viewpoint 1

Warners Bay Apartments - Warners Bay

VIEWPOINT LOCATION

The intersection of The Esplanade and Howard Street.

COMMENTS:

Driver viewpoint approaching Warners Bay retail precinct from the south.

Existing development to the south of the site obstructs views to the southern interface.

Articulated building design complements the existing built form at the lower two levels. Upper levels are set back from the ixisting building line to reduce the visual impact.

Proposed street trees shall provide some softening of the built form as they mature.

FOCAL LENGTH: 26mm

SITE:
Cnr The Esplanade & Howard Street, Warners Bay
CLIENT:
Bloc
DATE:
19.04.2017
JOB NUMBER:
11159.5
DRAWN:
KM / YY
REVISION:
B

terras
landscape architects

5 – SEPP 65 REVIEW

Lake Macquarie City Council

SEPP 65 Urban Design Review Panel Recommendations

Property Details:	482 The Esplanade, WARNERS BAY NSW 2282 Lot 122 DP 578045, Lot 1 DP 1116535, Lot 2 DP 1116535
SEPP Application No.:	SEPP65/16/2016
Development Application No.: (if applicable)	PL/190/2015 and PL/190/2015/A
Proposal:	Mixed Use Development - Commercial and Residential Apartments
Responsible Officer:	Brian T Gibson
Applicants Name:	BLOC
Applicants Address:	Unit 9, Ground Floor Hotel Realm, 19 National Cct, BARTON NSW 2600
Panel Members Present:	Philip Pollard (Chairperson) Robert Denton John O'Grady
Applicant/Proponents Present:	Peter Bowyer – BLOC Matt Travis – SHAC Architects Marcus Graham – Stewart Architecture Brett Stein – ADW Johnson
Council Officers Present:	Elizabeth Lambert – Senior Development Planner Michael Little – Acting Panel Coordinator
Apologies:	Alison McCabe – Panel Member David Ryan – Panel Member Brian Gibson – Development Planner
Chair:	Philip Pollard
Date of Meeting:	14 December 2016

Introduction

The Design Review Panel (the Panel), comments are to assist Lake Macquarie City Council in its consideration of the development application.

The absence of a comment under any of the principles does not necessarily imply that the Panel considers the particular matter has been satisfactorily addressed, as it may be that changes suggested under other principles will generate a desirable change.

The Panel draws the attention of applicants to the Apartment Design Guide (ADG), as published by NSW Department of Planning & Environment (June 2015), which provides guidance on all the issues addressed.

The nine design quality principles to be addressed in SEPP 65 are grouped together where relevant, to avoid the unnecessary repetition of comments.

Panel Comments

The nine design principles as set out in SEPP 65 were considered by the panel in discussion of the development application. These are: **Context & Neighbourhood Character, Built Form & Scale, Density, Sustainability, Landscape, Amenity, Safety, Housing Diversity & Social Interaction, and Aesthetics.**

Context & Neighbourhood Character	The site is on the corner of the Esplanade and King Street and Howard Street Warners Bay. It is located towards the southern end of the Warners Bay town centre precinct and the design is informed by the Warners Bay Town Centre Plan. It enjoys westerly and north-westerly views across the lake and good winter solar exposure from the north. The panel considered a previous proposal for the site prepared by SHAC Architects for a previous owner. The current owner purchased the site and intellectual property pertaining the previous design, and the proposal presented represents design development undertaken by Stewart Architecture and SHAC in association. The primary points raised by the panel in response to the previous proposal have been substantially addressed, by increasing the width of the central courtyard, lowering its height as well as a range of other positive design revisions and refinements.
Built Form & Scale	The visual bulk of the previous proposal has been reduced and there has been a minor reduction in the overall building height, which is fully compliant with the building envelope with the minor exception of the upper 5th and 6th floors setbacks facing Howard Street. The panel considers the latter to be acceptable in the context.

	The proposal responds to the Warners Bay Town Centre Plan Guidelines which require a two storey scaled base to a building by presenting King Street and The Esplanade, with a two-storey high portal or framed structure which follows the site street boundaries. This element was considered to be quite attractive as it is represented in the hand drawn elevational sketches presented, but is less successful as viewed in the 3D rendering, as seen from the roundabout. In the latter, the masonry framed structure does not turn the corner comfortably, and is visually at odds with the curved format of the balustrade up-stands above. The panel understands that this 3D simply represents a process in the design development, but encourages the architects to explore further refinement of this device to better integrate it in the overall building form and to more sympathetically compliment the curved form of the balustrades. Some horizontal layering of shade or shelter for the open space between the building footprint and the frame device would assist in this respect, as would mere extensive use of climbing vines and vegetation as suggested in the elevations.
Density	Density was considered appropriate to the site.
Sustainability	At this stage, there remain to be explored a range of inclusions such as PV panels, rainwater collection, natural light and ventilation to bathrooms wherever possible, and other opportunities for a more sustainable development.
Landscape	The proposal in its current form provides significant opportunities for high quality landscape treatment to communal open space and public domain. The panel notes that much of the landscape treatment will be on slab and encourages the applicant to explore means of including large scale canopy trees in these areas. One positive means of achieving this would be to create dropped areas in the slab in order to accommodate deep soil.
Amenity	High level of amenity should be achievable for all dwellings within the development. Consideration should be given to providing adjustable sun shading, in particular to the afternoon western summer sun for all units. The amenity of the adjacent apartment building to the south on The Esplanade was raised as an issue - in particular those rooms and very small balconies facing north near the common property boundary. Further information should be obtained in respect to the nature of these rooms – whether habitable or not, and some articulation and visual treatments applied to the southern wall of the proposed development. It is noted that the significant improvement over the previous proposal has been achieved via the

	inclusion of ground level deep soil planting to the eastern end of this common boundary. The latter will assist considerably in maintaining an attractive and functional northerly aspect from the rear courtyards of the adjacent properties. Provision should be made for the appropriate, screened location of outdoor air conditioning compressor units, giving due consideration to both the acoustic and visual impacts of this infrastructure (whether provided as part of the construction or post-fitted).
Safety	The issue of whether the central courtyard was secured in respect to access by the public was raised, and the panel was advised that because very good casual surveillance from the adjacent apartments, one option under consideration was to have this central area visible and accessible to the public. It was noted that in any event, the swimming pool would need to be fenced, and while the panel was supportive of the desire to retain public visual and physical access, it may eventuate that at least after hours, it is necessary for this area to be secured. Rather than such fencing thus becoming a post construction afterthought, it was suggested that the design be undertaken such that it could be fenced if necessary without detracting from the integrity of the design.
Housing Diversity & Social Interaction	The proposal includes an appropriate mix of apartment types and a useful provision of attractive commercial and retail space.
Aesthetics	The panel strongly supportive of the treatments implied in respect to the façade concepts and layering as depicted in the hand drawn elevations. This textured layering appears to have lost a degree of its refinement in conversion to the 3D rendering, and the architects were encouraged revisit the streetfront ground floor frame element in particular, with a view to achieving the finer grained aesthetics implied in the hand drawn sketches and the character shown in the precedent photographs. The panel was generally supportive of the concept treatment of the corner on the upper levels and the expression of the roof form.

Note

To address the Panel's comments, the applicant is advised to *(recommendation of panel)*
The panel considers the revised proposal to be a very positive design development to the previous scheme, and providing the relatively few issues raised under the headings above are addressed well, the proposal is likely to constitute a very positive lakefront presence, in respect to its presentation and performance under the ADG principles.

Council Reference Number	Details	No. of Pages
D08139536	Design Verification Statement - SEPP65/16/2016 - 482 The Esplanade WARNERS BAY	27

6 – DESIGN VERIFICATION STATEMENT

STEWART
ARCHITECTURE

36 Mildura Street Fyshwick ACT 2609
PO Box 3469 Manuka ACT 2603
www.stewartarchitecture.com.au
T 02 6228 1200

SEPP 65 Design Verification Statement

Prepared to accompany the Development Application submitted to Lake Macquarie City Council.

Project Address:
Comprising a number of lots of the following addresses;
482 – 488 the Esplanade, Warners Bay
12 – 16 King Street, Warners Bay
1 Howard Street, Warners Bay

Prepared on behalf of:
BLOC

Prepared by:
Stewart Architecture

Verification of Qualifications

Marcus Graham is a registered architect in the Australian Capital Territory and is enrolled in the Division of Chartered Architects in the register of Architects pursuant to the Architect Act 1921. His ACT Registered Architect No. is 1090

Statement of Design

Stewart Architecture has been responsible for the design of the project since its inception and have worked with a wider consultant team. The project has been designed to contribute positively to the local area and respond respectfully to the local planning and design controls including the best practice design principles of SEPP 65.

We verify that our proposed residential development complies with the design quality principles set out in the Apartment Design Guide within SEPP 65. Details of the design compliance are included in the attached SEPP 65 Design Statement.

Marcus Graham
Practice Principal, Stewart Architecture
ACT Registered Architect No. 1090

STEWART ARCHITECTURE

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Apartment Design Guide Compliance Statement

Prepared to accompany the Development Application submitted to Lake Macquarie City Council.

Project Address:
Comprising a number of lots of the following addresses;
482 – 488 the Esplanade, Warners Bay
12 – 16 King Street, Warners Bay
1 Howard Street, Warners Bay

Design Criteria		Compliance	Notes
3D	Communal Open Space	✓	Communal open space makes up 35% of the proposed development site. 50% of this open space will receive in excess of 2 hours of direct sunlight during the middle of the day on the winter solstice.
3E	Deep Soil Zones	✓ Minor non-compliance	Deep root planting is provided along The Esplanade, on King Street and a 9m x 15m deep root zone is provided in the south of the communal open space. These deep root zones are less than 7% of the total site area, but non-compliance this is offset by extensive planting throughout the development in large planter boxes.
3F	Visual Privacy	✓ Minor non-compliance	The Howard Street building is largely setback at a distance of 4.8m from the side boundary with the exception of the lift and stair core. It does not have any habitable rooms or balconies which face the side boundary. There is a 3.6m separation between The Esplanade building and the existing adjacent development for the first 12m. This separation is increased to 8.7 above 12m in height. Habitable rooms to the side boundary are only on level 6 and 7, above the height of the existing building.
3J	Car Parking	✓ Minor non-compliance	The proposal provides off street parking which complies with the councils parking generation rates for residential parking, commercial motorbike and bicycle parking.
4A	Solar and Daylight Access	✓	The proposal orientates living rooms and private open spaces to the north or west (to access lake views). 26% of apartments have north orientation and receive sunlight throughout the day. The remaining 74% of apartments have living rooms and private open space orientation to the west and receive direct sunlight for 3 hours between 9am and noon. 100% of apartments receive direct sunlight between 9am and 3pm at mid-winter (exceeding the minimum requirement of 85%)

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4B	Natural Ventilation	✓	68% of apartments are naturally cross ventilated. Maximum depth of a cross-through apartment is 18m.
4C	Ceiling Heights	✓	Ceiling heights of 2.7m are provided for habitable rooms and 2.4m for non-habitable rooms.
4D-1	Apartment Size	✓	Apartments are greater than minimum area and each habitable room has a window to an external wall of not less than 10% of the floor area.
4D-2	Apartment Depth	✓ Minor non-compliance	With the exception of Unit Type 2A habitable rooms do not exceed 2.5 x the ceiling height in depth, the maximum habitable depth in open plan layouts not exceeding 8m. Unit Type 2A has slightly deeper open plan layout but this is considered acceptable due to the northern orientation, full height glazing and living room glazed on two frontages.
4D-3	Apartment Layout	✓ Minor non-compliance	Bedrooms and living rooms meet or exceed minimum dimensional requirements except cross-through skip-stop dwellings which are 4m centre-to-centre so slightly less than 4m internal width. This is considered acceptable because the proposal provides a wide variety of dwelling typologies.
4E	Private Open Space and Balconies	✓	All balconies and primary open space exceed minimum dimensions.
4F	Common Circulation and Spaces	✓ Minor non-compliance	Typical levels in the Esplanade building have 3 to 5 apartments per core. The Howard Street building is of unusual design and has up to 14 apartments per core due to the skip-stop unit planning. This is considered appropriate because the corridors have excellent access to daylight and outlook at each end so a high degree of amenity.
4G	Storage	✓	Storage size volumes for each apartment type exceed the minimum criteria. 50% or greater of the required storage volume is located with each apartment.

SEPP 65 Design Statement

Lakehouse Village - Warners Bay

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CONTENTS

Acronyms + Notes

SEPP - State Environmental Planning Policy
DCP - Development Control Plan
LEP - Local Environmental Plan
FSR - Floor Space Ratio

Project
Warners Bay

Prepared by
Stewart Architecture + SHAC

Prepared for
Bloc

Date
November 2016

Revision
Rev B

Contact
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E: m.graham@stewartarchitecture.com.au

The following documentation portrays the proposal for the blocks bound by the Esplanade, King Street and Howard Street, Warners Bay.

The design seeks to instil the sense of a ‘village’ development to this prominent block. As such, it was considered a vital design principle to break down the visual scale of the proposal by instilling distinct and legible ‘zones’ of the development which respond to both place and development controls under the Lake Macquarie Development Control Plan (2014).

The street wall binds the ‘base’ of the proposal, through a series of double-height masonry frames which step their way along each street interface. Encapsulated within these frames at street level are a series of smaller scaled commercial premises which are afforded the opportunity to activate the public domain. Colours, tones and materials are envisaged to vary to create an interesting and active public domain.

The architecture then ‘lightens’ up the building’s façade: distinct ‘middle’ and ‘upper’ languages are developed to aid in the breaking down of the building’s scale. It is the proposal’s almost complete adherence to the building envelope which aids the creation of these distinct languages. Each building steps appropriately as per this control to effectively minimise apparent bulk whilst also mitigating impact to the neighbouring buildings.

Particular concern was taken regarding the amenity of the existing dwellings to the south of site. As such, a generous (35m) ‘garden’ zone including resident recreational facilities has been created through the centre of site allowing abundant light through to these southern neighbours. Furthermore, the proposal’s slight encroachment to the King Street building envelope has been proposed in order to allow this building to set back further from the southern boundary: effectively creating a more appropriate interface with these dwellings.

This proposal also aims to provide excellent amenity to its residents. Most units have opportunity for lake outlook. Furthermore, the unit designs allow both excellent solar and cross-ventilation opportunities.

KEY PRINCIPLES

- A relaxed mised-use development appropriate for the Warners Bay context.

- Fine-grain commercial modulation at ground floors.

- Extensive central gardens for residents.

- Clear residential address points and circulation.

- All residences receive morning and/or afternoon sun.

- Majority of residences have excellent natural ventillation.

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INTRODUCTION

Purpose of the Report

This Design Verification Statement has been prepared by Stewart Architecture on behalf of the Bloc, the owners of the site at the corner of King Street and The Esplanade, Warners Bay

The statement is submitted as part of the Development Application for the above site, and should be considered alongside the other documents prepared by the applicant team.

This Design Statement has been prepared to demonstrate that the proposed mixed-use multi-unit residential development has been designed to be consistent with the 9 principles outlined in the Apartment Design Guide (SEPP 65).

This submission to the SEPP 65 Urban Design Review Panel follows a previous presentation on 2nd November 2016. The design has been evolved to address all comments provided in this previous presentation; each resolution outlined in the following discussion of the nine design principles.

The proposal was presented to the Lake Macquarie City Council on 02 November 2016. A number of changes have been made to the proposal in response to feedback received at this meeting including;

- Basement entry relocated from King Street to Howard Street
- Commercial shopfront recessed from King Street to provide level outdoor seating area.

The proposal was further presented to the SEPP65 Urban Design Review Panel on 14 December 2016. Further changes and design refinements were made following endoresement recommendations by the panel, including:

- Revised interface to souther neighbouring development,
- Refinement of all facades to achieve a finer grain aesthetic treatment.

Supplementing this report are a series of architectural analysis and drawings, providing both explanation of and justification for the revised scheme.

These drawings are as follows:

- Cover page
- Local context sketch plan
- Streetscape Analysis: The Esplanade
- Streetscape Analysis: King Street
- Streetscape Analysis: Howard Street
- Aerial Photograph
- Site Survey
- Site Analysis
- Plan: All levels
- Building Elevation: The Esplanade
- Building Elevation: King Street
- Building Elevation: Howard Street
- Building Elevation: Internal Elevations
- Sections
- Perspectives
- Development summary

SEPP65 Design Compliance Report

Principle 1 : Context and Neighbourhood Character

Good design responds and contributes to its context.
Context is the key natural and built features of an area, their relationship and the character they create when combined. It also includes social, economic, health and environmental conditions.

Responding to context involves identifying the desirable elements of an area's existing or future character. Well designed buildings respond to and enhance the qualities and identity of the area including the adjacent sites, streetscape and neighbourhood. Consideration of local context is important for all sites, including sites in established areas, those undergoing change or identified for change.

The subject site is located in Warners Bay, on the corner of The Esplanade and King Street. Located within the 'Warners Bay Town Centre' area of Lake Macquarie City Council, it is situated prominently at the gateway of Warners Bay town and Lake Macquarie and its foreshore.

The site is currently comprised of eight separate Deposited Plans; housing a petrol station to the North-West, and four single dwelling to the South and North-East respectively. One lot is currently undeveloped and vacant. The site therefore serves additionally as the border between Warners Bay's commercial precinct to the North, and residential zone to the South and East. Broadly, the site's immediate context is typically small in scale: single storey residential dwellings are customary, and two-storey commercial buildings address the either the Lake's foreshore or their respective street.

However, there are some distinct exceptions to this. SP72323 – the lot immediately south of the subject site - currently houses three multi-residential buildings of varying scales. Two buildings addressing Howard Street are three storeys, with one building to The Esplanade of five storeys. Further, the lots immediately East of the subject site are currently under construction for a six storey residential building, housing 112 apartments plus supermarket and specialty shops.

This transition toward higher density building reflects the desired future character under the Warners Bay Town Centre Development Control Plan (DCP). Under this plan, Warners Bay is envisaged to develop in such a manner as to activate and invigorate The Esplanade with both commercial and residential premises. Furthermore, the site's immediate context is zoned in such a manner as to facilitate this future development. The blocks bound by The Esplanade, King and Lake Street in addition to those bound by The Esplanade, King and Queen Street are zoned B2 – Local Centre; permitting similar developments. Its broader context is zoned both B4 – Mixed Use and R3 – Medium Density Residential.

Noteworthy is the finer grain commercial character of the surrounding context from which the proposal derives its street wall language. The street wall is to be constructed in brick: giving a sense of materiality and scale to the immediate street.

Whilst the proposal is in keeping with the future strategic vision of the Warners Bay Town Centre, it responds to certain desirable aspects of the existing context.

The Warners Bay Town Centre DCP envisages that the commercial area north of the site will become a Market Place including the shared zone' Postmans Lane. The proposal provides an attractive visual culmination opposite Postmans Lane with stair to the central landscaped garden.


Lake Macquarie


King Street, towards the Lake


Neighbouring Development


The Esplanade


King Street and The Esplanade


King Street


King Street


Howard Street and King Street

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Principle 2 : Built Form and Scale

Good design achieves a scale, bulk and height appropriate to the existing or desired future character of the street and surrounding buildings.

Good design also achieves an appropriate built form for a site and the building's purpose in terms of building alignments, proportions, building type, articulation and the manipulation of building elements. Appropriate built form defines the public domain, contributes to the character of streetscapes and parks, including their views and vistas, and provides internal amenity and outlook.

The building form of the proposal has been derived in keeping with both the controls of the Lake Macquarie Development Control Plan, and the future 'building type C' controls under the Warners Bay Town Centre plan. The proposal therefore responds to the desired future character of Warners bay and its town centre.

The proposal is thus divided into three distinct elements:
- The 'base' which defines the street-wall and reflects the fine-grain commercial context,
- The slightly lighter 'middle' which mediates the transition between the dense base and light upper in response to the development controls, and,
- The lightest 'upper' component defining the building's top.

This design strategy allows the proposal to be developed in such a way as to be in keeping with the planning controls under the Lake Macquarie DCP. The height of the proposal sits below the 22 metres permissible on the site, whilst still facilitating expansive views across the city centre and lake. The definition of three distinct languages also aids in the articulation of the proposal; again lessening its visual scale.

The siting of buildings within the proposal is developed with particular regard to the amenity of the existing dwellings to the south of site. As such, a generous 'garden' zone - including resident recreational facilities - is created through the centre of site allowing abundant light through to these southern neighbours.

The lower 'base' defines the future street wall and therefore the streetscape and public domain. The framing of the street wall breaks down the scale of the proposal: facilitating small scale premises and their subsequent activation of the street domain. Its materiality is responsive to the human scale and provides a textural character to the immediate street-scape.

In response to previous comments from the SEPP65 UDRP;
- The relationship of the podium to the adjoining properties to the south has been refined to provide a deep-soil zone transitional space and landscape buffer between podium and boundary. Levels of the space are exactly aligned with adjacent properties.
- Ground floor residential units have been deleted from the proposal in lieu of active commercial tenancies.
- Interfaces of commercial tenancies with the to King Street have been developed to provide improved relationship with the gradient of the footpath. The space has been widened and planting included.

Principle 3 : Density

Good design achieves a high level of amenity for residents and each apartment, resulting in a density appropriate to the site and its context.

Appropriate densities are consistent with the area's existing or projected population. Appropriate densities can be sustained by existing or proposed infrastructure, public transport, access to jobs, community facilities and the environment.

The site is located amidst the Warners Bay Town Centre, within the B2 – Local Centre planning zone. As such, the allowable building height stands at 22 metres: with the proposal sitting neatly below this control. The proposal also maintains the prescribed building envelope with only one small encroachment to King Street. This minor encroachment has been proposed in order to allow facilitating in different manners each building to set further back from the southern boundary: effectively creating a more appropriate interface with these neighbouring dwellings.

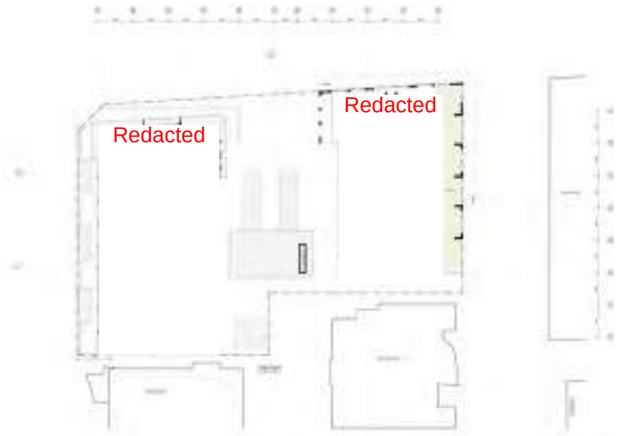
Most significant to the amenity of future residents, and the existing residents located to the south of the site, is the proposed landscape zone to the site's centre. The success of such a space is multi-faceted: not only does it allow approximately a third of the site to be reclaimed for residents' use and therefore encouraging social interaction, but also, it ensures the ongoing amenity of the residential development to the south. Such a space softens the apparent density of the proposal: increasing opportunities for planting and therefore the proposal's impact to its broader neighbourhood context. A deep soil planting zone has been included to the southern boundary to further soften the building's interface.

Units have been designed efficiently with access and amenity in mind. The development also provides a mix of unit types, providing for a variety of lifestyles and resident numbers. The range of unit types within the development facilitate social diversity within the project.

The proposed apartment unit mix is:
- 1 bedroom 23%
- 2 bedroom 50%
- 3 bedroom 27%

Lower Ground

Upper Ground



Typical Floor with Skip-Stop Lower Plan

Typical Floor with Skip-Stop Upper Plan

Principle 4 : Sustainability

Good design combines positive environmental, social and economic outcomes.

Good sustainable design includes use of natural cross ventilation and sunlight for the amenity and liveability of residents and passive thermal design for ventilation, heating and cooling reducing reliance on technology and operation costs. Other elements include recycling and reuse of materials and waste, use of sustainable materials and deep soil zones for groundwater recharge and vegetation.

The consideration to the project's interface with, and amenity of, the existing southern neighbours was deemed to be vital in the building design process. It was this key consideration – in tangent with the desire for expansive and outstanding communal open space – that ultimately determined the buildings' footprints. The proposal thus runs North-South, facilitating address to the Esplanade, Howard Street and the communal open space.

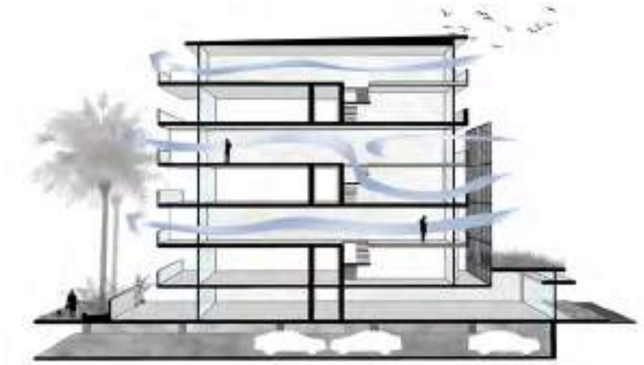
With this in mind: the proposal's access to daylight is assessed under the scope of extended hours (8-4pm), mid-winter. 79% of the units within the proposal therefore meet the minimum 2 hour standard; far exceeding the 70% stipulated in the Apartment Design Guide.

The proposal exceeds the minimum standard for cross ventilation; with 70% of units being naturally cross-ventilated due to their design incorporating more than one aspect.

The proposed materials of the building have been selected to both ensure longevity, as well and the potential for material recycling: particularly within the street-wall 'base', and 'middle' components of the building.
The location of the communal open space has been determined with both solar amenity and connection to the broader neighbourhood context in mind. Its expanse and excellent access to northern light encourages year-round use.

Finally, the project will meet the minimum BASIX requirements.

Cross-ventilation : The Esplanade



Cross-ventilation : Howard Street

Redacted

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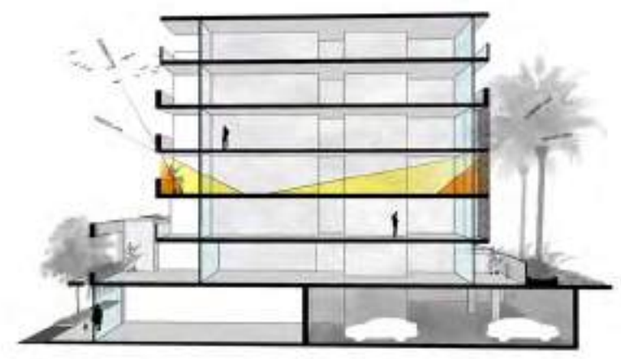
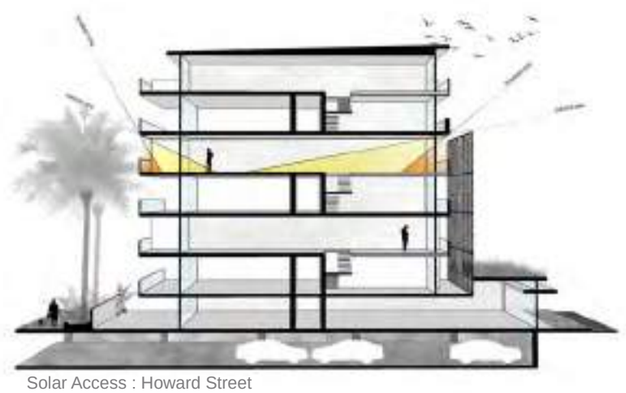


Solar Access : The Esplanade



Solar Access : Howard Street

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Principle 5 : Landscape

Good design recognises that together landscape and buildings operate as an integrated and sustainable system, resulting in attractive developments with good amenity.
A positive image and contextual fit of well designed developments is achieved by contributing to the landscape character of the streetscape and neighbourhood.

Good landscape design enhances the development's environmental performance by retaining positive natural features which contribute to the local context, co-ordinating water and soil management, solar access, micro-climate, tree canopy, habitat values and preserving green networks.
Good landscape design optimises useability, privacy and opportunities for social interaction, equitable access, respect for neighbours' amenity and provides for practical establishment and long term management.

A variety of landscaping strategies have been implemented to enhance the existing landscape context. The proposal seeks to connect with the landscaped lake edge through the provision of an expansive garden zone and the site's centre. This connection, currently broken by the extensive hard-scaped petrol station, is integral to the success of the proposal as a design which recognises the significance of its contextual landscape.
The proposal provides multiple opportunities for landscaping at different levels. To the street, additional street trees are proposed. These trees not only extend the landscaped shoreline through Warners Bay commercial heart, but also provide opportunities for shelter for commercial tenancies activating the streetscape.

At the podium, the garden heart of the proposal facilitates vast and varied landscape opportunities to be enjoyed by residents and visitors alike. Further, dwellings to this level are afforded the opportunity to create their own landscaped spaces within their private courtyards. This garden will occur over multiple levels: sympathetic to the existing contours and interface with neighbouring dwellings.

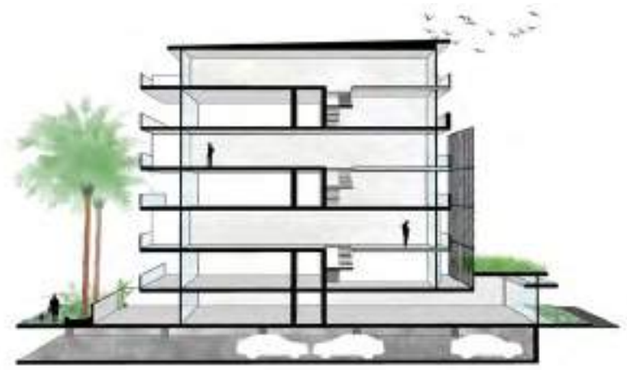
The street wall also facilitates opportunities of planting, softening its interface with the street. Terraces to level one in particular have the opportunity for broad planting.

Finally, the proposal is located in the proximity of a range of recreational landscaped areas. Lake Macquarie and its extensive shoreline is directly accessible from the proposal. Similarly, soccer and Seaman Oval are s short walk away, with the Charlestown Recreation Reserve slightly further afield.

In response to previous comments from the SEPP65 UDRP;

- The communal landscape space has been significantly increased with unhindered northern aspect.
- This space is sufficiently large to support variation in levels and include large trees. Deep root planting zones are provided at the King Street entry stair and southern boundary interface with adjacent sites.
- The podium has been lowered to allow the central garden to be accessible at grade from Howard Street, as well as from some commercial tenancies from King Street.

Landscape Opportunities : The Esplanade



Landscape Opportunities : Howard Street

Podium Garden Landscape Strategy
Refer Terras landscape plan for further information

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Principle 6 : Amenity

Good design positively influences internal and external amenity for residents and neighbours. Achieving good amenity contributes to positive living environments and resident well being.

Good amenity combines appropriate room dimensions and shapes, access to sunlight, natural ventilation, outlook, visual and acoustic privacy, storage, indoor and outdoor space, efficient layouts and service areas and ease of access for all age groups and degrees of mobility.

The proposal has been designed to provide the maximum amenity to the future residents and its neighbours. It achieves – and often exceeds – minimum requirements of the Apartment Design Guide pertaining to solar access, natural ventilation, private open space and overlooking.

Each dwelling has access to private open space, which exceeds the minimum requirements, at all levels. Units lower to the street have been recessed within the street wall envelope maximising privacy and minimising overlooking concerns. A similar treatment has been implemented to the proposal's 'middle'. The upper-most levels have balconies sized to surpass the minimum requirements, and will receive appropriate solar access mid-winter. All units are afforded views across either Lake Macquarie, the internal garden zone, or both.

The units have been designed in such a manner as to ensure solar access, without detrimentally impacting the southern neighbouring dwellings; and that 70% are naturally cross-ventilated.

100% of the units are designed with their kitchens being less than 8 metres from a window.

In response to previous comments from the SEPP65 UDRP;

- The introduction of additional lift cores has maximised dual-aspect apartments and eliminated the use of light wells to achieve natural ventilation.
- All habitable rooms have ventilation, daylighting and outlook.
- All common corridors have ventilation, daylighting and outlook.
- The wide central garden with no built elements to the north significantly increases solar access to the garden. Slender building masses significantly increase solar access to adjacent properties to the south.
- Analysis of solar access to living rooms and decks of apartments has been analysed to confirm compliance with the ADG.

Ceiling Heights : The Esplanade

Ceiling Heights : Howard Street

Commercial : 2.7m minimum; 3.7m typical

Non-habitable : 2.4m

Habitable : 2.7m

SHAC | STEWART ARCHITECTURE

Principle 7 : Safety

Good design optimises safety and security within the development and the public domain. It provides for quality public and private spaces that are clearly defined and fit for the intended purpose. Opportunities to maximise passive surveillance of public and communal areas promote safety.

A positive relationship between public and private spaces is achieved through clearly defined secure access points and well lit and visible areas that are easily maintained and appropriate to the location and purpose.

A range of strategies have been implemented within the design in order to optimise its safety and security. These include:

- Primary residential entries are clearly identifiable off all streetscapes. Their locations facilitate passive surveillance within these streets. Principle commercial entries address all streets, furthering surveillance opportunities.
- Car parking for residents and visitors is located in a secure carpark accessed via Howard Street. The carparks have been designed in such a manner as to allow clear lines of sight.
- Secure access to carparks, lobbies, and residential zones will be provided in the form of keys, swipe cards, or remote controllers. Residents will have direct access to their residential floors via lift access.
- Refer to CTPED report for further information

Principle 8 : Housing Diversity + Social Interaction

Good design achieves a mix of apartment sizes, providing housing choice for different demographics, living needs and household budgets.

Well designed apartment developments respond to social context by providing housing and facilities to suit the existing and future social mix.

Good design involves practical and flexible features, including different types of communal spaces for a broad range of people and providing opportunities for social interaction among residents.

This proposal incorporates a broad mix of unit typologies. One, two and three-bedroom units have been designed in order to respond to differing market desires and enable diversity within the proposal. Within this mix a range of unit types have been developed. These vary in overall footprint ensuring affordability for a range of demographics and budget types.

With Warners Bay looking at developing in the near future, this proposal encourages market diversity and will cater to the changing population dynamics.

Units have been designed to afford open-plan living and dining spaces for occupants. These spaces flow onto large balconies assisting flexible living arrangements.

A large communal space has been provided to the centre of the proposal facilitating a broad range of activities and encouraging year-round use. This variety of activities encourages social interaction between residents.

Private + Common Open Space : The Esplanade

Private + Common Open Space : Howard Street

Principle 9 : Aesthetics

Good design achieves a built form that has good proportions and a balanced composition of elements, reflecting the internal layout and structure. Good design uses a variety of materials, colours and textures.

The visual appearance of a well designed apartment development responds to the existing or future local context, particularly desirable elements and repetitions of the streetscape.

This proposal has been designed as a high quality architectural contribution to the local built environment and encapsulates the desired future character of the area whilst being respectful to its current context.

In keeping with the requirements of the Lake Macquarie Development Control Plan; a masonry street-wall has been instilled along all street elevations. Constructed of light masonry elements; it effectively breaks down apparent scale and bulk, bringing an appropriate human scale to the buildings' street interfaces.

Ample opportunties for planting are provided: softening the buildings interface with the streets, and its impact on neighbouring dwellings.

The further breaking down of the facades - in to distinct 'middle' and 'upper' elements only further this break down of scale. The uppermost levels are designed to seemingly 'float' above their more substantial counterparts - only accentuated by the fine roofscape.

Ultimately; this design responds positively to the existing Warners Bay neighbourhood and provides exceptional amenity to its future residents and those currently inhabiting the neighbouring dwellings.

The Esplanade

Howard Street

7 – DCP COMPLIANCE TABLE

LMCC DCP 2014 Checklist

Proposed Mixed Use Development
482 The Esplanade Warners Bay

Part 4 – Development in Business Zones		
ISSUE	**RELEVANCE**	**COMMENT AND SECTION**
INTRODUCTION		
Additional Controls for Specific Land Uses	Yes	Given a component of the mixed use development is for a Residential Flat Building. Part 9 of LMCC LEP has also been addressed as has specific requirements of the Warners Bay Area plan.
Aims for Development in Business Zones	Yes	The proposed development is considered to be consistent with the aims for development in Business Zones.
B2 Local Centres	Yes	The proposed land uses are consistent with the identified preferred land uses which provide for commercial premises at ground level and residential apartments above.
CONTEXT AND SETTING		
Site Analysis	Yes	A Site Analysis Plan has been prepared and is provided as part of the Architectural Drawings within **Appendix 2**.
Scenic Values	Yes	As addressed within the SoEE and Visual Impact Statement provided within **Appendix 4**, it is not expected that the proposal will result in the loss of identified public or private view corridors The height of the proposed building is within the prescribed height limit for the site with some minor exceptions and is considered to be in keeping with the desired character for the Warners Bay Area Plan.
Geotechnical	Yes	A Geotechnical Assessment of the site has been undertaken. The site is within a Mines Subsidence Area and Mine Subsidence Board approval is required. A structural engineer has reviewed the proposal and provided structural engineers certificate refer **Appendix 10.**
Cut and Fill	Yes	Due to the slope of the site (4 metres from east to west) significant cut will be required to provide the proposed basement car parking. The design of the building uses the slope such that commercial frontage is provided at street level at both The Esplanade and Howard Street frontages. Bored Piles and shoring will be required.
Mine Subsidence	Yes	The proposed development is considered to be integrated development under Section 91 of the Environmental Planning and Assessment Act, 1979, because the proposed development is within a Mine Subsidence Area. Mine Subsidence Board is required under S15 of the Mine Subsidence Compensation Act 1961. Council will refer the application to the Mine Subsidence Board.
Contaminated Land	yes	Environmental reports have identified the site contains contaminated soils in the vicinity of the operational area of the existing service station. This material has been classified as General Solid Waste and will require disposal to an approved landfill site. Other non- contaminated material

		satisfies ENM criteria and can be used as fill on other sites. (Refer to **Appendix 11.**
Acid Sulfate Soils	Yes	The subject site is not identified as containing Acid Sulphate Soils. Refer to Environmental Reports (**Appendix 11.)**
Stormwater Management	Yes	A Stormwater Management Report and Plan has been prepared and is included as **Appendix 9 .** The plans demonstrate that the proposed development is acceptable in terms of stormwater and drainage.
Catchment Flood Management	N/A	The site is not identified as being subject to flooding.
Lake Flooding and Tidal Inundation (incorporating sea level rise)	N/A	The site is not subject to Lake Flooding or Tidal inundation.
Natural Water Systems	N/A	No natural Water Systems are within close proximity to the site.
Bushfire	N/A	The site is not on bushfire prone land
Flora and Fauna	N/A	Trees on the site will be removed. Arborist Report has been prepared and is pr*ovid*ed within Appendix F.
Preservation of Trees and Vegetation	N/A	The development form anticipated for the B2 zone and with the Warners Bay Area Plan anticipates the loss of trees across the site. Landscaping is to be provided including deep soil planting as part of the development. Refer to **Appendix 3**.
European Heritage	N/A	The subject site is not identified as containing any items of European Heritage Significance, nor is it identified as being located within either a heritage conservation area or within proximity to any known heritage items.
Aboriginal Heritage	N/A	The subject site is not identified as containing any items of Aboriginal Heritage Significance, nor is it identified as being located within 100m of an Aboriginal Site or Place.
Natural Heritage	N/A	The subject site is not within 50m of an item of natural heritage significance.
Social Impact	Yes	The proposed development will have several significant social and economic benefits to the local community. These include: • Provision of additional housing to satisfy and contribute to on-going demand; • Increase housing choice and contribution to more affordable housing; • Provision of adaptable housing units as part of the development • Increased commercial opportunities and activation of the street frontage. • Contributes to meeting the objectives of urban communities including efficient use of land and associated ESD Principles; and • Capital investment will provide for local positions of employment.
Economic Impact	Yes	The proposal will generate employment opportunities and associated spending during construction works and

		additional housing following completion. The proposal will positively contribute to the Warners Bay Town Centre and surrounding area.
Lot Amalgamation	Yes	The existing sites will be consolidated as part of the development.
Utility Infrastructure	Yes	Public utility services including reticulated water and sewer, electricity, and telecommunications are available to the site and will be upgraded as necessary. It is understood underground electricity will be required for the development. A chamber substation is proposed off Howard Street.
Sites where a Concept Plan is Required	N/A	The site is not identified as requiring a concept plan.
STREETS AND PUBLIC SPACE		
Pedestrian Links through Buildings	Yes	The podium level provides for pedestrian access through the site. Public pedestrian links are not required.
Streetscape Improvements	Yes	The proposed development will upgrade and enhance the existing streetscape along all street frontages.
Non-discriminatory Access	Yes	A Disability Access Report has been provided with this application. Adaptable units, have been incorporated into the development. The Access Report is included as **Appendix 15.**
Lighting	Yes	Appropriate lighting will be installed throughout the development in accordance with Australian Standards.
ACTIVE STREET FRONTAGE		
Ground Floor Residential Uses in the Business Zones	Yes	As required by the controls in this section of LMCC DCP 2014 and Clause 7.10 of LMCC LEP 2014 The proposal is also consistent with Clause 7.10(3) as the residential flat building proposed forms part of a mixed use development which includes ground floor commercial component.
Ground Floor Entries	Yes	The architecturally designed building has ensured that the entry to the commercial premises is located on the street frontage and clearly recognisable. King Street facades have been set back to facilitate access having regard for the slope of the site.
Street Awnings	Yes	A low profile awning has been provided along the each street frontage to complement the development and provide weather protection for pedestrians out the front of the Commercial Premises. The awning will not be continuous along King Street due to the podium between the two building elements.
ACCESS AND PARKING		
Traffic and Vehicle Access	Yes	A Traffic Impact Assessment has been prepared and is provided within **Appendix 8**. Vehicular Access to the site will be provided via Howard Street being the minor road of the three frontages. Two levels of basement car parking area proposed.
Design of Parking and	Yes	As demonstrated by the Traffic Impact Assessment it is considered that the proposed development provides

Service Areas		sufficient and adequate on-site car parking to meet the requirements and design standards of this Section of LMCC DCP 2014 and Australia Standards AS2890.1-2004 Parking Facilities – Part 1 off-street car parking.
Bike Parking and Facilities	Yes	Bicycle parking has been provided within the basement car park of the development in nominated storage areas.
Motor Bike Parking	Yes	Motorcycle parking has been provided within the basement car park of the development.
Car Parking Rates	Yes	The following rates for Commercial Premises and Residential Flat Buildings are applicable: **Commercial Premises** – 1 space per 40m2 GFA; **Residential Flat Buildings** – 0.5 spaces per 1 bedroom unit;0.75 spaces per 2 bedroom units; 1 space per 3 bedroom units; and 0.25 spaces per unit for visitor parking. The site is located within the B2 Local Centre Zone and is located on a bus route Parking is excess of Council requirements has been provided. The allocation of parking spaces is to be addressed in the strata subdivision application. A 20% reduction in the number of visitor spaces is sought having regard for the over supply of allocated spaces to residential apartments, opportunities for multipurpose trips to commercial facilities and the availability of some kerb side parking in Howard Street and The Esplanade
DEVELOPMENT DESIGN		
Front Setbacks – Main Street Shops in B1 B2 and B3 Zones	Yes	The Esplanade frontage is built to the boundary at street level other than that the entries and an area for landscaping has been set back from the boundary. The King Street façade has been set back to facilitate pedestrian access and address the slope of the land. The Howard Street frontage is built to the boundary. It is considered the design solution satisfies the objectives of this clause. The Howard Street Building in built to the boundary at street level for the commercial frontage. A roof garden is provided above level 1 and the building setback from the street for all upper level apartments.
Façade Articulation	Yes	The development has incorporated façade articulation into the design. Refer to SEPP 65 Design Verification Statement
Building Exteriors	Yes	The design has included design elements and high quality materials and finishes which are consistent with the controls of this Section of the LMCC DCP 2014.
Building Separation	Yes	The building has been designed to comply with the building separation requirements for residential flat buildings in accordance with SEPP 65 Design Quality of Residential Flat Buildings and the accompanying

		Residential Flat Building Design Code. A Design Verification Statement has also been provided in support of the development plans provided in **Appendix 6**.
Side and Rear Setbacks	Yes	The development does not comply with side boundary setback controls for the Lakefront Building. The DCP specifies that buildings where possible must be built to the side boundary at street level and to the second level. This is achieved. The depth should however not exceed 12 metres from the street boundary. The Lakefront building has a depth of greater than 12 metres with a wall length of 20.4 metres broken up with a 4.8 metre long void. If the above is not achieved the DCP states that buildings must otherwise be setback a minimum of 1.5 metres from the side boundary for the first and second floor and 3.0 metres for the third level The Lakefront Building is built to the southern boundary for the first four levels. In support of this position it is submitted that the length of wall built to the boundary is only 20.4 metres broken up by a 4.8 metre long void adjacent to bathrooms which is set back from the boundary. No openings are provided to the boundary other than glazed bathroom windows. Privacy is therefore not an issue. Privacy screens are provided on balcony edges. Part 10 Warners Bat Area Plan Cl 7.3 specifies for Building Type C specifies each façade must be at least 3 storeys high at the street boundary. This supports more than 2 levels being built to the boundary. The setback of the adjoining building from the boundary will allow some light and ventilation for those dwellings. The Howard Street building is built to boundary at the street level which creates a wall as the site slopes away from Howard Street. With the exception of the stair and lift well located on the southern end of the building the building is set back 4.88 metres. The lift and stair well is set back 2.2 metres. No windows are proposed in the southern elevation of the building.
Minimum Landscaped Area	Yes	Landscaping Plans (Category 3) for the proposed development have been prepared and are provided within **Appendix 3**. The proposed landscape design has included street tree planting, raised planting beds, and deep soil planting.
Building Depth	Yes	All proposed habitable floor spaces areas are within nine metres of an adequate natural light source.
Maximum Occupied Area	Yes	The proposed development does not exceed the allowed maximum occupied area.
Setbacks from Residential Zoned Land	N/A	Adjoining land is zoned B2
Building Height	Yes	The maximum building height map under Lake Macquarie

		LEP 2014 for the area prescribes a maximum building height of 22m for the site. Cl 6.12 and Part 10 Warners Bay Area Plan specifies a maximum of 6 storeys. The proposed building complies within the allowable height limit around the site perimeter however due to ground level variation there are minor height exceedances with respect to lift over runs and part of the roof structure. Refer to SoEE it is considered the objectives of the standard are satisfied by the design outcome and the one additional storey will not have a significant impact on surrounding development.
Building Height at the Street	Yes	The proposal will provide three storeys in height along both street frontages in accordance with Part 10 of DCP 2014.
Floor to Ceiling Heights	Yes	The proposal is compliant with the minimum floor to ceiling height limits. Ground Floor commercial, upper floors commercial 3.0 residential 2.7.
Roofs	Yes	The proposed roof form is to be flat. 2% pitch. Due to the relative height, extent and location of lift over runs it is not considered necessary for them to be integrated within the roof or within an architectural roof feature.
Views	Yes	A Visual Impact Statement has been prepared to accompany the Development Application. A copy of this is provided within **Appendix 4.** The proposed building does not intercept any public or private view corridors. The proposed building fits within the building envelope anticipated in the Warners Bay Area Plan. The development will provide a positive streetscape outcome and the building will frame the view of the Lake from King street.
Balconies and Communal Open Space	Yes	The proposed development proposes to provide a 88.2m^2 communal outdoor area. In addition to this each unit will have a principle private open space area in the form of a balcony which all exceed the required 8m^2 minimum area.
Planting on Structures	Yes	A raised garden bed is proposed to be provided around the edge of the Communal Terrace Area on Level 1.
Solar Access and Orientation	Yes	The proposed development is generally compliant with this element of LMCC DCP 2014 and the Architect has given particular consideration to ensure solar orientation of the communal open space area and living areas for each of the individual units. The proposal orientates living rooms and private open spaces to the north or west (to access lake views). 26% of apartments have north orientation and receive sunlight throughout the day. The remaining 74% of apartments have living rooms and private open space orientation to the west and receive direct sunlight for 3 hours between 9am and noon. 100% of apartments receive direct sunlight between 9am and 3pm at mid-winter (exceeding the minimum requirement of 85%) A Shadow Diagram Plan has been prepared as part of the proposed development application and is submitted with the architectural plans provided within **Appendix 2.**

Energy Efficient and Generation	Yes	The architecturally design development has been designed to achieve the energy requirements of the BCA. All buildings will achieve a minimum 5 star green rating. The design incorporates efficiencies such as water reuse and energy minimisation while ensuring tenant and comfort through appropriate window screens, glazing, energy efficient air conditioning systems and lighting.
Visual Privacy	Yes	Visual privacy to external dwellings has been considered and no windows are proposed other than frosted bathroom windows are proposed on the southern boundary. Screens will be provided on ends of balconies to minimise direct or close views.
Acoustic Privacy		An acoustic of the development has been undertaken. The development can achieve internal comfort levels in accordance with Australian Standards this is achieved through.
Safety and Security	Yes	The proposed development responds to the CPTED principles based on the following: • Given the proposal seeks to upgrade the entire site and associated landscaping, significant passive surveillance opportunity will exist to deter anti-social behaviour; • The site is located at the southern end of a well established commercial area with new and upgraded commercial facilities within a residential fringe. Passive surveillance opportunities exist from surrounding businesses; and • Appropriate lighting and CCTV will be installed throughout the development.
LANDSCAPE		
Landscape Design	Yes	Landscaping Plans (Category 3) for the proposed development have been prepared by Terras Landscape Architects and are provided within **Appendix 3** of this report. Development of the site will require removal of existing trees on the site. The site will be transformed from low scale residential and commercial uses to a modern mixed use development site. It is proposed to provide a sustainable landscape outcome that includes soft landscaping and built form elements. The deep soil zone on the southern boundary is lower than the podium level to soften visual impact to neighbours. Significant planting will be provided at the entry to the podium level off King Street. The proposed development will upgrade and enhance the existing streetscape. Paving of footways and street tree planting will compliment site landscaping. Landscaping will provide visual relief and screening and quality communal open space for residents. In keeping with LMCC requirements and crime prevention through environmental

		design (CPTED) practices, the landscape is designed to ensure adequate visual surveillance will be maintained.
Street Trees and Streetscape improvements	Yes	The proposed development will upgrade and enhance the existing streetscape. Footpaths will include full width paving with streets trees.
Landscape and Tree Planting in Front Setback Areas	Yes	Planting is provided in setbacks to The Esplanade.
Landscape and Tree Planting in Car Parks	N/A	All parking is under the building.
OPERATIONAL REQUIREMENTS		
Demolition and Construction Waste Management	Yes	Waste disposal from the proposed demolition and construction will be undertaken by an appropriate contractor. Any left-over building materials will be recycled where possible at a licensed recycling facility. Any non-recyclable items will be removed from site and transported to a licensed waste management facility. Excavated material classified as Solid Waste will be disposed of to landfill.
Waste Management	Yes	Storage and Collection areas for garbage and recycling have been provided within a designated area within the Basement Car Park. Waste collection is proposed via by a private contractor with bins will generally be presented to Howard Street for collection. Establishment of a loading zone adjacent to the bin collection area is requested. Overall it is considered that the development can be adequately serviced with regard to waste storage and collection.
On-site Sewage Management	N/A	The proposed development will be connected to reticulated sewer.
Liquid Trade Waste and Chemical Storage	N/A	
Erosion and Sediment Control	Yes	All relevant measures will be undertaken to prevent erosion and sediment impacts, in accordance with the DCP and erosion and sediment control plan provided where applicable during construction works. A copy of the Erosion and Sediment Control Plan is provided within **Appendix 9.** Groundwater is discussed in the Remediation Action Plan included in **Appendix 11.**
Air Quality	NA	Construction management will occur as per conditional requirements. No operation air quality impacts are anticipated.
Noise and Vibration	Yes	An Acoustic Assessment of the proposed development has been undertaken by Spectrum Acoustic and is provided within **Appendix 13.** The assessment has confirmed that there is no acoustic reason why the proposal cannot be supported.

Part 9 – Specific Land Uses – Residential Flat Buildings		
ISSUE	**RELEVANCE**	**COMMENT AND SECTION**
RESIDENTIAL FLAT BUILDINGS		
Site Requirements	Yes	The development site has an area of 5093m^2 and direct frontage to The Esplanade, King Street and Howard Streets. Street frontages exceed 20 metres.
Housing Mix	Yes	The proposal provides a mix of dwelling types. The proposal comprises the following: 26 x 1 Bedroom Units; 56 x 2 Bedroom Units; and 30 x 3 Bedroom Units.
Street Setback	N/A	
Side Setback	Yes	Residential flat buildings must be setback a minimum of 3.0 metres according to DCP. Setbacks are discussed in the SoEE while the proposal does not comply with setbacks privacy issues have been addressed by not facing widows to the south for habitable rooms. Shadow diagrams have been produced for both the proposal and a complying development outcome and there is no difference in the impact. Refer to **Appendix 2 (Additional Shadow diagrams)**
Site Coverage	N/A	
Landscape Area	Yes	Landscaping Plans (Category 3) for the proposed development have been prepared and are provided within **Appendix 3**. The proposed landscape design has included street tree planting, garden beds, planter boxes and hard landscaped areas. While some deep soil planting is provided it does not meet the 20% requirement. Deep root zones are less than 7% of site area. Raised planters are used to ensure substantial planting at the podium level.
Planting on Structures	Yes	Planter boxes, pots have been used to provide landscaping over the structured car park.
Landscape and Tree Planting in Front Setback Areas	Yes	As shown on the Landscape Plans provided within **Appendix 3** where practical street trees will be provided. Landscaping is considered appropriate given the sites urban context.
Street Trees	Yes	

Principle Private Open Space	Yes	The proposed development proposes to provide approximately 1800 m^2 of communal outdoor area. In addition to this each unit will have a principle private open space area in the form of a balcony which all can either achieve or exceed the required 8m^2 minimum area.
Services	Yes	Where required plants and all air-conditioning units will be acoustically insulated.
Driveways and Parking Areas	Yes	The proposed development complies with all of the controls applicable for driveways and parking areas. The proposal is consistent with the following: • On-site parking has been provided in 2 basement levels of the development; • Stacked parking has been provided where two spaces per apartment are proposed, • Access is to be provided via the secondary street frontage (Howard Street).
Adaptable Dwellings	Yes	11 adaptable dwellings and 22 liveable 'silver' class dwellings are provided. This achieves the target for universal design in the Apartment Design Guide. Part 9 of Council's DCP 2014 requires for residential flat buildings of more than 10 dwellings, one adaptable dwelling must be provided for every 10 dwellings.
Waste Management	Yes	Waste management for the proposed development will be carried out in accordance with Council's Waste Management Guidelines. A Site Waste Minimisation and Management Plan (SWMMP) (Council's pro-forma) has been prepared and is included as **Appendix 12**.

Part 10 - Town Centre Area Plans – Warners Bay		
ISSUE	**RELEVANCE**	**COMMENT AND SECTION**
INTRODUCTION		
Town Centre Structure	Yes	The proposed development is consistent with the desired Town Centre Structure in particular objective d as the proposal will provide mixed use commercial and residential development on the site. The Warners bay Town Centre lies on low ground surrounded be a vegetated ridge line. The setting is best appreciated from the open water of the Lake and vantage points around the lake. The Warners bay Area Plan if fully implemented will change the character of the built landscape.
Environmental Constraints		The site is above RL 3.0 m AHD. Preliminary investigations indicate that acid sulfate soils are not present on the site. The site is within a mine subsidence area
Desired Future Character		The proposal is consistent with the built form and land use character envisaged in the Warners Bay Area Plan.
DEVELOPMENT CONTROLS		
Building Types	Yes	The site is identified as being suitable for Building Type C in the Area Plan. Objectives include ensuring higher building do not have an adverse visual impact on the treed ridgeline back drop to Warners Bay. Establish a clear street wall with smaller facades and good quality architectural detailing. The following controls apply: • Each façade must be a least three storeys high at the street boundary • Each façade must be no more than 10m in width • Wider building must be composed of narrower facades • Façade predominantly masonary construction with punched voids for balconies windows and doors • Shop front glazing at street level to be between 70 and 90% of the frontage width. • Continuous glazing not acceptable. The building design attempts to break the breakup the façade by providing a top middle and bottom to the development. The framing elements provided on the lower levels also break up the façade at the street level.
Concept Plan Sites	N/A	
Mix of Uses	Yes	Street level commercial development provides opportunities for cafes / restaurants that would complement extended trading hours. Residential development is provided on the upper levels
Public Domain		Upgrading of the footways and providing development at street level that activates the street will provide positive

		public domain outcomes.
Pedestrian and cycle facilities		Footways will be upgraded as part of the development
Public transport		The area plan shows a bus stop on King Street west of Howard Street a bus shelter will be provided by the developer.
Upgraded Road Facilities		Future Plans to upgrade the intersection of King Street and The Esplanade to provide traffic signals are noted.
Car Parking		Appropriate levels of car parking are provided.
BUILDING DESIGN		
Building Height		Maximum number of storeys is exceeded but building fits with height limits other than minor exceedances noted in SOEE and addressed in clause 4.6 exception report.
Maximum Occupied Area		Maximum Occupied area complies with requirement of maximum 50% of site area. Units only area is 1890 m^2 which is 37% of site. Including balconies is 2560 m^2 or 50%.
Balconies		Balconies are an extension of the built form and form a continuous street façade. Balconies are not set back from the face of the building.

8 – TRAFFIC AND PARKING ASSESSMENT

D08347832

TRAFFIC & PARKING ASSESSMENT

MIXED USE DEVELOPMENT
LAKEHOUSE VILLAGE

LOTS 1 & 2 IN DP 1116535, LOTS 3 & 4 IN DP 32518, LOT 122 IN DP 578045 AND LOTS 1, 2, & 3 IN DP 155951

482 – 488 THE ESPLANADE, 12 – 16 KING STREET & 1 HOWARD STREET, WARNERS BAY

PREPARED FOR: BLOC (ACT) PTY LTD

MARCH 2017

17/021

TRAFFIC AND PARKING ASSESSMENT
BLOC (ACT) Pty Ltd

MIXED USE DEVELOPMENT
LOTS 1 & 2 IN DP 1116535, LOTS 3 & 4 IN DP 32518,
LOT 122 IN DP 578045 AND LOTS 1, 2, & 3 IN DP 155951

482 – 488 THE ESPLANADE, 12 – 16 KING STREET
& 1 HOWARD STREET, WARNERS BAY

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QUALITY ASSURANCE

This document has been prepared, checked and released in accordance with the Quality Control Standards established by Intersect Traffic Pty Ltd.

Issue	Date	Description	By
A	13/03/13	Draft	PA
B	20/03/17	Edit	JG
C	22/03/17	Final Proof / Client Amendments	JG
D		Approved	JG

This document has been authorised by 

Date March 2017

Disclaimer

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EXECUTIVE SUMMARY

Intersect Traffic Pty Ltd has been engaged by BLOC (ACT) Pty Ltd to prepare a traffic and parking assessment report for a mixed-use development on Lots 1 & 2 in DP 1116535, Lots 3 & 4 in DP 32518, Lot 122 in DP 578045 and Lots 1, 2, & 3 in DP 155951, 482 – 488 The Esplanade, 12 – 16 King Street & 1 Howard Street, Warners Bay.

The proposal involves the demolition of all the buildings on the site and the construction of a mixed-use development containing two levels (basement and lower ground) of on-site parking, six (6) commercial tenancies (lower ground and ground floor) and one hundred and twelve (112) 1, 2 & 3 bedroom residential apartments within two separate towers above the lower ground floor (presenting as seven levels to the street). A new combined entry / exit driveway and access crossing provides vehicular access off Howard Street approximately 30 metres south of King Street. The development concept plans are shown in ***Attachment A***. The report has concluded the following:

- The proposed development is likely to generate approximately 106 vtph during the AM weekday peak traffic periods, 78 vtph during the PM weekday peak traffic periods or 687 vtpd. This only represents an increase on existing site traffic of approximately 27 vtph in the AM peak and no increase in the PM peak.
- The local road network around the site has sufficient capacity to cater for the development without the need to upgrade the local road network.
- The proposed development therefore does not adversely impact on the local road network.
- The proposed vehicular access to the site is suitable and would comply with Australian Standard *AS2890.1 – 2004 Parking facilities – Part 1 Off street car parking* and *Lake Macquarie City Council's DCP 2014 – Revision 6 – Part 9 – Specific Land Uses Residential Flat Buildings - Section 13.12 of the Driveways and Parking Areas.*
- The proposed access also complies with RMS requirements for vehicular access to be off a secondary road if possible for developments on classified roads. The removal of the existing accesses off King Street and The Esplanade also results in a positive impact on the road network and this needs to be considered in any merits based assessment of the development.
- The proposed on-site car parking supply and layout is suitable and would comply with Australian Standard *AS2890.1 – 2004 Parking facilities – Part 1 Off street car parking* and *Lake Macquarie City Council's Warners Bay Town Centre Area Plan and its DCP (2014) for residential and business zones.*
- The servicing arrangements within the development are suitable though Council approval for a 15 metre loading zone on Howard Street immediately north of the development's vehicular access will be required.
- Suitable public transport services already exist to the site and no additional services or infrastructure is required. S94 contributions collected from the development will be used to upgrade a number of bus stops in King Street; and
- It is not considered that the external pedestrian and bicycle traffic generated by the development would not be significant enough to provide a nexus for the provision of additional external pedestrian and bicycle infrastructure (on or off road) to the site as the existing infrastructure near the site is considered satisfactory for the scale of development proposed. However the pedestrian footpath along the three site frontages would need to be reconstructed to full width in accordance with the requirements of *Lake Macquarie City Council's Warners Bay Town Centre Area Plan.*

Having carried out this traffic impact assessment for a mixed-use development on Lots 1 & 2 in DP 1116535, Lots 3 & 4 in DP 32518, Lot 122 in DP 578045 and Lots 1, 2, & 3 in DP 155951, 482 – 488 The Esplanade, 12 – 16 King Street & 1 Howard Street, Warners Bay it is recommended that the proposal can be supported from a traffic impact perspective as it will not adversely impact on the local and state road network and complies with the requirements of Lake Macquarie City Council, Australian Standards and NSW Roads and Maritime Services.

CONTENTS

ATTACHMENTS

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TABLES

1. INTRODUCTION

Intersect Traffic Pty Ltd has been engaged by BLOC (ACT) Pty Ltd to prepare a traffic and parking assessment report for a mixed-use development on Lots 1 & 2 in DP 1116535, Lots 3 & 4 in DP 32518, Lot 122 in DP 578045 and Lots 1, 2, & 3 in DP 155951, 482 – 488 The Esplanade, 12 – 16 King Street & 1 Howard Street, Warners Bay.

The proposal involves the demolition of all the buildings on the site and the construction of a mixed-use development containing two levels (basement and lower ground) of on-site parking, six (6) commercial tenancies (lower ground and ground floor) and one hundred and twelve (112) 1, 2 & 3 bedroom residential apartments within two separate towers above the lower ground floor (presenting as seven levels to the street). A new combined entry / exit driveway and access crossing provides vehicular access off Howard Street approximately 30 metres south of King Street. The development concept plans are shown in ***Attachment A***.

This report is required to support a development application to Lake Macquarie City Council and allow the Council and NSW Roads and Maritime Services (RMS) to assess the proposal in respect of its impact on the local and state road network.

This report presents the findings of the traffic assessment and includes the following:

1. An outline of the existing situation near the site.
2. An assessment of the traffic impacts of the proposed development including the predicted traffic generation and its impact on existing road and intersection capacities.
3. Reviews parking, public transport, pedestrian and cycle way requirements for the proposed development, including assessment against Council and RMS standards and requirements.
4. Presentation of conclusions and recommendations.

2. SITE DESCRIPTION

The subject site is shown in ***Figure 1*** below. It is located on the south-eastern corner of the King Street / The Esplanade roundabout intersection at Warners Bay on the southern outskirts of the Warners Bay shopping and commercial area.

The site contains eight separate land titles as follows:

- Lot 1 in DP 1116535 - 482 The Esplanade and 16 King Street, Warners Bay;
- Lot 2 in DP 1116535 - 482 The Esplanade and 16 King Street, Warners Bay;
- Lot 3 in DP 32518 – 486 – 488 The Esplanade, Warners Bay;
- Lot 4 in DP 32518 - 486 – 488 The Esplanade, Warners Bay;
- Lot 122 in DP 578045 - 16 King Street and 482 The Esplanade, Warners Bay;
- Lot 1 in DP 155951 – 14 King Street, Warners Bay;
- Lot 2 in DP 155951 – 12 King Street, Warners Bay; and
- Lot 3 in DP 155951 – 1 Howard Street, Warners Bay.

The site has a total area of approximately 5,094 m^2 and is zoned B2 – Local Centre pursuant to Lake Macquarie City Council's LEP (2014). The site has frontage to King Street, The Esplanade and Howard Street and currently contains a service station and four (4) residential dwellings. Site vehicular accesses include: 2 commercial crossings at the service station and 1 residential crossing at King Street; 1 commercial crossing at the service station and 2 residential crossings at The Esplanade; as well as 2 residential crossings at Howard Street. ***Photographs 1 & 2*** below shows some of the existing site development while ***Photographs 3 & 4*** shows some of the existing vehicular accesses at the site.

Figure 1 – Site Location

Photograph 1 - Existing Site Development – King Street

Photograph 2 - Existing Site Development – Howard Street

Photograph 3 - Existing Vehicular accesses – King Street

Photograph 4 - Existing Vehicular accesses – The Esplanade

3. EXISTING ROAD NETWORK

King Street, The Esplanade and Howard Street are the roads predominately impacted by the proposed mixed use development.

King Street connects the nearby Lakelands suburb and traffic from northwest, north and north eastern suburbs of Lake Macquarie areas to Warners Bay and to The Esplanade for travel to the east and west along the Lake Macquarie foreshore. It is a sub arterial road (B89) which is a classified road and therefore is under the care and control of the NSW Roads and Maritime Services (RMS). Under a functional road hierarchy, it functions as a sub-arterial road connecting sub regions in the lower Hunter area. King Street is generally a four-lane two-way high standard sealed urban road with marked lane widths between 3.3 and 4.1 metres. Near The Esplanade both sides of King Street have kerb and gutter with on-street parking prohibited along the site frontage on the approach to the roundabout intersection with The Esplanade. Time limited (2 hours) angled on-street parking exists on King Street on the northern side of the street opposite the development. A 40 km/h speed limit applies to this section of road as a high pedestrian area being within the Warners Bay Town Centre and at the time of inspection King Street was observed to be in good condition. ***Photograph 5*** shows King Street near the site.

Photograph 5 - King Street near the site

The Esplanade runs along the foreshore of Lake Macquarie at Warners Bay. It collects and distributes traffic from and to the local residential and commercial streets of Warners Bay. South of King Street it continues as the same sub arterial road (B89) as King Street which is a classified road and therefore is under the care and control of the NSW Roads and Maritime Services (RMS). North of King Street it is a major local road and is under the care and control of Lake Macquarie City Council. Under a functional road hierarchy, it functions as a major collector road connecting local roads in the area and distributing traffic to other transportation routes. The Esplanade is a four-lane two-way high standard sealed urban road with lane widths between 3.2 and 3.4 metres. In the vicinity of King Street both sides of the road have kerb and gutter. Along the site frontage a parallel parking lane exists on the eastern side of the road only and a 40 km/h speed limit applies to this section of road. At the time of inspection, The Esplanade was observed to be in good condition. ***Photograph 6*** shows The Esplanade near the site.

Photograph 6 – The Esplanade near the site

Howard Street under a functional road hierarchy operates as a local two-way two-lane urban street providing vehicular access to properties along its length. It connects to both King Street and The Esplanade creating an urban block and near the site has a sealed carriageway width of approximately 11.5 metres providing a single lane of travel in each direction. Both sides of the road have kerb and gutter and parking lanes which are approximately 2.7 metres wide. A 50 km/h speed zoning exists in front of the proposed site access in Howard Street though 40 km/h applies near King Street. At the time of inspection Howard Street was observed to be in good condition. ***Photograph 7*** shows Howard Street near the site.

Photograph 7 – Howard Street near the site

4. ROAD NETWORK IMPROVEMENTS

There are no known road upgrades near the site that will increase the capacity of the surrounding road network. Lake Macquarie City Council has identified within its Warners Bay Town Centre Plan that the existing roundabout at the King Street / The Esplanade intersection will be upgraded to traffic signals in the future. Whilst this would provide some additional capacity within this intersection and thus the local road network it is thought this upgrade has more to do with pedestrian safety i.e. safer road crossing facilities for pedestrians rather than road network capacity issues particularly in regard to The Esplanade.

Improvements to the local road network may be undertaken in the future in line with Lake Macquarie City Council's and NSW Roads and Maritime Services Works Programmes.

5. TRAFFIC VOLUMES

On behalf of Intersect Traffic Pty Ltd, Northern Transport Planning and Engineering (NTPE) undertook manual traffic counts at the Esplanade /King Street roundabout intersection on 23rd February 2017 to determine the likely AM and PM peak hour traffic flows. From the counts obtained the 8:00 AM to 9:00 AM and 5:00 PM to 6:00 PM periods were determined as the peak AM and PM count periods respectively. The manual traffic count sheets sourced from the NTPE counts are shown in ***Attachment B***. These counts identified the following approximate current peak hour traffic counts:

- 1,618 vtph (AM) and 1,597 vtph (PM) in King Street;
- 1,765 vtph (AM) and 2,089 vtph (PM) in The Esplanade north; and
- 2,445 vtph (AM) and 2,546 vtph (PM) in The Esplanade south;

These traffic volumes in King Street and The Esplanade have been adopted as the existing peak traffic volumes for assessment in this report.

Adopting a background traffic growth rate of 1.5 % per annum (lower Hunter average background traffic growth) the likely 2027 traffic volumes also adopted for this report are as follows;

- 1,880 vtph (AM) and 1,855 vtph (PM) in King Street;
- 2,050 vtph (AM) and 2,425 vtph (PM) in The Esplanade north; and
- 2,840 vtph (AM) and 2,955 vtph (PM) in The Esplanade south;

6. ROAD CAPACITY

The capacity of the road network is generally determined by the capacity of intersections. However, RMS' *RTA's Guide to Traffic Generating Developments* provides some guidance on mid-block capacities and likely levels of service.

For urban roads *Table 4.3 and 4.4* of the RMS' *RTA's Guide to Traffic Generating Developments*, reproduced below, provides some guidance on mid-block capacities and likely levels of service.

Table 4.3
Typical mid-block capacities for urban roads with interrupted flow

Type of Road	One-Way Mid-block Lane Capacity (pcu/hr)	
Median or inner lane:	Divided Road	1,000
	Undivided Road	900
Outer or kerb lane:	With Adjacent Parking Lane	900
	Clearway Conditions	900
	Occasional Parked Cars	600
4 lane undivided:	Occasional Parked Cars	1,500
	Clearway Conditions	1,800
4 lane divided:	Clearway Conditions	1,900

Source: - RTA's Guide to Traffic Generating Developments (2002).

Table 4.4
Urban road peak hour flows per direction

Level of Service	One Lane (veh/hr)	Two Lanes (veh/hr)
A	200	900
B	380	1400
C	600	1800
D	900	2200
E	1400	2800

Source: - RTA's Guide to Traffic Generating Developments (2002).

A desirable level of service on an urban road is generally considered to be a level of service (LoS) C or better however on sub-arterial roads such as King Street and The Esplanade south and major collector roads such as The Esplanade north a LoS D is still considered acceptable. Noting a LoS E on two-lanes per direction flow occurs when mid-block traffic volumes exceed 2,800 vtph the two-way four-lane mid-block traffic volume threshold for a LoS D is 5,600 vtph. This means the two-way four-lane mid-block traffic volume threshold for a LoS D for King Street and The Esplanade is 5,600 vtph.

Therefore, it is considered that King Street and The Esplanade near the site have two-way mid-block road capacities of up to 5,600 vtph and this road network capacity has been adopted in this report.

7. ALTERNATE TRANSPORT MODES

Public transport in the area is provided by both Newcastle Buses and Ferries and Hunter Valley Buses. Newcastle Buses and Ferries runs route 363 (Warners Bay to Newcastle) near the site providing convenient public transport access to these centres as well as Stockland's Glendale, Cardiff Railway Station, John Hunter Hospital and Broadmeadow Railway Station. Hunter Valley Buses runs Route 269 (Toronto to Charlestown) providing access to many other bus routes to railway stations and destinations.

Route maps for these services are provided within ***Attachment C***. Bus stops are provided within convenient walking distance (< 200 metres). ***Photograph 8*** shows one of the bus stops near the development on John Street 150 metres northeast of the site.

Photograph 8 – Bus stop in the vicinity of the site.

A 1.2-metre-wide concrete pedestrian footpath exists over the King Street frontage that connects to The Esplanade as shown below in ***Photograph 9.*** It also connects the subject site to the footways in The Esplanade. The various widths of concrete footpaths in The Esplanade south of King Street are as shown in ***Photograph 10*** below. Footpaths in Howard Street adjacent to the site are predominately full width grass at present.

Safe access for pedestrians from these footpaths on the site frontages to other footways in the area are provided via a network of kerb ramps and signalised crossings near to the site. The signalised pedestrian crossing at the King Street / John Street intersection, adjacent to the site, facilitates safe passage for pedestrians between both sides of King Street and John Street (where the nearest bus stop is located). Safe crossing facilities for pedestrians are available within pedestrian phases on all legs of the intersection. The signalised pedestrian crossing is shown in ***Photograph 8***.

Kerb ramps and a pedestrian refuge between The Esplanade and the foreshore park adjacent to the site south of King Street are shown in ***Photograph* 9** below. This also provides access to the shared pathway which runs along the length of the foreshore.

Photograph 9 – Footpath in King Street over the frontage of the site.

Photograph 10 – Footpath in The Esplanade south of the site.

Photograph 11 –Pedestrian facilities adjacent to the site in The Esplanade.

Photograph 12 – Signalised pedestrian facilities adjacent to the site in King Street.

There is no on-road cycleway provided in the immediate vicinity of the proposed development site and cyclists would be required to share the travel lanes with all other vehicles. However, the shared pathway, depicted in ***Photograph 13***, runs parallel to The Esplanade. It is approximately

2.5 metres wide and provides a very scenic and safe route for pedestrians and cyclists along the foreshore.

Photograph 13 – Signalised pedestrian facilities adjacent to the site in King Street.

Lake Macquarie City Council proposes as part of its 'Cycleway Strategy 2021' to provide improvements to the cycleway network in surrounding areas as denoted by the broken lines in ***Figure 2*** below. This indicates an extension to the existing on-road cycleway network in King Street is proposed to connect to the off-road cycleway along the Foreshore.

Off-road (blue), On-road (red) -------Existing (solid line) - - - - Proposed (broken line)

Figure 2 – Cycleway facilities - on/off road, existing/proposed

8. DEVELOPMENT PROPOSAL

The proposed development involves the demolition of the existing service station, dwellings and commercial premises on the site and the construction of two seven-storey mixed use development buildings with basement and ground level car parking, commercial premises on ground level and 112 one, two and three bedroom residential apartments within the upper levels of the two buildings.

Specifically, the development consists of the following:

- Demolition of the existing service station, residential dwellings, commercial premises and associated buildings on the site;
- Construction of six (6) commercial tenancies with a total floor area of 1,514 m^2 Gross Floor Area (GFA). The Lakefront building contains four (4) commercial tenancies with a floor area of 949 m^2 GFA while the Howard Street building contains two (2) commercial tenancies with a floor area of 565 m^2 GFA;
- Construction of sixty (60) residential apartments in the Lakefront Building over six levels comprising - fourteen (14) – one (1) bedroom apartments, twenty eight (28) – two (2) bedroom apartments and eighteen (18) – three (3) bedroom apartments;
- Construction of fifty two (52) residential apartments in the Howard Street Building over seven levels comprising - twelve (12) – one (1) bedroom apartments, twenty eight (28) – two (2) bedroom apartments and twelve (12) – three (3) bedroom apartments;
- One hundred and twenty two (122) undercover car parks including two (2) accessible car parks on basement level 1 with one hundred and one (101) resident car parks, including three (3) small car parks and twenty one (21) spaces for visitor use. Twenty four (24) of the resident car spaces are stacked parking. Storage cages for resident use are also located in basement level 1;
- Eighty five (85) undercover car parks including three (3) accessible car parks on lower ground level with forty eight (48) resident car parks, including eighteen (18) stacked car parks, thirty (30) spaces for the commercial premises and seven (7) spaces including one (1) accessible space for visitor use. Storage cages for resident use are also located in basement level 1;
- Construction of ancillary recreational facilities for the development including a swimming pool and gymnasium.
- Removal of the existing access crossings to King Street, The Esplanade and Howard Street as well as reinstatement of the kerb and gutter / footpath at these locations including the upgrading of the footpath along the site frontage to full width construction as per Lake Macquarie City council's requirements;
- Construction of a new combined entry / exit driveway access crossing 6 metres wide to Howard Street;
- Property drainage to Lake Macquarie City Council's requirements; and
- Landscaping.

The development concept plans are shown in ***Attachment A***.

9. TRAFFIC GENERATION

The *RTA's Guide to Traffic Generating Development's* provides information on the traffic generating potential of developments.

Table 3.7 of the above guide, the summary table of land use traffic generation rates requires for:

1. ***Commercial premises***

- Daily vehicle trips per 100 m^2 GFA = 10
*- PM * hourly vehicle trips per 100 m^2 GFA = 2*

*The AM peak hourly rate is assumed to be the same as the PM peak hourly rate for the purposes of this assessment.

Further *RMS Technical Note TDT 13/04* also provides updated traffic generation rates based on more recent survey work for certain development types including for high density residential flat buildings.

2. ***High density residential flat buildings*** provide the following table for guidance.

Weekday Rates	Sydney Average	Sydney Range	Regional Average	Regional Range
AM peak (1 hour) vehicle trips per unit	0.19	0.07-0.32	0.53	0.39-0.67
AM peak (1 hour) vehicle trips per car space	0.15	0.09-0.29	0.35	0.32-0.37
AM peak (1 hour) vehicle trips per bedroom	0.09	0.03-0.13	0.21	0.20-0.22
PM peak (1 hour) vehicle trips per unit	0.15	0.06-0.41	0.32	0.22-0.42
PM peak (1hour) vehicle trips per car space	0.12	0.05-0.28	0.26	0.11-0.40
PM peak (1 hour) vehicle trips per bedroom	0.07	0.03-0.17	0.15	0.07-0.22
Daily vehicle trips per unit	1.52	0.77-3.14	4.58	4.37-4.78
Daily vehicle trips per car space	1.34	0.56-2.16	3.22	2.26-4.18
Daily vehicle trips per bedroom	0.72	0.35-1.29	1.93	1.59-2.26

The **higher** values of the regional range rates from this table are considered applicable and have been adopted for this assessment.

The appropriate rates for **high density residential flat** development are therefore:

Daily vehicle trips per unit = 4.78
AM Peak vehicles trips per unit (regional range) = 0.67
PM Peak vehicles trips per unit (regional range) = 0.42

The estimated daily and peak hour traffic volumes generated by the proposed development are therefore calculated as follows (rounded up) noting the development contains 112 units and 1,514 m^2 of commercial tenancies:

Daily trips = 10 / 100 x 1,514 + 112 x 4.78 vtpd
= **687 vtpd.**

Weekday AM peak hour trips = 2 / 100 x 1,514 + 112 x 0.67 vtph
= **106 vtph.**

Weekday PM peak hour trips = 2 / 100 x 1,514 + 112 x 0.42 vtph
= **78 vtph.**

It is noted that the existing development on the site includes;

- Service station with a site area of 1,800 m^2;
- Four (4) dwellings; and
- Small Café/Restaurant (60 m^2 GFA).

Using the rates contained in the *RTA's Guide to Traffic Generating Developments* and *RMS Technical Note TDT 13/04* the existing site development has the potential to generate the following peak traffic volumes;

Daily trips = 4 x 7.4 + 60/100 x 60 + 10 x (0.04 x 1800) vtpd
= **786 vtpd.**

Weekday AM peak hour trips = 0.85 x 4 + 60/100 x 5 + 0.04 x 1800 vtph
= **79 vtph.**

Weekday PM peak hour trips = 0.9 x 4 + 60/100 x 5 + 0.04 x 1800 vtph
= **79 vtph.**

Therefore in terms of the critical AM and PM peak hour periods the new development is only likely to increase traffic flows on the local road network by;

Weekday AM peak hour trips = 106 - 79
= **27 vtph.**

Weekday PM peak hour trips = 78 -79
= **-1 vtph.**

Therefore the development will only increase traffic on the local and state road network in the AM peak by up to 27 vtph.

It is noted however that there will be a redistribution of traffic and whilst traffic increases on King Street and The Esplanade will be negligible there will be a significant increase in traffic on Howard Street of in the order of 100 vtph in the AM peak and 70 vtph in the PM peak.

The additional development traffic needs to be distributed through the road network and the likely development trip distribution adopted for this assessment is:

- In the AM peak 80 % of traffic is outbound and 20 % of traffic is inbound;
- 30 % of inbound traffic will approach via Howard Street from King Street.
- 70 % of inbound traffic will approach via Howard Street from The Esplanade
- 70 % of outbound traffic will exit via Howard Street to King Street.
- 30 % of inbound traffic will exit via Howard Street to The Esplanade.
- At the King Street / The Esplanade roundabout 40 % of outbound traffic will turn right into The Esplanade and 30 % of outbound traffic will do a U-turn.
- At the King Street / The Esplanade roundabout 40 % of inbound traffic will head straight through on The Esplanade towards Howard Street and 30 % of inbound traffic will do a U-turn on The Esplanade to head towards Howard Street.

The resulting trip distribution for the development is presented diagrammatically in ***Figure 3*** below with the likely resulting additional AM trips over existing traffic at the King Street / The Esplanade roundabout also shown.

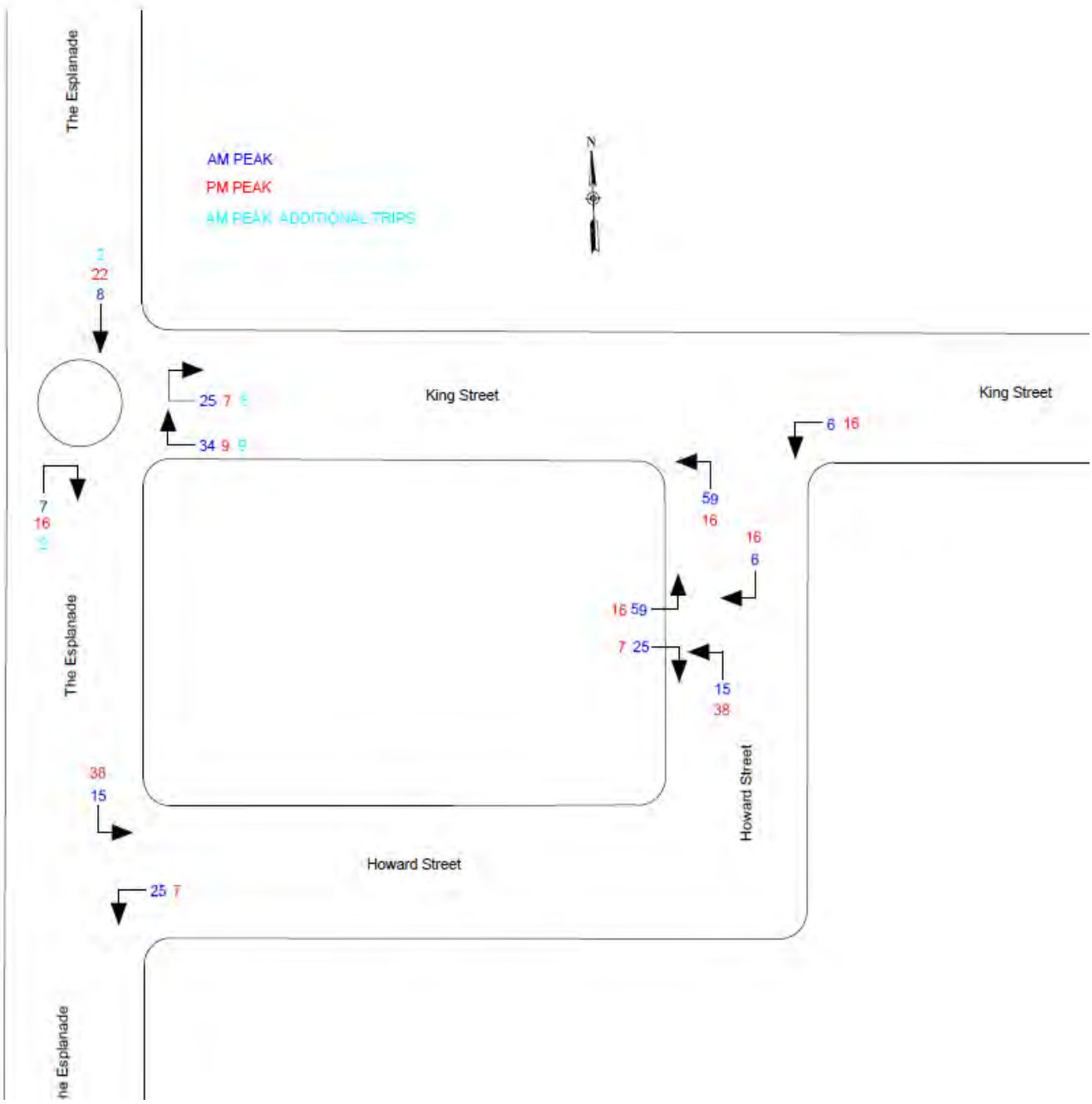


Figure 3 – Development traffic trip distribution

10. TRAFFIC IMPACTS

10.1 Road Network & Intersection Capacity

This assessment (***Section 5***) has determined that King Street and The Esplanade currently have peak hour traffic volumes in the order of 1,618 vtph for King Street and 2,546 vtph for The Esplanade which could be expected to increase up to 1,880 vtph and 2,955 vtph respectively in 2027, allowing for a 1.5 % per annum background traffic growth.

Section 6 of this report determined that the likely LoS D mid-block two-way capacity of King Street and The Esplanade is in the order of 5,600 vtph. This indicates that King Street and The Esplanade have some spare mid-block capacity and are operating satisfactorily for their relative positions within the road hierarchy. This was confirmed by observation on site.

In regard to Howard Street whilst no traffic counts were undertaken on the site given the through road connections to both King Street and The Esplanade and the level of residential development in the street it would be expected that current peak hour traffic volumes would be in the order of 100 vtph maximum. Noting the RMS Guidelines (Table 4.6 of the *RTA's Guide to Traffic Generating Developments (2002)*) as shown below indicates that the environmental capacity of a local street would be a maximum of 300 vtph it is concluded that Howard Street is operating within its environmental capacity goal. Therefore Howard Street also has scope to accept additional traffic from this development without the residential amenity in the street being adversely impacted upon.

Table 4.6
Environmental capacity performance standards on residential streets

Road class	Road type	Maximum Speed (km/hr)	Maximum peak hour volume (veh/hr)
Local	Access way	25	100
	Street	40	200 environmental goal
			300 maximum
Collector	Street	50	300 environmental goal
			500 maximum

Note: Maximum speed relates to the appropriate design maximum speeds in new residential developments. In existing areas maximum speed relates to 85th percentile speed.

Source RTA's Guide to Traffic generating Developments (2002)

Section 9 of this report determined that the proposed mixed use development is likely to generate a maximum of approximately 118 vtph in King Street, 42 vtph on any leg of The Esplanade and 65 vtph on any leg of Howard Street with development traffic distributed as per ***Figure 3***. It is noted this assessment ignores existing traffic from the development site therefore is a conservative worst case assessment with the real impact probably being slightly less than reported in this document. A summary of the impact on the road network traffic volumes and the two-way mid-block road network capacities is shown below in ***Table 1***.

Table 1 – Two way mid-block road capacity assessment

Road	2017 AM peak (vtph)	2017 PM peak (vtph)	2027 AM peak (vtph)	2027 PM peak (vtph)	Road Capacity
King Street	1736	1629	1998	1887	5600
The Esplanade north of King Street	1807	2120	2092	2456	5600
The Esplanade south of King Street	2477	2591	2872	3009	5600
Howard Street	165	145	181	161	300

This assessment shows the local and state road network will remain within its technical and environmental capacity goals post development through to 2027. Therefore, it is concluded that the local and state road network has sufficient spare two way mid-block capacity to cater for the increase in traffic generated by the development.

With the Howard Street intersections with King Street and The Esplanade being left in and left out only intersections the only intersection likely to be adversely impacted on by the development is the King Street / The Esplanade roundabout. The impacts of the development on this intersection are best assessed using the Sidra intersection modelling software. This software package predicts likely delays, queue lengths and thus levels of service that will occur at intersections. Assessment is then based on the level of service requirements of the RMS shown below;

Table 4.2
Level of service criteria for intersections

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

Source: - RTA's Guide to Traffic Generating Developments (2002)

Assumptions made in this modelling for this intersection were;

- The intersection was modelled as per the current layout and speed zoning;
- Existing traffic volumes used were as recorded by NTPE on 23rd February 2017;
- Development traffic was distributed as per ***Figure 3*** therefore did not consider existing traffic generated by the current site development. The assessment is therefore a conservative worst case assessment.
- A background traffic growth of 1.5 % per annum was adopted..

The results of the modelling are show below in ***Table 2*** while the Sidra Movement Summary Sheets are provided in ***Attachment D***.

Table 2 – Sidra results – King Street / The Esplanade roundabout

Model	Deg. Satn (v/c)	Average Delay (s)	Worst Level of Service	95 % back of queue length (cars)
2017 AM	0.617	3.4	A	5.2
2017 PM	0.668	5.8	A	5.2
2017 AM + development	0.635	6.6	A	5.9
2017 PM + development	0.687	6.2	A	5.5
2027 AM + development	0.831	12	A	13.2
2027 PM + development	0.899	10.8	A	11.9

The Sidra modelling shows that the King Street / The Esplanade roundabout will continue to operate satisfactorily post development through to beyond 2027, in both the AM and PM peak periods, without the need for upgrading. Average delays, LoS and back of queue lengths for all movements remain within the satisfactory criteria set by the RMS.

It can therefore be concluded that the proposed development will not adversely impact on the local and state road network.

10.2 Access

From observation on site it has been determined that suitable safe sight distance at the proposed vehicular access to the site in accordance with Australian Standard requirements (*AS2890.1 – 2004 Parking facilities – Part 1 Off street car parking*) which is 35 to 45 metres for a 40 km/h speed environment is available to the north and south of the access off Howard Street. It is noted the access being off Howard Street complies with RMS requirements for access to be off a secondary road if possible for developments on classified roads. The removal of the existing accesses to the site off King Street and The Esplanade also results in a positive impact on the road network and this needs to be considered in any merits based assessment of the development.

Further as the site provides resident and employee parking (Class 1A) for between 101 and 300 vehicles fronting a local road a category 2 access facility is required. *AS2890.1 – 2004 Parking facilities – Part 1 Off street car parking* denotes a category 2 access as a combined entry exit 6 metres to 9 metres wide. As the development proposes a combined entry / exit at least 6 metres wide it is concluded that the proposed access crossing is compliant with *AS2890.1 – 2004 Parking facilities – Part 1 Off-street car parking.*

In addressing compliance with *Lake Macquarie City Council's DCP 2014 – Revision 6 – Part 9 – Specific Land Uses Residential Flat Buildings - Section 13.12 of the Driveways and Parking Areas* also requires a single driveway access with a minimum width of 5.5 metres. Therefore the proposal is compliant with this requirement.

Overall it is concluded that the proposed vehicular access to the site is suitable and would comply with *AS2890.1 – 2004 Parking facilities – Part 1 Off street car parking* and *Lake Macquarie City Council's DCP 2014 – Revision 6 – Part 9 – Specific Land Uses Residential Flat Buildings - Section 13.12 of the Driveways and Parking Areas.*

10.3 On-site car parking

On-site car parking provision needs to be in accordance with Australian Standard *AS2890.1 – 2004 Parking facilities – Part 1 Off street car parking* and *Lake Macquarie City Council's Warners Bay Town Centre Area Plan.* The car parking provision rates applicable for residential flat buildings and commercial space / business sourced from the Warners Bay Town Centre Area Plan are as follows:

1 bedroom units	-	*0.5 car spaces per dwelling;*
2 bedroom units	-	*0.75 car space per dwelling;*
3 bedroom units	-	*1 car space per dwelling;*

Plus

Visitor parking *0.25 spaces per dwelling;*

Business / Office / Retail Premise *- 1 space per 40 m^2 GFA.*

Accessible parking *- 1 space per 50 car parks.*

Under Council's Business Zone and Residential Zone DCP's the following additional bicycle and motor bike parking is also required in the development;

Bicycle storage areas for residents;
One bike parking space per 20 car spaces for customers and short term users;
One bike parking space per 20 employees with suitable end of trip facilities;
One motor bike parking space per 20 spaces for residents; and
One motorbike parking space per 20 cars for employees and customers.

Therefore, the on-site parking requirement for the development can be calculated as shown in ***Table 3*** and ***Table 4*** below.

Table 3 – LMCC on-site car parking requirement

Land-use	Quantity	Parking Rate	No. Spaces
1 bedroom apartment (no.)	26	0.5	13
2 bedroom apartment (no.)	56	0.75	42
3 bedroom apartment (no.)	30	1	30
Visitors (no. apartments)	112	0.25	28
Commercial/business/retail (m^2 GFA)	1514	0.025	38
Total			**151**

Table 4 – LMCC on-site bike and motor bike parking requirement

Land-use	Quantity	Parking Rate	No. Spaces
Resident bike parking			storage areas required
Staff bike parking (per employee)	40	0.05	2
Visitor bike parking	151	0.05	8
Total Bike parking			**10**
Total Motor Bike parking	151	0.05	**8**

The development provides 149 residential car parking spaces, 30 commercial car parking spaces and 28 visitor car parking spaces which represents a 56 space excess on the car parking required for the development. Five Australian Standard compliant accessible spaces are provided throughout the car park which is again compliant with LMCC DCP requirements. The excess parking is within the resident parking (64 spaces) areas while the visitor car parking provided is compliant with the LMCC DCP requirement and an 8 space deficiency exists in the commercial parking area. Currently no motor bike or bicycle parking is shown on the plans therefore a deficiency exists for this type of parking also.

The additional resident parking is provided to meet the market with purchasers of 2 and 3 bedroom units often seeking 2 car parks rather than a single car park. The current provision of resident car parks allows a single space to be provided to all units which is the current market expectation while the excess allows some flexibility in providing the customers desire for additional resident parking. The advantage of providing additional resident parking is that the visitor parking has a better chance to be used for what it is provided for i.e. visitors to the complex rather than being the overflow parking area for the residents.

Further the current provision of car parking results in small 20 % deficiency in commercial parking spaces. It is considered this can be supported by Lake Macquarie City Council as the deficiency is within the range that their DCP allows and the provision of 30 commercial parking spaces should be sufficient to meet the likely employee parking requirements for the commercial premises. Customers of these premises are unlikely to utilise the undercover parking as it will not be obvious to them, they are more likely to park elsewhere in the Warners Bay Town Centre and combine their trip making purpose and there is an availability of shared on and off-street public parking in the Warners Bay Town Centre.

A 20 % reduction in visitor car parking (down to 22 visitor car parks) could also be supported on the same basis of multi-purpose trip making and the availability of on and off-street public parking in the area though the development currently provides the required visitor car parking. The provision of an excess of resident parking also means there is less pressure on the visitor car parking as overflow resident parking further supporting the argument for a reduced visitor car parking supply within the development.

Regarding the deficiency in bicycle parking and motor bike parking spaces there is adequate room in the proposed car parking areas to remove some of the excess residential parking to provide the required 8 motorbike spaces and suitable bicycle storage areas therefore this requirement could be conditioned on any consent issued for the proposal.

In assessing the proposed car parking layout against the requirements of Australian Standard *AS2890.1 – 2004 Parking facilities – Part 1 Off street car parking* the following is noted;

- The car spaces are a minimum 2.4 metres x 5.4 metres with end bay parks provided with additional width as required by the Standard;
- The accessible spaces are 2.4 metres x 5.4 metres with a 2.4 metre clear area adjacent;
- The aisle width / shared driveway is a minimum 5.8 metres wide;
- The submitted plans show suitable forward entry and exit from the car parking spaces.

Overall it is concluded that the proposed on-site car parking supply and layout is suitable and would comply with Australian Standard *AS2890.1 – 2004 Parking facilities – Part 1 Off street car parking* and *Lake Macquarie City Council's DCP 2014 Revision 6 – Part 4 – Developments in Business Zones Section 5 – Access and Parking.*

10.4 Servicing

The development has been designed such that waste collection will be undertaken using private contractor with kerbside collection from Howard Street with a bin area provided near the vehicle access from Howard Street. For this reason Council approval for a 15 metre loading zone on Howard Street immediately north of the developments vehicular access is sought to facilitate servicing of the site. The commercial tenancies proposed would typically be serviced by small rigid vehicles for stationary and food and drink supplies that could utilise existing on-site commercial parking bays during non-peak parking demand periods. Larger vehicles which would be infrequent would be required to service from the kerbside in the proposed loading zone on Howard Street.

Overall it is concluded that the servicing arrangements within the development are suitable.

10.5 Alternate Transport Modes

The site is currently serviced by public transport (bus) services provided by Newcastle Buses and Ferries as well as Hunter Valley Buses providing a suitable service to all necessary services, facilities and locations near the site. Therefore, suitable public transport services already exist to the site and no additional services or infrastructure required. It is noted that under the LMCC Developer Contributions plan for the Glendale Contributions Catchment the development is required to pay a S94 contribution and works this will fund includes the upgrading of a number of bus stops in King Street, Warners Bay.

It is considered that the external pedestrian and bicycle traffic generated by the development would not be significant enough as to provide a nexus for the provision of additional external pedestrian and bicycle paths (on or off road) to the site and the existing infrastructure is considered satisfactory for the scale of development proposed. It would however be expected that full width reconstruction of the footpath around the site in accordance with the Warners Bay Town Centre Area Plan would be required of this development.

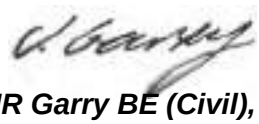
11. CONCLUSIONS

This traffic and parking assessment of a mixed-use development on Lots 1 & 2 in DP 1116535, Lots 3 & 4 in DP 32518, Lot 122 in DP 578045 and Lots 1, 2, & 3 in DP 155951, 482 – 488 The Esplanade, 12 – 16 King Street & 1 Howard Street, Warners Bay has concluded the following:

- The proposed development is likely to generate approximately 106 vtph during the AM weekday peak traffic periods, 78 vtph during the PM weekday peak traffic periods or 687 vtpd. This only represents an increase on existing site traffic of approximately 27 vtph in the AM peak and no increase in the PM peak.
- The local road network around the site has sufficient capacity to cater for the development without the need to upgrade the local road network.
- The proposed development therefore does not adversely impact on the local road network.
- The proposed vehicular access to the site is suitable and would comply with Australian Standard *AS2890.1 – 2004 Parking facilities – Part 1 Off street car parking* and *Lake Macquarie City Council's DCP 2014 – Revision 6 – Part 9 – Specific Land Uses Residential Flat Buildings - Section 13.12 of the Driveways and Parking Areas.*
- The proposed access also complies with RMS requirements for vehicular access to be off a secondary road if possible for developments on classified roads. The removal of the existing accesses off King Street and The Esplanade also results in a positive impact on the road network and this needs to be considered in any merits based assessment of the development.
- The proposed on-site car parking supply and layout is suitable and would comply with Australian Standard *AS2890.1 – 2004 Parking facilities – Part 1 Off street car parking* and *Lake Macquarie City Council's Warners Bay Town Centre Area Plan and its DCP (2014) for residential and business zones.*
- The servicing arrangements within the development are suitable though Council approval for a 15 metre loading zone on Howard Street immediately north of the development's vehicular access will be required.
- Suitable public transport services already exist to the site and no additional services or infrastructure is required. S94 contributions collected from the development will be used to upgrade a number of bus stops in King Street; and
- It is not considered that the external pedestrian and bicycle traffic generated by the development would not be significant enough to provide a nexus for the provision of additional external pedestrian and bicycle infrastructure (on or off road) to the site as the existing infrastructure near the site is considered satisfactory for the scale of development proposed. However the pedestrian footpath along the three site frontages would need to be reconstructed to full width in accordance with the requirements of *Lake Macquarie City Council's Warners Bay Town Centre Area Plan.*

12. RECOMMENDATION

Having carried out this traffic impact assessment for a mixed-use development on Lots 1 & 2 in DP 1116535, Lots 3 & 4 in DP 32518, Lot 122 in DP 578045 and Lots 1, 2, & 3 in DP 155951, 482 – 488 The Esplanade, 12 – 16 King Street & 1 Howard Street, Warners Bay it is recommended that the proposal can be supported from a traffic impact perspective as it will not adversely impact on the local and state road network and complies with the requirements of Lake Macquarie City Council, Australian Standards and NSW Roads and Maritime Services.

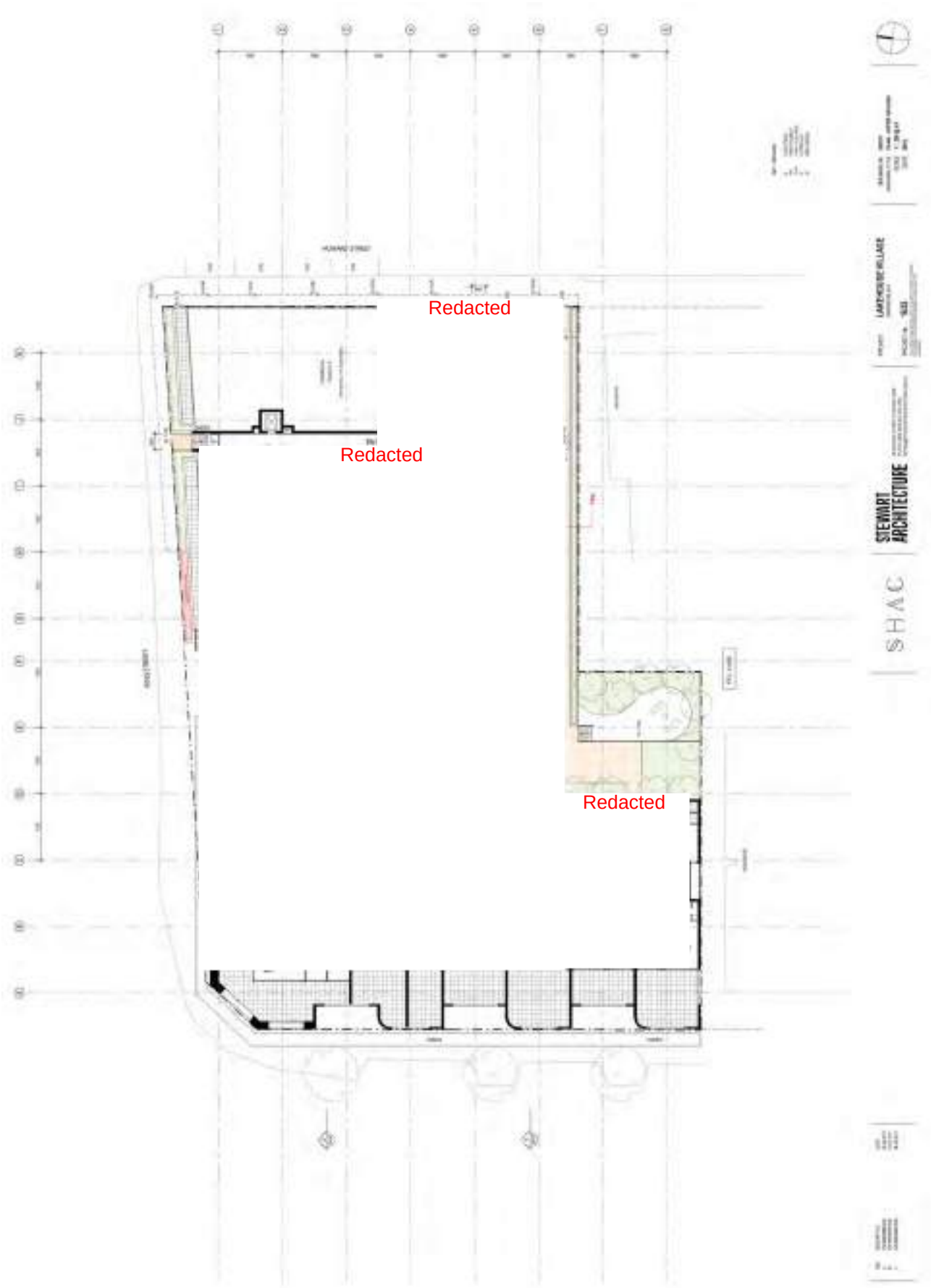


JR Garry BE (Civil), Masters of Traffic
Director
Intersect Traffic Pty Ltd

ATTACHMENT A
DEVELOPMENT PLANS


STEWART ARCHITECTURE
SHAC
UNCONTROLLED ISSUE


STEWART ARCHITECTURE
SHAC
UNCONTROLLED ISSUE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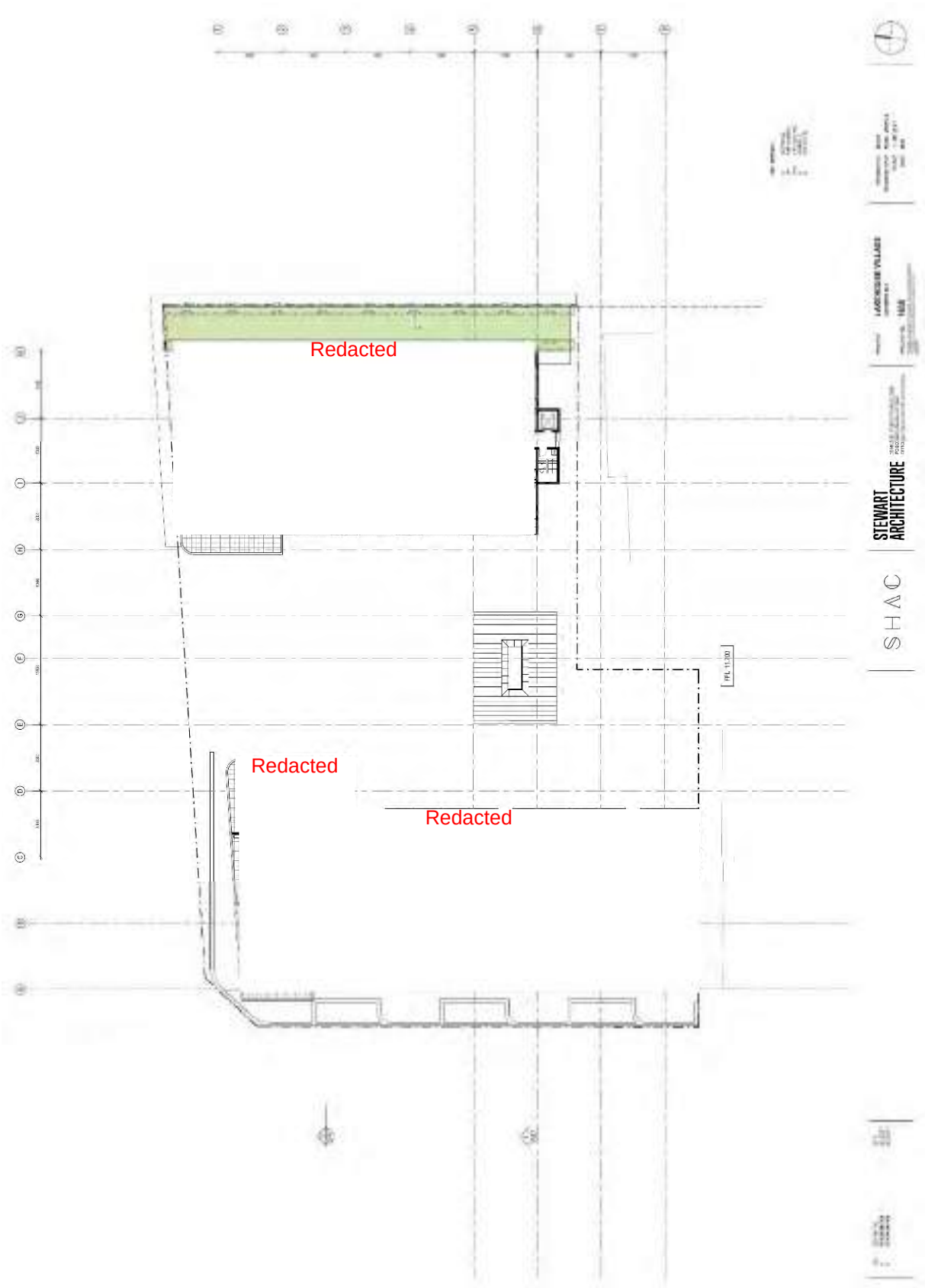
SHAC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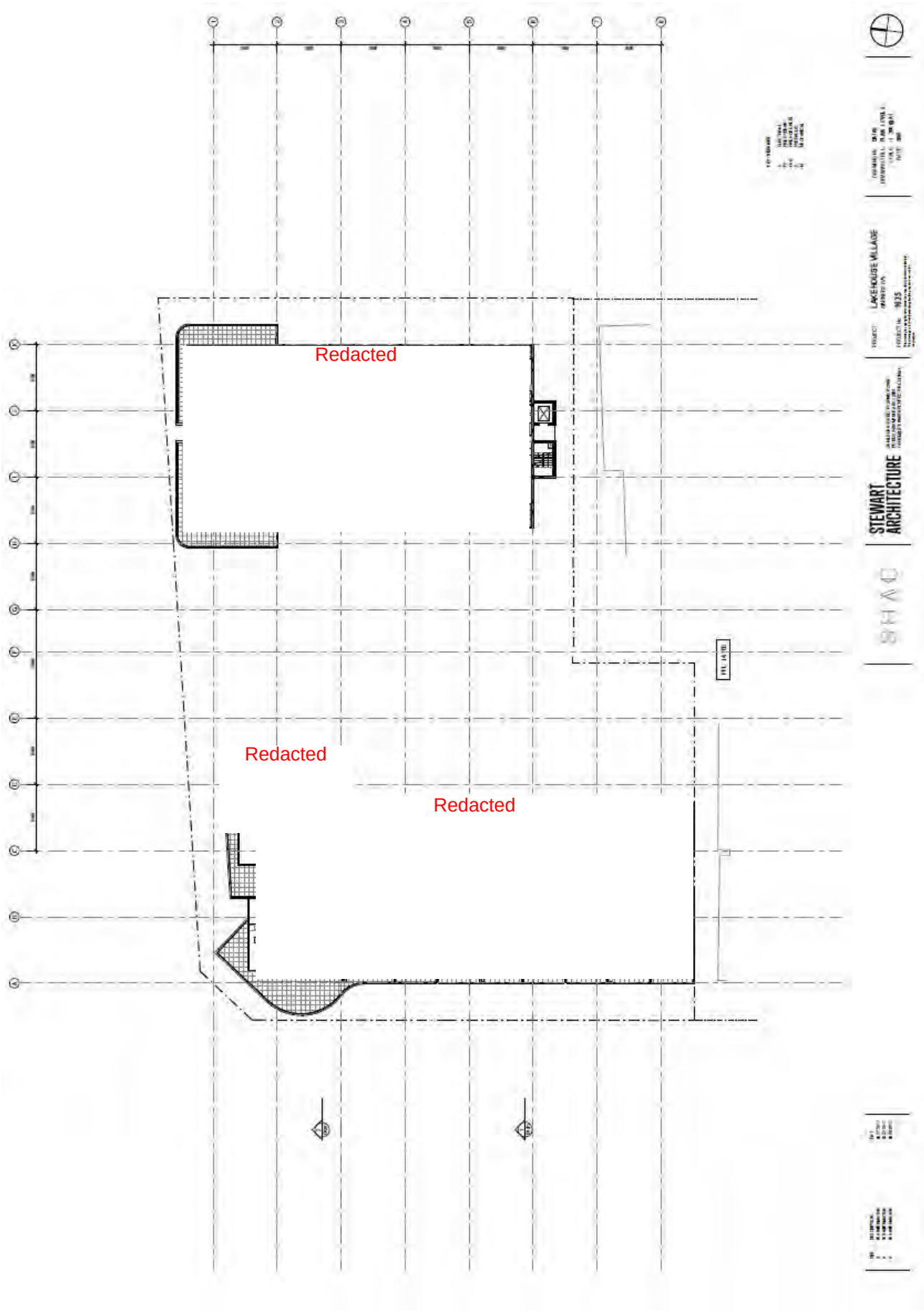
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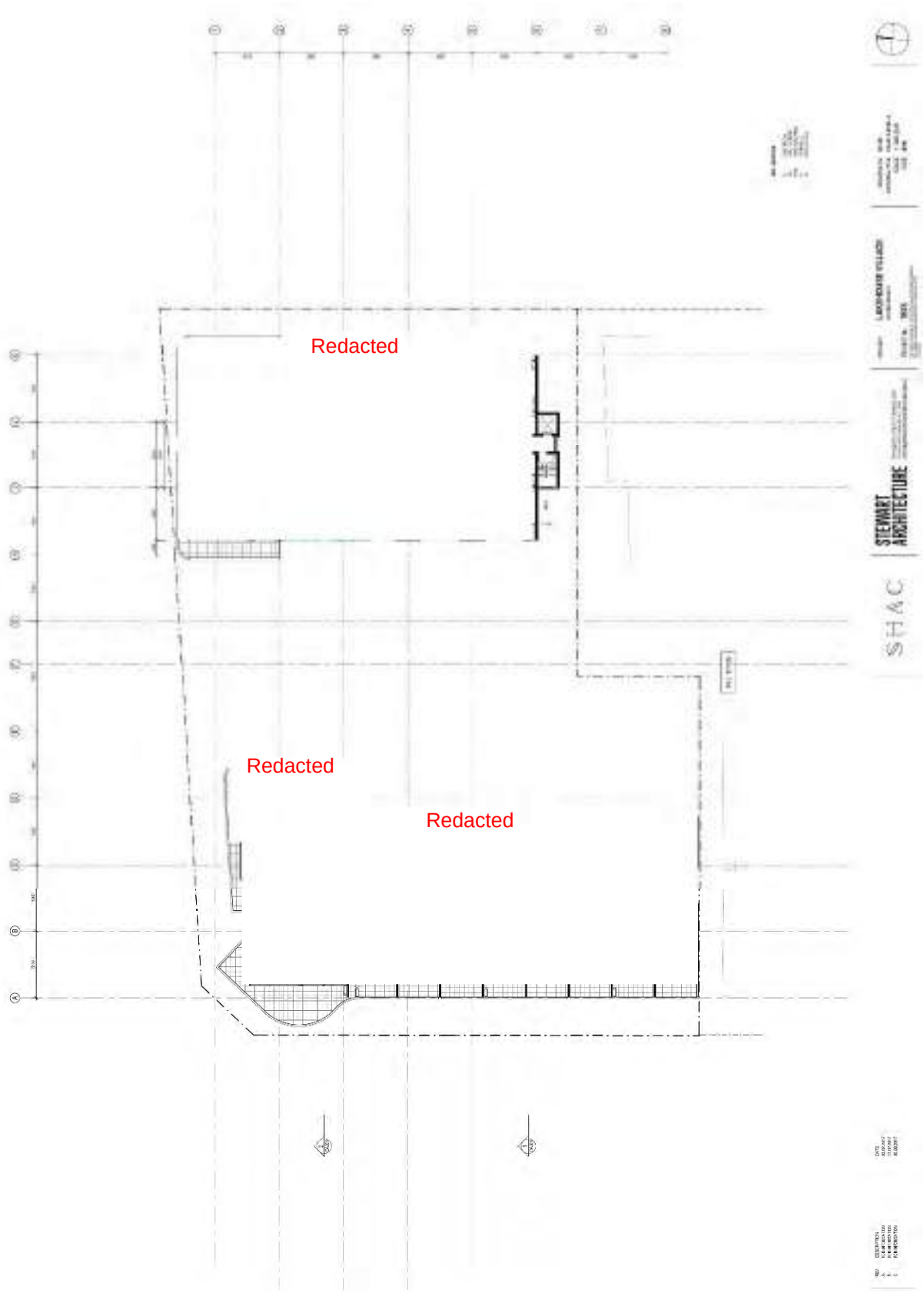
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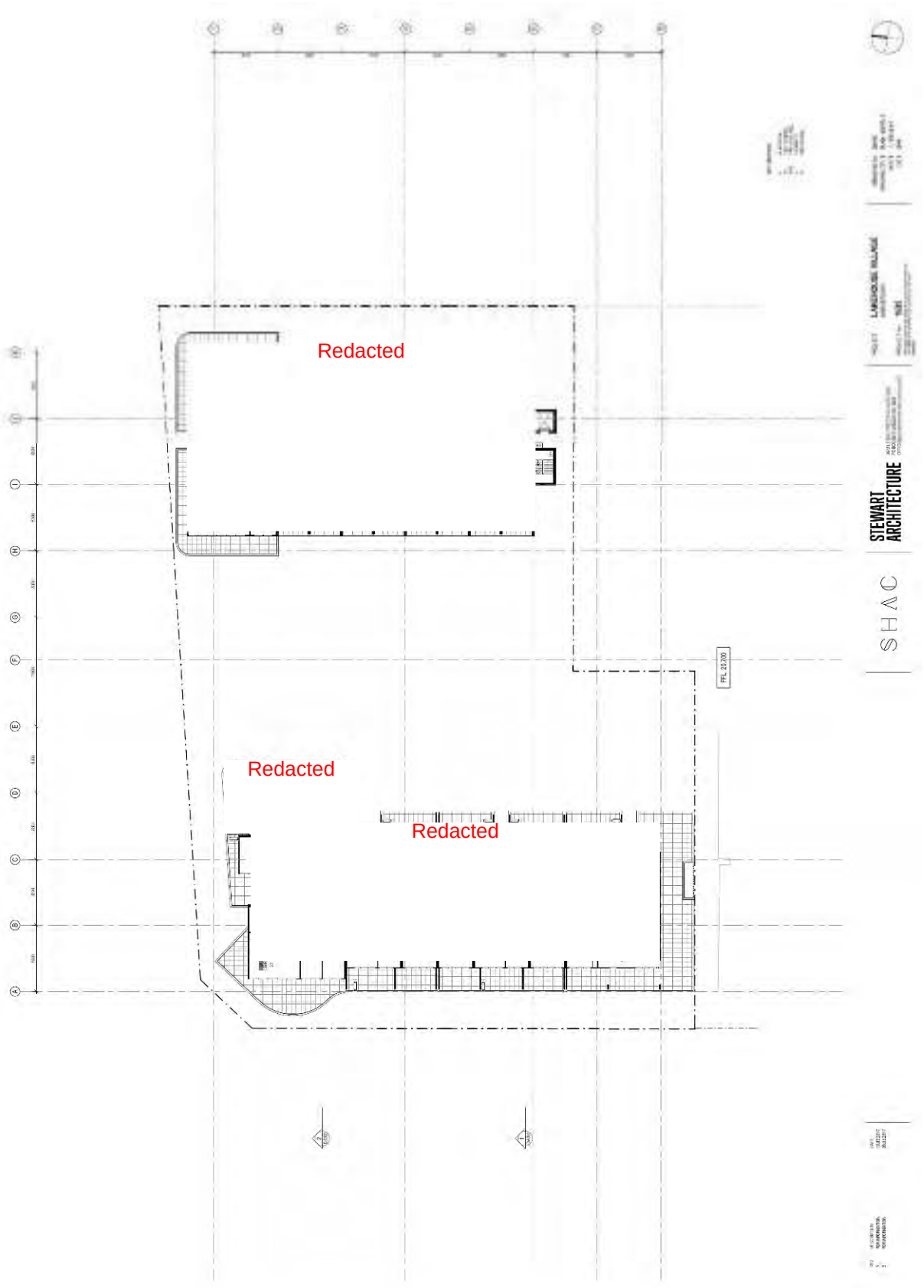
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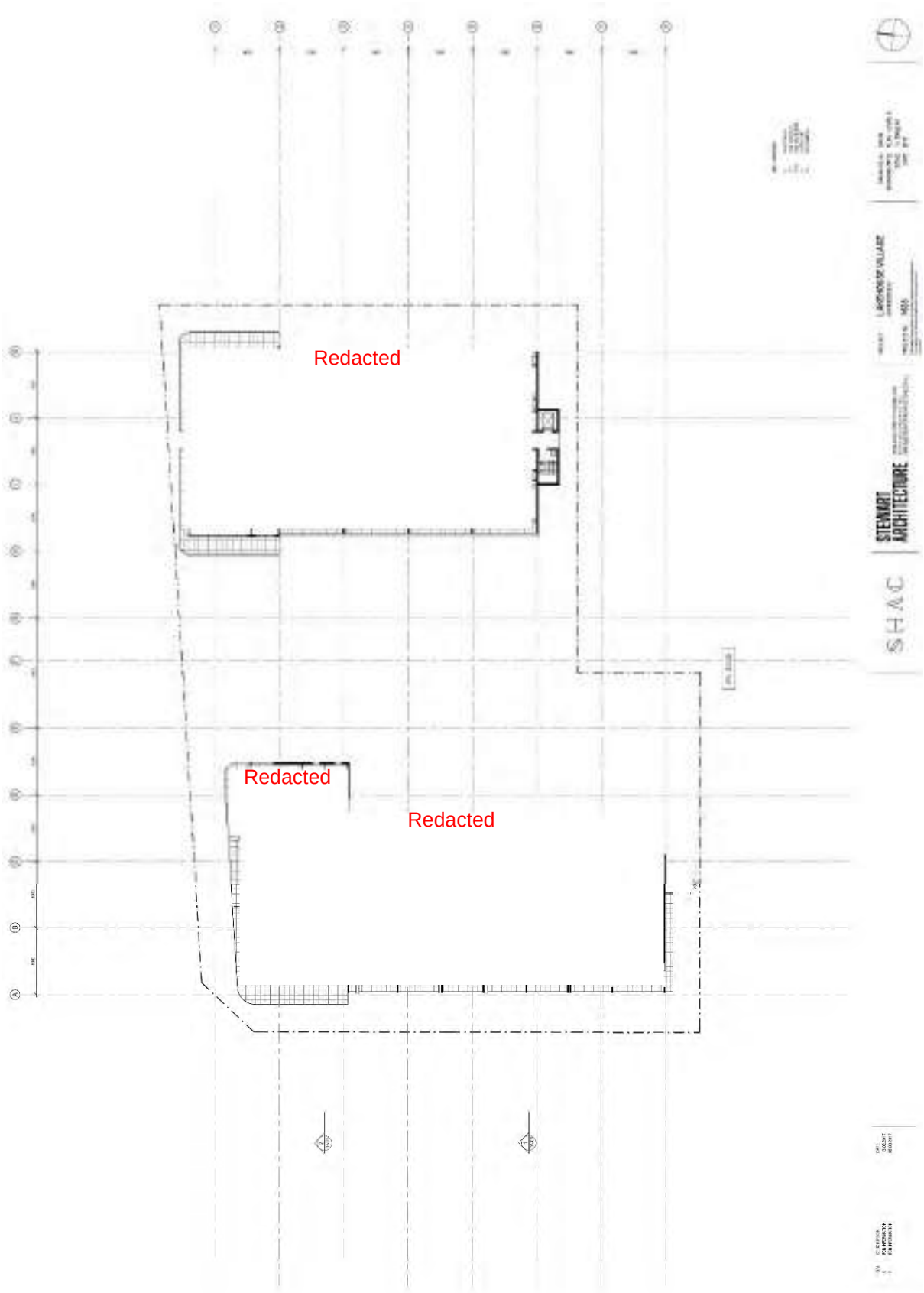
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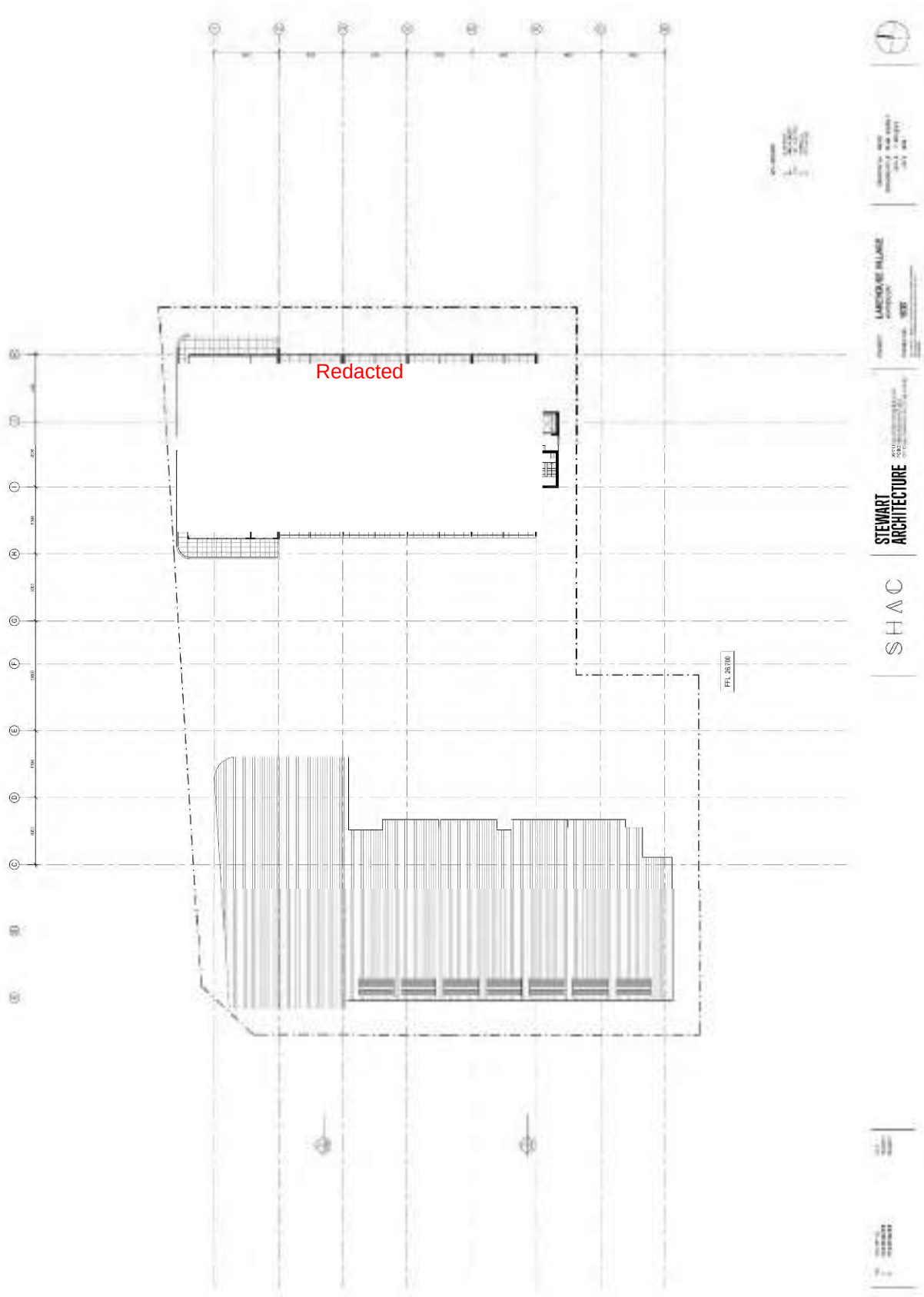
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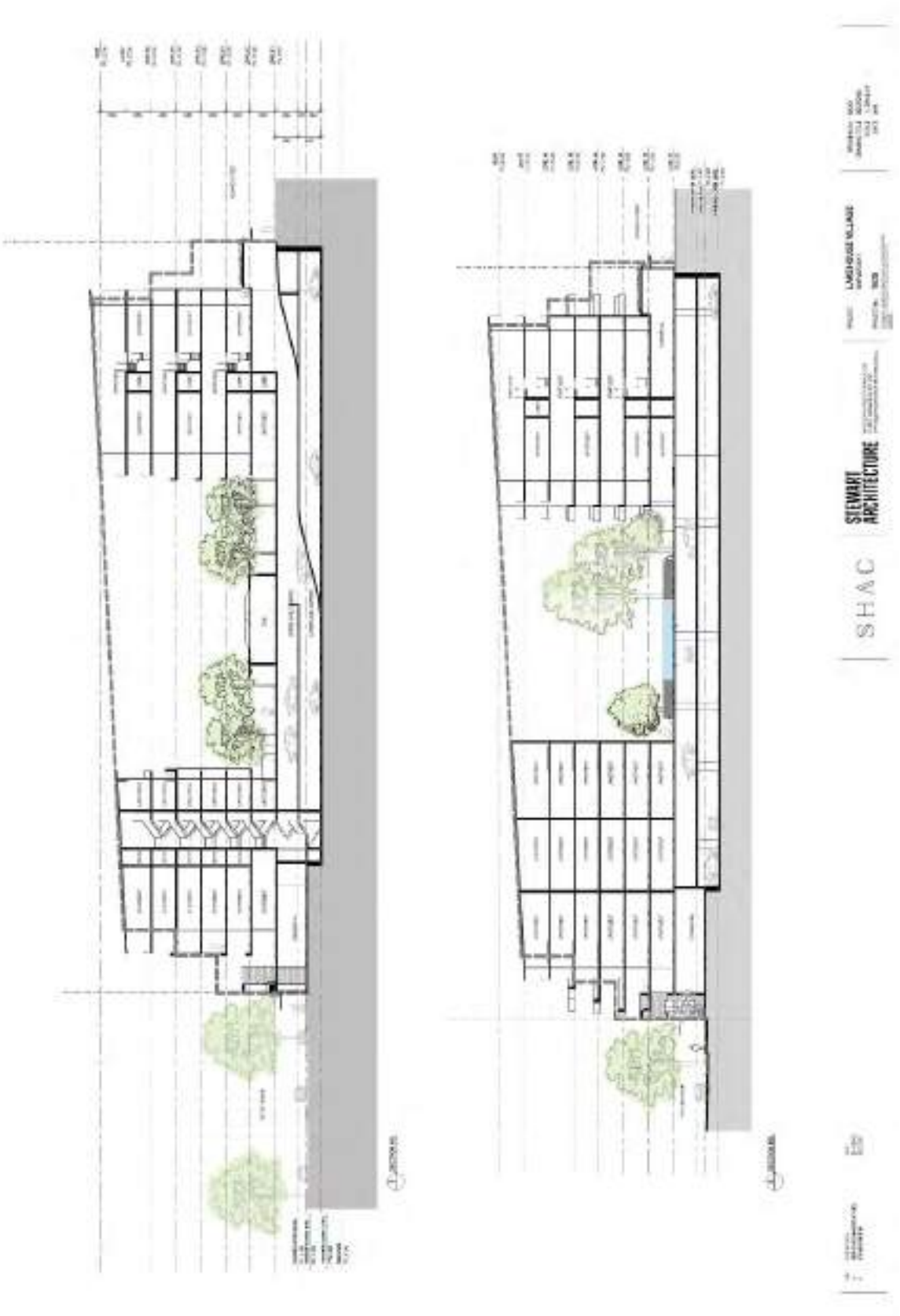
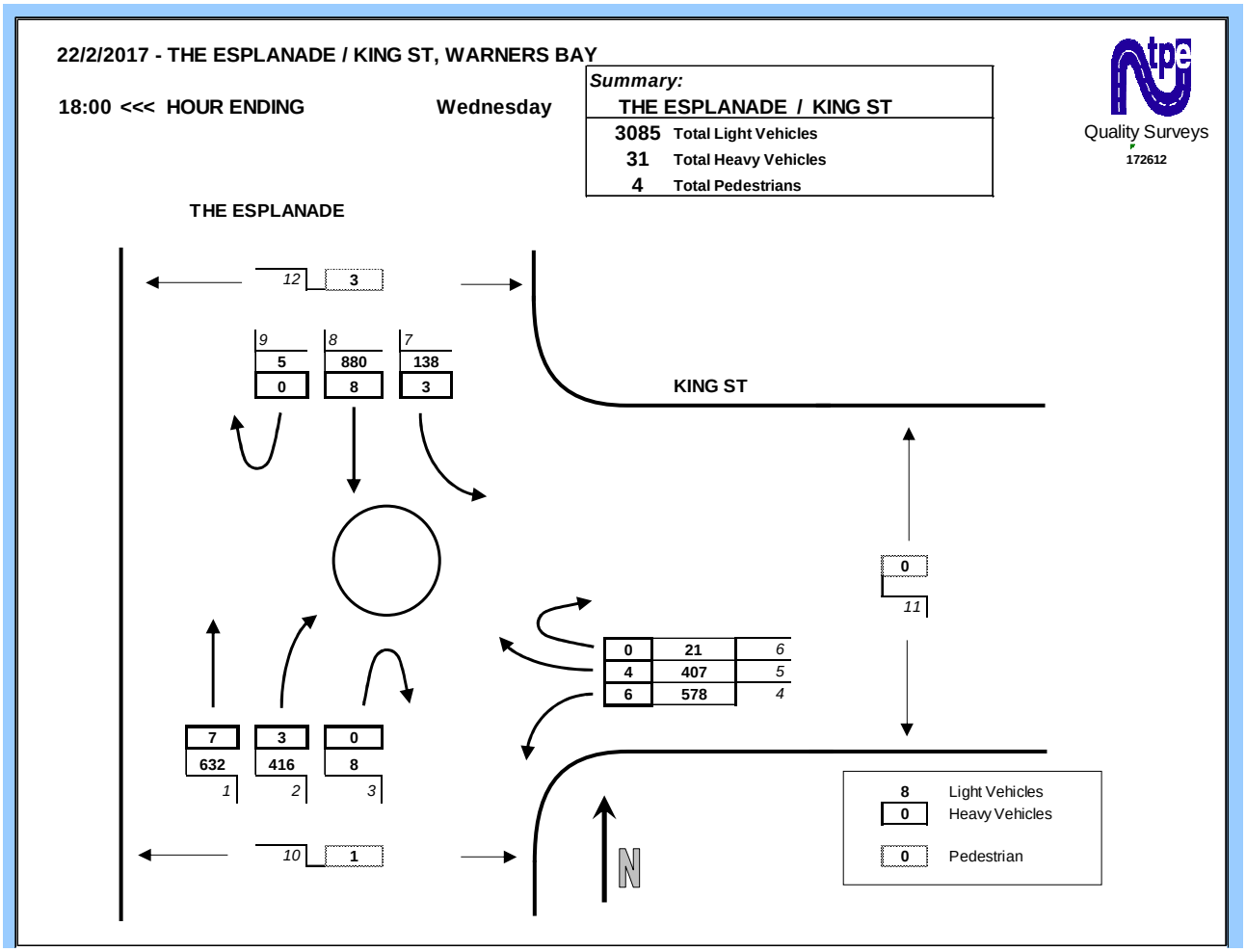
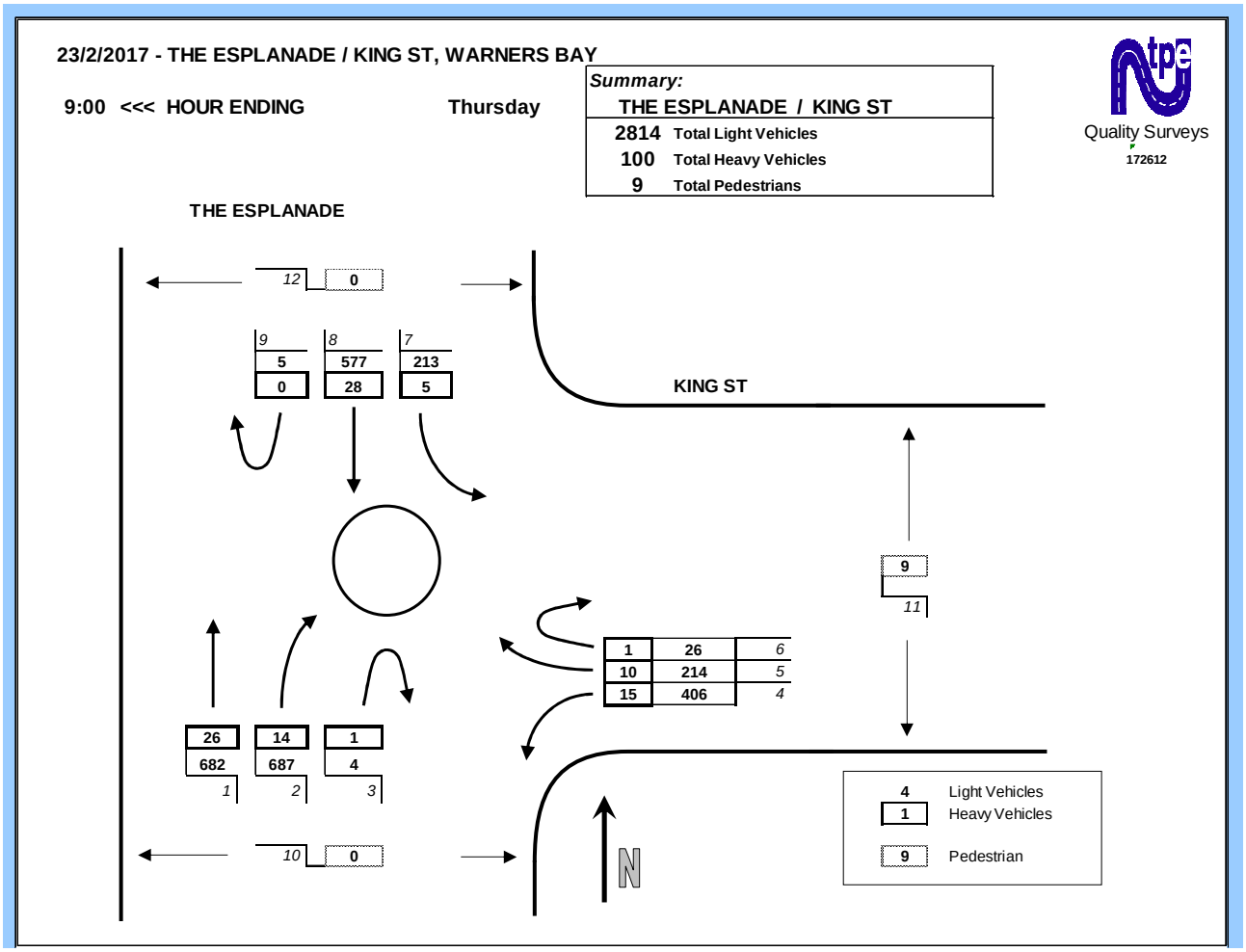
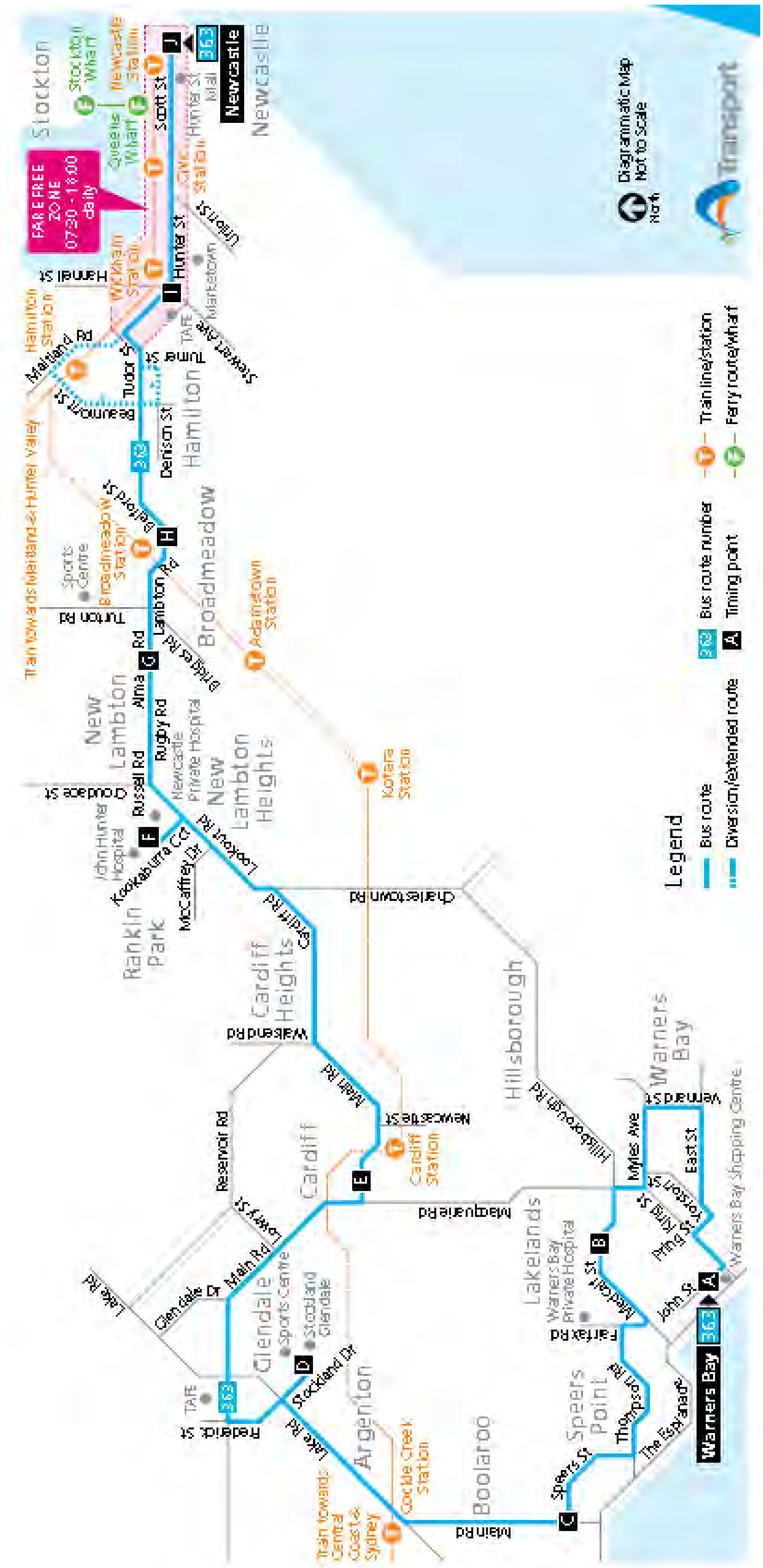

STEWART ARCHITECTURE
SHAC

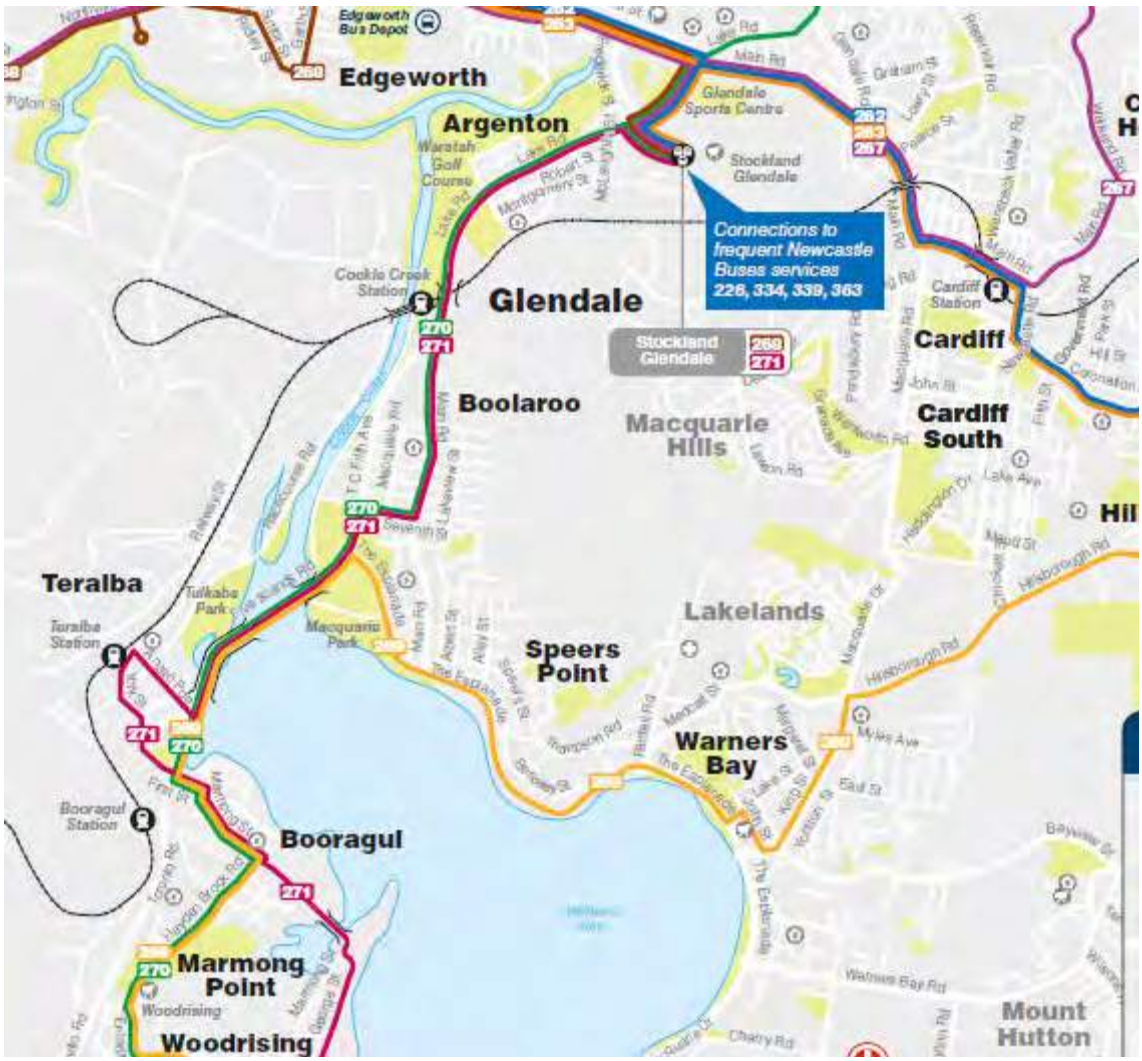
ATTACHMENT B
TRAFFIC DATA


22/2/2017 - THE ESPLANADE / KING ST, WARNERS BAY
18:00 <<< HOUR ENDING
Wednesday
Summary:
THE ESPLANADE / KING ST
3085 Total Light Vehicles
31 Total Heavy Vehicles
4 Total Pedestrians
Quality Surveys
172612
THE ESPLANADE
KING ST
12
3
9
5
0
8
880
8
7
138
3
0
11
0
21
6
4
407
5
6
578
4
7
632
1
3
416
2
0
8
3
10
1
N
8 Light Vehicles
0 Heavy Vehicles
0 Pedestrian


23/2/2017 - THE ESPLANADE / KING ST, WARNERS BAY
9:00 <<< HOUR ENDING
Thursday
Summary:
THE ESPLANADE / KING ST
2814 Total Light Vehicles
100 Total Heavy Vehicles
9 Total Pedestrians
Quality Surveys
172612
THE ESPLANADE
KING ST
12
0
9
5
0
8
577
28
7
213
5
9
11
1
26
6
10
214
5
15
406
4
26
682
1
14
687
2
1
4
3
10
0
N
4 Light Vehicles
1 Heavy Vehicles
9 Pedestrian

ATTACHMENT C
BUS ROUTE MAPS


Newcastle
363
Warners Bay
FARE FREE ZONE 07:30 - 18:00 daily
Diagrammatic Map Not to Scale
North
Transport
Legend
Bus route
Diversion/extended route
Bus route number
Timing point
Train line/station
Ferry route/wharf


Edgeworth Bus Depot
Edgeworth
Argenton
Waratah Golf Course
Glendale Sports Centre
Stockland Glendale
Connections to frequent Newcastle Buses services 226, 334, 339, 363
Cookie Creek Station
Glendale
Stockland Glendale
Cardiff Station
Cardiff
Boolaroo
Macquarie Hills
Cardiff South
Teralba
Teralba Station
Tulkaba Park
Macquarie Park
Speers Point
Lakelands
Warners Bay
Booragul Station
Booragul
Marmong Point
Woodrising
Woodrising
Mount Hutton


Seahampton
West Wallsend
Holmesville
Killingworth
Barnsley
Cameron Park
Fletcher
Mirmi
Maryland
Shortland
Birmingham Gardens
Wallsend
Jesmond
North Lambton
Elermore Vale
Edgeworth
Argenton
Glendale
Boolaroo
Macquarie Hills
Cardiff
Cardiff Heights
Cardiff South
Garden Suburb
Hillsborough
Teralba
Lakelands
Speers Point
Warners Bay
Booragul
Marmong Point
Woodrising
Fennell Bay
Fassifern
Blackalls Park
Toronto West
Toronto
Bolton Point
Mount Hutton
Tingira Heights
Eleebana
Groudace Bay
Cooranbong
Morisset
Wallsend Inset
Charlestown Inset
Morisset Inset
Visit transportnsw.info
Call 131 500 TTY 1800 637 500

ATTACHMENT D
SIDRA MOVEMENT SUMMARY TABLES

MOVEMENT SUMMARY

Site: 2017 AM

King Street / The Esplanade
Warners Bay
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: The Esplanade											
2	T1	708	3.7	0.572	2.1	LOS A	4.5	32.5	0.60	0.30	39.7
3	R2	701	2.0	0.617	7.3	LOS A	5.2	37.4	0.65	0.68	38.7
3u	U	5	20.0	0.617	9.1	LOS A	5.2	37.4	0.65	0.68	39.6
Approach		1414	2.9	0.617	4.7	LOS A	5.2	37.4	0.62	0.49	39.2
East: King Street											
4	L2	421	3.6	0.439	3.8	LOS A	2.6	19.0	0.68	0.64	38.6
6	R2	224	4.5	0.327	7.9	LOS A	1.6	12.0	0.65	0.78	38.6
6u	U	27	3.7	0.327	9.4	LOS A	1.6	12.0	0.65	0.78	39.5
Approach		672	3.9	0.439	5.4	LOS A	2.6	19.0	0.67	0.69	38.6
North: The Esplanade											
7	L2	218	2.3	0.559	7.7	LOS A	5.1	36.5	0.89	0.96	37.5
8	T1	605	4.6	0.559	7.6	LOS A	5.1	36.5	0.88	0.96	38.4
9u	U	5	0.0	0.559	14.0	LOS A	4.7	34.5	0.88	0.99	39.8
Approach		828	4.0	0.559	7.7	LOS A	5.1	36.5	0.88	0.96	38.1
All Vehicles		2914	3.4	0.617	5.7	LOS A	5.2	37.4	0.71	0.68	38.8

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.

MOVEMENT SUMMARY

Site: 2017 AM + development

King Street / The Esplanade
Warners Bay
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: The Esplanade											
2	T1	708	3.7	0.635	3.6	LOS A	5.9	41.9	0.71	0.57	39.3
3	R2	701	2.0	0.635	7.8	LOS A	5.9	41.9	0.70	0.72	38.7
3u	U	12	8.3	0.635	9.4	LOS A	5.9	41.9	0.70	0.72	39.6
Approach		1421	2.9	0.635	5.7	LOS A	5.9	42.0	0.71	0.65	39.0
East: King Street											
4	L2	421	3.6	0.445	3.9	LOS A	2.7	19.5	0.70	0.66	38.6
6	R2	258	3.9	0.390	8.0	LOS A	2.1	15.3	0.68	0.81	38.5
6u	U	52	1.9	0.390	9.4	LOS A	2.1	15.3	0.68	0.81	39.5
Approach		731	3.6	0.445	5.7	LOS A	2.7	19.5	0.69	0.72	38.6
North: The Esplanade											
7	L2	218	2.3	0.591	8.8	LOS A	5.7	41.1	0.92	1.03	37.2
8	T1	613	4.6	0.591	8.7	LOS A	5.7	41.1	0.92	1.05	37.9
9u	U	5	0.0	0.591	15.1	LOS B	5.3	38.4	0.91	1.06	39.3
Approach		836	3.9	0.591	8.8	LOS A	5.7	41.1	0.92	1.04	37.7
All Vehicles		2988	3.3	0.635	6.6	LOS A	5.9	42.0	0.76	0.78	38.6

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.

MOVEMENT SUMMARY

Site: 2027 AM + development

King Street / The Esplanade
Warners Bay
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: The Esplanade											
2	T1	814	3.7	0.759	6.0	LOS A	9.8	69.8	0.87	0.88	38.9
3	R2	806	2.0	0.759	9.9	LOS A	9.8	69.8	0.85	0.89	38.2
3u	U	13	7.7	0.759	11.6	LOS A	9.8	69.8	0.85	0.89	39.1
Approach		1633	2.9	0.759	8.0	LOS A	9.8	69.8	0.86	0.89	38.5
East: King Street											
4	L2	484	3.5	0.551	4.9	LOS A	3.9	28.2	0.79	0.88	38.4
6	R2	292	4.1	0.490	9.1	LOS A	3.0	21.3	0.76	0.93	38.3
6u	U	56	1.8	0.490	10.5	LOS A	3.0	21.3	0.76	0.93	39.3
Approach		832	3.6	0.551	6.7	LOS A	3.9	28.2	0.77	0.90	38.4
North: The Esplanade											
7	L2	251	2.4	0.831	22.8	LOS B	13.2	95.2	1.00	1.50	32.6
8	T1	704	4.5	0.831	23.4	LOS B	13.2	95.2	1.00	1.49	33.0
9u	U	6	0.0	0.831	30.2	LOS C	11.7	85.3	1.00	1.48	33.9
Approach		961	4.0	0.831	23.2	LOS B	13.2	95.2	1.00	1.49	32.9
All Vehicles		3426	3.4	0.831	12.0	LOS A	13.2	95.2	0.88	1.06	36.8

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.

MOVEMENT SUMMARY

Site: 2017 PM

King Street / The Esplanade
Warners Bay
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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: The Esplanade											
2	T1	639	1.1	0.536	3.4	LOS A	4.3	30.6	0.73	0.64	39.2
3	R2	419	0.7	0.536	8.5	LOS A	4.2	29.9	0.74	0.78	38.8
3u	U	8	0.0	0.536	9.9	LOS A	4.2	29.9	0.74	0.78	39.8
Approach		1066	0.9	0.536	5.4	LOS A	4.3	30.6	0.73	0.63	39.1
East: King Street											
4	L2	584	1.0	0.668	6.4	LOS A	5.2	37.0	0.83	1.00	37.9
6	R2	411	1.0	0.609	10.7	LOS A	4.1	29.0	0.81	1.01	37.8
6u	U	21	0.0	0.609	12.2	LOS A	4.1	29.0	0.81	1.01	38.7
Approach		1016	1.0	0.668	8.3	LOS A	5.2	37.0	0.82	1.01	37.8
North: The Esplanade											
7	L2	141	2.1	0.520	4.2	LOS A	4.0	28.4	0.72	0.54	38.4
8	T1	888	0.9	0.520	3.6	LOS A	4.0	28.4	0.72	0.56	39.4
9u	U	5	0.0	0.520	9.9	LOS A	3.9	27.8	0.72	0.57	41.0
Approach		1034	1.1	0.520	3.7	LOS A	4.0	28.4	0.72	0.56	39.3
All Vehicles		3116	1.0	0.668	5.8	LOS A	5.2	37.0	0.76	0.73	38.7

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.

MOVEMENT SUMMARY

Site: 2017 PM + development

King Street / The Esplanade
Warners Bay
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: The Esplanade											
2	T1	639	1.1	0.555	3.7	LOS A	4.7	33.2	0.76	0.59	39.2
3	R2	419	0.7	0.555	8.8	LOS A	4.6	32.2	0.76	0.82	38.7
3u	U	24	0.0	0.555	10.3	LOS A	4.6	32.2	0.76	0.82	39.6
Approach		1082	0.9	0.555	5.8	LOS A	4.7	33.2	0.76	0.68	39.0
East: King Street											
4	L2	584	1.0	0.687	6.8	LOS A	5.5	39.2	0.85	1.03	37.7
6	R2	420	1.0	0.648	11.4	LOS A	4.6	32.5	0.83	1.05	37.5
6u	U	28	0.0	0.648	12.9	LOS A	4.6	32.5	0.83	1.05	38.4
Approach		1032	1.0	0.687	8.9	LOS A	5.5	39.2	0.84	1.04	37.6
North: The Esplanade											
7	L2	141	2.1	0.543	4.6	LOS A	4.4	31.5	0.75	0.61	38.4
8	T1	910	0.9	0.543	4.0	LOS A	4.4	31.5	0.75	0.63	39.3
9u	U	5	0.0	0.543	10.4	LOS A	4.3	30.6	0.75	0.65	40.9
Approach		1056	1.0	0.543	4.1	LOS A	4.4	31.5	0.75	0.63	39.2
All Vehicles		3170	1.0	0.687	6.2	LOS A	5.5	39.2	0.78	0.78	38.6

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.

MOVEMENT SUMMARY

Site: 2027 PM + development

King Street / The Esplanade
Warners Bay
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: The Esplanade											
2	T1	735	1.1	0.694	6.3	LOS A	7.9	55.8	0.91	0.96	38.7
3	R2	482	0.8	0.694	11.6	LOS A	7.6	53.3	0.91	1.03	37.7
3u	U	25	0.0	0.694	13.1	LOS A	7.6	53.3	0.91	1.03	38.6
Approach		1242	1.0	0.694	8.5	LOS A	7.9	55.8	0.91	0.99	38.3
East: King Street											
4	L2	672	1.0	0.899	15.8	LOS B	11.9	84.0	0.99	1.49	34.5
6	R2	482	1.0	0.862	19.2	LOS B	8.9	63.0	0.96	1.36	34.9
6u	U	31	0.0	0.862	20.6	LOS B	8.9	63.0	0.96	1.36	35.6
Approach		1185	1.0	0.899	17.3	LOS B	11.9	84.0	0.98	1.43	34.7
North: The Esplanade											
7	L2	162	1.9	0.679	7.1	LOS A	7.5	52.9	0.90	0.95	37.9
8	T1	1043	0.9	0.679	6.6	LOS A	7.5	52.9	0.90	0.97	38.7
9u	U	6	0.0	0.679	13.1	LOS A	7.2	50.6	0.90	0.98	40.2
Approach		1211	1.0	0.679	6.7	LOS A	7.5	52.9	0.90	0.96	38.6
All Vehicles		3638	1.0	0.899	10.8	LOS A	11.9	84.0	0.93	1.12	37.2

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.

9 – STORMWATER MANAGEMENT PLAN

APPENDIX A

Detailed Site Survey

King Street

LEGEND

CADMAN CONSULTANTS

Detail & Contour Surveys
Cnr Howard & King Streets
& The Esplanade
Warners Bay

D08347843

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STORMWATER MANAGEMENT PLAN REPORT

Associated with the Proposed Multi-Storey Mixed-Use Development

At Lots 1 DP 90877, 122 DP 578045, 1-3 DP155951 and 3-4 DP 32518 482-488 The Esplanade Warners Bay

For Bloc Pty Ltd
Ref. 20160518_R01 Rev A
April 2017

Lake Macquarie City Council
Local Government Area





CONTENTS

Revision Title		Prepared	Reviewed	Date
A	Issued for DA	N.L.	B.W.	11/04/17

EXECUTIVE SUMMARY

RGH Consulting Group Pty Ltd (RGH) has been engaged by Bloc Pty Ltd (the Client) to undertake conceptual stormwater and civil engineering design for Development Application (DA) and a Stormwater Management Plan (SMP) Report associated with the proposed multi-storey mixed-use development at Lots 1 DP 90877, 122 DP 578045, 1-3 DP155951 and 3-4 DP 32518, 482-488 The Esplanade, Warners Bay (the Subject Site). The site lies within the Lake Macquarie City Council (Council) Local Government Area (LGA). RGH has prepared DA Engineering Drawings (RGH Drawing Set) which should be referenced during review of this SMP Report.

Council's stormwater management guidelines require that the proposed development manage stormwater qualitatively prior to discharge into receiving waters or drainage infrastructure. Council has advised RGH that quantitative stormwater management is not required for this particular development due to its proximity to Lake Macquarie. The stormwater management requirements satisfied by this SMP were sourced from Council's Development Control Plan (DCP) or Engineering Design Guidelines, Council's Water Cycle Management (WCM) Guidelines, Council's Stormwater Quality Improvement Devices Guidelines and Council's Handbook on Drainage Design.

After construction, the development is expected to generate an increase in the amount of pollutants being transported by stormwater that will leave the development. Council specifies within its WCM Guidelines that pollutant reduction targets must be satisfied prior to approval of the development. The qualitative models prepared involved the inclusion of rainwater tanks and bio-retention filter areas to treat the stormwater runoff prior to discharge from the site. The rainwater tanks proposed by RGH and shown within the RGH Drawing Set provide some pollutant reduction due to their storage, retention and re-use properties. The modelling conducted using the MUSIC stormwater quality modelling programme tested the performance of the 'treatment train' with respect to achieving the targets provided by Council.

During construction, implementation of water quality control as defined in the NSW Department of Housing Publication "*Soils and Construction*" (The Blue Book) is to be adopted to maximise the capture of sediments and minimise erosion of disturbed soils during the construction phase. Calculation involves the methods as outlined within the Blue Book and this SMP Report will require the final detailed design drawings to adopt the Blue Books standard management measures in this regard.

Stormwater quality was managed in accordance with Council's WCM Guidelines, with the requirements for medium-high density residential developments addressed and modelled within the MUSIC stormwater quality programme to determine the reduction percentages provided through treatment of stormwater runoff.

A 5 kilolitre (kL) rainwater tank is proposed for each roof area and was modelled within the MUSIC programme. Two bio-retention areas are incorporated into the landscaped area of the development to effectively and efficiently manage the removal of nitrates and phosphates for complete stormwater treatment. Figure 2 below shows a screen shot of the results of the stormwater quality modelling. The summary output report from MUSIC can be found at Appendix B.

The stormwater drainage system will need to be maintained at regular intervals depending on the type of catchment usage. It is recommended that monitoring and recording of the performance of a stormwater system be undertaken regularly over a period of one year until such time as typical maintenance periods can be established. Initially, it is recommended that inspections of all new stormwater systems at quarterly intervals and after large rainfall events be conducted until a suitable baseline can be estimated. Suitable intervals for maintenance work to be undertaken can then be programmed.

Therefore, it is the recommendation of RGH Consulting Group Pty Ltd that the Stormwater Management Plan and strategy contained within this report be approved and adopted by Council for the proposed development.

1. INTRODUCTION

RGH Consulting Group Pty Ltd (RGH) has been engaged by Bloc Pty Ltd (the Client) to undertake conceptual Development Application (DA) stormwater and civil engineering design for the proposed Multi-Storey Residential Building development at Lots 1 DP 90877, 122 DP 578045, 1-3 DP155951 and 3-4 DP 32518, known as 482-488 The Esplanade, Warners Bay (the Subject Site). A qualified engineer from RGH attended the site to gain an understanding of the constraints which may affect the final layout or design of the development. RGH has prepared DA engineering design drawings (RGH Drawing Set) which should be reviewed in conjunction with this Stormwater Management Plan (SMP) Report.

The Subject Site is located within the Lake Macquarie City Council (Council) Local Government Area (LGA) and in order to gain approval for the development, Council's stormwater management targets for new development must be satisfied or addressed. Specifically in regards to stormwater management, Council requires that the proposed development manage stormwater qualitatively prior to discharge into receiving waters or drainage infrastructure.

Council has advised RGH that quantitative stormwater management, in the form of On-Site Detention, is not required for this particular development due to its proximity to Lake Macquarie. The stormwater management requirements satisfied by this SMP were sourced from Council's Development Control Plan (DCP) or Engineering Design Guidelines, Council's Water Cycle Management (WCM) Guidelines, Council's Stormwater Quality Improvement Devices Guidelines and Council's Handbook on Drainage Design.

After construction, the development is expected to generate an increase in the amount of pollutants being transported by stormwater that will leave the development. Council specifies within its WCM Guidelines that pollutant reduction targets must be satisfied prior to approval of the development. The qualitative models prepared involved the inclusion of rainwater tanks and bio-retention filter areas to treat the stormwater runoff prior to discharge from the site. The rainwater tanks proposed by RGH, and shown within the RGH Drawing Set, provide some pollutant reduction due to their storage, retention and re-use properties. The modelling conducted using the MUSIC stormwater quality modelling programme tested the performance of the 'treatment train' with respect to achieving the targets provided by Council.

During construction, implementation of water quality control as defined in the NSW Department of Housing Publication "*Soils and Construction*" (The Blue Book) is to be adopted to maximise the capture of sediments and minimise erosion of disturbed soils during the construction phase. Calculation involves the methods as outlined within the Blue Book and this SMP Report will require the final detailed design drawings to adopt the Blue Books standard management measures in this regard.

This report summarises the modelling techniques employed and the results of the modelling.

1.1. Site and Catchment Description

The Subject Site is located along the southern alignment of the King Street carriageway, the western alignment of the Howard Street carriageway and the northern alignment of The Esplanade carriageway. It is approximately 80m east of Lake Macquarie as can be seen in

Figure 1 below. The site catchment has a westerly aspect and the typical slope gradients are between 3-5%. The total site area is approximately 5.1 hectares (ha) and currently contains a petrol station, residential and commercial structures.

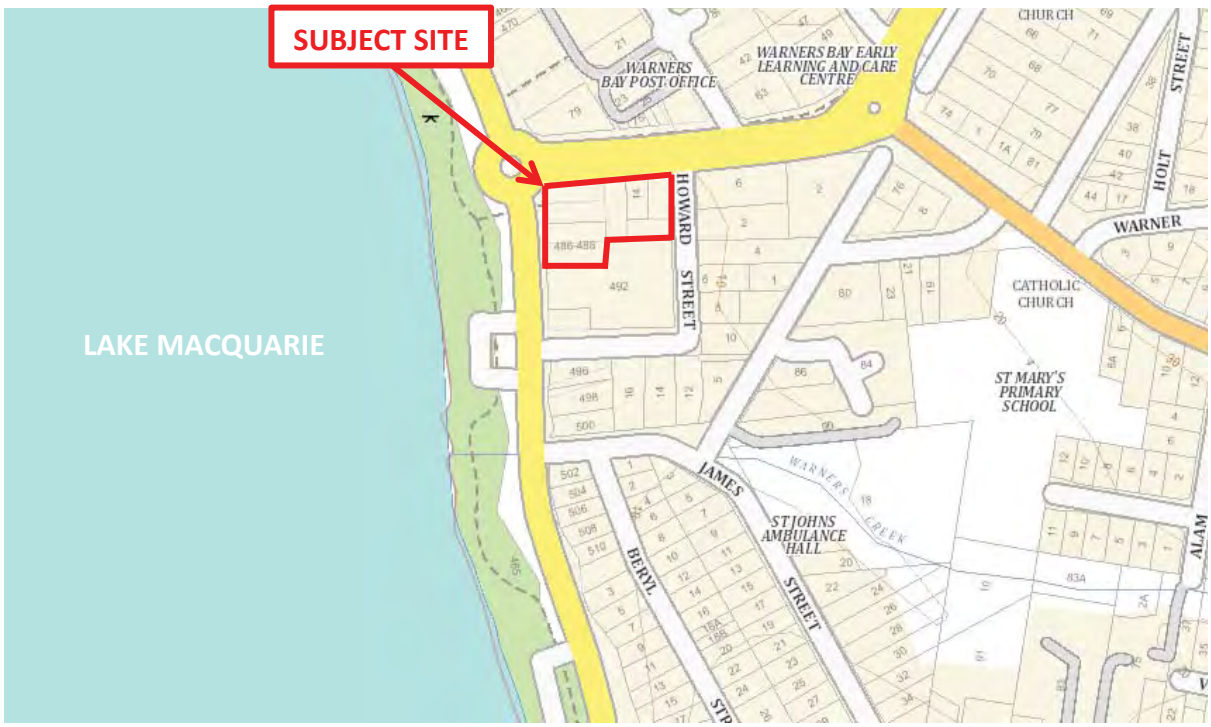


Figure 1 - Locality Map of the Subject Site

2. STORMWATER MANAGEMENT PLAN

The RGH Drawing Set shows the entirety of the proposed development, the proposed stormwater infrastructure and indicates the locations of the proposed bio-retention basin and outlet configuration.

2.1. Catchment Hydrology and Hydraulic Design

Council currently requires that site stormwater system be modelled using the Rational Method, in accordance with the Engineers Australia Publication "*Australian Rainfall and Runoff*" (ARR). Generally proposed development sub-catchment areas were idealised and catchment flow path lengths were adopted from the proposed site layout. Piped systems were sized to cater for the design storm being the 1 in 20 year critical Average Recurrence Interval (ARI) storm as per AS3500.1 'Plumbing and Drainage', and it is assumed that 1 in 100 year flows will be directed to the road reserve as part of more detailed construction issue revisions. The upstream catchment is managed by Council's drainage system within the King Street and Howards Street road carriageways.

2.2. Stormwater Quality Management

Stormwater quality will be managed in accordance with Council's WCM Guidelines, with the requirements for mixed-use developments addressed and modelled within the MUSIC stormwater quality programme to determine the reduction percentages provided through treatment of stormwater runoff.

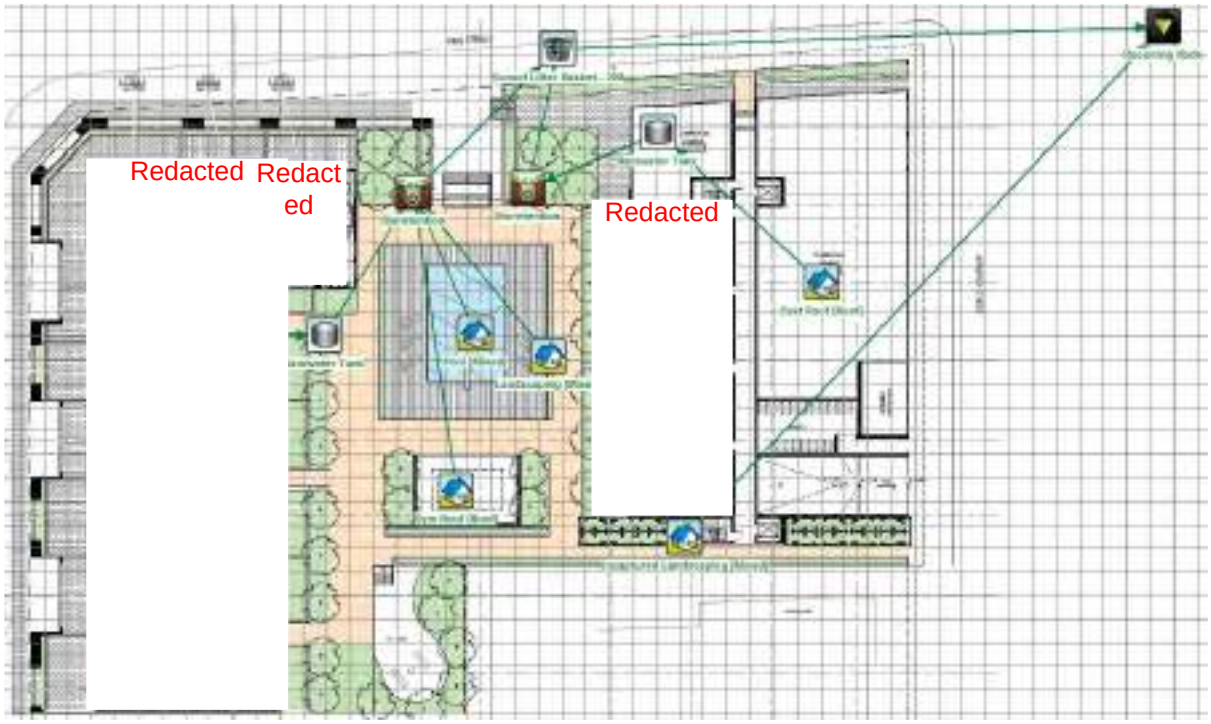
A 5 kilolitre (kL) rainwater tank is proposed for each roof area and was modelled within the MUSIC programme. Two bio-retention areas are incorporated into the landscaped area of the development to effectively and efficiently manage the removal of nitrates and phosphates for complete stormwater treatment. Stormwater from the driveway, basement carpark and roof areas are captured and filtered through the bio-retention filter mediums as shown on the RGH Drawing Set. Figure 2 below shows a screen shot of the results of the stormwater quality modelling. The summary output report from MUSIC can be found at Appendix B.

The MUSIC programme combines litter and coarse sediment and outputs these pollutants as Gross Pollutants (GP). The rainwater re-use tanks provided are installed with first-flush diverters, which capture the initial stormwater flow from the roof areas, expected to contain the majority of pollutant runoff. Additionally, proprietary Ecosol Litter Baskets are proposed to be installed on each stormwater pit within the bio-retention areas and the small landscaped area on the southern boundary to further treat stormwater and manage GPs and Suspended Solids (SS).

It was determined that a total of 16m^2 of bio-retention filter area, split into two bio-retention basins, will be required to achieve the nutrient removal, particularly nitrates and phosphates, which are removed through the provision of nutrient removal vegetation as specified within the RGH Drawing Set. By constructing the bio-retention areas, as can be seen from the results presented within Figure 2 below, the pollutant removal targets can be achieved to satisfy Council's pollutant reduction targets.

The bio-retention basins designed consist of a 550mm deep filters with underdrain pipes consisting of 100mm diameter corrugated and perforated uPVC subsoil drain and geo-fabric

sock (ag-line), laid 100mm below the filter base, and discharging to an outlet at a minimum 1% grade due to the constraints of the Subject Site. Suitable high nutrient demand plant types have been specified on the RGH Drawing Set to satisfactorily remove nutrients and pollutants to an acceptable level. The sandy loam filter medium specified on the RGH Drawing Set has typical data supplied by the MUSIC programme and will need to achieve a saturated hydraulic conductivity of 180mm per hour (mm/hr).



	Sources	Residual Load	% Reduction
Flow (ML/yr)	3.61	3.34	7.6
Total Suspended Solids (kg/yr)	316	53.9	83
Total Phosphorus (kg/yr)	0.757	0.309	59.2
Total Nitrogen (kg/yr)	7.91	4.01	49.3
Gross Pollutants (kg/yr)	101	2.54	97.5

Figure 2 - MUSIC Model Schematic and Pollutant Reduction Results

A portion of the landscaped area within the development area is unable to be captured and conveyed to the bio-retention basin for treatment and therefore, RGH has modelled the specific area as 'Uncaptured Landscaping', discharging it to the street and providing a treatment train which makes up for the shortfall of stormwater treatment for the uncaptured flows. The small amount of stormwater that will enter the basement car park will be pumped to the street drainage system via a basement pump out system.

3. SEDIMENT AND EROSION CONTROL

Sediment and erosion control design was undertaken in accordance with the NSW Department of Housing Publication "Soils and Construction", more commonly referred to as the "Blue Book". Typically, staged release of land will disturb much less area than the total basin catchment, and sediment and erosion control design and plans will need to be undertaken for each individual stage construction drawing set.

The Blue Book's RUSLE method was adopted to undertake detailed calculations for the sediment and erosion control design. Group B Warners Bay formation was adopted based upon the site characteristics and locality and RUSLE K factors of 0.037, 0.059 and 0.027 were implemented in calculation. Other factors calculated or adopted were the soil erosivity factor (R) of 3714, Erosion Control Practice (P) of 1.3 and a Ground Cover (C) factor of 1.0. The 5 day rainfall depth was adopted and the 75th percentile adopted as the site is not expected to be disturbed longer than 6 months. The 75th percentile 5 day rainfall depth adopted was 24.4mm as per the Blue Book for a site located within the Lake Macquarie region.

Under the Blue Book guidelines, if an area of up to 2,500m^2 of disturbance is proposed, sediment basin calculations are not required to be undertaken. Furthermore, if an area of greater than 2,500m^2 of disturbance can be shown to expect an annual soil loss of less than 150m^3, under the RUSLE method, a sediment basin is also deemed unnecessary. The RUSLE calculations performed for the Subject Site resulted in a worst case soil loss of 156m^3 per hectare per year (m^3/ha/yr). This is to be multiplied by the maximum area of disturbance, which for the Subject Site catchment is approximately 5.10ha.

Therefore, a minimum pond volume of 135m^3 is required in accordance with the Blue Book's RUSLE method of sediment retention volume calculation. The proposed multi-storey mixed-use development includes a basement which will be excavated first. RGH expects no sediment basin to be required, as sediment and erosion runoff will pond within the excavated basement area during storm events and can be treated and pumped out when required.

Therefore, provided the appropriate sediment and erosion control methods as detailed within the RGH Drawing Set are implemented on-site during construction, it is considered that the above sediment and erosion control strategy will adequately capture siltation and control sedimentation carried by stormwater to acceptable standards during the construction period.

4. STORMWATER SYSTEM MAINTENANCE

The stormwater drainage system will need to be maintained at regular intervals depending on the type of catchment usage. It is recommended that monitoring and recording of the performance of a stormwater system be undertaken regularly over a period of one year until such time as typical maintenance periods can be established. Initially, it is recommended that inspections of all new stormwater systems at quarterly intervals and after large rainfall events be conducted until a suitable baseline can be estimated. Suitable intervals for maintenance work to be undertaken can then be programmed.

Performance of the bio-retention basins will also need to be considered. The MUSIC programme user guide suggests that bio-retention filters should adequately serve a development for 25 years. Replacement of sub-soil drainage lines and sand filter media should be undertaken if the basin stores water longer than 1 week after rainfall. It should be noted that during wet periods, the basin may hold water for extended periods until the filter empties the basin. Outlet lines from the bio-retention filter can be flushed if necessary to clear any obstructions. Filter mediums will need to be replaced by plant machinery or by manual labour, and plantings also replaced. Table 1 below provides a schedule of maintenance procedures for the stormwater system.

Table 1 - Operation and Maintenance Intervals and Procedures

Item	Inspection Interval	Maintenance Interval	Task/Procedure
Pits and Pipes Network	Quarterly	As required / Yearly	Remove and Dispose of Debris from Item
Litter Baskets	Quarterly	As required / Yearly	Remove and Dispose of Debris from Item
Bio-retention Filter and Outlet	Yearly	25 Years As Required	Replace Filter Medium Remove and Dispose of Debris from Item
Rainwater Re-Use Tank	Yearly	5 Years Maximum	5 Years Maximum

5. CONCLUSIONS AND RECOMMENDATIONS

RGH Consulting Group Pty Ltd has been engaged by Bloc Pty Ltd to undertake conceptual stormwater and civil engineering design for Development Application and a Stormwater Management Plan Report associated with the proposed Multi-Storey Residential Building development at Lots 1 DP 90877, 122 DP 578045, 1-3 DP155951 and 3-4 DP 32518, 482-488 The Esplanade, Warners Bay.

This SMP Report has shown that Council's requirements for short-term construction stormwater quality and long-term stormwater quality targets have been met provided the detailed designers adopt the strategies suggested.

Overall, it is proposed to collect all stormwater from roof areas into rainwater re-use tanks, running through proprietary Ecosol Litter Baskets (or approved equivalent) and a bio-retention area to manage stormwater effectively and efficiently. An overview of sediment and erosion control has also been provided, with recommendations for basin sizes or staged land release within.

Further detailed design adopting the items designed and described within this SMP Report will need to be produced in order to provide adequate tender and construction documentation for constructors.

Therefore, it is the recommendation of RGH Consulting Group Pty Ltd that the Stormwater Management Plan and strategy contained within this Report be approved and adopted by Council for the proposed development.

6. REFERENCES

Australian Rainfall and Runoff, ***"A Guide to Flood Estimation"***, Volume 1, 2001.

Lake Macquarie Council, ***"Development Control Plan – Engineering Design Guidelines"***, July 2016.

Lake Macquarie Council, ***"Handbook on Drainage Design Guidelines"***, December 2013.

Lake Macquarie Council, ***"Stormwater Quality Improvement Devices Guidelines"***, December 2013.

Lake Macquarie Council, ***"Water Cycles Management Guidelines"***, Revision 2, June, 2013.

NSW Government ***"Floodplain Development Manual"***, April 2005.

Streeter, V.L., and Wylie, E.B., ***"Fluid Mechanics"***, McGraw Hill, 1983.

APPENDIX B

MUSIC Modelling Results

LAKE MACQUARIE CITY COUNCIL

music@link

MUSIC-*link* Report

Project Details		Company Details	
Project:	20160518	**Company:**	RGH Consulting Group Pty Ltd
Report Export Date:	3/04/2017	**Contact:**	Ben Williams
Catchment Name:	20160518_MUSIC_20170330	**Address:**	482-488 The Esplanade Warners Bay
Catchment Area:	0.507ha	**Phone:**	(02) 4351 9022
Impervious Area*:	84.84%	**Email:**	b.williams@rghconsulting.com.au
Rainfall Station:			
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1999 - 31/12/2008 11:54:00 PM		
Mean Annual Rainfall:	902mm		
Evapotranspiration:	1408mm		
MUSIC Version:	6.2.1		
MUSIC-link data Version:	6.22		
Study Area:	North Region		
Scenario:	North Region		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: Receiving Node	**Reduction**	**Node Type**	**Number**	**Node Type**	**Number**
Flow	7.58%	Rain Water Tank Node	2	Urban Source Node	6
TSS	82.5%	Bio Retention Node	2		
TP	59.2%	GPT Node	1		
TN	49.4%				
GP	97.5%				

Comments

LAKE MACQUARIE CITY COUNCIL

music@link

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
GPT	Ecosol Litter Basket - 200	Hi-flow bypass rate (cum/sec)	None	None	0.05
Rain	Rainwater Tank	% Reuse Demand Met	80	None	80.91
Rain	Rainwater Tank	% Reuse Demand Met	80	None	80.36
Receiving	Receiving Node	% Load Reduction	None	None	7.58
Receiving	Receiving Node	GP % Load Reduction	70	None	97.5
Receiving	Receiving Node	TN % Load Reduction	45	None	49.4
Receiving	Receiving Node	TP % Load Reduction	45	None	59.2
Receiving	Receiving Node	TSS % Load Reduction	80	None	82.5
Urban	East Roof	Area Impervious (ha)	None	None	0.119
Urban	East Roof	Area Pervious (ha)	None	None	0
Urban	East Roof	Total Area (ha)	None	None	0.119
Urban	Gym Roof	Area Impervious (ha)	None	None	0.008
Urban	Gym Roof	Area Pervious (ha)	None	None	0
Urban	Gym Roof	Total Area (ha)	None	None	0.008
Urban	Landscaping	Area Impervious (ha)	None	None	0.129
Urban	Landscaping	Area Pervious (ha)	None	None	0.066
Urban	Landscaping	Total Area (ha)	None	None	0.196
Urban	Pool	Area Impervious (ha)	None	None	0.032
Urban	Pool	Area Pervious (ha)	None	None	0
Urban	Pool	Total Area (ha)	None	None	0.032
Urban	Uncaptured Landscaping	Area Impervious (ha)	None	None	0.008
Urban	Uncaptured Landscaping	Area Pervious (ha)	None	None	0.009
Urban	Uncaptured Landscaping	Total Area (ha)	None	None	0.018
Urban	West Roof	Area Impervious (ha)	None	None	0.134
Urban	West Roof	Area Pervious (ha)	None	None	0
Urban	West Roof	Total Area (ha)	None	None	0.134

Only certain parameters are reported when they pass validation

LAKE MACQUARIE CITY COUNCIL

MUSIC SUMMARY REPORT

Source nodes

Location	East Roof	West Roof	Gym Roof	Pool	Landscaping	Uncaptured Landscaping
ID	1	2	3	4	5	11
Node Type	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode
Zoning Surface Type	Roof	Roof	Roof	Mixed	Mixed	Mixed
Total Area (ha)	0.119	0.134	0.008	0.032	0.196	0.018
Area Impervious (ha)	0.119	0.134	0.008	0.032	0.129023582	0.008118134
Area Pervious (ha)	0	0	0	0	0.066976418	0.009881866
Field Capacity (mm)	70	70	70	70	70	70
Pervious Area Infiltration Capacity coefficient - a	210	210	210	210	210	210
Pervious Area Infiltration Capacity exponent - b	4.7	4.7	4.7	4.7	4.7	4.7
Impervious Area Rainfall Threshold (mm/day)	1	1	1	1	1	1
Pervious Area Soil Storage Capacity (mm)	170	170	170	170	170	170
Pervious Area Soil Initial Storage (% of Capacity)	30	30	30	30	30	30
Groundwater Initial Depth (mm)	10	10	10	10	10	10
Groundwater Daily Recharge Rate (%)	50	50	50	50	50	50
Groundwater Daily Baseflow Rate (%)	5	5	5	5	5	5
Groundwater Daily Deep Seepage Rate (%)	0	0	0	0	0	0
Stormflow Total Suspended Solids Mean (log mg/L)	1.3	1.3	1.3	2.15	2.15	2.15
Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.32	0.32	0.32	0.32
Stormflow Total Suspended Solids Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic
Stormflow Total Suspended Solids Serial Correlation	0	0	0	0	0	0
Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.89	-0.89	-0.6	-0.6	-0.6
Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.25	0.25	0.25	0.25
Stormflow Total Phosphorus Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic
Stormflow Total Phosphorus Serial Correlation	0	0	0	0	0	0
Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3	0.3	0.3	0.3
Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.19	0.19	0.19	0.19
Stormflow Total Nitrogen Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic
Stormflow Total Nitrogen Serial Correlation	0	0	0	0	0	0
Baseflow Total Suspended Solids Mean (log mg/L)	1.1	1.1	1.1	1.2	1.2	1.2
Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.17	0.17	0.17	0.17
Baseflow Total Suspended Solids Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic
Baseflow Total Suspended Solids Serial Correlation	0	0	0	0	0	0
Baseflow Total Phosphorus Mean (log mg/L)	-0.82	-0.82	-0.82	-0.85	-0.85	-0.85
Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.19	0.19	0.19	0.19
Baseflow Total Phosphorus Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic
Baseflow Total Phosphorus Serial Correlation	0	0	0	0	0	0
Baseflow Total Nitrogen Mean (log mg/L)	0.32	0.32	0.32	0.11	0.11	0.11
Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.12	0.12	0.12	0.12
Baseflow Total Nitrogen Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic
Baseflow Total Nitrogen Serial Correlation	0	0	0	0	0	0
Flow based constituent generation - enabled	Off	Off	Off	Off	Off	Off
Flow based constituent generation - flow file						
Flow based constituent generation - base flow column						
Flow based constituent generation - pervious flow column						
Flow based constituent generation - impervious flow column						
Flow based constituent generation - unit						
OUT - Mean Annual Flow (ML/yr)	0.954	1.07	6.41E-02	0.257	1.18	8.59E-02
OUT - TSS Mean Annual Load (kg/yr)	24.8	28.2	1.67	48.1	207	14.2
OUT - TP Mean Annual Load (kg/yr)	0.146	0.166	9.89E-03	7.62E-02	0.339	2.39E-02
OUT - TN Mean Annual Load (kg/yr)	2.08	2.35	0.141	0.558	2.53	0.178
OUT - Gross Pollutant Mean Annual Load (kg/yr)	26.1	29.3	1.75	7.01	34.7	2.54
Rain In (ML/yr)	1.0732	1.20848	0.0721479	0.288592	1.76763	0.162333
ET Loss (ML/yr)	0.119083	0.134094	0.0080056	0.0320223	0.588545	0.0763082
Deep Seepage Loss (ML/yr)	0	0	0	0	0	0
Baseflow Out (ML/yr)	0	0	0	0	0.0845244	0.0125569
Imp. Stormflow Out (ML/yr)	0.954119	1.07438	0.0641424	0.25657	1.03718	0.0649442
Perv. Stormflow Out (ML/yr)	0	0	0	0	0.0567522	0.0084311
Total Stormflow Out (ML/yr)	0.954119	1.07438	0.0641424	0.25657	1.09393	0.0733753
Total Outflow (ML/yr)	0.954119	1.07438	0.0641424	0.25657	1.17846	0.0859322
Change in Soil Storage (ML/yr)	0	0	0	0	0.0006234	9.26E-05
TSS Baseflow Out (kg/yr)	0	0	0	0	1.44758	0.214595
TSS Total Stormflow Out (kg/yr)	24.8427	28.1805	1.67283	48.0969	205.556	13.9943
TSS Total Outflow (kg/yr)	24.8427	28.1805	1.67283	48.0969	207.004	14.2089
TP Baseflow Out (kg/yr)	0	0	0	0	0.0131233	0.0019519
TP Total Stormflow Out (kg/yr)	0.146047	0.166183	0.0098947	0.0761873	0.325509	0.0219155
TP Total Outflow (kg/yr)	0.146047	0.166183	0.0098947	0.0761873	0.338632	0.0238674
TN Baseflow Out (kg/yr)	0	0	0	0	0.113051	0.0168087
TN Total Stormflow Out (kg/yr)	2.07667	2.34907	0.1411	0.557618	2.41288	0.161198
TN Total Outflow (kg/yr)	2.07667	2.34907	0.1411	0.557618	2.52593	0.178007
GP Total Outflow (kg/yr)	26.0627	29.3479	1.75211	7.00846	34.77	2.55433

No Imported Data Source nodes

USTM treatment nodes

Location	Rainwater Tank	Rainwater Tank	Bioretention	Bioretention

ID		6	7	8	12
Node Type	RainWaterTankNode	RainWaterTankNode	BioRetentionNodeV4	BioRetentionNodeV4	
Lo-flow bypass rate (cum/sec)		0	0	0	0
Hi-flow bypass rate (cum/sec)		100	100	100	100
Inlet pond volume		0	0		
Area (sqm)		2.5	2.5	50	20
Initial Volume (m^3)		5	5		
Extended detention depth (m)		0.2	0.2	0.3	0.3
Number of Rainwater tanks		1	1		
Permanent Pool Volume (cubic metres)		5	5		
Proportion vegetated		0	0		
Equivalent Pipe Diameter (mm)		100	100		
Overflow weir width (m)		10	10	2	2
Notional Detention Time (hrs)		1.33E-02	1.33E-02		
Orifice Discharge Coefficient		0.6	0.6		
Weir Coefficient		1.7	1.7	1.7	1.7
Number of CSTR Cells		2	2	3	3
Total Suspended Solids - k (m/yr)		400	400	8000	8000
Total Suspended Solids - C* (mg/L)		12	12	20	20
Total Suspended Solids - C** (mg/L)		0	0		
Total Phosphorus - k (m/yr)		300	300	6000	6000
Total Phosphorus - C* (mg/L)		0.13	0.13	0.13	0.13
Total Phosphorus - C** (mg/L)		0	0		
Total Nitrogen - k (m/yr)		40	40	500	500
Total Nitrogen - C* (mg/L)		1.4	1.4	1.4	1.4
Total Nitrogen - C** (mg/L)		0	0		
Threshold Hydraulic Loading for C** (m/yr)		0	0		
Horizontal Flow Coefficient				3	3
Reuse Enabled	On	On	Off	Off	
Max drawdown height (m)		2	2		
Annual Demand Enabled	Off	Off	Off	Off	
Annual Demand Value (ML/year)					
Annual Demand Distribution					
Annual Demand Monthly Distribution: Jan					
Annual Demand Monthly Distribution: Feb					
Annual Demand Monthly Distribution: Mar					
Annual Demand Monthly Distribution: Apr					
Annual Demand Monthly Distribution: May					
Annual Demand Monthly Distribution: Jun					
Annual Demand Monthly Distribution: Jul					
Annual Demand Monthly Distribution: Aug					
Annual Demand Monthly Distribution: Sep					
Annual Demand Monthly Distribution: Oct					
Annual Demand Monthly Distribution: Nov					
Annual Demand Monthly Distribution: Dec					
Daily Demand Enabled	On	On	Off	Off	
Daily Demand Value (ML/day)		0.0004	0.0004		
Custom Demand Enabled	Off	Off	Off	Off	
Custom Demand Time Series File					
Custom Demand Time Series Units					
Filter area (sqm)				6	10
Filter perimeter (m)				14	14
Filter depth (m)				0.55	0.55
Filter Median Particle Diameter (mm)					
Saturated Hydraulic Conductivity (mm/hr)				180	180
Infiltration Media Porosity				0.35	0.35
Length (m)					
Bed slope					
Base Width (m)					
Top width (m)					
Vegetation height (m)					
Vegetation Type			Vegetated with Effective Nutrient Removal Plants	Vegetated with Effective Nutrient Removal Plants	
Total Nitrogen Content in Filter (mg/kg)				800	800
Orthophosphate Content in Filter (mg/kg)				55	55
Is Base Lined?			Yes	Yes	
Is Underdrain Present?			Yes	Yes	
Is Submerged Zone Present?			No	No	
Submerged Zone Depth (m)					
B for Media Soil Texture		-9999	-9999	13	13
Proportion of upstream impervious area treated					
Exfiltration Rate (mm/hr)		0	0	0	0
Evaporative Loss as % of PET		0	0	100	100
Depth in metres below the drain pipe					
TSS A Coefficient					
TSS B Coefficient					
TP A Coefficient					
TP B Coefficient					
TN A Coefficient					
TN B Coefficient					

Sfc			0.61	0.61
S*			0.37	0.37
Sw			0.11	0.11
Sh			0.05	0.05
Emax (m/day)			0.008	0.008
Ew (m/day)			0.001	0.001
IN - Mean Annual Flow (ML/yr)	1.07	0.954	2.46	0.837
IN - TSS Mean Annual Load (kg/yr)	28.2	24.8	280	20.1
IN - TP Mean Annual Load (kg/yr)	0.166	0.146	0.57	0.126
IN - TN Mean Annual Load (kg/yr)	2.35	2.08	5.29	1.8
IN - Gross Pollutant Mean Annual Load (kg/yr)	29.3	26.1	43.5	0
OUT - Mean Annual Flow (ML/yr)	0.956	0.837	2.44	0.815
OUT - TSS Mean Annual Load (kg/yr)	23.4	20.1	60.6	7
OUT - TP Mean Annual Load (kg/yr)	0.145	0.126	0.349	0.109
OUT - TN Mean Annual Load (kg/yr)	2.07	1.8	3.27	0.958
OUT - Gross Pollutant Mean Annual Load (kg/yr)	0	0	0	0
Flow In (ML/yr)	1.07441	0.954125	2.45219	0.836737
ET Loss (ML/yr)	0	0	0.0165407	0.021491
Infiltration Loss (ML/yr)	0	0	0	0
Low Flow Bypass Out (ML/yr)	0	0	0	0
High Flow Bypass Out (ML/yr)	0	0	0	0
Orifice / Filter Out (ML/yr)	0.884121	0.783463	1.17757	0.571977
Weir Out (ML/yr)	0.0720767	0.0532736	1.26018	0.242704
Transfer Function Out (ML/yr)	0	0	0	0
Reuse Supplied (ML/yr)	0.118387	0.117587	0	0
Reuse Requested (ML/yr)	0.146308	0.146308	0	0
% Reuse Demand Met	80.9163	80.3695	0	0
% Load Reduction	11.0025	12.3033	0.588848	2.63594
TSS Flow In (kg/yr)	28.1805	24.8427	279.55	20.1486
TSS ET Loss (kg/yr)	0	0	0	0
TSS Infiltration Loss (kg/yr)	0	0	0	0
TSS Low Flow Bypass Out (kg/yr)	0	0	0	0
TSS High Flow Bypass Out (kg/yr)	0	0	0	0
TSS Orifice / Filter Out (kg/yr)	21.6232	18.8494	2.52204	1.69854
TSS Weir Out (kg/yr)	1.74727	1.29914	58.0747	5.29977
TSS Transfer Function Out (kg/yr)	0	0	0	0
TSS Reuse Supplied (kg/yr)	1.78227	1.76977	0	0
TSS Reuse Requested (kg/yr)	0	0	0	0
TSS % Reuse Demand Met	0	0	0	0
TSS % Load Reduction	17.0686	18.8955	78.3234	65.2665
TP Flow In (kg/yr)	0.166183	0.146047	0.569214	0.125601
TP ET Loss (kg/yr)	0	0	0	0
TP Infiltration Loss (kg/yr)	0	0	0	0
TP Low Flow Bypass Out (kg/yr)	0	0	0	0
TP High Flow Bypass Out (kg/yr)	0	0	0	0
TP Orifice / Filter Out (kg/yr)	0.134329	0.117606	0.141898	0.0753681
TP Weir Out (kg/yr)	0.0110009	0.00799576	0.207021	0.0338584
TP Transfer Function Out (kg/yr)	0	0	0	0
TP Reuse Supplied (kg/yr)	0.0161056	0.0159678	0	0
TP Reuse Requested (kg/yr)	0	0	0	0
TP % Reuse Demand Met	0	0	0	0
TP % Load Reduction	12.5483	13.9991	38.7016	13.0372
TN Flow In (kg/yr)	2.34907	2.07667	5.28392	1.79913
TN ET Loss (kg/yr)	0	0	0	0
TN Infiltration Loss (kg/yr)	0	0	0	0
TN Low Flow Bypass Out (kg/yr)	0	0	0	0
TN High Flow Bypass Out (kg/yr)	0	0	0	0
TN Orifice / Filter Out (kg/yr)	1.91502	1.68432	0.727488	0.45955
TN Weir Out (kg/yr)	0.152103	0.114812	2.54301	0.497635
TN Transfer Function Out (kg/yr)	0	0	0	0
TN Reuse Supplied (kg/yr)	0.231211	0.227425	0	0
TN Reuse Requested (kg/yr)	0	0	0	0
TN % Reuse Demand Met	0	0	0	0
TN % Load Reduction	12.0025	13.3646	38.1046	46.7974
GP Flow In (kg/yr)	29.3479	26.0627	43.4596	0
GP ET Loss (kg/yr)	0	0	0	0
GP Infiltration Loss (kg/yr)	0	0	0	0
GP Low Flow Bypass Out (kg/yr)	0	0	0	0
GP High Flow Bypass Out (kg/yr)	0	0	0	0
GP Orifice / Filter Out (kg/yr)	0	0	0	0
GP Weir Out (kg/yr)	0	0	0	0
GP Transfer Function Out (kg/yr)	0	0	0	0
GP Reuse Supplied (kg/yr)	0	0	0	0
GP Reuse Requested (kg/yr)	0	0	0	0
GP % Reuse Demand Met	0	0	0	0
GP % Load Reduction	100	100	100	100
PET Scaling Factor			2.1	2.1

Generic treatment nodes

Location	Ecosol Litter Basket - 200
ID	10
Node Type	GPTNode
Lo-flow bypass rate (cum/sec)	0
Hi-flow bypass rate (cum/sec)	0.05
Flow Transfer Function	
Input (cum/sec)	0
Output (cum/sec)	0
Input (cum/sec)	10
Output (cum/sec)	10
Input (cum/sec)	
Output (cum/sec)	
Input (cum/sec)	
Output (cum/sec)	
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Input (cum/sec)	
Output (cum/sec)	
Input (cum/sec)	
Output (cum/sec)	
Input (cum/sec)	
Output (cum/sec)	
Gross Pollutant Transfer Function	
Enabled	TRUE
Input (kg/ML)	0
Output (kg/ML)	0
Input (kg/ML)	1000
Output (kg/ML)	0
Input (kg/ML)	
Output (kg/ML)	
Input (kg/ML)	
Output (kg/ML)	
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Input (kg/ML)	
Output (kg/ML)	
Input (kg/ML)	
Output (kg/ML)	
Input (kg/ML)	
Output (kg/ML)	
Total Nitrogen Transfer Function	
Enabled	TRUE
Input (mg/L)	0
Output (mg/L)	0
Input (mg/L)	1000
Output (mg/L)	890
Input (mg/L)	
Output (mg/L)	
Input (mg/L)	
Output (mg/L)	
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Output (mg/L)	
Input (mg/L)	
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Output (mg/L)	
Input (mg/L)	
Output (mg/L)	
Input (mg/L)	
Output (mg/L)	
Total Phosphorus Transfer Function	
Enabled	TRUE
Input (mg/L)	0
Output (mg/L)	0
Input (mg/L)	1000
Output (mg/L)	610
Input (mg/L)	
Output (mg/L)	
Input (mg/L)	

Output (mg/L)		
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Output (mg/L)		
Total Suspended Solids Transfer Function		
Enabled		TRUE
Input (mg/L)		0
Output (mg/L)		0
Input (mg/L)		1000
Output (mg/L)		590
Input (mg/L)		
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Output (mg/L)		
Input (mg/L)		
Output (mg/L)		
TSS Flow based Efficiency Enabled	Off	
TSS Flow based Efficiency		
TP Flow based Efficiency Enabled	Off	
TP Flow based Efficiency		
TN Flow based Efficiency Enabled	Off	
TN Flow based Efficiency		
GP Flow based Efficiency Enabled	Off	
GP Flow based Efficiency		
IN - Mean Annual Flow (ML/yr)		3.25
IN - TSS Mean Annual Load (kg/yr)		67.6
IN - TP Mean Annual Load (kg/yr)		0.458
IN - TN Mean Annual Load (kg/yr)		4.23
IN - Gross Pollutant Mean Annual Load (kg/yr)		0
OUT - Mean Annual Flow (ML/yr)		3.25
OUT - TSS Mean Annual Load (kg/yr)		42.3
OUT - TP Mean Annual Load (kg/yr)		0.286
OUT - TN Mean Annual Load (kg/yr)		3.78
OUT - Gross Pollutant Mean Annual Load (kg/yr)		0
Flow In (ML/yr)		3.25029
ET Loss (ML/yr)		0
Infiltration Loss (ML/yr)		0
Low Flow Bypass Out (ML/yr)		0
High Flow Bypass Out (ML/yr)		0.0906091
Orifice / Filter Out (ML/yr)		0
Weir Out (ML/yr)		0
Transfer Function Out (ML/yr)		3.15993
Reuse Supplied (ML/yr)		0
Reuse Requested (ML/yr)		0
% Reuse Demand Met		0
% Load Reduction		-0.00769778
TSS Flow In (kg/yr)		67.491
TSS ET Loss (kg/yr)		0
TSS Infiltration Loss (kg/yr)		0
TSS Low Flow Bypass Out (kg/yr)		0
TSS High Flow Bypass Out (kg/yr)		5.98249
TSS Orifice / Filter Out (kg/yr)		0
TSS Weir Out (kg/yr)		0
TSS Transfer Function Out (kg/yr)		36.2913
TSS Reuse Supplied (kg/yr)		0
TSS Reuse Requested (kg/yr)		0
TSS % Reuse Demand Met		0
TSS % Load Reduction		37.3637
TP Flow In (kg/yr)		0.457729
TP ET Loss (kg/yr)		0

TP Infiltration Loss (kg/yr)	0
TP Low Flow Bypass Out (kg/yr)	0
TP High Flow Bypass Out (kg/yr)	0.0169116
TP Orifice / Filter Out (kg/yr)	0
TP Weir Out (kg/yr)	0
TP Transfer Function Out (kg/yr)	0.268921
TP Reuse Supplied (kg/yr)	0
TP Reuse Requested (kg/yr)	0
TP % Reuse Demand Met	0
TP % Load Reduction	37.5543
TN Flow In (kg/yr)	4.22241
TN ET Loss (kg/yr)	0
TN Infiltration Loss (kg/yr)	0
TN Low Flow Bypass Out (kg/yr)	0
TN High Flow Bypass Out (kg/yr)	0.187896
TN Orifice / Filter Out (kg/yr)	0
TN Weir Out (kg/yr)	0
TN Transfer Function Out (kg/yr)	3.59031
TN Reuse Supplied (kg/yr)	0
TN Reuse Requested (kg/yr)	0
TN % Reuse Demand Met	0
TN % Load Reduction	10.5203
GP Flow In (kg/yr)	0
GP ET Loss (kg/yr)	0
GP Infiltration Loss (kg/yr)	0
GP Low Flow Bypass Out (kg/yr)	0
GP High Flow Bypass Out (kg/yr)	0
GP Orifice / Filter Out (kg/yr)	0
GP Weir Out (kg/yr)	0
GP Transfer Function Out (kg/yr)	0
GP Reuse Supplied (kg/yr)	0
GP Reuse Requested (kg/yr)	0
GP % Reuse Demand Met	0
GP % Load Reduction	100

Other nodes

Location	Receiving Node
ID	9
Node Type	ReceivingNode
IN - Mean Annual Flow (ML/yr)	3.34
IN - TSS Mean Annual Load (kg/yr)	56.5
IN - TP Mean Annual Load (kg/yr)	0.31
IN - TN Mean Annual Load (kg/yr)	3.96
IN - Gross Pollutant Mean Annual Load (kg/yr)	2.54
OUT - Mean Annual Flow (ML/yr)	3.34
OUT - TSS Mean Annual Load (kg/yr)	56.5
OUT - TP Mean Annual Load (kg/yr)	0.31
OUT - TN Mean Annual Load (kg/yr)	3.96
OUT - Gross Pollutant Mean Annual Load (kg/yr)	2.54
% Load Reduction	7.58
TSS % Load Reduction	82.5
TN % Load Reduction	49.4
TP % Load Reduction	59.2
GP % Load Reduction	97.5

Links

Location	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link
Source node ID	1	2	6	8	4	8	10	5	3	7	12	11
Target node ID	7	6	8	8	10	9	8	8	12	10	9	
Muskingum-Cunge Routing	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	
Muskingum K												
Muskingum theta												
IN - Mean Annual Flow (ML/yr)	0.954	1.07	0.956	0.257	2.44	3.25	1.18	6.41E-02	0.837	0.815	8.59E-02	
IN - TSS Mean Annual Load (kg/yr)	24.8	28.2	23.4	48.1	60.6	42.3	207	1.67	20.1	7	14.2	
IN - TP Mean Annual Load (kg/yr)	0.146	0.166	0.145	7.62E-02	0.349	0.286	0.339	9.89E-03	1.26E-01	1.09E-01	2.39E-02	
IN - TN Mean Annual Load (kg/yr)	2.08	2.35	2.07	0.558	3.27	3.78	2.53	0.141	1.8	0.958	0.178	
IN - Gross Pollutant Mean Annual Load (kg/yr)	26.1	29.3	0	7.01	0	0	34.7	1.75	0	0	2.54	
OUT - Mean Annual Flow (ML/yr)	0.954	1.07	0.956	0.257	2.44	3.25	1.18	6.41E-02	0.837	0.815	8.59E-02	
OUT - TSS Mean Annual Load (kg/yr)	24.8	28.2	23.4	48.1	60.6	42.3	207	1.67	20.1	7	14.2	
OUT - TP Mean Annual Load (kg/yr)	0.146	0.166	0.145	7.62E-02	0.349	0.286	0.339	9.89E-03	1.26E-01	1.09E-01	2.39E-02	
OUT - TN Mean Annual Load (kg/yr)	2.08	2.35	2.07	0.558	3.27	3.78	2.53	0.141	1.8	0.958	0.178	
OUT - Gross Pollutant Mean Annual Load (kg/yr)	26.1	29.3	0	7.01	0	0	34.7	1.75	0	0	2.54	

Catchment Details

Catchment Name	20160518_MUSIC_20170330
Timestep	6 Minutes
Start Date	1/01/1999
End Date	31/12/2008 23:54
Rainfall Station	

ET Station	User-defined monthly PET
Mean Annual Rainfall (mm)	902
Mean Annual ET (mm)	1408
MUSIC-link Area	North Region
MUSIC-link Scenario	North Region

DEVELOPMENT APPLICATION STORMWATER MANAGEMENT PLANS

FOR

PROPOSED MULTI UNIT DEVELOPMENT

AT

482-488 THE ESPLANADE
WARNERS BAY

LAKE MACQUARIE CITY COUNCIL LOCAL GOVERNMENT AREA

LOCALITY PLAN

DRAWING LIST - DA SERIES	
DA.1.01	COVER SHEET & LOCALITY PLAN
DA.2.01	CONCEPT SEDIMENT & EROSION CONTROL PLAN
DA.2.02	CONCEPT SEDIMENT & EROSION CONTROL DETAILS
DA.3.01	CONCEPT BASEMENT PUMPOUT PLAN
DA.3.02	CONCEPT LOWER GROUND FLOOR DRAINAGE PLAN
DA.3.03	CONCEPT UPPER GROUND FLOOR DRAINAGE PLAN
DA.3.04	CONCEPT STORMWATER DETAILS SHEET
DA.4.01	CONCEPT DRIVEWAY LONG SECTIONS

SURVEY

1. SURVEY BY:
   CADMAN CONSULTANTS
2. ORIGIN OF COORDINATES:

SSM NO.	E	N	R.L.
PM49044	NOT SUPPLIED	NOT SUPPLIED	10.351

3. ALL WORKS TO BE SET OUT BY A REGISTERED SURVEYOR
4. ALL LEVELS SHOWN ARE TO AHD

DIAL 1100 BEFORE YOU DIG www.1100.com.au

NOTE

ALL UTILITIES ARE TO BE ACCURATELY LOCATED BY CONTRACTOR BEFORE CONSTRUCTION.

RGH CONSULTING GROUP
Multi-discipline Engineering

Postal Address: PO Box 3197, Tuggerah NSW 2259

Central Coast Office:
Unit 1, 3 Teamster Close
Tuggerah, NSW 2259
Ph 02 4351 9022

Newcastle Office:
Shop 113, The Junction Village Centre
Kenrick Street,
The Junction NSW 2291
Ph 02 4962 4414

DO NOT SCALE DRAWINGS. VERIFY ALL DIMENSIONS ON SITE.

A1

REVISION	DESCRIPTION	DATE
A	ISSUE FOR REVIEW	31/03/17
B	ISSUE FOR DA	11/04/17

VERSION: FOR REVIEW

SCALE:

RGH CONSULTING GROUP
Multi-discipline Engineering

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Central Coast Office: Unit 1, 3 Teamster Close, Tuggerah NSW 2259 ***Ph*** 02 4351 9022
Newcastle Office: Shop 113, The Junction Village Centre, Kenrick Street, The Junction NSW 2291 ***Ph*** 02 4962 4414

SURVEY BY	CADMAN CONSULTANTS
REFERENCE	8395
DATED	15/02/2009
DATUM	AHD

CLIENT	BLOC
ADDRESS	482-488 THE ESPLANADE WARNERS BAY
PROJECT	PROPOSED MULTI UNIT DEVELOPMENT

DRAWING TITLE: COVER SHEET AND LOCALITY PLAN

ANTHONY JOHN GRIFFITHS
MIE AUST CPENG 2342830
signed date

SCALE	N.T.S. INT.
DRAWN	AFJG
DESIGNED	BW
CHECKED	BW
DATE	MARCH 2017
JOB NUMBER	20160518

SHEET: DA1.01

REV: B

D08347837

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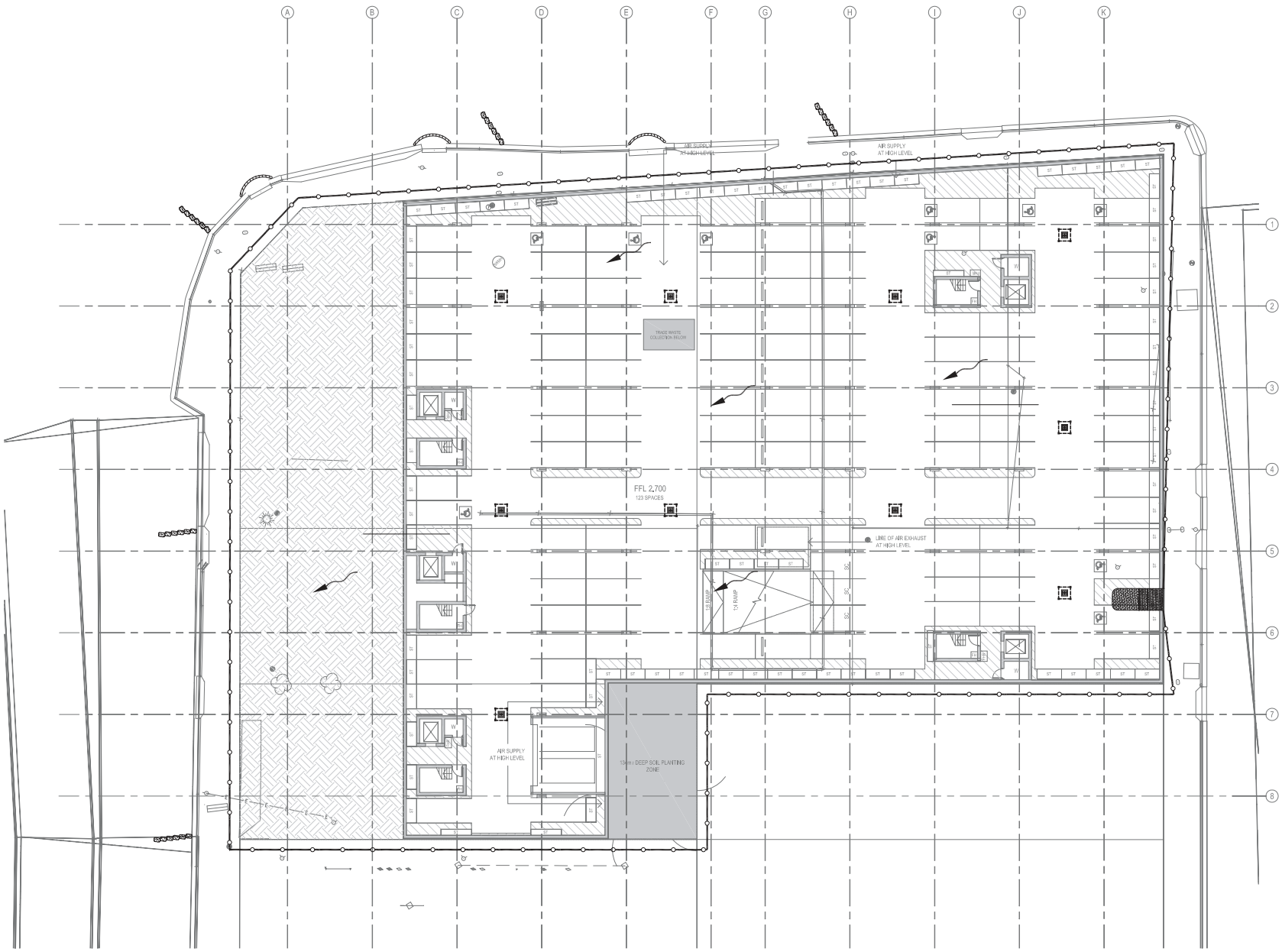
2/24/17



LEGEND

- SEDIMENT FENCE
- DENOTES TEMPORARY SURFACE INLET SEDIMENT TRAP
- STABILISED SITE ACCESS
- DIRECTION OF OVERLAND FLOW
- GUTTER SEDIMENT TRAP
- DENOTES MESH AND GRAVEL INLET FILTER FOR KERB INLET PITS

SEDIMENT AND EROSION CONTROL PLAN

SCALE 1:200 @ A1

DO NOT SCALE DRAWINGS. VERIFY ALL DIMENSIONS ON SITE.

A1

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2/24/17

REVISION	DESCRIPTION	DATE
A	ISSUE FOR REVIEW	31/03/17
B	ISSUE FOR DA	11/04/17

VERSION: FOR REVIEW

SCALE: 4 2 0 4 8 12 16 20

SCALE OF METRES (1:200 AT A1 SHEET BEFORE REDUCTION)

RGH CONSULTING GROUP
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Newcastle Office: Shop 113, The Junction Village Centre, Kenrick Street, The Junction NSW 2291 *Ph* 02 4962 4414

SURVEY BY	CADMAN CONSULTANTS
REFERENCE	8395
DATED	15/02/2009
DATUM	AHD

CLIENT	BLOC
ADDRESS	482-488 THE ESPLANADE WARNERS BAY
PROJECT	PROPOSED MULTI UNIT DEVELOPMENT

DRAWING TITLE: CONCEPT SEDIMENT AND EROSION CONTROL PLAN

ANTHONY JOHN GRIFFITHS
MIE AUST CPENG 2342830
signed date

SCALE	N.T.S. INT.
DRAWN	AFJG
DESIGNED	BW
CHECKED	BW
DATE	MARCH 2017
JOB NUMBER	20160518

SHEET: DA2.01

REV: B

N W E S

DA0347837