designed to determine the mobility of both organic and inorganic analytes present in wastes. The standard TCLP leach is for non-volatile and Semivolatile test parameters.
Separatory Funnel Extraction of Liquids	ORG14	SOIL	USEPA SW 846 - 3510B 500 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2). ALS default excludes sediment which may be resident in the container.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**
- **For all matrices, no Matrix Spike outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)	Date extracted	Due for extraction	**Days overdue**	Date analysed	Due for analysis	**Days overdue**
EN33: TCLP Leach						
LabSplit: Leach for organics and other tests BH1 0.1-0.2	----	----	----	28-MAY-2012	25-APR-2012	**33**
LabSplit: Leach for organics and other tests BH7 0.25-0.35	----	----	----	28-MAY-2012	03-MAY-2012	**25**

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

LABORATORY TEST REQUEST

PROJECT NUMBER: RGS00372.1

CLIENT: ASPECT PROJECT MANAGERS

PROJECT : BELMONT DEVELOPMENT

REGIONAL GEOTECHNICAL SOLUTIONS

DATE: 24-May-12

LOCATION:

SAMPLE STORE LOCATION:

TEST LABORATORY:

	SAMPLE LOCATION & DEPTH:		SAMPLE TYPE	TCLP for PAH	TCLP for Pb				
(1)	BH1	0.1 - 0.2 (1)		X	X				
(2)	BH5	0.1 - 0.2 (7)			X				
(3)	BH5	0.2 - 0.3 (8)			X				
(4)	BH7	0.25 - 0.35 (14)		X					
(5)	101	(1)			X				
(6)	103	(3)			X				
(7)	109	(9)			X				
(8)	110	(10)			X				
(9)	112	(12)			X				
(10)	113	(13)			X				

Report Results to: Steve Morton

Email: steve.m@regionalgeotech.com.au

Regional Geotechnical Solutions Pty Ltd ABN 51141848820

44 Bent Street Wingham NSW 2429

Ph. (02) 6553 5641 Email steve.m@regionalgeotech.com.au

www.regionalgeotech.com.au

Received by: [illegible] 24/5/12 4:20pm

Environmental Division
Sydney
Work Order
ES1212943

Telephone : +61-2-8784 8555

D08936555

LABORATORY TEST REQUEST

PROJECT NUMBER: RGS00372.1

CLIENT: ASPECT PROJECT MANAGERS

PROJECT : BELMONT DEVELOPMENT

REGIONAL GEOTECHNICAL SOLUTIONS

DATE: 24-May-12

LOCATION:

SAMPLE STORE LOCATION:

TEST LABORATORY:

	SAMPLE LOCATION & DEPTH:		SAMPLE TYPE	TCLP for PAH	TCLP for Pb				
(1)	BH1	0.1 - 0.2 1		X	X				
(2)	BH5	0.1 - 0.2 7			X				
(3)	BH5	0.2 - 0.3 8			X				
(4)	BH7	0.25 - 0.35 14		X					
(5)	101	1			X				
(6)	103	3			X				
(7)	109	9			X				
(8)	110	10			X				
(9)	112	12			X				
(10)	113	13			X				

Report Results to: Steve Morton

Email: steve.m@regionalgeotech.com.au

Regional Geotechnical Solutions Pty Ltd ABN 51141848820

44 Bent Street Wingham NSW 2429

Ph. (02) 6553 5641 Email steve.m@regionalgeotech.com.au

www.regionalgeotech.com.au

Received by: [illegible] 24/5/12 4:20pm

Environmental Division
Sydney
Work Order
ES1212943

Telephone : +61-2-8784 8555

Fadi Soro

Fadi 24/5/12 4:55pm

From: Saman Taeidi
Sent: Thursday, 24 May 2012 3:58 PM
To: Fadi Soro
Subject: FW: TCLP Testing
Attachments: RGS00372.1 Laboratory Request TCLP.pdf

Hi Fadi,

5481-452 1,7,5,14 1,3,9,20,12,13

Please rebatch work orders ES1209295 and ES1210665 for TCLP testing on samples specified in the PDF file attached to this email. ~~6875~~ w 671, 11 | 5.

Please let me know if there were any issues with rebatching.

Kind Regards

*How was your customer experience? **Please send us your feedback**(click link)*

Saman Taeidi

CLIENT SERVICES OFFICER

ALS | Environmental Division

Address

277-289 Woodpark Road, Smithfield, NSW, 2164

PHONE +61 2 8784 8555

DIRECT +61 2 8784 8504

FAX +61 2 8784 8500

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From: Steve Morton [mailto:steve.m@regionalgeotech.com.au]
Sent: Thursday, 24 May 2012 3:16 PM
To: Sydney
Subject: TCLP Testing

Hello,

We recently had some testing done on work order numbers ES1209295 and ES1210665.

Could I please order TCLP testing on some of the samples from those batches as per the attached test request.

Regards

Steve Morton
Principal

REGIONAL GEOTECHNICAL SOLUTIONS PTY LTD
44 Bent Street, Wingham, 2429
Ph. 6553 5641
mob: 0432 258578
email: steve.m@regionalgeotech.com.au
www.regionalgeotech.com.au

ALS Group: Click here to report this email as spam.

This document has been prepared on behalf of **Monteath & Powys Pty Ltd** by:

Northstar Air Quality Pty Ltd,
Level 40, 100 Miller Street, North Sydney, NSW 2060

www.northstarairquality.com | Tel: +61 (02) 9931 7870

32 Brooks Parade, Belmont – Odour Impact Assessment

Addressee(s):	**Monteath & Powys Pty Ltd**
Report Reference:	**18.1048.FR1V1**
Date:	**27 February 2018**

Disclaimer

This report has been prepared with the due care and attention of a suitably qualified consultant. Information is obtained from sources believed to be reliable, but is in no way guaranteed. No guarantee of any kind is implied or possible where predictions of future conditions are attempted. This report (including any enclosures and attachments) has been prepared for the exclusive use and benefit of the addressee(s) and solely for the purpose for which it is provided. Unless we provide express prior written consent, no part of this report should be reproduced, distributed or communicated to any third party. We do not accept any liability if this report is used for an alternative purpose from which it is intended, nor to any third party in respect of this report.

Quality Control

Study	Status	Prepared by	Checked by	Authorised by
INTRODUCTION	Final	Northstar Air Quality	G Graham	M Doyle
THE PROPOSAL	Final	Northstar Air Quality	G Graham	M Doyle
LEGISLATION, REGULATION AND GUIDANCE	Final	Northstar Air Quality	G Graham	M Doyle
EXISTING CONDITIONS	Final	Northstar Air Quality	G Graham	M Doyle
METHODOLOGY	Final	Northstar Air Quality	G Graham	M Doyle
ODOUR IMPACT ASSESSMENT	Final	Northstar Air Quality	G Graham	M Doyle
CONCLUSION	Final	Northstar Air Quality	G Graham	M Doyle

Report Status

Northstar References		Report Status	Report Reference	Version
Year	Job Number	(Draft: Final)	(R*x*)	(V*x*)
18	1048	F	R1	V1
Based upon the above, the specific reference for this version of the report is:				**18.1048.FR1V1**

Final Authority

This report must by regarded as draft until the above study components have been each marked as final, and the document has been signed and dated below.



Martin Doyle **27 February 2018**

Non-Technical Summary

Monteath & Powys Pty Ltd has engaged Northstar Air Quality Pty Ltd to perform an odour impact assessment to assess the potential impact of odour emissions resulting from the operation of an existing waste water pump station on an adjacent proposed residential development.

The assessment has adopted measurements of hydrogen sulphide and flow rates for the vent stacks of waste water pump station which were provided by Hunter Water Corporation. Hydrogen sulphide measurements have been used as a proxy for odour concentrations, with this assessment focussed on the impacts of both hydrogen sulphide and odour, for which there are specific NSW Environment Protection Authority (EPA) criteria.

A dispersion modelling exercise has been performed which has determined that, adopting the maximum (peak) hydrogen sulphide measurements provided by Hunter Water Corporation, significant exceedances of the NSW EPA criteria are predicted across the Proposal site and particularly at height on the proposed building façade.

A further level of assessment has been performed, which calculated the concentration of hydrogen sulphide within the ventilation stack which would be required not to be exceeded, to meet the NSW EPA criteria for hydrogen sulphide and odour. A comparison of these values with what could be achieved through the use of odour control measures, indicates that they can easily be achieved.

In conclusion, the results of this assessment indicate that any odour and hydrogen sulphide impacts can be managed, and managed to be below NSW EPA criteria, although any further determination of how that management may be implemented is outside the scope of this work and should be discussed in detail with Hunter Water Corporation.

As a first step however, it is strongly recommended that hydrogen sulphide concentrations and flow rate data for the vent stacks are provided by Hunter Water Corporation in a format sufficient to allow the proponent to complete a detailed assessment. The data should allow calculation of the potential variation in emissions, rather than the peak conditions represented within this assessment.

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Units Used in the Report

All units presented in the report follow the International System of Units (SI) conventions, unless derived from references using non-SI units. In this report, units formed by the division of SI and non-SI units are expressed as a negative exponent, and do not use the solidus (/) symbol. For example:

- 500 odour units cubic metres per second would be presented as 500 $OU \cdot m^3 \cdot s^{-1}$ and not 500 $OU \cdot m^3/s$
- 7.8 metres per second would be presented as 7.8 $m \cdot s^{-1}$ and not 7.8 m/s

Common Abbreviations

Abbreviation	Term
AHD	Australian height datum
AQIA	air quality impact assessment
EPA	NSW Environmental Protection Authority
GIS	geographical information system
HWC	Hunter Water Corporation
$mg \cdot m^{-3}$	milligram per cubic metre of air
$\mu g \cdot m^{-3}$	microgram per cubic metre of air
OIA	odour impact assessment
OU	odour unit

1. INTRODUCTION

Monteath & Powys Pty Ltd has engaged Northstar Air Quality Pty Ltd (Northstar) to perform an odour impact assessment to assess the potential impact of odour emissions resulting from the operation of an existing waste water pump station (WWPS) on an adjacent proposed residential development (the Proposal). The Proposal is located in Belmont across a number of Lots bounded by Edgar Street, Sharp Street, Brooks Parade and an existing stormwater channel on the boundary between 28 Brooks Parade and 32 Brooks Parade. The location of the overall development is termed 'the Proposal site' within this report.

The policies and guidelines which have been referenced within this assessment include:

- Protection of the Environment Operations (Clean Air) Regulation 2002;
- Approved Methods for the Modelling and Assessment of Air Quality in NSW (NSW EPA, 2017);
- Technical Framework: Assessment and Management of Odour from Stationary Sources in NSW (NSW DECC, 2006a); and
- Technical Notes: Assessment and Management of Odour from Stationary Sources in NSW (NSW DECC, 2006b).

The assessment has been performed in response to a request from Hunter Water Corporation (HWC):

> *"Hunter Water will require that a developer-funded odour assessment and control report be prepared to assess the impact of odours and any necessary mitigation measures that may be required."*

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2. THE PROPOSAL

The following provides a description of the Proposal including the environmental setting and includes an overview of the purpose of this assessment.

2.1. Environmental Setting

The Proposal site is located across numerous addresses on Brooks Parade, Belmont (numbers 32, 36, 38, 40, 42 and 44), Edgar Street, Belmont (numbers 7, 9 and 11) and Sharp Street, Belmont (numbers 2, 4, 6, 8 and 10), see **Figure 1**. The Proposal site is located within the Local Government Area (LGA) of Lake Macquarie.

Figure 1 Layout of Proposal site



Source: Monteath & Powys (19 January 2018)

The waste water pump station (WWPS, named Belmont #1) is located at 28 Brooks Parade (see **Figure 2**).

Of the addresses which constitute the Proposal site, 32 Brooks Parade and 7 Edgar Street are closest to the WWPS, and specifically closest to the ventilation stacks servicing the WWPS (refer **Section 5.2**).

The Proposal site is set 40 metres (m) from the edge of Lake Macquarie and is surrounded by residential land uses. The WWPS is located approximately 15 m from the Proposal site, and the ventilation stacks associated with the WWPS are located approximately 35 m from the Proposal site.

The location of the WWPS, associated ventilation stacks and the Proposal site boundary are illustrated in **Figure 2**.

Figure 2 Map of WWPS and Proposal site boundary



Source: Northstar Air Quality

2.2. Overview and Purpose

This assessment seeks to provide information on whether odour emissions resulting from the operation of the WWPS, specifically the emission of odour through the ventilation stacks, will give rise to potential amenity impacts at the Proposal site.

A dispersion modelling exercise has been performed which uses site-specific modelled meteorological data, and an estimate of odour emissions and exhaust flow rate through each ventilation stack. A recognised atmospheric dispersion model has been used to predict concentrations of odour (and odorous compounds) across the Proposal site at:

- ground level; and,
- across the facade of the buildings at the Proposal site which are nearest to the WWPS.

Measurements of the odorous gas hydrogen sulphide (H_2S) have been made at the WWPS ventilation stacks by HWC, and these measurements are used in conjunction with flow rate calculations to estimate emissions

of H_2S. Predicted concentrations across the Proposal site are compared to the NSW Environment Protection Authority (EPA) amenity criterion for H_2S.

In addition, a 'back-modelling' assessment has been performed to determine the emission rate of odour (and odorous compounds) which would be required to meet the relevant criterion at the Proposal site. These theoretical emission values have been converted to in-stack concentration values and then compared to emission values which could be achieved through the implementation of odour control.

Although no measurements of odour have been made at the ventilation stacks for the WWPS, a relationship between H_2S and odour concentrations has been determined to allow assessment of both odour and H_2S (refer **Section 5.3**).

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3. LEGISLATION, REGULATION AND GUIDANCE

Impacts from odorous air contaminants are often nuisance-related rather than health-related. Odour performance goals guide decisions on odour management but are generally not intended to achieve "no odour", but manage odour impacts to an acceptable level.

Odours can be classified into two distinct categories; individual identifiable compounds, and complex mixtures of odorous compounds (NSW DECC, 2006a).

Ground level concentration (glc) criteria are used for individual identifiable compounds to assess impacts from point sources. Odour assessment criteria are used for complex mixtures of odorous compounds to assess impacts from both point and diffuse sources.

The following outlines the definition of odour and provides the relevant criteria (for both odour and glc) adopted within this assessment. The individual identifiable compound of interest within this assessment is H_2S and is discussed further in **Section 5.2**.

3.1. Definitions of Odour

The detectability of an odour is a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation. This point is called the odour detection threshold (ODT) and defines one odour unit (OU). An odour goal of less than 1 OU would (by definition) result in no odour impact being detectable in laboratory conditions. In practice, the character of an odour can only be judged by the receiver's reaction to it, and preferably only compared to another odour under similar social and regional conditions.

Based on the literature available, the level at which an odour is perceived to be a nuisance can range from 2 OU to 10 OU (or greater) depending on a combination of the following factors:

- **Odour quality:** whether an odour results from a pure compound or from a mixture of compounds. Pure compounds tend to have a higher threshold (lower offensiveness) than a mixture of compounds.
- **Population sensitivity:** any given population contains individuals with a range of sensitivities to odour. The larger a population, the greater the number of sensitive individuals it contains.
- **Background level:** whether a given odour source, because of its location, is likely to contribute to a cumulative odour impact. In areas with more closely-located sources it may be necessary to apply a lower threshold to prevent offensive odour.
- **Public expectation:** whether a given community is tolerant of a particular type of odour and does not find it offensive, even at relatively high concentrations. For example, background agricultural odours may not be considered offensive until a higher threshold is reached than for odours from a landfill facility.
- **Source characteristics:** whether the odour is emitted from a stack (point source) or from an area (diffuse source). Generally, the components of point source emissions can be identified and treated more easily

using control equipment than diffuse sources. Point sources tend to be located in urban areas, while diffuse sources are more prevalent in rural locations.

- **Health effects:** whether a particular odour is likely to be associated with adverse health effects. In general, odours from agricultural activities are less likely to present a health risk than emissions from industrial facilities.

3.2. Odour Assessment Criteria in NSW

Experience gained through odour assessments from proposed and existing facilities in NSW indicates that an odour performance goal of 7 OU is likely to represent the level below which "offensive" odours should not occur (for an individual with a 'standard sensitivity' to odours). Therefore, the Odour Technical Framework (NSW DECC, 2006a) recommends that, as a design goal, no individual be exposed to ambient odour levels of greater than 7 OU. In modelling and assessment terms, this is expressed as the 99th percentile value, as a nose response time average (approximately one second).

Odour assessment criteria need to consider the range in sensitivities to odours within the community to provide additional protection for individuals with a heightened response to odours. This is addressed in the Technical Framework (NSW DECC, 2006a) by setting a population dependant odour assessment criterion, and in this way, the odour assessment criterion allows for population size, cumulative impacts, anticipated odour levels during adverse meteorological conditions and community expectations of amenity. A summary of odour performance goals for various population densities, as referenced in the Odour Technical Notes (NSW DECC, 2006b) is shown in **Table 1**. This table shows that in situations where the population of the affected community lies between 125 and 500 people, an odour assessment criterion of 4 OU at the nearest residence (existing or any likely future residences) is to be used. For isolated residences, an odour assessment criterion of 7 OU is appropriate.

3.3. Ground-Level Concentration Assessment Criteria in NSW

The primary purpose of a stack or control equipment, in relation to odour, is to control the discharge of a pollutant so that the odour is diluted and dispersed, and subsequently reduced to an acceptable concentration by the time it has reached a location where it might be detected by people. An indication of whether this will be achieved can be determined by using glc criteria. In general, the criteria are set to protect the public against adverse health effects, aesthetic effects, offensiveness and economic loss that might occur. Since the area of interest (the 'breathing zone') is close to the ground, the acceptable concentrations are referred to as ground-level concentrations (glcs) (NSW DECC, 2006a). In the case of a multi-level development (such as the Proposal site), the breathing zone may occur at multiple points (and heights) across the development.

The EPA has adopted glc criteria for individual odorous and toxic compounds, set on the basis of either odour or health impacts, whichever is more stringent, for use in NSW.

The glc criteria are referred to in the *Approved Methods for the Modelling and Assessment of Air Quality in NSW* (NSW EPA, 2017). To ensure that odour impacts are maintained within acceptable levels, odour emissions from an activity should be assessed against the glc criteria. Where several activities with similar odour character will result in a cumulative impact, the total of the odour emissions from all contributing activities needs to be considered. When carrying out an odour impact assessment, the concentration of pollutants should be predicted at and beyond the boundary of the premises. For point sources, dispersion modelling can be used to determine a stack emission limit that will ensure the glc criteria are not exceeded at these locations. This limit is prescribed to ensure that people living in the vicinity are unlikely to be impacted by 'offensive odour' (NSW DECC, 2006a).

Odour concentration criteria and glc criteria for H_2S appropriate to this assessment are presented in **Table 1**, and are expressed on a scale relative to the size of the potentially exposed population.

Table 1 NSW EPA Technical Framework odour and H_2S criteria

Population of Affected Community	Impact Assessment Criteria	
	Complex Mixture of Odours (OU)	Hydrogen Sulphide (H_2S) ($\mu g \cdot m^{-3}$)
Urban area (≥2000)	2.0	1.38
500 – 2000	3.0	2.07
125 – 500	4.0	2.76
30 – 125	5.0	3.45
10 – 30	6.0	4.14
Single residence (≤2)	7.0	4.83

Source: The Odour Technical Framework (NSW DECC, 2006a), (NSW EPA, 2017)

Given the proposed residential nature of the Proposal, and the residential nature of the area, an odour performance goal of 2 OU and 1.38 $\mu g \cdot m^{-3}$ of H_2S has been adopted for this assessment.

3.4. Regulation of Odour

It is noted that the odour assessment criteria (see **Section 3.2**) are a **design** tool rather than a **regulatory** tool. The benchmark for operational facilities is not the odour assessment criteria outlined above but whether the emission of odour is *'offensive'* or being prevented or minimised using best management practices.

The *Protection of the Environment (Operations) Act* 1997 (POEO) is applicable to scheduled activities in NSW and emphasises the importance of preventing 'offensive odour'. The operations at the WWPS may or may not be scheduled, depending on the equivalent population served by the pumping station (≥2,500), or capacity (750 kilolitres per day). Either way, the principles contained within the POEO framework are applicable.

For reference, "offensive odour" is defined within the POEO Act as:

> *an odour:*
>
> *(a) that, by reason of its strength, nature, duration, character or quality, or the time at which it is emitted, or any other circumstances:*
>
> *(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or*
>
> *(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or*
>
> *(b) that is of a strength, nature, duration, character or quality prescribed by the regulations or that is emitted at a time, or in other circumstances, prescribed by the regulations.*

Further to the discussion of factors that determine whether an odorous mixture may be determined to lead to a nuisance in **Section 3.1** and the impact assessment criterion determined in **Section 3.2** and **Section 3.3**, numerous papers and articles identify the disconnect between that two drivers that help regulate odour (as referenced in (Graham, Lawrence, & Doyle, 2013)). The description provided in the POEO Act may be summarised as a function of five broad factors, called the FIDOL factors, namely:

- **Frequency:** indicates how often an odour is experienced. Exposure to relatively pleasant odours (such as a bakery, for example) may be perceived to be a nuisance (or 'offensive odour') if it is experienced too frequently., and conversely, a more unpleasant odour may be tolerated if it is experienced hardly ever.
- **Intensity:** indicates the relative strength of the odour;
- **Duration:** in parallel to frequency, duration is an important factor representing the length of time of which an odour exposure is observed;
- **Offensiveness:** indicates how pleasant / unpleasant an odour is to the population. Whilst individuals may express a personal opinion of acceptance to specific odours, it is generally accepted that some odours are more unpleasant than others due to their chemical composition and also a hazard identification function. The relative scale of typical pleasantness / unpleasantness is described as the odour's hedonic tone.
- **Location:** indicates the relationship between the odour experienced and the general perception of amenity that would be expected at that location. An odour that may be tolerated at an industrial site may be less tolerated at a healthcare centre, for example.

4. EXISTING CONDITIONS

4.1. Land Sensitivity

4.1.1. Discrete Receptor Locations

Air quality assessments typically use a desk-top mapping study to identify 'discrete receptor locations', which are intended to represent a selection of locations that may be susceptible to changes in air quality and odour. In broad terms, the identification of sensitive receptors refers to places at which humans may be present for a period representative of the averaging period for the pollutant being assessed. Typically, these locations are identified as residential properties although other sensitive land uses may include schools, medical centres, places of employment, recreational areas or ecologically sensitive locations. In the case of this assessment, the sensitive receptors are defined as the Proposal site which includes (primarily) residential receptor locations but also some retail/commercial uses.

It is important to note that the selection of discrete receptor locations is not intended to represent a fully inclusive selection of all sensitive receptors across the study area. The location selected should be considered to be representative of its location and may be reasonably assumed to be representative of the immediate environs.

Furthermore, it is of value to state that the purpose of this report is to assess the potential impacts at the Proposal site, not provide a wider-scale assessment of the performance of the WWPS.

A total of 138 discrete receptor points have been located across the facade of the proposed residences immediately to the south of the WWPS (shown in **Figure 3**). The receptors have been located at heights of 0 m (ground level) to 25 m, at 5 m increments, representing six layers of receptors. The receptors are spaced horizontally 3.75 m apart (approximately 6° at 35m). These have been included to assess the potential risks to residents on all floors of the Proposal site.

Figure 3 Elevation of Proposed site (view south from WWPS)



Source: Monteath & Powys (12 February 2018)

It is noted that in addition to the identified 'discrete' receptor locations, the entire modelling area, covering the Proposal site is gridded with 'uniform' receptor locations (see **Section 4.1.2**) that are used to plot out the predicted impacts, and as such the accidental non-inclusion of a location sensitive to changes in air quality does not render the assessment invalid, or otherwise incapable of assessing those potential risks.

4.1.2. Uniform Receptor Locations

Additional to the sensitive receptors discussed in **Section 4.1.1**, a grid of uniform receptor locations has been used to allow identification of the maximum odour and glc concentration across the Proposal site. This grid covers a radius of approximately 150 m from the WWPS ventilation stacks.

4.2. Existing Sources of Odour

The odour experienced at any location will be a result of emissions generated by natural and anthropogenic sources on a variety of scales. The relative contributions of sources at each of these scales to the odour at a location will vary based on a wide number of factors including the type, location, proximity and strength of the emission source(s), prevailing meteorology, land uses and other factors affecting the emission, dispersion and fate of the odour.

When assessing the impact of any particular source of emissions on the potential odour impacts at a location, the impact of all other sources of odour must also be assessed.

The current odour environment of the area surrounding the Proposal site cannot be quantified through real-time monitoring. Through a desk-top review, it has been identified that there are no other similar sources of potential odour occurring locally (within approximately 400 m) around the Proposal site. The Belmont Waste Water Treatment Works (WWTW) is located approximately 1.7 km to the southeast of the Proposal site. No other WWPS are located within a 250 m radius of the Proposal site.

Based on the above discussion, for the purposes of this assessment background odour has been assumed to be negligible. This assumption is consistent with the general application of cumulative odour assessments, in so far that odours of similar nature may be aggregated, and odour of significantly different character are assessed as discrete impacts.

4.3. Topography

The topography of the area immediately surrounding the WWPS and the Proposal site is a relatively flat coastal area that ranges from approximately 1 m Australian Height Datum (AHD) to approximately 6 m AHD. The Proposal site and the WWPS are both located at approximately 4 m AHD, with no significant terrain features evident between.

4.4. Meteorology

The meteorology experienced within an area can govern the dispersion, transport and eventual fate of odour and odorous pollutants in the atmosphere. The meteorological conditions surrounding the Proposal site have been characterised using data collected by the Australian Government Bureau of Meteorology (BoM) at a number of surrounding Automatic Weather Stations (AWS).

To provide a characterisation of the meteorology which would be expected at the Proposal site, a meteorological modelling exercise has also been performed. A summary of the inputs and outputs of the meteorological modelling assessment, including validation of those outputs is presented in **Appendix A**.

4.5. Meteorological Modelling

The meteorological dataset has been developed using the Commonwealth Scientific and Industrial Research Organisation (CSIRO) developed The Air Pollution Model (TAPM, v 4.0.5).

TAPM, is a prognostic model which may be used to predict three-dimensional meteorological data and air pollution concentrations. TAPM predicts wind speed and direction, temperature, pressure, water vapour, cloud, rain water and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations at user-defined levels within the atmosphere.

The parameters used in TAPM modelling are presented in **Table 2**.

Table 2 Meteorological parameters used for this study

TAPM v 4.0.5	
Modelling period	1 January 2012 to 31 December 2012
Centre of analysis	375,242mE, 6,363,630 mS (UTM Coordinates)
Number of grid points	68 × 68 × 25
Number of grids (spacing)	4 (22 km, 9 km, 3 km, 1 km)
Terrain	AUSLIG 9 second DEM
Data assimilation	Williamtown RAAF AWS

A comparison of the TAPM generated meteorological data, and that observed at the Newcastle Nobbys Signal Station AWS are presented in **Appendix A**. These data compare well which provides confidence that the meteorological conditions modelled as part of this assessment are appropriate.

Further information relating to the modelled meteorological data is provided in **Appendix A**.

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5. METHODOLOGY

The methodologies adopted for the quantitative odour assessment are discussed in detail below.

5.1. Quantitative Odour Assessment

A dispersion modelling assessment has been performed using the NSW EPA approved CALPUFF atmospheric dispersion model. The modelling has been performed in CALPUFF 2-dimensional (2-D) mode. Given the near-field environment and non-complex topography between the emission source and the Proposal site, it is considered that this approach is suitable. The 2-D meteorological dataset has been developed using the TAPM model as discussed in **Section 4.5**.

The Approved Methods requires that for Level 2 assessment (this assessment), the 99th percentile of model predictions is presented for both H_2S and odour.

5.2. Description of Odour Sources

Hunter Water Corporation (HWC) operates and maintains the Belmont #1 WWPS, located at 28 Brooks Parade, Belmont. The ventilation system associated with Belmont #1 WWPS was reviewed prior to 2009 with a summary of the proposed ventilation system outlined in Advitech (2009) *Belmont #1 Waste Water Pumping Station - Review of Proposed Ventilation Modifications* (Advitech, 2009). The review outlines the proposed changes, which have been assumed to have been adopted for the purposes of this assessment. The relevant variables are outlined in **Table 3**.

Table 3 Belmont #1 ventilation stack parameters

Parameter	Value	Units	Source
Number of ventilation stacks	2	no.	(Advitech, 2009) Table 1
Ventilation stack height	17.5	m	(Advitech, 2009) Table 1
Ventilation stack diameter	300	mm	(Advitech, 2009) Table 1
Ventilation stack cross sectional area	0.07	m^2	Calculated
Minimum stack flow rate	2.85	$m^3 \cdot min^{-1}$	(Advitech, 2009) Table 2
Minimum stack flow rate	0.047	$m^3 \cdot s^{-1}$	Calculated
Maximum stack flow rate	6.83	$m^3 \cdot min^{-1}$	(Advitech, 2009) Table 2
Maximum stack flow rate	0.114	$m^3 \cdot s^{-1}$	Calculated
Minimum stack velocity	0.67	$m \cdot s^{-1}$	Calculated
Maximum stack velocity	1.61	$m \cdot s^{-1}$	Calculated

Source: (Advitech, 2009)

The two ventilation stacks are attached to the southern side of 24-26 Brooks Parade, Belmont (Wharf Apartments), as shown in **Figure 2**.

The WWPS also includes switchgear, switchgear housing, a pump well (wet well) and valve pit. The HWC standard design for wet well and pit covers is for these to be 'gas-tight' (Hunter Water Corporation, 2009). Emissions of odour from the gas-tight covers are therefore anticipated to be negligible/zero.

5.3. Approach to Assessment

5.3.1. Modelling at Measured Emission Rates

The following section outlines the calculation of emission rates of H_2S and odour resulting from the operation of the WWPS. These have been modelled adopting both the minimum and maximum flow rate characteristics outlined in **Table 3**. The predicted impacts are compared to the relevant criteria (refer **Table 1**) in **Section 6**.

H_2S Emission Rate

Information received from HWC indicates that a recent round of odour testing at the ventilation stacks measured H_2S concentrations of between 4 parts per million (ppm) and 87 ppm (peak) (pers. comm. Michael Breedon) (equivalent to between 6.1 $mg \cdot m^{-3}$ and 132.3 $mg \cdot m^{-3}$ (calculated at 273 K). Combined with the potential minimum and maximum flow rates through the ventilation stacks (refer **Table 3**), emission rates can be calculated (concentration [$mg \cdot m^{-3}$] × volumetric flow rate [$m^3 \cdot s^{-1}$] = emission rate [$mg \cdot s^{-1}$]).

The higher concentration of H_2S measured (132.3 $mg \cdot m^{-3}$) has been combined with both the minimum and maximum flow rates outlined in **Table 3** to ensure that the assessment captures the potential impacts of poor emission characteristics from the ventilation stacks.

The calculated H_2S emission rates used in dispersion modelling are (for each stack):

- At minimum flowrate - 6.28 $mg \cdot s^{-1}$ (132.3 $mg \cdot m^{-3}$ × 0.047 $m^3 \cdot s^{-1}$); and,
- At maximum flowrate - 15.06 $mg \cdot s^{-1}$ (132.3 $mg \cdot m^{-3}$ × 0.114 $m^3 \cdot s^{-1}$).

Odour Emission Rate

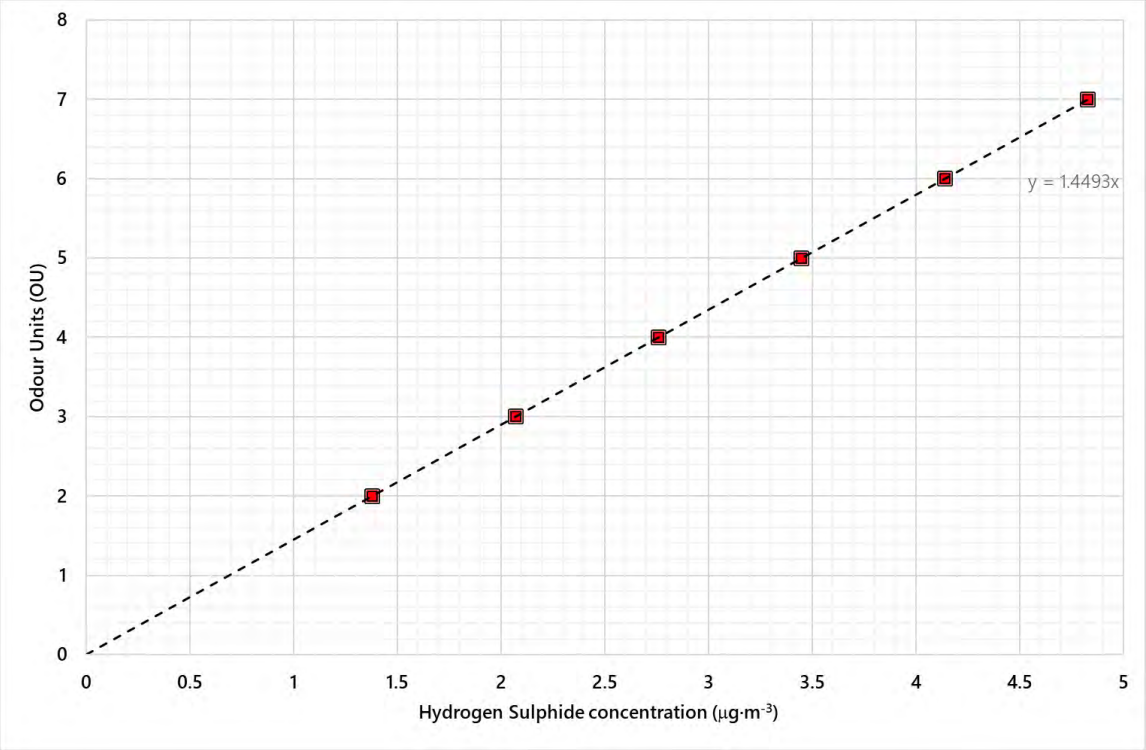
Specific measurements of odour relating to the Belmont #1 WWPS have not been provided by HWC. To provide an estimation of the likely odour emission rate from the WWPS ventilation stacks, the relationship between the H_2S and odour criteria (refer **Table 1**) has been examined. Based on the comparison between those criteria, the association between H_2S concentration and odour is defined by the relationship OU = 1.4493 × H_2S ($\mu g \cdot m^{-3}$) as presented in **Figure 4**.

Concentrations of H_2S of 4 ppm (6,082 $\mu g \cdot m^{-3}$) can therefore be calculated to represent odour concentrations of 8,815 OU and concentrations of H_2S of 87 ppm (132,284 $\mu g \cdot m^{-3}$) calculated to represent concentrations of 191,719 OU. For comparison, Sydney Water determine that a sewage pump station (SPS) with a well operated odour control unit should have an odour concentration of ≤500 OU and H_2S concentration of ≤0.1 ppm at the point of emission (Sydney Water, 2011).

Based on the relationship derived above, the specific odour emission rates can be calculated to be (for each stack):

- At minimum flowrate - 9,107 $OU \cdot s^{-1}$ (132,284 $\mu g \cdot m^{-3}$ × 1.4493 × 0.047 $m^3 \cdot s^{-1}$); and,
- At maximum flowrate - 21,824 $OU \cdot s^{-1}$ (132,284 $\mu g \cdot m^{-3}$ × 1.4493 0.114 $m^3 \cdot s^{-1}$).

Figure 4 Relationship between odour and H_2S concentrations



Source: Northstar Air Quality, based on data from (NSW EPA, 2017) and (NSW DECC, 2006a)

The NSW EPA Approved Methods document (NSW EPA, 2017) states that Peak-to-Mean ratios should be incorporated when conducting atmospheric dispersion modelling of odour and H_2S. The peak to mean ratio (P/M60) is defined as the ratio of peak 1-second average concentrations to mean 1-hour average concentrations. To estimate peak concentrations, Table 6.1 of the Approved Methods outlines the P/M60 ratio to be used.

Specifically, to establish a conservatively high estimate of peak odour or H_2S concentrations from wake-affected point sources (the WWPS ventilation stacks), the peak to mean ratio (P/M60) of 2.3 is required to be adopted in all stability classes (A to F).

However, given that the H_2S concentration of 87 ppm is a peak measured value, then it is considered to already incorporate the P/M60 ratio, which has not been applied further.

P/M60 ratios are used within this assessment to determine the maximum odour emission rate which would result in compliance with the 2 OU criterion and is discussed further in **Section 6**.

5.3.2. Modelling at Unit Emission Rates

Modelling at unit emission rates (e.g. 1 $OU \cdot s^{-1}$ or 1 $mg \cdot s^{-1}$) allows post-processing of model output files to calculate the actual emission rate which would result in compliance with the relevant criterion.

The results are presented in **Section 6**.

6. ODOUR IMPACT ASSESSMENT

Query of the dispersion modelling outputs indicates that the maximum predicted impacts at the Proposal site are predicted across the facade of the building facing towards the ventilation stacks (as shown in **Figure 3**). Results and discussion presented in this section are therefore concentrated on those maximum predicted impacts.

6.1. Modelling at Measured Emission Rates

The results of the dispersion modelling exercise, using the peak measured H_2S concentrations (87 ppm) (and derived odour concentrations) as outlined in **Section 5.3.1** are presented in **Table 4**

Table 4 Predicted H_2S and odour concentrations – at peak measured emission rates

Flow rate	Predicted 99th percentile H_2S concentration ($\mu g \cdot m^{-3}$)	Predicted 99th percentile 1-hour average (1-second nose response time) odour concentration (OU)
Minimum flow rate	47.65	69.1
Maximum flow rate	119.18	172.7
Criterion	1.38	2.0

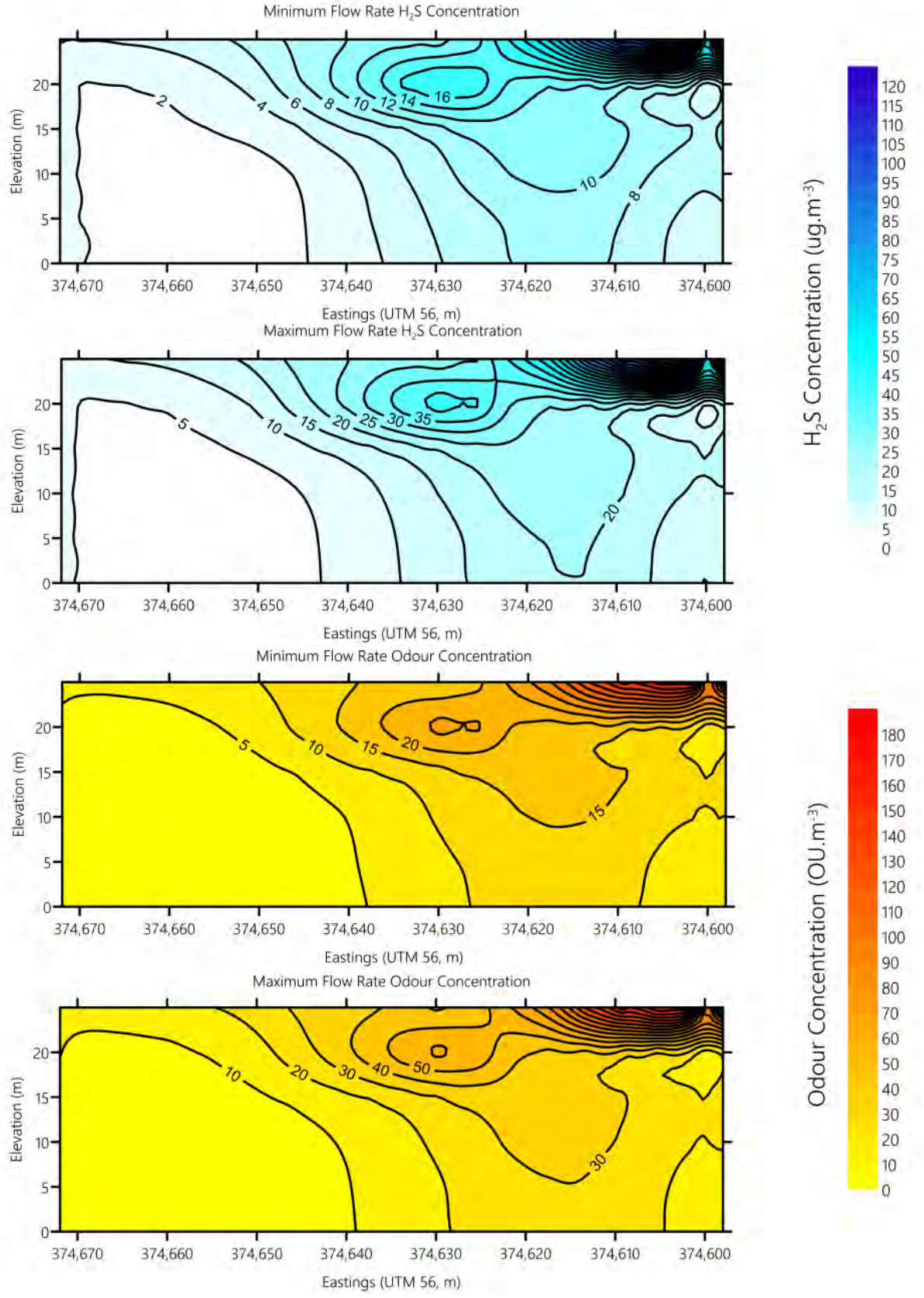
Results are presented graphically in **Figure 5**, which shows the predicted impingement of H_2S (top two panels), and odour (bottom two panels) upon the nearest facade of the Proposal site (that is, looking south from the WWPS) as per **Figure 3**.

The results indicate that at the peak measured concentrations, the criteria for both H_2S and odour would be significantly exceeded. The magnitude of the exceedances clearly indicates that the results are not an accurate representation of the existing odour environment of the area; a significant level of complaints would be generated by such levels of odour.

As previously discussed, the measured value of 87 ppm H_2S is a peak value and is not likely to be experienced on a regular basis. In the absence of further information relating to the actual distribution of H_2S concentration measurements between 4 ppm and 87 ppm, the average value (which would be of greater value) cannot be determined.

Modelling using unit emission rates allows an assessment of the maximum emission rate which could be experienced whilst ensuring that the NSW EPA criteria for H_2S and odour are not exceeded. The results of this assessment are described in **Section 6.2**.

Figure 5 **Representation of predicted H_2S and odour concentrations – at peak measured emission rates**



Note: View south facing Proposal site (from WWPS), H_2S criterion – 1.38 µg·m^{-3}, odour criterion – 2 OU

6.2. Modelling at Unit Emission Rates

The results of the dispersion modelling exercise which provide an estimate of the emission rates and in-stack concentrations of H_2S and odour which could occur with NSW EPA criteria being achieved across the Proposal site are presented in **Table 5** (for H_2S) and **Table 6** (for odour).

Table 5 Calculated H_2S emission rates and in-stack concentrations to achieve EPA criterion

	Predicted 99th percentile H_2S concentration ($\mu g \cdot m^{-3}$)	Actual emission rate ($mg \cdot s^{-1}$)	Number of times higher (pred. vs. req.)	Requirements to achieve criterion[1]		
				Emission rate ($mg \cdot s^{-1}$) per stack	In-stack concentration ($mg \cdot m^{-3}$)	In-stack concentration (ppm)
Minimum flow rate	47.65	12.56	34.5	0.18	3.87	2.5
Maximum flow rate	119.18	30.12	86.4	0.17	1.53	1.0
Criterion	1.38	-	-	-	-	-

Note 1: Required emission rates quoted on a 'per-stack' basis

Should the H_2S emission rates outlined in **Table 5** be achieved, the predicted concentrations across the nearest facade of the Proposal site are presented in **Figure 6**. The highest concentrations are predicted at the upper levels of the north-western corner of the Proposal site (adjacent to Brooks Parade). Lower concentrations are anticipated across the rest of the Proposal site.

Table 6 Calculated odour emission rates and in-stack concentrations to achieve EPA criterion

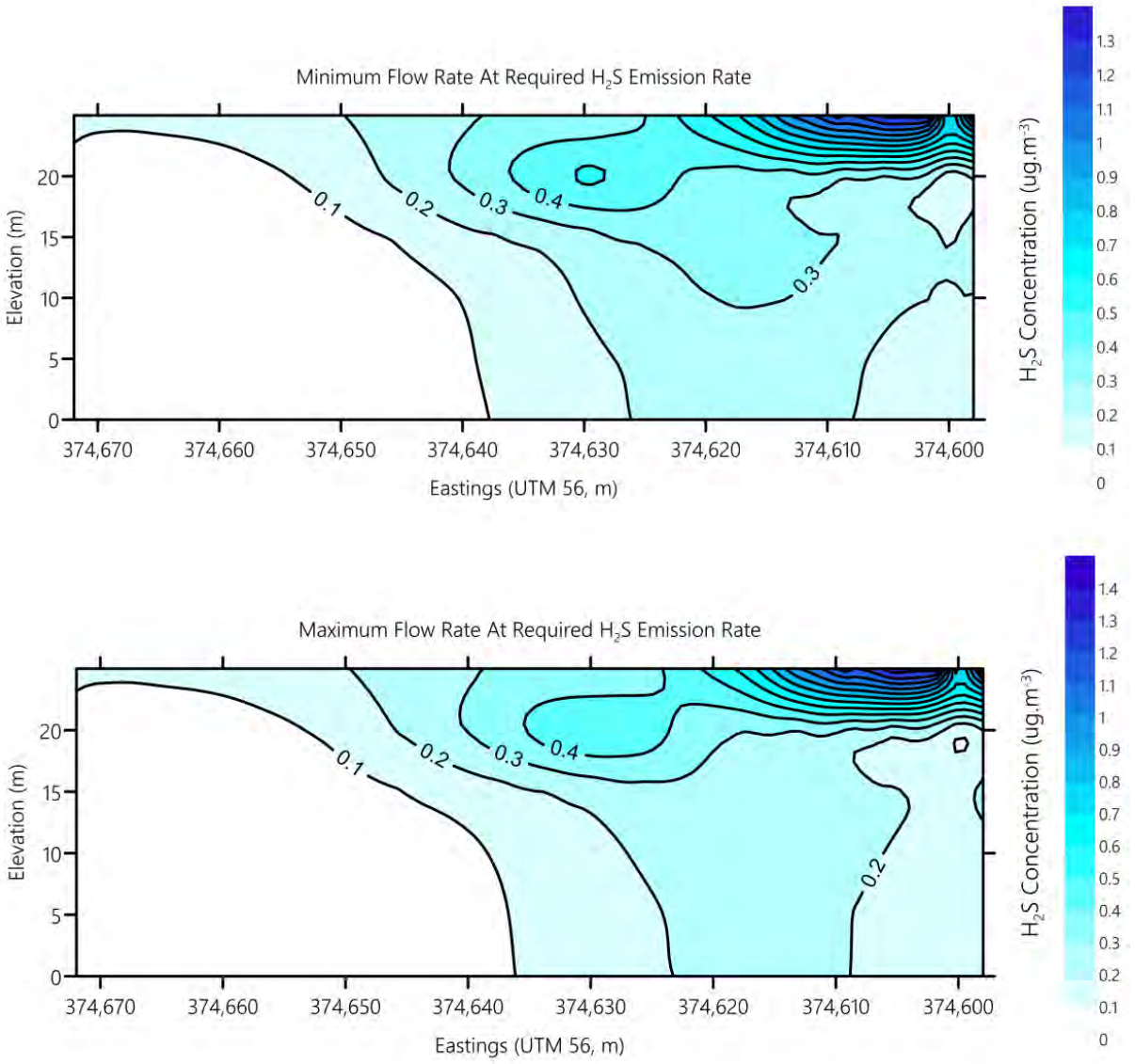
	Predicted 99th percentile odour concentration (OU)	Actual emission rate ($OU \cdot s^{-1}$)	Number of times higher (pred. vs. req.)	Requirements to achieve criterion[1]	
				Emission rate ($OU \cdot s^{-1}$) per stack[2]	In-stack concentration $(OU)^2$
Minimum flow rate	69.1	18,214	34.5	114.6	2,438
Maximum flow rate	172.7	43,648	86.4	109.9	964
Criterion	2	-	-	-	-

Note 1: Required emission rates quoted on a 'per-stack' basis

Note 2: Accounting for Peak to Mean ratio of 2.3 – value represents what would be required to be measured rather than modelled

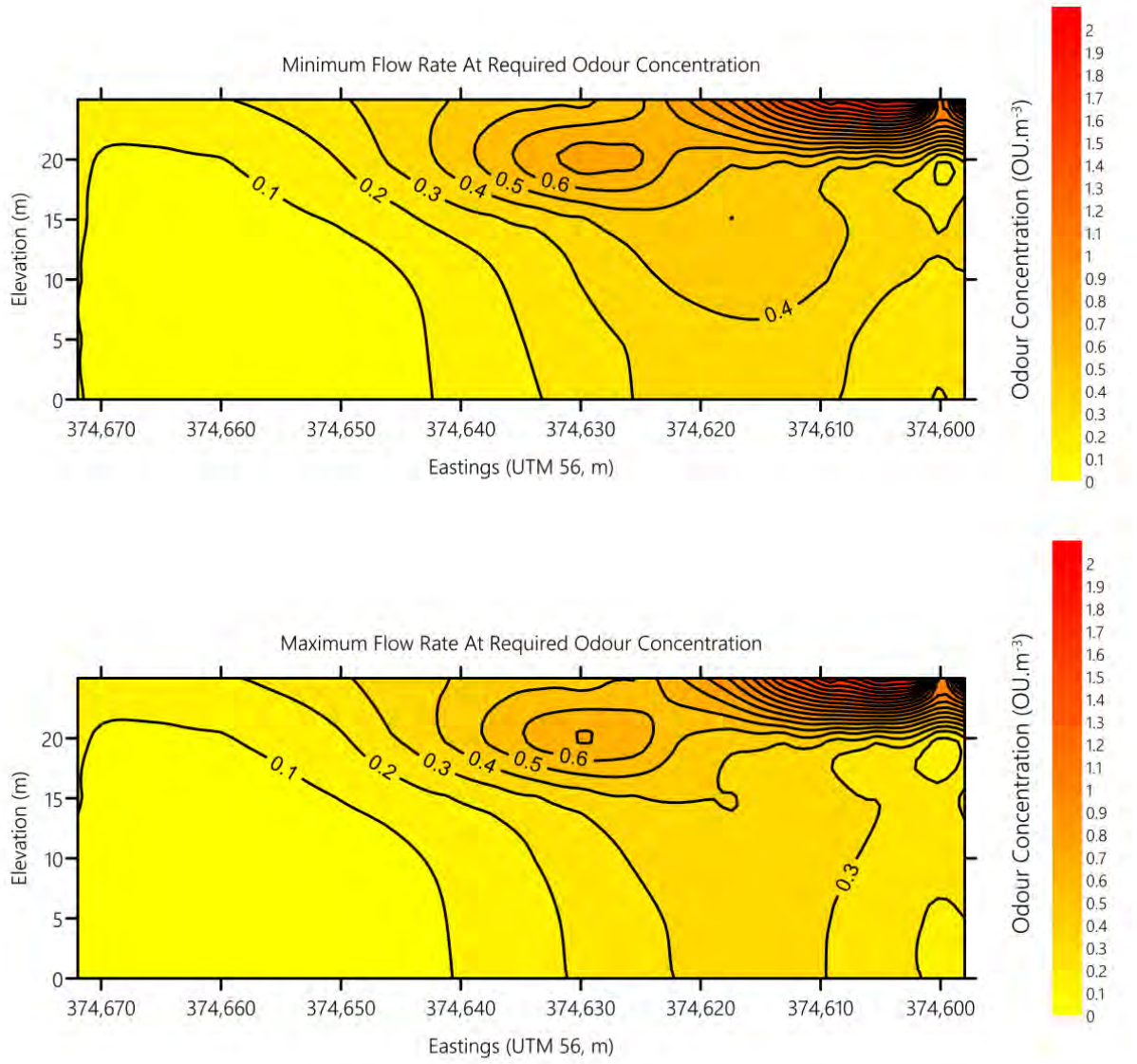
Should the odour emission rates outlined in **Table 6** be achieved, the predicted concentrations at the nearest facade of the Proposal site is presented in **Figure 7**. Once again, the highest concentrations are predicted at the upper levels of the north-western corner of the Proposal site (adjacent to Brooks Parade). Lower concentrations are anticipated across the rest of the Proposal site.

Figure 6 **Representation of calculated H_2S concentrations – at derived emission rates (as per Table 5)**



Note: View south facing Proposal site (from WWPS), H_2S criterion – 1.38 µg·m^{-3}

Figure 7 **Representation of calculated odour concentrations – at derived emission rates (as per Table 6)**



Note: View south facing Proposal site (from WWPS), odour criterion – 2 OU

The results indicate that in-stack concentrations of H_2S would be required to be significantly lower than the measured peak concentration of 87 ppm. During minimum flow rate conditions (refer **Table 3**) in-stack concentrations should be ≤2.5 ppm and during maximum flow rate conditions, ≤1 ppm. To ensure no exceedances in any flow condition represented in **Table 3**, in-stack H_2S concentrations at the vent stack should be ≤1 ppm. For clarity, these values represent the concentration within each vent stack.

In terms of odour, during minimum flow rate conditions (refer **Table 3**) in-stack concentrations should be ≤ 2,438 OU and during maximum flow rate conditions, ≤964 ppm. To ensure no exceedances in any flow condition represented in **Table 3**, in-stack odour concentrations at the vent stack should be ≤964 ppm.

A discussion of whether these concentrations are likely to be able to be achieved is presented in **Section 7**.

7. CONCLUSION

Monteath & Powys Pty Ltd has engaged Northstar Air Quality Pty Ltd to perform an odour impact assessment to determine the potential impact from an existing waste water pumping station (WWPS) upon a proposed residential development located on Brooks Parade, Belmont.

The findings of the assessment are summarised below:

- At peak emission rates of H_2S, at either potential minimum or maximum flowrates, the impacts upon the Proposal site from the operation of the WWPS would be in significant exceedance of the NSW EPA criterion (refer **Table 4**).
- At peak emission rates of odour (derived from H_2S measurements), at either potential minimum or maximum flowrates, the impacts upon the Proposal site from the operation of the WWPS would be in significant exceedance of the NSW EPA criterion (refer **Table 4**).

Emission rates of H_2S or odour at the peak values modelled are not likely to be experienced over long periods of time, although this is not quantifiable given the data currently available.

- Emission rates of H_2S which should not be exceeded for the NSW EPA criterion to be achieved at the Proposal site are 0.17 $mg \cdot s^{-1}$ (per stack), which relates to an in-stack H_2S concentration of 1 ppm (refer **Table 5**).
- Emission rates of odour which should not be exceeded for the NSW EPA criterion to be achieved at the Proposal site are 110 $OU \cdot s^{-1}$ which relates to an in-stack odour concentration of 964 OU (refer **Table 6**).

Measured in-stack concentrations of H_2S provided by HWC were between 4 ppm and 87 ppm (refer **Section 5.3.1**). It is clear that the required in-stack concentration of 1 ppm (which would ensure no adverse amenity impacts across the Proposal site) is exceeded even at the lower end of those measurements. Based on those measurements, some level of odour control may therefore be required (assuming that those measured values are representative of 'typical' WWPS operation) to ensure that odour impacts are not experienced across the Proposal site.

With regard to odour control in WWPS, HWC (Hunter Water Corporation, 2008) state that:

> *"Where natural venting is unacceptable, due to visual aesthetics or the likelihood of unacceptable levels of offensive odours, consideration should be given to the installation of odour control equipment such as soil absorption beds with forced air removal. Such units strip out the offensive odours and the remaining air may be vented to the atmosphere. This control is recommended wherever the size of incoming sewer exceeds 600 mm and may be justified in many smaller situations. The soil beds must be of sufficient size to deal with the expected air quantities and replacement of the soil bed media may be found necessary depending on the actual concentrations of hydrogen sulphide passed through the soil bed. Odour control systems may be either a bypass to the wet well extraction system or a separate system. Odour control systems should have an air flowrate of 4 to 6 well volume air changes per hour and be controlled by a time switch."*

Sydney Water outline the requirements of an Odour Control Unit (OCU) and ventilation parameters in a standard specification document (Sydney Water, 2011). In terms of the performance of the OCU, the requirements are outlined in **Table 7**.

Table 7 OCU Minimum Requirements

Item	Criteria
Outlet concentration as measured at the exit of the vent stack	Hydrogen sulphide (H_2S) ≤ 0.1 ppm
	Mercaptans (Thiols) ≤ 0.02ppm
	Odour concentration ≤ 500 Odour Units (OU)
	Or otherwise, at a level that is demonstrated to achieve no odour nuisance at the nearest residence or public space
Flow rate	Minimum of 6 x airspace/headspace volume per hour
Discharge vent stack	The discharge vent stack height shall generally comply with Sewerage Code of Australia for vent stacks (14m above ground level) unless otherwise agreed by the Principal. Typically the vent stack shall be designed to maximise the air velocity out of the top of the stack to obtain maximum dilution with the surrounding air

Source: (Sydney Water, 2011)

Essentially, the above information derived from HWC (Hunter Water Corporation, 2008) and Sydney Water (Sydney Water, 2011) indicates that the installation of an OCU would ensure that H_2S and odour concentrations would be below the requirements outlined above (i.e. ≤1 ppm H_2S [≤0.1 ppm achievable] and ≤964 OU odour [≤500 ppm achievable]). Clarification regarding the flow rate would be required to ensure that it is within the limits outlined within **Table 3**.

Assuming that the flow rates are within the limits assessed, should an OCU be installed at the WWPS odour and H_2S concentrations would meet NSW EPA criteria across the Proposal site.

It is recognised that not-insignificant costs may be associated with the installation and ongoing operation of an OCU. Alternative methods which might be appropriate may include an increase in vertical velocity through the vent stacks (by either increasing flow rate, or by decreasing the diameter of the vent stacks, or both), increasing the height of the ventilation stacks, or by adopting some method of septicity control within the WWPS itself (e.g. through the use of lime, air injection, hydrogen peroxide, chlorine, nitrate, iron salts, biological reagents, or flushing (Hunter Water Corporation, 2008)), although the actual method to be adopted would be required to be investigated by HWC given that any changes in waste water composition may impact upon the operation of the downstream waste water treatment works at Belmont.

In conclusion, the results of this assessment indicate that any odour and H_2S impacts can be managed, and managed to be below NSW EPA criteria, although any further determination of how that management may be implemented is outside the scope of this work and should be discussed in detail with HWC.

As a first step however, it is strongly recommended that H_2S concentrations and flow rate data for the vent stacks are provided by Hunter Water Corporation in a format sufficient to allow the proponent to complete a detailed assessment. The data should allow calculation of the potential variation in emissions, rather than the peak conditions represented within this assessment.

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8. REFERENCES

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APPENDIX A

Meteorology

As discussed in **Section 4.4**, a meteorological modelling exercise has been performed to characterise the meteorology of the Proposal site in the absence of site specific measurements. The meteorological monitoring has been based on measurements taken at a number of surrounding automatic weather stations (AWS) operated by the Bureau of Meteorology (BoM).

A summary of the relevant monitoring sites is provided in **Table A1** and also displayed in **Figure A1**.

Table A1 Details of meteorological monitoring surrounding the Proposal site

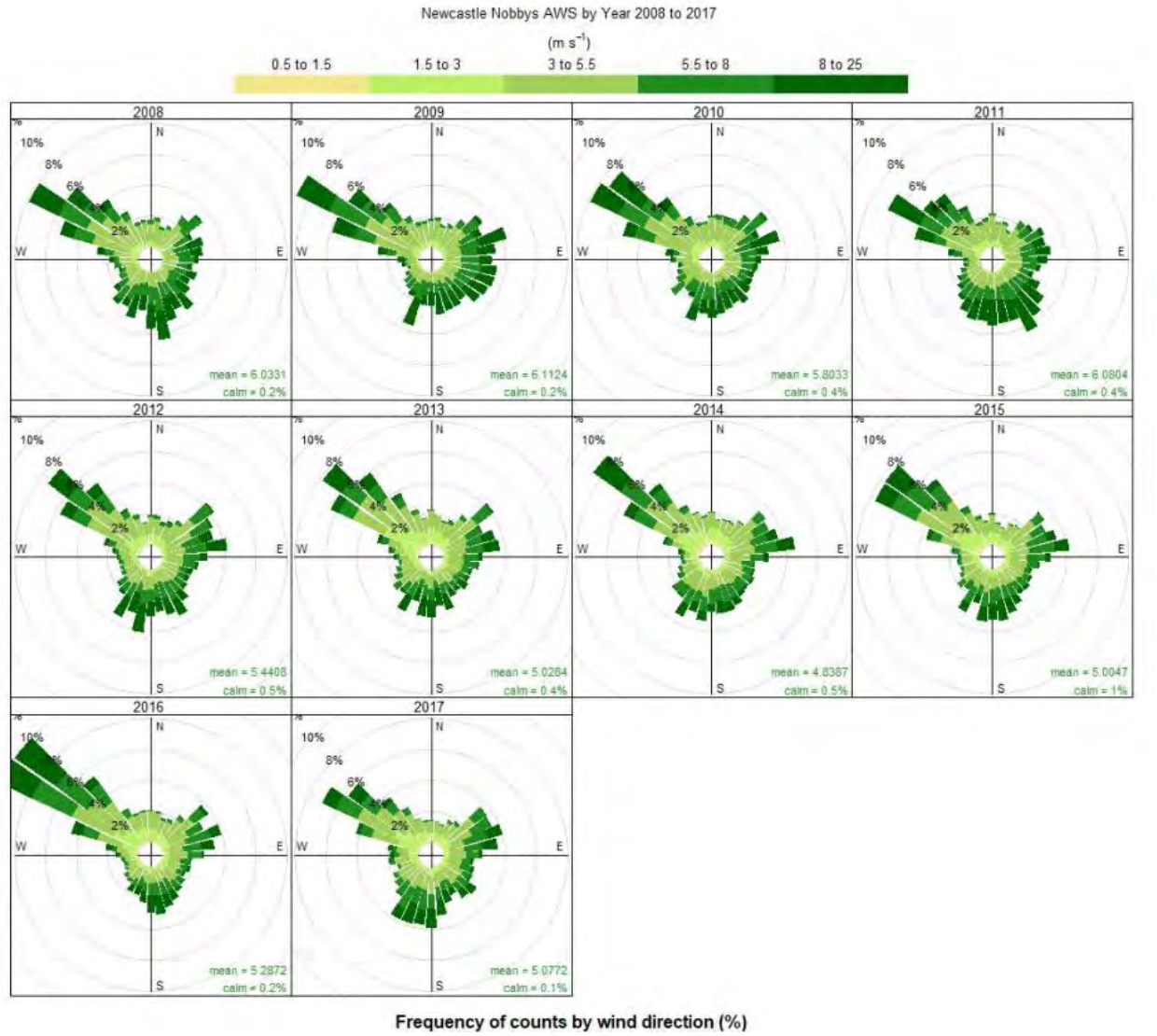
Site Name	Approximate Location (Latitude, Longitude)	
	°S	°E
Newcastle Nobbys Signal Station AWS – Station # 061055	32.92	151.80
Williamtown RAAF AWS – Station # 061078	32.79	151.84
Cooranbong (Lake Macquarie) AWS – Station # 061412	33.09	151.46

Figure A1 Meteorological and air quality monitoring surrounding the Proposal site



Meteorological conditions at Newcastle Nobbys Signal Station AWS have been examined to determine a 'typical' or representative dataset for use in dispersion modelling. Annual wind roses for the most recent years of data (2008 to 2017) are presented in **Figure A2.**

Figure A2 Annual wind roses 2008 to 2017, Newcastle Nobbys Signal Station AWS



The wind roses indicate that from 2008 to 2017, winds at Newcastle Nobbys Signal Station AWS show a generally similar pattern.

The majority of wind speeds experienced at these stations between 2008 and 2017 are generally in the range 0.5 metres per second ($m \cdot s^{-1}$) to 5.5 $m \cdot s^{-1}$ with the highest wind speeds (greater than 8 $m \cdot s^{-1}$) occurring from a north westerly direction. Winds of this speed are somewhat frequent, occurring 18% of the observed hours during the years at Newcastle Nobbys AWS. Calm winds (<0.5 $m \cdot s^{-1}$) occur <1% of hours on average across the years.

Given wind direction and wind speed distribution across the years examined, data for the year 2012 has been selected as being appropriate for further assessment, as it best represents the general trend across the 10-year period studied.

Presented in **Figure A3** are the annual wind rose for the 2008 to 2017 period and the year 2012 and in **Figure A4** the annual wind speed distribution for Newcastle Nobbys Signal Station AWS. These figures indicate that the distribution of wind speed and direction in 2012 is very similar to that experienced across the longer-term period.

It is concluded that conditions in 2012 may be considered to provide a suitably representative dataset for use in dispersion modelling.

Figure A3 Annual wind roses 2008 to 2017, and 2012 – Newcastle Nobbys Signal Station AWS

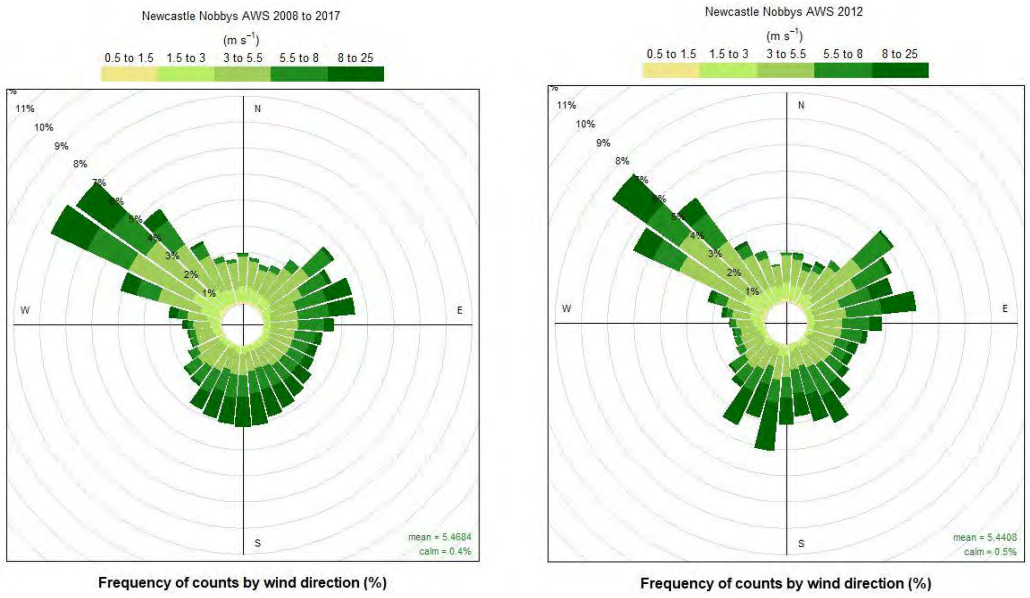
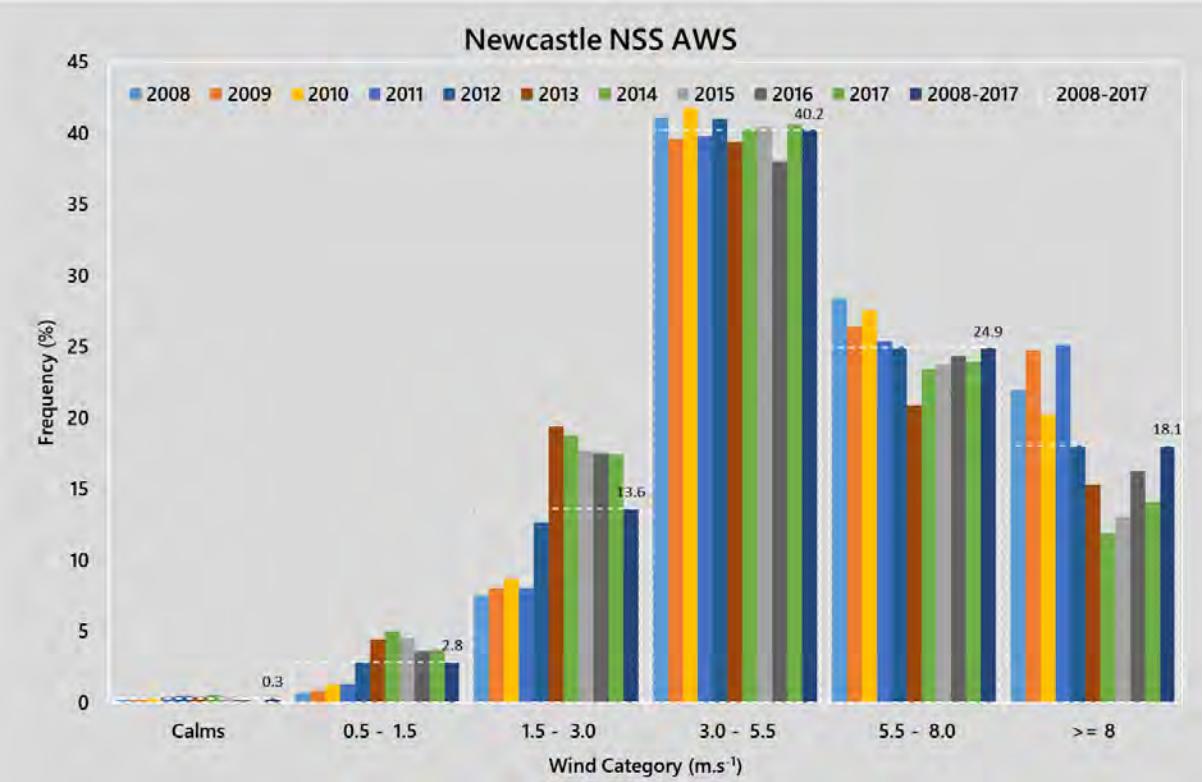


Figure A4 Annual wind speed distribution - Newcastle Nobbys Signal Station AWS



Meteorological Processing

The BoM data adequately covers the issues of data quality assurance, however it is limited by its location compared to the Proposal site. To address these uncertainties, a multi-phased assessment of the meteorology data has been performed.

In absence of any measured onsite meteorological data, site representative meteorological data for this proposal was generated using the TAPM meteorological model in a format suitable for using in the CALPUFF dispersion model (refer **Section 5**).

Meteorological modelling using The Air Pollution Model (TAPM, v 4.0.5) has been performed to predict the meteorological parameters required for CALPUFF. TAPM, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) is a prognostic model which may be used to predict three-dimensional meteorological data and air pollution concentrations.

TAPM predicts wind speed and direction, temperature, pressure, water vapour, cloud, rain water and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations at user-defined levels within the atmosphere.

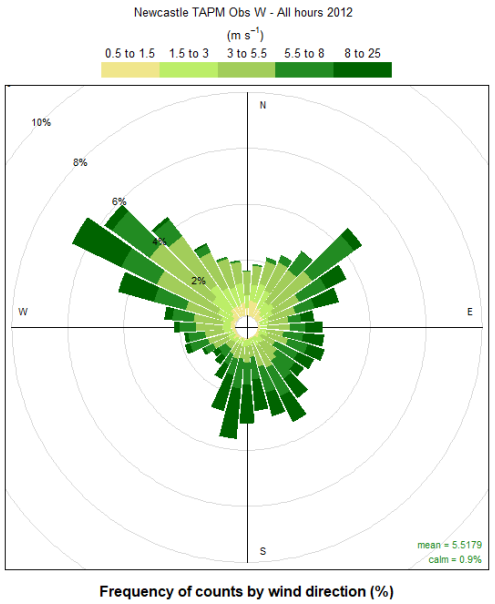
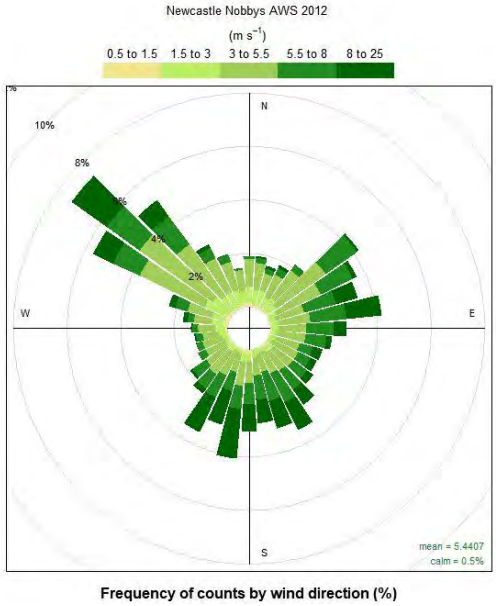
The parameters used in TAPM modelling are presented in **Table A2**.

Table A2 Meteorological parameters used for this study

TAPM v 4.0.5	
Modelling period	1 January 2012 to 31 December 2012
Centre of analysis	375,242mE, 6,363,630 mN (UTM Coordinates)
Number of grid points	68 × 68 × 25
Number of grids (spacing)	4 (22 km, 9 km, 3 km, 1 km)
Terrain	AUSLIG 9 second DEM
Data assimilation	Williamtown RAAF AWS

A comparison of the TAPM generated meteorological data, and that observed at the Newcastle Nobbys Signal Station AWS are presented in **Figure A5**. These data generally compare well which provides confidence that the meteorological conditions modelled as part of this assessment are appropriate.

Figure A5 Modelled and observed meteorological data – Newcastle Nobbys Signal Station, 2012

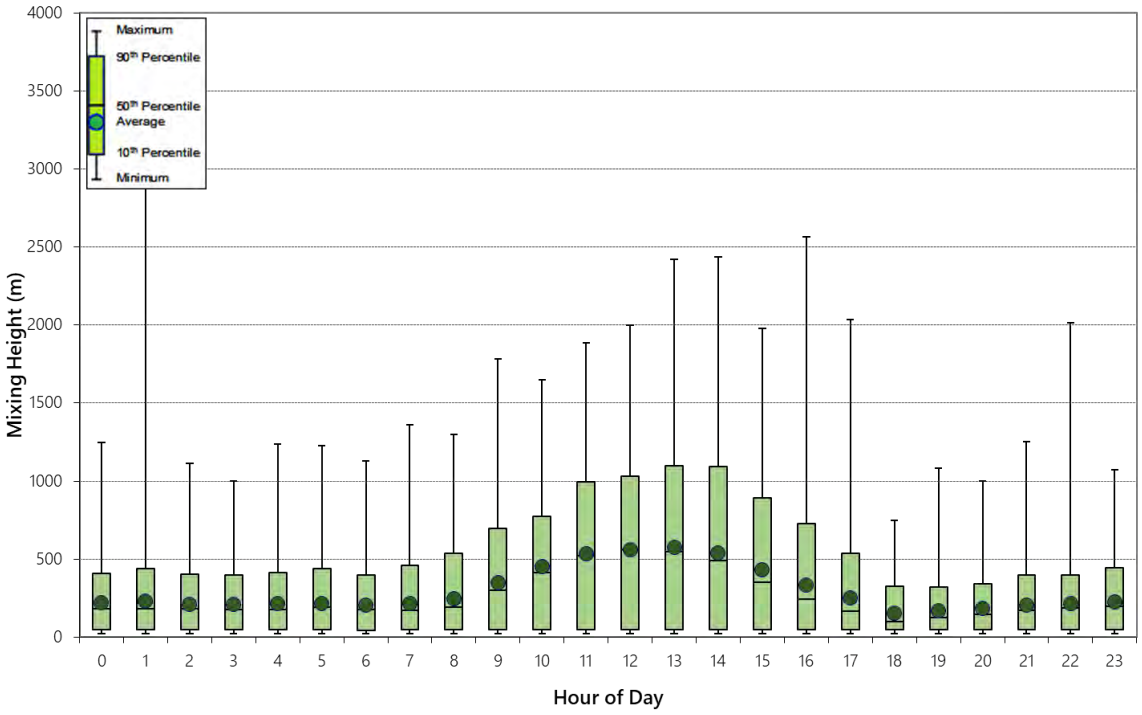
TAPM generated windrose	Observations at Newcastle AWS
	

As generally required by the NSW EPA the following provides a summary of the modelled meteorological dataset. Given the nature of the pollutant emission sources at the Proposal site, detailed discussion of the humidity, evaporation, cloud cover, katabatic air drainage and air recirulation potential of the Proposal site has not been provided. Details of the predictions of wind speed and direction, mixing height and temperature at the Proposal site are provided below.

Diurnal variations in maximum and average mixing heights predicted by TAPM at the Proposal site during 2012 period are illustrated in **Figure A6**.

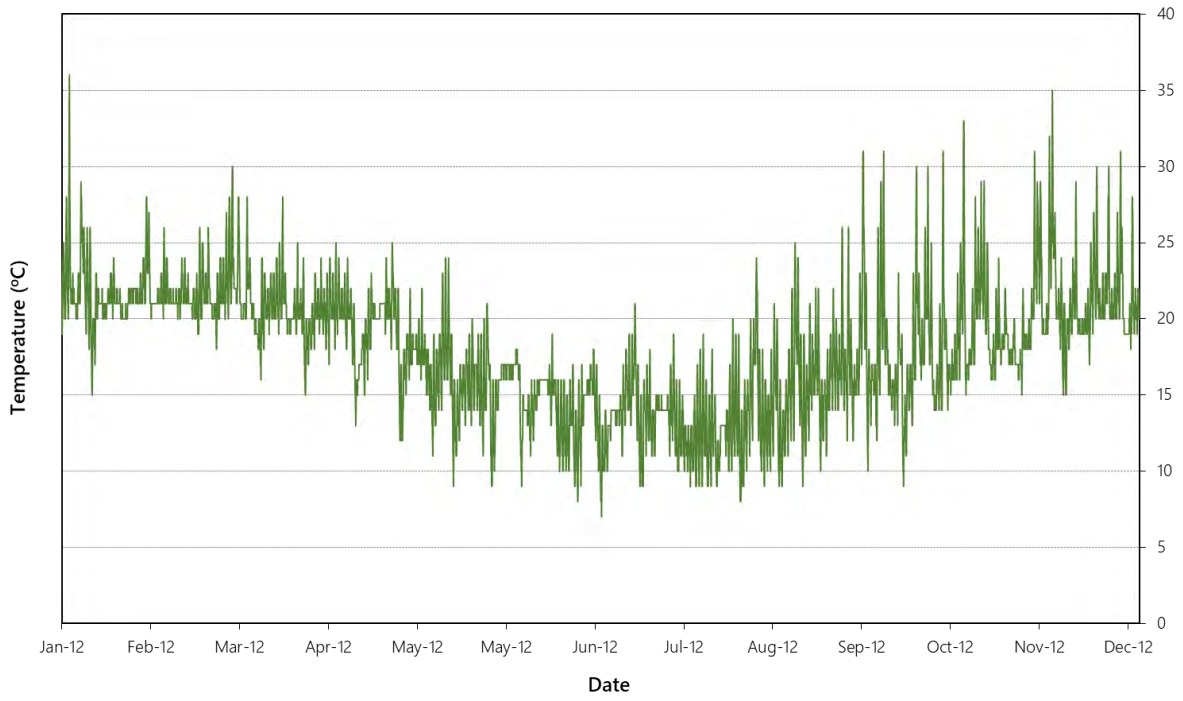
As expected, an increase in mixing height during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground based temperature inversions and growth of the convective mixing layer.

Figure A6 Predicted mixing height – Proposal site, 2012



The modelled temperature variations predicted at the Proposal site during 2012 are presented in **Figure A7**.

Figure A7 Predicted temperature – Proposal site, 2012



The maximum temperature of 36°C was predicted on 4 January 2012 and the minimum temperature of 7°C was predicted on 2 July 2012.

The modelled wind speed and direction at the Proposal site during 2012 are presented in **Figure A8**.

Figure A8 Predicted wind speed and direction – Proposal site, 2012

