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14<sup>th</sup> January 2014

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Nominated Architect  
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## ARCHITECTURAL DESIGN VERIFICATION STATEMENT

### 148-150 Great Western Highway – Westmead

### Proposed Three 8 Storey Residential Buildings, Retail and car parking

The architectural design documents for the residential flat building identified below have been directed by me as the Nominated Architect of HBO EMTB Architecture Pty Limited.

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This design verification statement has been prepared in response to SEPP 65 and is intended to respond to the key principles embodied in SEPP65 and is to be read in conjunction with the Assessment Table prepared by Graeme David Allen dated 14<sup>th</sup> January 2015

## Design Principles

### Principle 1: Context

***Good design responds and contributes to its context. Context can be defined as the key natural and built features of an area.***

***Responding to context involves identifying the desirable elements of a location's current character or, in the case of precincts undergoing a transition, the desired future character as stated in planning and design policies. New buildings will thereby contribute to the quality and identity of the area.***

Development in the surrounding area comprises a diverse mix of uses including the Penrith Museum of Fire, an extensive commuter car park to the south with access top Penrith Rail Station and the future urban

development associated with “Thornton Estate” promoted by UrbanGrowth and outlined in Design Guidelines 2013 – North Penrith.

The context is captured in the site analysis plan (Drawing A-003) and a Photo Analysis (Drawing A-006)

The project has been designed to respond to the form of proposed future development envisaged in the planning controls and development standards promoted by Penrith Council through the LEP and DCP documents and public consultation processes.

## **Principle 2: Scale**

***Good design provides an appropriate scale in terms of the bulk and height that suits the scale of the street and the surrounding buildings.***

***Establishing an appropriate scale requires a considered response to the scale of existing development. In precincts undergoing a transition, proposed bulk and height needs to achieve the scale identified for the desired future character of the area.***

The proposed buildings are designed as 8 storey buildings, with ground floor at grade parking and part first floor parking in relation to Building C; comprising 99 dwellings in both buildings A and Building B (predominately 2 bedrooms) and 104 dwellings in Building C including a Retail facility on the corner of Lord Sheffield Circuit and Dunshea Street

The Buildings will read as eight storey flat roofed building when viewed from all elevations of the building. Elements of the building have been recessed to read slimmer buildings with each building separated. This scale is consistent with the future scale, bulk and height of this precinct particularly with the grain of future development proposed on the northern side of Lord Sheffield Circuit

The buildings have adopted a staggered set back along the southern boundary of the site, which forms the rear boundary of the neighbouring commuter car park associated with Penrith Rail Station.

The ground floor configuration of the building, showing relevant setbacks is set out in the A-100 Ground Floor Plan

## **Principle 3: Built form**

***Good design achieves an appropriate built form for a site and the building’s purpose, in terms of building alignments, proportions, building type 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 has been carefully sculpted to directly respond to its location with its main axis running east west. Consequently units are oriented north south and adopt a single aspect orientation.

The building is designed in a contemporary feel yet grounded in cost effective materials including precast panels with limited lightweight steel framing and applied finished panel. Finishes are proposed as simple, elegant and sophisticated. The use of the punctuating framed window and balcony elements along both the northern and southern facade is used to create a sophisticated, rhythmic aesthetic, yet creating strong visual interest.

## **Principle 4: Density**

***Good design has a density appropriate for a site and its context, in terms of floor space yields (or number of units or residents).***

***Appropriate densities are sustainable and consistent with the existing density in an area or, in precincts undergoing a transition, are consistent with the stated desired future density. Sustainable densities respond to the regional context, availability of infrastructure, public transport, community facilities and environmental quality.***

The building includes 302 “affordable” dwellings and is of a scale and density consistent with the future adjoining mixed use and residential flat buildings and will sit comfortably within its future built form context.

## **Principle 5: Resource, energy and water efficiency**

***Good design makes efficient use of natural resources, energy and water throughout its full life cycle, including construction.***

***Sustainability is integral to the design process. Aspects include demolition of existing structures, recycling of materials, selection of appropriate and sustainable materials, adaptability and reuse of buildings, layouts and built form, passive solar design principles, efficient appliances and mechanical services, soil zones for vegetation and reuse of water.***

The proposed satisfies the rule of thumb standards for natural ventilation and solar access, and also exceeds minimum BASIX requirements. The full BASIX Report generated by NSW Department of Planning and Environment is available for review in full.

Water from its roof is harvested for reuse in landscape irrigation. The Building will contain energy and water efficient appliances, and is to be constructed of readily recyclable materials including brick, concrete, steel, aluminium and glass. Preliminary assessment of the building has achieved a 7.5 rating under NATHERS

## **Principle 6: Landscape**

***Good design recognises that together landscape and buildings operate as an integrated and sustainable system, resulting in greater aesthetic quality and amenity for both occupants and the adjoining public domain.***

***Landscape design builds on the existing site’s natural and cultural features in responsible and creative ways. It enhances the development’s natural environmental performance by co-ordinating water and soil management, solar access, micro-climate, tree canopy and habitat values. It contributes to the positive image and contextual fit of development through respect for streetscape and neighbourhood character, or desired future character.***

***Landscape design should optimise useability, privacy and social opportunity, equitable access and respect for neighbours’ amenity, and provide for practical establishment and long term management.***

Private courtyards are provided for all ground floor apartments in the Building, while limited common landscaped area is proposed.

Landscaping will generally comprise a combination of trees and shrubs, lawn, paved areas and walkways, all of which form an integral part of the design of external spaces for access to and from the cores of each Residential Building. The landscaped space has also been designed to provide a series of smaller open spaces.

## Principle 7: Amenity

***Good design provides amenity through the physical, spatial and environmental quality of a development.***

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

Most dwellings in the building have multiple aspects, providing for cross ventilation opportunities and solar access and outlook from more than one orientation.

All apartments have been designed to comply with the requirements of AS1428, and residents will be able to access their dwelling via a passenger lift which also connects the car park.

The proposal will encourage pedestrian access from the facility to the Lord Sheffield Circuit, Dunshea Street and Combewood Avenue frontages with some facilities of convenience within very close walking distance.

The proposed Buildings almost fully satisfy the rules of thumb in SEPP 65 for solar access, cross ventilation and single aspect South facing apartments.

## Principle 8: Safety and security

***Good design optimises safety and security, both internal to the development and for the public domain.***

***This is achieved by maximising overlooking of public and communal spaces while maintaining internal privacy, avoiding dark and non-visible areas, maximising activity on streets, providing clear, safe access points, providing quality public spaces that cater for desired recreational uses, providing lighting appropriate to the location and desired activities, and clear definition between public and private spaces.***

The main entry points to the buildings for Residents and Visitors are from the three street frontages. These entry points are overlooked by units which will ensure a high level of surveillance.

Car parking for the building is located at grader in a secure car park with lift access directly to the residential floors.

Secure residential lobbies are provided for each of the three cores. The entries to these lobbies are clearly visible from the development.

## Principle 9: Social dimensions and housing affordability

***Good design responds to the social context and needs of the local community in terms of lifestyles, affordability, and access to social facilities.***

***New developments should optimise the provision of housing to suit the social mix and needs in the neighbourhood or, in the case of precincts undergoing transition, provide for the desired future community.***

***New developments should address housing affordability by optimising the provision of economic housing choices and providing a mix of housing types to cater for different budgets and housing needs.***

The development is entirely aimed at providing affordable housing accommodation consistent with the future community of this precinct. Justification of minor departures from the SEPP65 "rule of Thumbs" have been argued on the basis of potential impact on the affordability of the end product produced within this proposal

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## Principle 10: Aesthetics

***Quality aesthetics require the appropriate composition of building elements, textures, materials and colours and reflect the use, internal design and structure of the development. Aesthetics should respond to the environment and context, particularly to desirable elements of the existing streetscape or, in precincts undergoing transition, contribute to the desired future character of the area.***

The building is contemporary, simple, elegant and sophisticated. The use of the punctuating framed window and balcony elements to the southern facades is used to create a sophisticated, rhythmic aesthetic responding to the planning controls inherent in the DCP for this precinct. The scale of the proposed building is sympathetic with its future built form; this precinct is in transition.

The proposed development will make a positive contribution to the site and surrounds and will substantially improve the appearance of the site and will be an important catalyst for the future redevelopment of the precinct.

I am satisfied that the design quality principles set out in Part 2 of State Environmental Planning Policy No 65—Design Quality of Residential Flat Development are achieved for the proposed residential flat development component within the mixed use development

If matters of clarification are required please contact the writer or Mr Graeme Allen National Principal Architecture.

Yours sincerely:

**HBO EMTB Architecture Pty Ltd**



Kevin Fitzgerald  
Managing Director  
Nominated Architect 5113

Encs. SEPP 65 – Residential Flat Design Code – Compliance Table

## Lot 3105 Thornton Estate, North Penrith: SEPP 65 – Residential Flat Design Code – Compliance Table

ITEM	RFDC GUIDELINE	COMMENT	COMPLIES?
<b>Part 01 Local Context</b>			
<b>Context</b>	<b>Relating to Local Context</b>	<p>Analysis provided in Architectural documentation.</p> <p>The buildings have been designed at a scale and height that will sit well in the context of future development to be undertaken immediately to the southeast by St Hilliers.</p> <p>The proposed buildings are of a scale and form entirely consistent with the permitted and anticipated development immediately to the north of the site on the opposite side of Lord Sheffield Circuit. T</p> <p>There will be a uniform east west “grain” in this location established by the subdivision pattern undertaken by UrbanGrowth and reinforced by the built environment.</p>	Yes
<b>Primary Development Controls</b>	<b>Building Height</b>	<p>No numerical standards in RFDC.</p> <p>The proposed development complies with the height control within the Penrith LEP. The LEP provides for a maximum height of 32metres and the proposed height is consistent with the guidelines formulated for North Penrith – Design Guidelines 2013.</p> <p>The objective within the guidelines is “to ensure building heights achieve built form outcomes that reinforce quality urban and building design,” The proposed design meets this objective.</p>	Yes

**Lot 3105 Thornton Estate, North Penrith: SEPP 65 – Residential Flat Design Code – Compliance Table (continued)**

ITEM	RFDC GUIDELINE	COMMENT	COMPLIES?
<b>Part 01 Local Context (Continued)</b>			
<p><b>Primary Development Controls</b></p>	<p><b>Building Depth</b> The RFDC advises that an apartment building depth of 10-18 metres is appropriate.</p> <p>Developments that propose wider than 18 metres must demonstrate how satisfactory daylighting and natural ventilation are to be achieved.</p>	<p>Building 1 has a minimum internal depth of 20.5 metres and a maximum external depth of 25.8metres.</p> <p>Building 2 has a minimum internal depth of 19.6 metres and an external maximum depth of 27.0metres.</p> <p>Building 3 has a minimum internal depth of 21.8 metres and a maximum external depth of 28.2metres.</p> <p>The adoption of a double loaded central corridor and an efficient structural grid dictates that the Guidelines as to the desired building depths are exceeded numerically.</p> <p>The maximum depth of an apartment from the daylight source (sliding door to balcony) is 9.0m while the preferred depth outlined in the RFDC is 8.0m. While exceeded the only portion of living area beyond the recommended 8.0metres are portions of the kitchen including storage units.</p> <p>All north facing units (157 Units - 52% of total units) will receive in excess of three hours of direct sunlight to the living area of the unit during mid-winter.</p> <p>All South facing units on the upper level (17 units – 5.6%) will receive in excess of three hours of direct sunlight to the living area of the unit during mid-winter due to the inclusion of skylights to these apartments.</p> <p>All due east and due west units on Building C and Building A respectively will receive in excess of three hours of direct sunlight to the living area (13units – 4.3%).</p> <p>A total of 62% of all units will receive in at least three hours of direct sunlight to the living area of the unit.</p> <p>Twenty seven (27) South facing corner units 8.9% will receive one hour to two plus hours of direct sunlight to the living area of the unit during mid-winter and will receive ample daylight.</p>	<p>Yes</p> <p>Numerical non - compliance, but satisfactory day lighting and natural ventilation are achieved.</p>

**Lot 3105 Thornton Estate, North Penrith: SEPP 65 – Residential Flat Design Code – Compliance Table (continued)**

ITEM	RFDC GUIDELINE	COMMENT	COMPLIES?
<b>Part 01 Local Context (Continued)</b>			
<b>Primary Development Controls</b>	<b>Building Separation</b>  Increase building separation distances as building height increases as follows:  Up to four storeys: <ul style="list-style-type: none"> <li>• 12m between habitable rooms/balconies.</li> <li>• 9m between habitable rooms/balconies and non-habitable rooms.</li> <li>• 6m between non-habitable rooms</li> </ul> Up to five to eight storeys: <ul style="list-style-type: none"> <li>• 18m between habitable rooms/balconies.</li> </ul>	Building 1 and Building 2 are joined by ground floor parking and communal open space area at Level 1. A separation of 7500mm has been adopted between Buildings 1 and 2 as well as Building 2 and 3.  Compliance with a 13metre building separation would result in a reduced affordable housing yield of 30 units within the Project.  The windows located within the walls between the buildings are located and treated in a manner to ensure privacy between buildings although a reduced building separation is proposed.	No  Non-compliance with the rule of thumb standard is considered justified as there is no effect on residents' privacy through the reduced building separation.
	<b>Street Setbacks</b>	No numerical standards in RFDC. Generally complies with front setbacks in the guidelines formulated for North Penrith – Design Guidelines 2013.	YES
	<b>Side and Rear Setbacks</b>	No numerical standards in RFDC. Generally complies with side and rear setbacks in the guidelines formulated for North Penrith – Design Guidelines 2013.	YES

**Lot 3105 Thornton Estate, North Penrith: SEPP 65 – Residential Flat Design Code – Compliance Table (continued)**

ITEM	RFDC GUIDELINE	COMMENT	COMPLIES?
<b>Part 02 Site Design(Continued)</b>			
	<b>Floor Space Ratio</b>	No numerical standards in RFDC.  No Numerical controls in the guidelines formulated for North Penrith – Design Guidelines 2013.  Generally satisfies the objectives for FSR in the RFDC.	YES
<b>Site Analysis</b>		Site analysis provided in Architectural documentation.	Yes
<b>Site Configuration</b>	<b>Deep Soil Zones</b> Minimum of 25% of open space area of site should be a deep soil zone.	Approximately 11% of the open space area of the site comprises areas of deep soil. (Measurement of deep soil excludes car park ramp and substation locations). Deep soil provided along Lord Sheffield Circuit frontage allows for large screening trees.  The screen planting on site will also be supplemented through the street planting that will occur along Lord Sheffield Circuit and the side streets to the Project.  In addition there is an extensive buffer planting area between the southern edge of the project and the adjoining commuter car park which will also assist in providing a landscaped context for the proposed Project.	Non-Compliance  However ample opportunity existing to effectively landscape the site and adjoining property with substantial planting
	<b>Fences and Walls</b>	Fencing (at min height 1.7m) provided: ▪ To secure private courtyards/external areas of ground floor units	Yes
	<b>Landscape Design</b>	Landscape proposal meets intent of RFDC.	Yes
	<b>Open Space</b> <ul style="list-style-type: none"> <li>Area of Communal open space should be 25% to 30% of site area.</li> <li>Minimum private open space for each apartment is 25m<sup>2</sup> at ground level/above podium with minimum dimension of 4m.</li> </ul>	The minimum required area of Communal open space is 0.25 x 6370 = 1592m <sup>2</sup> Area of Communal open space required under the RFDC is considered excessive and does not take into consideration the extent of open space external to the site within the Thornton Estate. <ul style="list-style-type: none"> <li>At this point an area of 136m<sup>2</sup> is proposed at level 2 between Buildings 1 &amp; 2</li> <li>The project could numerically comply with this rule of thumb by utilizing roof top area or areas formed by covering the car park levels of the project. This compliance could be achieved at considerable additional cost.</li> <li>In the interest of maintaining and affordable housing product the decision has been taken to seek relaxation of this requirement in favour of reducing the capital cost of each apartment by approximately \$4,000 per unit.</li> </ul>	Non-Compliance  The rule of thumb for the provision of communal open space can be complied with although the decision has been not to in this case in favour of a lower end cost per unit

## Lot 3105 Thornton Estate, North Penrith: SEPP 65 – Residential Flat Design Code – Compliance Table (continued)

ITEM	RFDC GUIDELINE	COMMENT	COMPLIES?
<b>Part 02 Site Design(Continued)</b>			
	<b>Orientation</b>	Building placement and massing responds to adjoining streets and maximizes north facing walls and living spaces within this configuration and delivers affordable housing outcomes.	Yes
	<b>Planting on Structures</b>	To be addressed during design development stage.	N/A
	<b>Storm water Management</b>	To be addressed during design development stage. However, storm water management has been addressed on a “whole of estate” basis and on site solutions do not need to be addressed.	Yes
<b>Site Amenity</b>	<b>Safety</b>	The principles of Crime Prevention Through Environmental Design (CPTED) have been and will continue to be adopted: <ul style="list-style-type: none"> <li>▪ Casual surveillance of streets from private courtyards, balconies, habitable rooms and communal open space areas</li> <li>▪ Access controlled through fencing and security locks</li> </ul>	Yes
	<b>Visual Privacy</b>	Visual privacy generally achieved, with some orienting and offsetting of openings between building separations.  While separation distance from wall opposite is 7.5m, whereas RFDC requires 13m; no loss of visual privacy results as a result of the building configurations. Visual privacy has been a primary design criteria	Yes
<b>Site Access</b>	<b>Building Entry</b>	<ul style="list-style-type: none"> <li>▪ All main building entries and lobbies are visible and accessed directly from public streets</li> <li>▪ All ground level units facing streets have direct entry from the street.</li> </ul>	Yes
	<b>Parking</b>	<ul style="list-style-type: none"> <li>▪ All parking is located at or above grade. Basement parking has not been pursued due to the additional cost involved and the consequential impost on the affordability of the final apartments</li> <li>▪ Bicycle parking is provided throughout.</li> </ul>	Yes
	<b>Pedestrian Access</b>	Direct access from streets maximized. Street frontages have been activated at ground level through the provision of “street” villas and a small retail facility on the corner of Lord Sheffield Circuit and Dunshea Street	Yes
	<b>Vehicle Access</b>	Vehicle access is from Coombewood Avenue (198 units) and Dunshea Street (104 units).	Yes

## Lot 3105 Thornton Estate, North Penrith: SEPP 65 – Residential Flat Design Code – Compliance Table *(continued)*

ITEM	RFDC GUIDELINE	COMMENT	COMPLIES?
<b>Part 03 Building Design</b> <i>(Continued)</i>			
<b>Building Configuration</b>	<b>Apartment Layout</b>	Single aspect units generally have an effective depth of around 8m. All living areas are contained in an 8.0m zone measured from the Sliding doors to external balcony.	Yes
	<b>Apartment Mix</b>	This scheme is for Affordable Housing. The apartment mix has been determined in consultation with the housing operator and is considered optimal for the target market.	Yes
	<b>Balconies</b>	All balconies have a minimum depth of 2.0m	Yes
	<b>Ceiling Heights</b>	Except at ground level (where heights are greater) floor-to-floor height is 3.0m, allowing minimum floor to ceiling height of 2.7m for all residential units.	Yes
	<b>Flexibility</b>	Typical for this type of residential development.	Yes
	<b>Ground Floor Apartments</b>	All ground floor units have direct access from the street.	Yes
	<b>Internal Circulation</b>	Three cores make all corridors short with a maximum of fourteen units (in the case of Building 3) served from the lift core. The corridor width varies from 1600mm to 2000mm to offset the additional units served. Entry to units are grouped and offset, to further ensure privacy within the internal circulation area.	Yes
	<b>Storage</b>	Various types of storage space (including over bonnet storage) for individual units provided in the parking areas. To be further addressed during design development.	Yes
<b>Building Amenity</b>	<b>Acoustic Privacy</b>	Adequate acoustic privacy is achieved through apartment layout design. Dividing walls between units are precast panel and are extended to also separate (enclose) external balconies to ensure maximum acoustic privacy when occupants are enjoying the use of the private open spaces.	Yes

## Lot 3105 Thornton Estate, North Penrith: SEPP 65 – Residential Flat Design Code – Compliance Table (continued)

ITEM	RFDC GUIDELINE	COMMENT	COMPLIES?
<b>Part 03 Building Design</b> (Continued)			
	<p><b>Daylight Access</b></p> <ul style="list-style-type: none"> <li>Living rooms and private open space of at least 70% of apartments should receive 3 hours direct sunlight between 9am and 3pm in mid-winter.</li> </ul> <p>Limit single aspect apartments with a southerly aspect to a maximum of 10% of total units.</p>	<ul style="list-style-type: none"> <li>All north facing units (50% of total units) will receive in excess of three hours of direct sunlight to the living area of the unit during mid-winter.</li> <li>All South facing units on the upper level (19 units – 6.3%) will receive in excess of three hours of direct sunlight to the living area of the unit during mid-winter due to the inclusion of skylights to these apartments.</li> <li>All south facing corner units (40 units – 13.24%) will receive in excess of two hours of direct sunlight to the living area of the unit during mid-winter and will receive ample daylight.</li> <li>91 units (29.9%) are single aspect south facing units.</li> </ul> <p>The site size, proportions and orientation do not allow for this rule of thumb to be met. All of the 91 units will have ample access to daylight and an acceptable thermal comfort level.</p> <p>The use of a double loaded corridor dictates that this portion of the guideline cannot be achieved yet still meet Affordable Housing financial imperatives.</p>	<p>Non-compliance for maximum number of single aspect apartments.</p> <p>56.3% apartments will receive 3 hours direct sunlight between 9am and 3pm in mid-winter.</p> <p>Almost 70% of apartments will receive 2 hours or more of sunlight over the same.</p>
	<p><b>Natural Ventilation</b></p> <ul style="list-style-type: none"> <li>60% of units to be naturally cross ventilated.</li> </ul>	108 (36%) of the total number of units are fully cross ventilated. While a further 185 units (61%) enjoy partial cross ventilation through a room or a combination of rooms.	Yes
<b>Building Form</b>	<b>Awnings and Signage</b>	Awnings are provided to all building entries. To be further addressed during design development.	Yes
	<b>Facades</b>	Generally consistent with RFDC. To be further addressed during design development.	Yes
	<b>Roof Design</b>	Flat roofs are although a Roof line “Top” have been added in response to an independent urban design review	Yes

## Lot 3105 Thornton Estate, North Penrith: SEPP 65 – Residential Flat Design Code – Compliance Table (continued)

ITEM	RFDC GUIDELINE	COMMENT	COMPLIES?
<b>Part 03 Building Design</b> (Continued)			
<b>Building Performance</b>	<b>Energy Efficiency</b>	General northerly orientation of building allows for effective passive energy design and sets the framework for an energy efficient building.  Building complies with BASIX requirements as to Energy and Thermal Comfort.  Energy efficient appliances are to be incorporated, along with high levels of thermal insulation, motion sensor lighting and natural ventilation where possible	Yes
	<b>Maintenance</b>	Building designed to ensure the on-going requirement for maintenance is minimized. Generally, these issues will be addressed during the design development stage.	Yes
	<b>Waste Management</b>	Waste Management plan and strategy has been provided in accordance with Council's Waste Management Strategy	Yes
	<b>Water Conservation</b>	As per requirements of BASIX. To be addressed further during the design development stage	Yes

Prepared by Graeme D Allen, National Principal Consulting HBO+EMTB,



Certified Practising Planner  
Master of Urban Studies  
Diploma of Urban Studies  
Bachelor of Arts

14<sup>th</sup> January 2015



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# **Lot 3105, Thornton Estate**

## **For FDC Construction and Fitout**

Traffic and Parking Assessment

For the attention of: Tim Bainbridge

14 January 2015



## Document Control

Our Reference: T2-1245, Lot 3105, Thornton Estate, FDC Construction and Fitout

ISSUE	DATE	ISSUE DETAILS	AUTHOR	REVIEWED
1	19/12/14	Final Issue	Andrew Morse	CL
2				
3				

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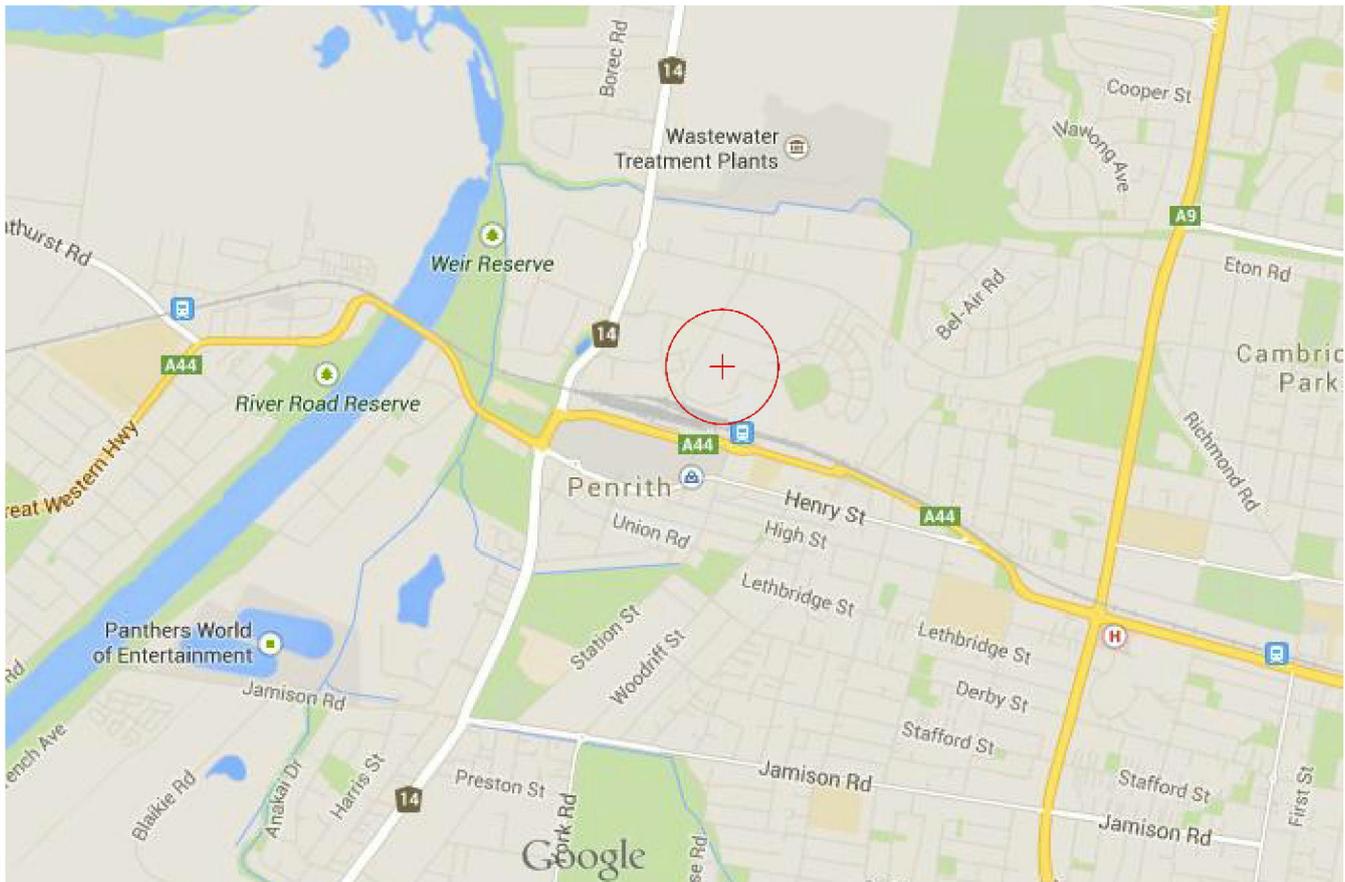
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# 1 Introduction

## 1.1 Project Summary

Parking and Traffic Consultants Pty Ltd (PTC) has been engaged by FDC Construction and Fitout Pty Ltd to prepare an assessment of the traffic and parking related considerations associated with a development proposal for a high density residential development, within Lot 3105 of the Thornton Estate project to the north of Penrith in NSW.



**Figure 1 – Site Location**

The site is located within the Thornton Estate project, which is located to the north of the Penrith CBD and railway station. The Estate was approved as a subdivision in 2011 and the subject to various assessments including the impact of traffic on the surrounding road network. The Estate was planned to accommodate up to 1,000 dwellings subject to the details of the individual development applications.

## 1.2 Purpose of this Report

This statement has been prepared to accompany a Development Application to Penrith City Council for the development of three buildings within the subject site, accommodating a total of 302 apartments with car parking provided within a basement and partial upper level car park.

This report presents the following considerations relating to the Traffic and Parking assessment of the proposal:

- Section 2 - A description of the project,

- Section 3 - A description of the road network serving the development property,
- Section 4 - Determination of the traffic activity associated with the development proposal, and the adequacy of the surrounding road network,
- Section 5 - Assessment of the proposed parking provision in the context of the relevant planning control requirements,
- Section 6 - Preliminary assessment of the proposed car park, vehicular access and internal circulation arrangements in relation to compliance with the relevant standards.

## 2 The Project

### 2.1 The Site

The site is located within the Thornton Estate, which comprises a subdivision of an old Defence site located to the north of Penrith CBD. The subdivision of the site was the subject of a Part 3A (Masterplan) planning application in 2010. The application was accompanied by a Transport Mobility and Accessibility Plan (TMAP) prepared by Parsons Brinckerhoff, which assessed the traffic and transport impacts associated with the overall Masterplan.



**Figure 2 – The Site**

The Thornton Estate was anticipated to accommodate up to 1,000 dwellings, and the traffic analysis presented in the TMP was undertaken based on this figure. The TMAP concluded that due to the location in relation to the Penrith CBD, the proposal “*would improve bus access from the north to Penrith Station and make provision for a grade-separated underpass under the Western Rail Line so future buses could directly serve both sides of the Station*”. In terms of traffic activity, the TMAP identified that road upgrades would be required in conjunction with other improvements associated with surrounding developments.

In 2012, the Masterplan was revised, which involved an adjustment to the apartment provisions within each site and also introduced a seniors living component. The outcome of the revised scheme was that 731 dwellings, plus 100 seniors living/aged care dwellings/beds would be proposed.

### 3 Road Network

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The subject development site is located to the north of Penrith CBD and is served by Castlereagh Road and Peachtree Road/Thornton Drive. The road network servicing the area comprises of a number of State Roads, making the site easily accessible from different regions of the metropolitan area and the Blue Mountains.

The road network in this area also comprises the new local streets constructed within the precinct to provide direct access to the Lots within the subdivision.

The NSW administrative road hierarchy comprises the following road classifications, which align with the generic road hierarchy as follows:

- State Roads - Freeways and Primary Arterials (RMS Managed)
- Regional Roads - Secondary or sub arterials (Council Managed, Part funded by the State)
- Local Roads - Collector and local access roads (Council Managed)

The road network serving the site includes:

**The M4 Western Motorway** provides a connection between Strathfield and the Blue Mountains. The motorway provides three lanes in each direction apart from the elevated sections near Parramatta, which provide two lanes. The sign posted speed limit is 110km/hr towards the western end and the intersection with Mulgoa Road is located 2.84km to the south of the site.

**Mulgoa Road – Castlereagh Road** is classified as a State Road and provides a connection between the M4 Motorway and the site, continuing north towards Richmond as Castlereagh Road. In the vicinity of the Peachtree Road intersection, the carriageway accommodates two lanes in each direction with auxiliary turning lanes provided at the intersections. The intersection of Castlereagh Road and Peachtree Road is controlled by traffic signals and accommodates all turning movements.

**Peachtree Road/Thornton Drive** provides the primary access to Thornton Estate and runs to the north of the subject site. The carriageway accommodates one lane in each direction, widening at the Castlereagh Road intersection to provide 2 inbound lanes and 3 outbound lanes. Thornton Drive currently provides access to the construction sites within the precinct and therefore is not complete in relation to the final surface, road markings or traffic controls.

## 4 Development Traffic Assessment

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### 4.1 Traffic Generation

The traffic generation of the proposed development has been established with reference to Technical Direction 13/04, which serves as an update to the RTA's Guide to Traffic Generating Developments, presents the traffic generation rates for a number of land uses based on the surveys undertaken more recently.

The proposed development is designated as residential use, comprising 302 residential units. The guide provides traffic generation based on trips per unit and trips per parking space and the traffic generation for the peak hour vehicle trips have been based on the unit provision.

#### 4.1.1 Morning Peak Period

High Density Residential – 302 Units @ 0.19 trips per unit = 57 Vehicle trips

#### 4.1.2 Evening Peak Period

High Density Residential – 302 Units @ 0.15 trips per unit = 45 Vehicle trips

It is noted that the rates presented above represent an average of 9 residential building survey by RMS as part of the review study. In relation to accessibility to public transport the most similar site was located in Rockdale (as opposed to the CBD based buildings) which recorded a peak hour trip rate of 0.32 trips per dwelling. Application of this rate to the proposal for 302 units would indicate 98 peak hour movements.

Section 4 of the TMAP presents the trip rates adopted for various land uses within the precinct. The rate adopted for the residential use of 0.76 peak trips per dwelling. During the time of the assessment, the subject site (then known as Part 2D) had an expected yield of 150 dwellings, which would have resulted in 114 vehicle movements adopting the trip rate used at that time. It is evident that the more recent surveys undertaken by RMS indicate a lower trip generation rate, with none of the surveyed buildings reaching the rate of 0.76 adopted in the TMAP.

In 2012 an addendum to the TMAP was prepared, which compared the original scheme with amendments to the yield across the entire estate. The result of the amendments reduced the overall number of apartments from 764 to 731, which introducing 100 seniors living apartments / beds, which have a much lower peak trip generation than typical residential developments (seniors living doesn't generally involve the work commute trips during the peak hours).

The addendum concluded that there would be an overall reduction in the trips generated by the estate during the peak periods. Our assessment of the proposed development, in the context of more recent traffic data, indicates that the proposed building will generate less traffic activity that originally anticipated in the modelling undertaken for the TMAP and is entirely consistent with the findings of the 2012 addendum. In this regard, the road network upgrades and improvements associated with the Thornton Estate and other surrounding developments will accommodate the traffic activity associated with the proposed building.

## 5 Car Parking Provision

### 5.1 Planning Policy Requirements

The proposed project is being developed by Evolve Housing as an affordable housing development and in this regard the applicable parking provision rates are presented the State Environmental Planning Policy (Affordable Housing) (AHSEPP).

The AHSEPP stipulates the following parking requirements:

*A consent authority must not refuse consent to development to which this Division applies on any of the following grounds:*

*(a) Parking*

*if:*

*(i) in the case of a development application made by a social housing provider for development on land in an accessible area—at least 0.4 parking spaces are provided for each dwelling containing 1 bedroom, at least 0.5 parking spaces are provided for each dwelling containing 2 bedrooms and at least 1 parking space is provided for each dwelling containing 3 or more bedrooms, or*

*(ii) in any other case—at least 0.5 parking spaces are provided for each dwelling containing 1 bedroom, at least 1 parking space is provided for each dwelling containing 2 bedrooms and at least 1.5 parking spaces are provided for each dwelling containing 3 or more bedrooms.*

The development is being proposed by Evolve Housing, and as a Social Housing provider the rates described in Point i apply, as summarised in the following table:

Table 1 - SEPPAH Parking Rates

Dwelling Type	Max. Parking Provision
1 bedroom	0.4 space / dwelling
2 bedroom	0.5 space / dwelling
3+ bedroom	1.0 spaces / dwelling
Visitor parking	N/A

The proposal also includes a small retail area of 126m<sup>2</sup>, which requires parking at a rate of 1 parking space per 30m<sup>2</sup> according to Section C10 of the Penrith DCP 2014. Application of this rate to the proposal requires a minimum of 4 parking spaces.

### 5.2 Proposed Parking Provision

The proposed car park has been designed to include a dividing wall between buildings 2 and 3, therefore grouping the parking for Buildings 1 and 2 in the western car park and Building 3 in the eastern car park, over two levels. To ensure that the corresponding parking provision has been accommodated in each car park, the provision calculations are presented in the following separate tables.

Table 2 - Parking Requirements – Buildings 1 and 2

Dwelling Type	Apartments	Parking Spaces
Studio	5	0
1 bedroom	32	13
2 bedroom	161	81
<b>Total</b>		<b>94</b>

Table 3 - Building 3 Parking Requirements

Dwelling Type	Apartments	Parking Spaces
Studio	6	0
1 bedroom	14	6
2 bedroom	84	42
<b>Total</b>		<b>48</b>

The proposed car park will be divided between buildings 2 and 3, in effect providing two car parks. In accordance with AHSEPP, the proposal includes a parking provision of 100 spaces within the western car park serving Buildings 1 and 2 and 97 spaces beneath Building 3 car park. This provision includes 28 accessible spaces and relies on two access driveways at the east and west ends of the site, serving the two car park separately.

It is proposed that 4 parking spaces will be allocated within the western car park, and these would be allocated to staff, as the retail component will primarily serve the residents of the precinct and the proposed building and the involve walk in trips rather than generating parking demand. This would allow the car park to be a secured area with only access provided to those with allocated spaces.

## 6 Access and Car park Assessment

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### 6.1 Vehicular Access

The proposed car park will be divided between Buildings 2 and 3, provision 100 spaces within the western part and 97 spaces in the eastern part. As such, separate access driveways are proposed at the western and eastern ends of the site and both have a width of 6.0 metres

According to AS2890.1, Section 3.2, the access facility is categorised as a Class 1 parking facility with an entry width of 3.0m to 5.0m. The proposed driveways will have a width of 6.0 metres thereby exceeding this minimum requirement.

### 6.2 Sight Distance

The sight distance requirements are described in Section 3.2 of AS2890.1 and are prescribed on the basis of the sign posted speed limit or 85th percentile vehicle speeds along the frontage road.

The internal road network has a speed limit of 50kph, which requires a desirable visibility distance of 69 metres and a minimum distance of 45 metres. The proposed driveways will each be located in a location where sufficient sight distance is provided, including sight lines to the intersections with Lord Sheffield Circuit.

### 6.3 Internal Circulation

The internal circulation arrangement has been designed in accordance with AS2890.1 including the access aisles and the ramp connecting between levels 1 and 2 in the eastern car park.

The car park is classified as a Class 1A car park, which requires parking aisle widths of 5.8 metres, while the proposed aisles are 6.0 metres, providing a slightly more generous manoeuvring area.

### 6.4 Car Park Arrangement

The car park access arrangement, internal circulation and parking arrangements have been designed in accordance with the requirements of Section 2 of AS2890.1.

Table 1.1 of AS2890.1 presents a number of classifications applicable to different land-uses. According to the Table, the most appropriate car park classification applicable to the subject car park will be a Class 1A facility, which is suitable for "Residential, domestic and employee parking".

The parking space dimensions and associated aisle widths for each classification are presented in Table 2.2, and accordingly, a Class 1A facility requires parking space dimensions of 2.4 x 5.4 metres with an access aisle width of 5.8 metres. The proposed car park has been designed to provide compliant parking space widths of 2.4 metres and a minimum aisle width of 6.0 metres, which meets the minimum requirement. An assessment of all elements of the car park has been undertaken including column locations, aisle extensions and ramp grades and in this regard, the car park design complies with the requirements of AS2890.1.

Included in the car park arrangements is the provision 28 eight accessibility spaces. These spaces have been assessed against the requirements of Section 2 of AS 2890.6 'Off Street Parking for People with Disabilities'. The standard requires parking space dimensions of 2.4 x 5.4 metres with a shared space of 2.4 metres width between spaces. An assessment of all elements of the car park has been undertaken and in this regard, the car park design complies with the requirements of AS2890.6.



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## **GEOTECHNICAL INVESTIGATION THORNTON ESTATE, THORNTON DRIVE, PENRITH**

**FOR**

**EVOLVE HOUSING PTY LIMITED**

**PROJECT NO. 19720/4340C  
REPORT NO. 14/1132**

**JUNE 2014**

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## **1. INTRODUCTION**

This report presents the results of a geotechnical investigation carried out by SMEC Testing Services Pty Limited (STS) for a proposed residential development at the Thornton Estate, Thornton Drive, Penrith. We have been informed the proposed development includes a double level basement level which will involve excavating up to 6 metres below the existing groundsurface.

The purpose of the investigation was to:

- determine the subsurface conditions,
- site classification in accordance with AS2870,
- provide recommendations regarding excavation support both in the short and long terms,
- provide foundation design parameters
- comment on the aggressivity of the subsurface materials to buried steel and concrete,
- comment on any construction problems that may be anticipated, and
- undertake a screen of soil samples for comparison with published guidelines for contamination.

The work was undertaken at the request of Gerard Sleiman of Impact Group Pty Limited on behalf of Evolve Housing Pty Limited.

Our scope of work did not include a formal contamination assessment of the site.

## **2. SITE DESCRIPTION AND GEOLOGY**

The site is located within the proposed new Thornton Estate. The site is rectangular in shape and is about 6300 m<sup>2</sup> in area. At the time of the fieldwork, the site was vacant. Site vegetation comprised grass and some trees. There were stockpiles of soil present on the site.

The groundsurface falls towards the south, relief being about 0.1 metres.

Reference to the Penrith geological series sheet at a scale of 1:100,000 shows that the site is underlain by Quaternary Age alluvial soils comprising gravel, sand, silt and clay.

### **3. FIELDWORK DETAILS**

The fieldwork consisted of drilling four boreholes numbered BH1 to BH4, inclusive, at the locations shown on Drawing No. 14/1132. Boreholes were drilled using an Edson RP70 drilling rig owned and operated by STS. The boreholes were advanced using solid flight augers. In order to determine soil strengths Dynamic cone penetrometer (DCPs) tests were carried out at each borehole location. In order to measure groundwater levels PVC standpipe piezometers were installed in BH1 and BH4. All fieldwork was undertaken by one of STS's experienced senior geologists who also logged the subsurface conditions encountered.

The subsurface conditions encountered are given on the borehole logs in Appendix A. A description of the terms used is also given in Appendix A. Notes relating to geotechnical reports are also attached.

### **4. SUBSURFACE CONDITIONS**

The following comments are based on the assumption that the conditions encountered in the boreholes are representative of the subsurface conditions at this site.

When making an assessment of the subsurface conditions across a site from a limited number of boreholes, there is the possibility that variations may occur between test locations. The data derived from the site investigation programme are extrapolated across the site to form a geological model and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. The actual conditions at the site may differ from those inferred herein, since no subsurface exploration programme, no matter how comprehensive, can reveal all subsurface details and anomalies.

The subsurface conditions consist of topsoil and concrete overlying silty clays and gravelly clays, in-turn underlain by weathered shale. Details are given below:

**FILL:** Fill was present in all boreholes to a depth of 0.4 to 0.8 metres and typically comprised silty clays and gravelly silty clays of firm to stiff and stiff consistency.

**ALLUVIAL SOILS:** The alluvial soils comprised a mixture of silty clays, clayey sands, and sandy clays. A gravel band was encountered at a depths of 4.0 to 5.0 metres,. Auger refusal occurred between these depths. The soils were assessed as moist and very moist and firm to stiff becoming very stiff.

No groundwater was observed in the boreholes during the fieldwork. Nine days later the piezometers remained dry.

## **5. DISCUSSION & SUPPORT**

### *5.1 Site Classification*

The classification has been prepared in accordance with the guidelines set out in the “Residential Slabs and Footings” Code, AS2870 – 2011.

Because of the fill present, the site is classified *a problem site (P)*. Provided the recommendations given below are adopted and the footings are founded in natural soils, the site may be reclassified *highly reactive (H1)*.

Foundation design and construction consistent with this classification shall be adopted as specified in the above referenced standard and in accordance with the following design details.

## 5.2 Excavation Conditions & Support

Based on subsurface conditions observed in the boreholes, it is expected that the proposed excavation will encounter fill and alluvial soils. We anticipate that excavators without assistance should be able to remove the soils to the proposed depth of excavation, 6.0 metres.

Unless the soils can be temporarily battered at an angle not exceeding 1:1, it will be necessary to provide temporary support. Support will probably need to be drilled and fixed in the materials below the base of the excavation. However, the presence of gravels and cobbles may make the installation of temporary support difficult, therefore, battering may be a better option.

When considering the design of the supports, it will be necessary to allow for the loading adjacent structures close to the boundaries, any ground surface slope and groundwater present. Where the structures are within the zone of influence of the excavation, it will be necessary to adopt  $K_o$  conditions when designing the temporary support. Anchors or props can be used to provide the required support. If anchors extend into adjoining property, it will be necessary to obtain the permission of the property owners. The fixed anchor length is that part of the anchor beyond a line drawn upwards at 45 degrees from the base of the excavation. When props or anchors are used for support, a rectangular earth pressure distribution should be adopted on the active side of the support. The permanent excavation support should be designed assuming  $K_o$  conditions.

The following parameters are suggested for the design of the retaining wall system where there is a level ground surface:

Active Earth Pressure Coefficient ( $K_a$ )	=	0.4
Passive Earth Pressure Coefficient ( $K_p$ )	=	2.5
At Rest Pressure Coefficient ( $K_o$ )	=	0.55
Total (Bulk) Density	=	20 kN/m <sup>3</sup>

Although groundwater was not recorded in the boreholes, some minor seepage can be expected in the excavation during construction, particularly after periods of increased rainfall. A sump and pump should be adjusted to handle the minor flows expected.

### *5.3 Foundations*

Pad and/or strip footings founded in natural materials below any fill at a minimum depth of 0.4 metres, may be proportioned using an allowable bearing pressure of 100 kPa. The minimum depth of founding must comply with the requirements of AS2870.

Pad and/or strip footings founded at the proposed depth of excavation, 6.0 metres may be proportioned using an allowable bearing pressure of 300 kPa. The minimum depth of founding must comply with the requirements of AS2870.

In order to ensure the bearing values given can be achieved, care should be taken to ensure the base of the excavations are free of all loose material prior to concreting. To this end, it is recommended that all excavations be concreted as soon as possible, preferably immediately after excavating, cleaning, inspecting and approval. Pier excavations should not be left open overnight. The possibility of groundwater inflow needs to be considered when drilling the piers and pouring concrete.

During foundation construction, should the subsurface conditions vary to those inferred in this report, a suitably experienced geotechnical engineer should review the design and recommendations given above to determine if any alterations are required.

### *5.4 Soil Aggressiveness*

The aggressiveness or erosion potential of an environment in building materials, particularly concrete and steel is dependent on the levels of soil pH and the types of salts present, generally sulphates and chlorides. In order to determine the degree of aggressiveness, the test values obtained are compared to Tables 6.4.2 (C) and 6.5.2 (C) in AS2159 – 2009 Piling – Design and Installation. The test results are attached and summarised below.

Sample No.	Location	Depth (m)	Chloride (mg/kg)	pH	Sulfate (mg/kg)
S1	BH1	0.5	280	5.3	40
S4	BH2	3.0	<10	5.7	30

The report results range between:

- pH - 5.3 and 5.7
- soluble SO<sub>4</sub> - 30 and 40 mg/kg (ppm)
- soluble chloride - <10 and 280 mg/kg (ppm)

The soils on the site consist of low permeability clays and clayey sands above the water table. Therefore, the soil conditions B are considered appropriate.

A review of the durability aspects indicates that:

- pH : minimum value of 5.3
- SO<sub>4</sub> : maximum value of 40 mg/kg (ppm) < 5000 ppm
- Cl : maximum value of 280 mg/kg (ppm) < 5000 ppm

The exposure classification for the onsite soils is non-aggressive for steel and mildly aggressive for concrete.

The minimum concrete strength of reinforcement cover for the various exposure classifications are given in Table 5.3 and 5.4 of AS2870-2011.

## 6. SOIL SAMPLING AND TESTING PROGRAMME

### 6.1 Introduction & Scope

The purpose of the soil sampling programme is to determine if the soils on the site are chemically contaminated when compared to published guidelines.

The scope of work was as follows:

- Collection of soil samples from four locations on the site and analysis of the samples for a broad screen of chemical contaminants.
- Assessment of the quality of the materials in accordance with EPA guidelines.
- Preparing a report on the findings of the soil sampling and classification program.

### 6.2 *Sampling Procedures*

Seven soil samples (S1 to S7) were retrieved from the boreholes. The samples were collected at depths that are shown on the borehole logs given in Appendix A. The samples were retrieved from the drill auger using disposable latex gloves.

The samples were placed into glass sample jars prepared by Australian Laboratory Services (ALS) and transferred directly to a chilled esky. The samples were transported under chain of custody (COC) conditions to ALS, who are NATA accredited for the analyses performed. The COC documentation is attached.

### 6.3 *Assessment Criteria*

A residential site is the most sensitive land use. The results of the soil sampling program have been compared to the Soil Investigation Levels (SILs) (Column 1) criteria for a residential land use with opportunities for soil access. These SIL criteria, which are outlined in EPA's *Guidelines for the NSW Site Auditor Scheme (2<sup>nd</sup> Edition)*, are protective of human-health for an EPA residential setting.

It is noted that no HIL criteria currently exists for petroleum hydrocarbon contaminants, in which case the '*threshold concentrations for a sensitive land use*' (EPA Threshold Concentrations) outlined in EPA's *Guidelines for Assessing Service Station Sites* (NSW EPA, 1994) are used.

In recent years the 1999 NEPM has been under review with an updated draft document being released in 2010. In April 2013 the updated NEPM was officially released and has been endorsed by EPA. The new 2013 NEPM has been developed using essentially the same framework as the 1999 version, however, it does provide updated HIL criteria for a range of chemical contaminants. It also builds on the PILs provided in the 1999 NEPM by outlining a more comprehensive set of environmental screening levels. Further, the 2013 NEPM outlines criteria for key volatile hydrocarbon compounds which are designed to be protective of human-health via a soil vapour inhalation exposure pathway.

#### *6.4 Results*

The analytical results for the soil samples are presented in the NATA endorsed laboratory results included in Appendix B.

The results of the soil sampling program are compared to the above contamination criteria in Table A and the analytical laboratory reports for the testing performed are provided in the report attachments.

The results show that the concentrations of chemical contaminants measured in the soil samples are low and well below the SILs (Column 1) criteria and the EPA Threshold Concentrations. Furthermore, asbestos was not detected in the samples tested.

#### *6.5 Quality Assurance/Quality Control Program*

Our review of the laboratory's internal QC program has shown that the majority of internal duplicate samples, spike recoveries, surrogate standards and laboratory blanks were within the laboratories' recommended range for acceptable reproducibility. Therefore, STS considers the laboratory data obtained in the sampling program to be of acceptable precision, accuracy and reliability and is considered to be representative of the site conditions encountered.

## 6.6 Conclusions

The results of this sampling program show that the concentrations of chemical contaminants within the materials tested are generally low and below criteria considered suitable for a residential land use.

## 7. FINAL COMMENTS

Due to the presence of gravel layers we were unable to drill the boreholes to the proposed depth of excavation. Gravels can also provide misleading information regarding the apparent consistency or density of the soils (from which foundation design parameters are determined). We therefore recommend that additional investigations be undertaken prior to the finalisation of design for the project. The presence of groundwater should be confirmed by undertaking at least 2 deep test pits on the site. The test pits should be undertaken using a large excavator and should extend to the proposed depth of excavation. The water inflow rates can be determined from the test pits. The test pits will also allow a detailed assessment of the soil conditions to confirm the bearing pressures provided in this report.

During construction should the subsurface conditions vary to those inferred in this report, a suitably experienced geotechnical engineer should review the design and recommendations given above to determine if any alterations are required.

A handwritten signature in black ink, appearing to read 'Matt Green'.

Matt Green BSC Hons  
Engineering Geologist

A handwritten signature in black ink, appearing to read 'Laurie Ihnativ'.

Laurie Ihnativ, BE, MEngSc, MBA, FIE Aust.  
Manager, SMC Testing Services Pty Limited

Table A Analytical Results for Soil Samples

Analytes	Sample Locations						NEPM Background Ranges <sup>1</sup>	NSW EPA Threshold Concentrations	SIL (Column 1) Residential Land Use with Accessible Soil
	S1	S2	S3	S5	S6	S7			
<b>Metals</b>									
Arsenic	7	<5	5	7	8	5	1-50		100
Barium			140			90	100-3000		
Beryllium			<1			<1			60 (c)
Cadmium	<1	<1	<1	<1	<1	<1	1		20
Chromium	16	11	15	17	51	17	5-1 000		12% (b)
Cobalt			8			9	1-40		100
Copper	27	13	22	21	6	11	2-100		6000 (c)
Lead	39	10	37	30	12	15	2-200		300
Manganese			787			756	850		3800 (c)
Mercury	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.001-0.1 (a)		40 (c),(d)
Nickel	12	7	10	10	6	7	5-500		400 (c)
Vanadium			30			36	20-500		
Zinc	56	16	55	67	13	29	10-300		7400 (c)
<b>Monocyclic Aromatic Hydrocarbons (MAHs)</b>									
Benzene	<0.2		<0.2	<0.2		<0.2	0.05-1 (a)	1	
Ethylbenzene	<0.5		<0.5	<0.5		<0.5		3.1	
Toluene	<0.5		<0.5	<0.5		<0.5	0.1-1 (a)	1.4	
Xylenes	<0.5		<0.5	<0.5		<0.5		14	
Napthalene	<1		<1	<1		<1			
Total MAHs above detection limits	ND		ND	ND		ND			
<b>Total Petroleum Hydrocarbons (TPHs)</b>									
Total C <sub>6</sub> -C <sub>9</sub>	<10		<10	<10		<10		65	
Total C <sub>10</sub> -C <sub>36</sub>	<50		<50	<50		<50		1000	
<b>Polycyclic Aromatic Hydrocarbons (PAHs)</b>									
Total PAHs above detection limits	12.0		<0.5	1.2		<0.5	0.95-5 (a)		300 (c)
Total carcinogenic PAHs	1.8		ND	1.3		ND			3 (e)
<b>Organochlorine Pesticides (OCPs)</b>									
Total OCPs above detection limits	ND	ND		ND	ND				
<b>Organophosphorus Pesticides (OPPs)</b>									
Total OPPs above detection limits	ND	ND		ND	ND				
<b>Phenolic</b>									
Total Phenols	ND			ND			0.03-0.5 (a)		3000 (c),(f)
<b>Polychlorinated Biphenyls (PCBs)</b>									
Total PCBs	<0.1						0.02-0.1 (a)		1 (c)
<b>Asbestos</b>									
	ND			ND					

Notes: Results expressed as mg/kg unless otherwise indicated

ND = No individual species detected above laboratory detection limits.

<sup>1</sup> Adopted from 1999 NEPM

Results shaded green exceed the NSW EPA threshold concentrations for a sensitive land use.

Results shaded red exceed the SILs (Column 1) criteria for a residential land use

with accessible soil, including childrens day care centres, preschools and primary schools

(a) ANZECC background ranges used where no NEPM criteria available.

(b) Criterion for chromium (III).

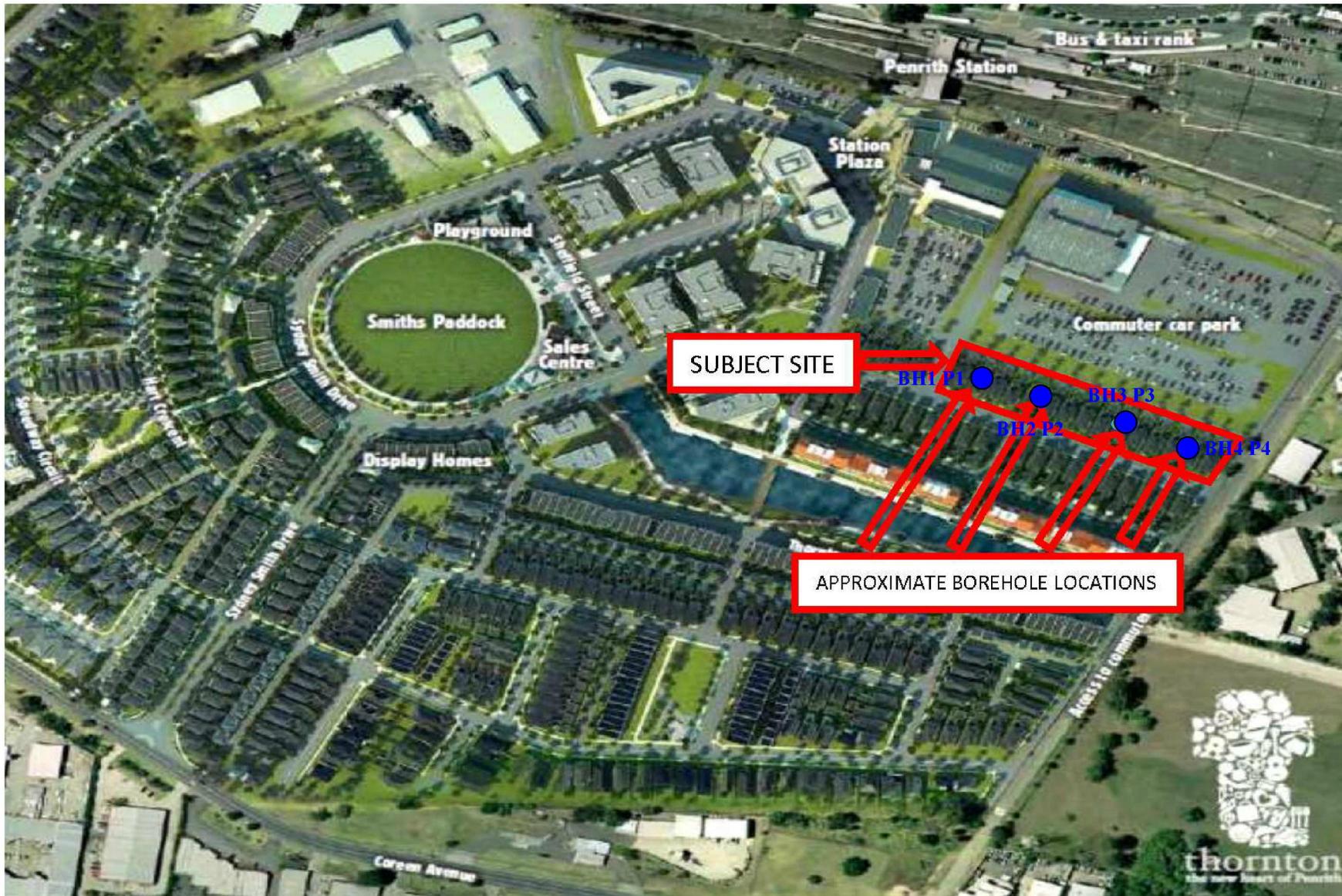
(c) NEPM 2013 criterion

(d) Criterion for inorganic mercury

(e) NEPM 2013 criterion for total carcinogenic PAHs as benzo(a)pyrene TEQ

(f) Criterion for combined DDT, DDE & DDD





**SMEC TESTING SERVICES Pty. Ltd.**

Scale: Unknown

Date: May 2014

**Client: EVOLVE HOUSING**

**GEOTECHNICAL INVESTIGATION  
 THORNTON ESTATE, THORNTON DRIVE, PENRITH  
 BOREHOLE & PENETROMETER LOCATIONS**

Project No.  
19720/4340C

Drawing No: 14/1132

## NOTES RELATING TO GEOTECHNICAL REPORTS

### Introduction

These notes have been provided to outline the methodology and limitations inherent in geotechnical reporting. The issues discussed are not relevant to all reports and further advice should be sought if there are any queries regarding any advice or report.

When copies of reports are made, they should be reproduced in full.

### Geotechnical Reports

Geotechnical reports are prepared by qualified personnel on the information supplied or obtained and are based on current engineering standards of interpretation and analysis.

Information may be gained from limited subsurface testing, surface observations, previous work and is supplemented by knowledge of the local geology and experience of the range of properties that may be exhibited by the materials present. For this reason, geotechnical reports should be regarded as interpretative rather than factual documents, limited to some extent by the scope of information on which they rely.

Where the report has been prepared for a specific purpose (eg. design of a three-storey building), the information and interpretation may not be appropriate if the design is changed (eg. a twenty storey building). In such cases, the report and the sufficiency of the existing work should be reviewed by SMEC Testing Services Pty Limited in the light of the new proposal.

Every care is taken with the report content, however, it is not always possible to anticipate or assume responsibility for the following conditions:

- Unexpected variations in ground conditions. The potential for this depends on the amount of investigative work undertaken.
- Changes in policy or interpretation by statutory authorities.
- The actions of contractors responding to commercial pressures.

If these occur, SMEC Testing Services Pty Limited would be pleased to resolve the matter through further investigation, analysis or advice.

### Unforeseen Conditions

Should conditions encountered on site differ markedly from those anticipated from the information contained in the report, SMEC

Testing Services Pty Limited should be notified immediately. Early identification of site anomalies generally results in any problems being more readily resolved and allows re-interpretation and assessment of the implications for future work.

### Subsurface Information

Logs of a borehole, recovered core, test pit, excavated face or cone penetration test are an engineering and/or geological interpretation of the subsurface conditions. The reliability of the logged information depends on the drilling/testing method, sampling and/or observation spacings and the ground conditions. It is not always possible or economic to obtain continuous high quality data. It should also be recognised that the volume or material observed or tested is only a fraction of the total subsurface profile.

Interpretation of subsurface information and application to design and construction must take into consideration the spacing of the test locations, the frequency of observations and testing, and the possibility that geological boundaries may vary between observation points.

Groundwater observations and measurements outside of specially designed and constructed piezometers should be treated with care for the following reasons:

- In low permeability soils groundwater may not seep into an excavation or bore in the short time it is left open.
- A localised perched water table may not represent the true water table.
- Groundwater levels vary according to rainfall events or season.
- Some drilling and testing procedures mask or prevent groundwater inflow.

The installation of piezometers and long term monitoring of groundwater levels may be required to adequately identify groundwater conditions.

### Supply of Geotechnical Information or Tendering Purposes

It is recommended tenderers are provided with as much geological and geotechnical information that is available and that where there are uncertainties regarding the ground conditions, prospective tenders should be provided with comments discussing the range of likely conditions in addition to the investigation data.



## **APPENDIX A**

### **BOREHOLE LOGS AND EXPLANATION SHEETS**





Client: Evolve Housing		Project No.: 19720/4340C		<b>BOREHOLE NO.: BH 3</b>		
Project: Thornton Estate, Thornton Drive, Penrith		Date: May 28, 2014		Sheet 1 of 1		
Location: Refer to Drawing No. 14/1132		Logged: JK				
W A T E R L E V E	S A M P L E S	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT  (Soil type, colour, grain size, plasticity, minor components, observations)	S Y M B O L	CONSISTENCY	M
					(cohesive soils) or RELATIVE DENSITY (sands and gravels)	O I S T U R E
	S5 @ 0.2 m		GRAVELLY SILTY CLAY: dark grey with dark brown and light grey, medium plasticity, some gravel	CL	STIFF	D-M
	S6 @ 0.6 m		FILL			
			CLAYEY SAND: red brown/orange brown, fine to medium grained	SC	VERY STIFF	M
					FIRM TO STIFF	
					STIFF	
				SANDY CLAY: orange brown with occasional light grey, fine to medium grained sand, medium plasticity	CL	VERY STIFF
			CLAYEY SAND: yellow brown with light grey, fine grained sand, trace of gravel	SC	VERY STIFF	M
			AUGER REFUSAL AT 4.1 M ON GRAVEL			
NOTES: D - disturbed sample      U - undisturbed tube sample      B - bulk sample WT - level of water table or free water      N - Standard Penetration Test (SPT)				Contractor: STS Equipment: Edson RP70		
See explanation sheets for meaning of all descriptive terms and symbols				Hole Diameter (mm): 100 Angle from Vertical (°) 0		

Client: Evolve Housing		Project No.: 19720/4340C		<b>BOREHOLE NO.: BH 4</b>		
Project: Thornton Estate, Thornton Drive, Penrith		Date: May 28, 2014		Sheet 1 of 1		
Location: Refer to Drawing No. 14/1132		Logged: JK				
W A T E R L E V E	S A M P L E S	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT  (Soil type, colour, grain size, plasticity, minor components, observations)	S Y M B O L	CONSISTENCY	M
					(cohesive soils) or RELATIVE DENSITY (sands and gravels)	S I S T U R E
	S7 @ 0.2 m		GRAVELLY SILTY CLAY: dark brown with dark grey and orange brown, medium plasticity, some gravel	CL	FIRM TO STIFF	D-M
			FILL			
		1.0	SANDY CLAY/CLAYEY SAND: orange brown, fine grained sand, low plasticity	CL/SC	STIFF TO VERY STIFF	M
		2.0			FIRM TO STIFF	
		3.0			STIFF	
		4.0			VERY STIFF	
	S8 @ 4.5 m	5.0	GRAVELLY CLAY: orange brown with light grey, low plasticity, some gravel, trace of fine grained sand	CL	VERY STIFF	M-VM
			AUGER REFUSAL AT 5.0 M ON GRAVEL			
			STANDPIPE PIEZOMETER INSTALLED			
NOTES: D - disturbed sample U - undisturbed tube sample B - bulk sample WT - level of water table or free water N - Standard Penetration Test (SPT)				Contractor: STS Equipment: Edson RP70		
See explanation sheets for meaning of all descriptive terms and symbols				Hole Diameter (mm): 100 Angle from Vertical (°) 0		

**SMEC Testing Services Pty Ltd**

14/1 Cowpasture Place, Wetherill Park NSW 2164  
 Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au



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*Dynamic Cone Penetrometer Test Report*

Project: THORNTON ESTATE, THORNTON DRIVE, PENRITH

Client: **EVOLVE HOUSING**

Address: 9-13 Argyle Street, Parramatta

Test Method: AS 1289.6.3.2

Project No.: 19720/4340C

Report No.: 14/1132

Report Date: May 29, 2014

Page: 1 of 1

Site No.	P1	P2	P3	P4		P1	P2	P3	P4
Location	Refer to Drawing No. 14/1132	Refer to Drawing No. 14/1132	Refer to Drawing No. 14/1132	Refer to Drawing No. 14/1132					
Starting Level	Surface Level	Surface Level	Surface Level	Surface Level					
Depth (m)	Penetration Resistance (blows / 150mm)				Depth (m)	Penetration Resistance (blows / 150mm)			
0.00 - 0.15	5	7	5	3	3.00 - 3.15	R	15	4	4
0.15 - 0.30	4	8	6	4	3.15 - 3.30		16	6	6
0.30 - 0.45	4	10	12	8	3.30 - 3.45		17	19	12
0.45 - 0.60	3	7	22	22	3.45 - 3.60		19	22	10
0.60 - 0.75	3	6	R	R	3.60 - 3.75		22	R	11
0.75 - 0.90	4	4	*	*	3.75 - 3.90		R		10
0.90 - 1.05	5	4	*	*	3.90 - 4.05				8
1.05 - 1.20	6	5	*	*	4.05 - 4.20				16
1.20 - 1.35	7	6	*	*	4.20 - 4.35				17
1.35 - 1.50	10	7	*	*	4.35 - 4.50				22
1.50 - 1.65	13	8	*	*	4.50 - 4.65				R
1.65 - 1.80	14	8	*	*	4.65 - 4.80				
1.80 - 1.95	14	10	*	*	4.80 - 4.95				
1.95 - 2.10	14	11	*	2	4.95 - 5.10				
2.10 - 2.25	15	12	*	3	5.10 - 5.25				
2.25 - 2.40	16	14	3	3	5.25 - 5.40				
2.40 - 2.55	17	11	2	3	5.40 - 5.55				
2.55 - 2.70	15	11	3	4	5.55 - 5.70				
2.70 - 2.85	18	12	3	4	5.70 - 5.85				
2.85 - 3.00	22	14	4	3	5.85 - 6.00				

Remarks: \* = Pre-drilled hole prior to testing

Approved Signatory.....

Laurie Ihnativ - Manager

Technician: JK

## E1. CLASSIFICATION OF SOILS

### E1.1 Soil Classification and the Unified System

An assessment of the site conditions usually includes an appraisal of the data available by combining values of engineering properties obtained by the site investigation with descriptions, from visual observation of the materials present on site.

The system used by SMEC in the identification of soil is the Unified Soil Classification system (USC) which was developed by the US Army Corps of Engineers during World War II and has since gained international acceptance and has been adopted in its metricated form by the Standards Association of Australia.

The Australian Site Investigation Code (AS1726-1981, Appendix D) recommends that the description of a soil includes the USC group symbols which are an integral component of the system.

The soil description should contain the following information in order:

#### Soil composition

- SOIL NAME and USC classification symbol (IN BLOCK LETTERS)
- plasticity or particle characteristics
- colour
- secondary and minor constituents (name estimated proportion, plasticity or particle characteristics, colour)

#### Soil condition

- moisture condition
- consistency or density index

#### Soil structure

- structure (zoning, defects, cementing)

#### Soil origin

interpretation based on observation eg FILL, TOPSOIL, RESIDUAL, ALLUVIUM.

### E1.2 Soil Composition

#### (a) Soil Name and Classification Symbol

The USC system is summarized in Figure E1.2.1. The primary division separates soil types on the basis of particle size into:

- Coarse grained soils - more than 50% of the material less than 60 mm is larger than 0.06 mm (60 µm).
- Fine grained soils - more than 50% of the material less than 60 mm is smaller than 0.06 mm (60 µm).

Initial classification is by particle size as shown in Table E1.2.1. Further classification of fine grained soils is based on plasticity.

TABLE E1.2.1 - CLASSIFICATION BY PARTICLE SIZE

NAME	SUB-DIVISION	SIZE
Clay (1)		< 2 µm
Silt (2)		2 µm to 60 µm
Sand	Fine Medium Coarse	60 µm to 200 µm 200 µm to 600 µm 600 µm to 2 mm
Gravel (3)	Fine Medium Coarse	2 mm to 6 mm 6 mm to 20 mm 20 mm to 60 mm
Cobbles (3)		60 mm to 200 mm
Boulders (3)		> 200 mm

Where a soil contains an appropriate amount of secondary material, the name includes each of the secondary components (greater than 12%) in increasing order of significance, eg sandy silty clay.

Minor components of a soil are included in the description by means of the terms "some" and "trace" as defined in Table E1.2.2.

TABLE E1.2.2 - MINOR SOIL COMPONENTS

TERM	DESCRIPTION	APPROXIMATE PROPORTION (%)
Trace	presence just detectable, little or no influence on soil properties	0-5
Some	presence easily detectable, little influence on soil properties	5-12

The USC group symbols should be included with each soil description as shown in Table E1.2.3

TABLE E1.2.3 - SOIL GROUP SYMBOLS

SOIL TYPE	PREFIX
Gravel	G
Sand	S
Silt	M
Clay	C
Organic	O
Peat	Pt

The group symbols are combined with qualifiers which indicate grading, plasticity or secondary components as shown on Table E1.2.4

TABLE E1.2.4 - SOIL GROUP QUALIFIERS

SUBGROUP	SUFFIX
Well graded	W
Poorly Graded	P
Silty	M
Clayey	C
Liquid Limit <50% - low to medium plasticity	L
Liquid Limit >50% - low to medium plasticity	H

(b) Grading

“Well graded”	Good representation of all particle sizes from the largest to the smallest.
“Poorly graded”	One or more intermediate sizes poorly represented
“Gap graded”	One or more intermediate sizes absent
“Uniformly graded”	Essentially single size material.

(c) Particle shape and texture

The shape and surface texture of the coarse grained particles should be described.

**Angularity** may be expressed as “rounded”, “sub-rounded”, “sub-angular” or “angular”.

Particle **form** can be “equidimensional”, “flat” or “elongate”.

**Surface texture** can be “glassy”, “smooth”, “rough”, “pitted” or “striated”.

(d) Colour

The colour of the soil should be described in the moist condition using simple terms such as:

Black	White	Grey	Red
Brown	Orange	Yellow	Green
Blue			

These may be modified as necessary by “light” or “dark”. Borderline colours may be described as a combination of two colours, eg. red-brown.

For soils that contain more than one colour terms such as:

- Speckled Very small (<10 mm dia) patches
- Mottled Irregular
- Blotched Large irregular (>75 mm dia)
- Streaked Randomly oriented streaks

(e) Minor Components

Secondary and minor components should be individually described in a similar manner to the dominant component.

E1.3 Soil Condition

(a) Moisture

Soil moisture condition is described as “dry”, “moist” or “wet”.

The moisture categories are defined as:

Dry (D) - Little or no moisture evident. Soils are running.  
Moist (M) - Darkened in colour with cool feel. Granular soil particles tend to adhere. No free water evident upon remoulding of cohesive soils.

In addition the moisture content of cohesive soils can be estimated in relation to their liquid or plastic limit.

(b) Consistency

Estimates of the consistency of a clay or silt soil may be made from manual examination, hand penetrometer test, SPT results or from laboratory tests to determine undrained shear or unconfined compressive strengths. The classification of consistency is defined in Table E1.3.1.

TABLE E1.3.1 - CONSISTENCY OF FINE-GRAINED SOILS

TERM	UNCONFINED STRENGTH (kPa)	FIELD IDENTIFICATION
Very Soft	<25	Easily penetrated by fist. Sample exudes between fingers when squeezed in the fist.
Soft	25 – 50	Easily moulded in fingers. Easily penetrated 50 mm by thumb.
Firm	50 – 100	Can be moulded by strong pressure in the fingers. Penetrated only with great effort.
Stiff	100 – 200	Cannot be moulded in fingers. Indented by thumb but penetrated only with great effort.
Very Stiff	200 – 400	Very tough. Difficult to cut with knife. Readily indented with thumb nail.
Hard	>400	Brittle, can just be scratched with thumb nail. Tends to break into fragments.

Unconfined compressive strength as derived by a hand penetrometer can be taken as approximately double the undrained shear strength ( $q_u = 2 c_u$ ).

(c) Density Index

The insitu density index of granular soils can be assessed from the results of SPT or cone penetrometer tests. Density index should not be estimated visually.

TABLE E1.3.2 - DENSITY OF GRANULAR SOILS

TERM	SPT N VALUE	STATIC CONE VALUE $q_c$ (MPa)	DENSITY INDEX (%)
Very Loose	0 – 3	0 - 2	0 - 15
Loose	3 – 8	2 - 5	15 - 35
Medium Dense	8 – 25	5 - 15	35 - 65
Dense	25 – 42	15 - 20	65 - 85
Very Dense	>42	>20	>85

#### E1.4 Soil Structure

##### (a) Zoning

A sample may consist of several zones differing in colour, grain size or other properties. Terms to classify these zones are:

Layer - continuous across exposure or sample

Lens - discontinuous with lenticular shape

Pocket - irregular inclusion

Each zone should be described, their distinguishing features, and the nature of the interzone boundaries.

##### (b) Defects

Defects which are present in the sample can include:

- fissures
- roots (containing organic matter)
- tubes (hollow)
- casts (infilled)

Defects should be described giving details of dimensions and frequency. Fissure orientation, planarity, surface condition and infilling should be noted. If there is a tendency to break into blocks, block dimensions should be recorded

#### E1.5 Soil Origin

Information which may be interpretative but which may contribute to the usefulness of the material description should be included. The most common interpreted feature is the origin of the soil. The assessment of the probable origin is based on the soil material description, soil structure and its relationship to other soil and rock materials.

Common terms used are:

“Residual Soil” - Material which appears to have been derived by weathering from the underlying rock. There is no evidence of transport.

“Colluvium” - Material which appears to have been transported from its original location. The method of movement is usually the combination of gravity and erosion.

“Landslide Debris” - An extreme form of colluvium where the soil has been transported by mass movement. The material is obviously distributed and contains distinct defects related to the slope failure.

“Alluvium” - Material which has been transported essentially by water. Usually associated with former stream activity.

“Fill” - Material which has been transported and placed by man. This can range from natural soils which have been placed in a controlled manner in engineering construction to dumped waste material. A description of the constituents should include an assessment of the method of placement.

#### E1.6 Fine Grained Soils

The physical properties of fine grained soils are dominated by silts and clays.

The definition of clay and silt soils is governed by their Atterberg Limits. Clay soils are characterised by the properties of cohesion and plasticity with cohesion defines as the ability to deform without rupture. Silts exhibit cohesion but have low plasticity or are non-plastic.

The field characteristics of clay soils include:

- dry lumps have appreciable dry strength and cannot be powdered
- volume changes occur with moisture content variation
- feels smooth when moist with a greasy appearance when cut.

The field characteristics of silt soils include:

- dry lumps have negligible dry strength and can be powdered easily
- dilatancy - an increase in volume due to shearing - is indicated by the presence of a shiny film of water after a hand sample is shaken. The water disappears upon remoulding. Very fine grained sands may also exhibit dilatancy.
- low plasticity index
- feels gritty to the teeth

#### E1.7 Organic Soils

Organic soils are distinguished from other soils by their appreciable content of vegetable matter, usually derived from plant remains.

The soil usually has a distinctive smell and low bulk density.

The USC system uses the symbol Pt for partly decomposed organic material. The O symbol is combined with suffixes “O” or “H” depending on plasticity.

Where roots or root fibres are present their frequency and the depth to which they are encountered should be recorded. The presence of roots or root fibres does not necessarily mean the material is an “organic material” by classification.

Coal and lignite should be described as such and not simply as organic matter.



## **APPENDIX B**

### **LABORATORY TEST RESULTS**

## CERTIFICATE OF ANALYSIS

Work Order	: <b>ES1411942</b>	Page	: 1 of 13
Client	: <b>SMEC TESTING SERVICES PTY LTD</b>	Laboratory	: Environmental Division Sydney
Contact	: <b>DAVID YONGE</b>	Contact	: Client Services
Address	: <b>P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164</b>	Address	: <b>277-289 Woodpark Road Smithfield NSW Australia 2164</b>
E-mail	: <b>dyonge@smectesting.com.au</b>	E-mail	: <b>sydney@alsglobal.com</b>
Telephone	: <b>+61 02 9756 2166</b>	Telephone	: <b>+61-2-8784 8555</b>
Facsimile	: <b>+61 02 9756 1137</b>	Facsimile	: <b>+61-2-8784 8500</b>
Project	: <b>19720 4340C</b>	QC Level	: <b>NEPM 2013 Schedule B(3) and ALS QCS3 requirement</b>
Order number	: <b>11135</b>	Date Samples Received	: <b>29-MAY-2014</b>
C-O-C number	: <b>P19720-COC1</b>	Issue Date	: <b>04-JUN-2014</b>
Sampler	: <b>----</b>	No. of samples received	: <b>8</b>
Site	: <b>----</b>	No. of samples analysed	: <b>7</b>
Quote number	: <b>EN/025/13</b>		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Descriptive Results
- Surrogate Control Limits



## General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ)** is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EA200 Legend
- EA200 'Am' Amosite (brown asbestos)
- EA200 'Ch' Chrysotile (white asbestos)
- EA200 'Cr' Crocidolite (blue asbestos)
- EA200 'Trace' - Asbestos fibres detected by trace analysis per AS4964. The result can be interpreted that the sample contains detectable 'respirable' asbestos fibres
- EA200: 'UMF' Unknown Mineral Fibres. "-" indicates fibres detected may or may not be asbestos fibres. Confirmation by alternative techniques is recommended.
- EA200: Asbestos Identification Samples were analysed by Polarised Light Microscopy including dispersion staining.
- EA200: Negative results for vinyl tiles should be confirmed by an independent analytical technique.



NATA Accredited Laboratory 825

Accredited for compliance with  
ISO/IEC 17025.

## Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Organics
Shaun Spooner	Asbestos Identifier	Newcastle - Asbestos
Shobhna Chandra	Metals Coordinator	Sydney Inorganics



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S1	S2	S3	S4	S5
				28-MAY-2014 12:45				
Compound	CAS Number	LOR	Unit	ES1411942-001	ES1411942-002	ES1411942-003	ES1411942-004	ES1411942-005
<b>EA002 : pH (Soils)</b>								
pH Value	----	0.1	pH Unit	----	5.3	----	5.7	----
<b>EA055: Moisture Content</b>								
Moisture Content (dried @ 103°C)	----	1.0	%	7.6	13.2	9.8	12.0	8.8
<b>EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples</b>								
Asbestos Detected	1332-21-4	0.1	g/kg	No	----	----	----	No
Asbestos Type	1332-21-4	-	--	-	----	----	----	-
Sample weight (dry)	----	0.01	g	43.0	----	----	----	49.0
APPROVED IDENTIFIER:	----	-	--	S.SPOONER	----	----	----	S.SPOONER
<b>ED040S : Soluble Sulfate by ICPAES</b>								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	40	----	30	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	10	mg/kg	----	280	----	<10	----
<b>EG005T: Total Metals by ICP-AES</b>								
Arsenic	7440-38-2	5	mg/kg	----	----	5	----	----
Barium	7440-39-3	10	mg/kg	----	----	140	----	----
Beryllium	7440-41-7	1	mg/kg	----	----	<1	----	----
Boron	7440-42-8	50	mg/kg	----	----	<50	----	----
Cadmium	7440-43-9	1	mg/kg	----	----	<1	----	----
Chromium	7440-47-3	2	mg/kg	----	----	15	----	----
Cobalt	7440-48-4	2	mg/kg	----	----	8	----	----
Copper	7440-50-8	5	mg/kg	----	----	22	----	----
Lead	7439-92-1	5	mg/kg	----	----	37	----	----
Manganese	7439-96-5	5	mg/kg	----	----	787	----	----
Nickel	7440-02-0	2	mg/kg	----	----	10	----	----
Selenium	7782-49-2	5	mg/kg	----	----	<5	----	----
Vanadium	7440-62-2	5	mg/kg	----	----	30	----	----
Zinc	7440-66-6	5	mg/kg	----	----	55	----	----
Arsenic	7440-38-2	5	mg/kg	7	<5	----	----	7
Cadmium	7440-43-9	1	mg/kg	<1	<1	----	----	<1
Chromium	7440-47-3	2	mg/kg	16	11	----	----	17
Copper	7440-50-8	5	mg/kg	27	13	----	----	21
Lead	7439-92-1	5	mg/kg	39	10	----	----	30
Nickel	7440-02-0	2	mg/kg	12	7	----	----	10



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S1	S2	S3	S4	S5
				28-MAY-2014 12:45				
Compound	CAS Number	LOR	Unit	ES1411942-001	ES1411942-002	ES1411942-003	ES1411942-004	ES1411942-005
<b>EG005T: Total Metals by ICP-AES - Continued</b>								
Zinc	7440-66-6	5	mg/kg	56	16	----	----	67
<b>EG035T: Total Recoverable Mercury by FIMS</b>								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	----	<0.1
<b>EP066: Polychlorinated Biphenyls (PCB)</b>								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	----	----	----	<0.1
<b>EP068A: Organochlorine Pesticides (OC)</b>								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
4.4'-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
4.4'-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
4.4'-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	----	----	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	----	----	<0.2
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
^ Sum of DDD + DDE + DDT	----	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
<b>EP068B: Organophosphorus Pesticides (OP)</b>								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	----	----	<0.05



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S1	S2	S3	S4	S5
				28-MAY-2014 12:45				
Compound	CAS Number	LOR	Unit	ES1411942-001	ES1411942-002	ES1411942-003	ES1411942-004	ES1411942-005
<b>EP068B: Organophosphorus Pesticides (OP) - Continued</b>								
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	----	----	<0.2
Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	----	----	<0.2
Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	----	----	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	----	----	<0.05
<b>EP075(SIM)A: Phenolic Compounds</b>								
Phenol	108-95-2	0.5	mg/kg	<0.5	----	----	----	<0.5
2-Chlorophenol	95-57-8	0.5	mg/kg	<0.5	----	----	----	<0.5
2-Methylphenol	95-48-7	0.5	mg/kg	<0.5	----	----	----	<0.5
3- & 4-Methylphenol	1319-77-3	1	mg/kg	<1	----	----	----	<1
2-Nitrophenol	88-75-5	0.5	mg/kg	<0.5	----	----	----	<0.5
2,4-Dimethylphenol	105-67-9	0.5	mg/kg	<0.5	----	----	----	<0.5
2,4-Dichlorophenol	120-83-2	0.5	mg/kg	<0.5	----	----	----	<0.5
2,6-Dichlorophenol	87-65-0	0.5	mg/kg	<0.5	----	----	----	<0.5
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg	<0.5	----	----	----	<0.5
2,4,6-Trichlorophenol	88-06-2	0.5	mg/kg	<0.5	----	----	----	<0.5
2,4,5-Trichlorophenol	95-95-4	0.5	mg/kg	<0.5	----	----	----	<0.5
Pentachlorophenol	87-86-5	2	mg/kg	<2	----	----	----	<2
<b>EP075(SIM)B: Polynuclear Aromatic Hydrocarbons</b>								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	----	<0.5	----	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	----	<0.5	----	<0.5



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S1	S2	S3	S4	S5
				28-MAY-2014 12:45				
Compound	CAS Number	LOR	Unit	ES1411942-001	ES1411942-002	ES1411942-003	ES1411942-004	ES1411942-005
<b>EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued</b>								
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	----	<0.5	----	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	----	<0.5	----	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	1.5	----	<0.5	----	<0.5
Anthracene	120-12-7	0.5	mg/kg	0.5	----	<0.5	----	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	2.5	----	<0.5	----	<0.5
Pyrene	129-00-0	0.5	mg/kg	2.1	----	<0.5	----	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	1.1	----	<0.5	----	<0.5
Chrysene	218-01-9	0.5	mg/kg	1.0	----	<0.5	----	<0.5
Benzo(b+j)fluoranthene	205-99-2	0.5	mg/kg	1.2	----	<0.5	----	0.6
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	0.6	----	<0.5	----	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	1.0	----	<0.5	----	0.6
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	----	<0.5	----	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	----	<0.5	----	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	0.5	----	<0.5	----	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	12.0	----	<0.5	----	1.2
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	1.3	----	<0.5	----	0.7
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	1.6	----	0.6	----	1.0
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	1.8	----	1.2	----	1.3
<b>EP080/071: Total Petroleum Hydrocarbons</b>								
C6 - C9 Fraction	----	10	mg/kg	<10	----	<10	----	<10
C10 - C14 Fraction	----	50	mg/kg	<50	----	<50	----	<50
C15 - C28 Fraction	----	100	mg/kg	<100	----	<100	----	140
C29 - C36 Fraction	----	100	mg/kg	<100	----	<100	----	300
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	----	<50	----	440
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013</b>								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	----	<10	----	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	----	<10	----	<10
>C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	----	<50	----	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	----	<100	----	320
>C34 - C40 Fraction	----	100	mg/kg	<100	----	<100	----	340
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	----	<50	----	660
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	----	<50	----	<50



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S1	S2	S3	S4	S5
				28-MAY-2014 12:45				
Compound	CAS Number	LOR	Unit	ES1411942-001	ES1411942-002	ES1411942-003	ES1411942-004	ES1411942-005
<b>EP080: BTEXN</b>								
Benzene	71-43-2	0.2	mg/kg	<0.2	----	<0.2	----	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	----	<0.5	----	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	----	<0.5	----	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	----	<0.5	----	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	----	<0.5	----	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	----	<0.2	----	<0.2
^ Total Xylenes	1330-20-7	0.5	mg/kg	<0.5	----	<0.5	----	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	----	<1	----	<1
<b>EP066S: PCB Surrogate</b>								
Decachlorobiphenyl	2051-24-3	0.1	%	109	----	----	----	89.0
<b>EP068S: Organochlorine Pesticide Surrogate</b>								
Dibromo-DDE	21655-73-2	0.1	%	112	89.8	----	----	91.1
<b>EP068T: Organophosphorus Pesticide Surrogate</b>								
DEF	78-48-8	0.1	%	71.5	104	----	----	72.3
<b>EP075(SIM)S: Phenolic Compound Surrogates</b>								
Phenol-d6	13127-88-3	0.1	%	118	----	108	----	112
2-Chlorophenol-D4	93951-73-6	0.1	%	95.1	----	94.6	----	89.8
2,4,6-Tribromophenol	118-79-6	0.1	%	86.4	----	84.2	----	83.9
<b>EP075(SIM)T: PAH Surrogates</b>								
2-Fluorobiphenyl	321-60-8	0.1	%	95.5	----	92.5	----	94.3
Anthracene-d10	1719-06-8	0.1	%	102	----	101	----	101
4-Terphenyl-d14	1718-51-0	0.1	%	94.0	----	92.2	----	91.5
<b>EP080S: TPH(V)/BTEX Surrogates</b>								
1,2-Dichloroethane-D4	17060-07-0	0.1	%	83.7	----	73.8	----	91.4
Toluene-D8	2037-26-5	0.1	%	104	----	97.6	----	115
4-Bromofluorobenzene	460-00-4	0.1	%	115	----	95.3	----	121



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S6	S7	---	---	---
				28-MAY-2014 12:45	28-MAY-2014 12:45	---	---	---
				ES1411942-006	ES1411942-007	---	---	---
Compound	CAS Number	LOR	Unit					
<b>EA055: Moisture Content</b>								
Moisture Content (dried @ 103°C)	---	1.0	%	7.5	6.0	---	---	---
<b>EG005T: Total Metals by ICP-AES</b>								
Arsenic	7440-38-2	5	mg/kg	---	5	---	---	---
Barium	7440-39-3	10	mg/kg	---	90	---	---	---
Beryllium	7440-41-7	1	mg/kg	---	<1	---	---	---
Boron	7440-42-8	50	mg/kg	---	<50	---	---	---
Cadmium	7440-43-9	1	mg/kg	---	<1	---	---	---
Chromium	7440-47-3	2	mg/kg	---	17	---	---	---
Cobalt	7440-48-4	2	mg/kg	---	9	---	---	---
Copper	7440-50-8	5	mg/kg	---	11	---	---	---
Lead	7439-92-1	5	mg/kg	---	15	---	---	---
Manganese	7439-96-5	5	mg/kg	---	756	---	---	---
Nickel	7440-02-0	2	mg/kg	---	7	---	---	---
Selenium	7782-49-2	5	mg/kg	---	<5	---	---	---
Vanadium	7440-62-2	5	mg/kg	---	36	---	---	---
Zinc	7440-66-6	5	mg/kg	---	29	---	---	---
Arsenic	7440-38-2	5	mg/kg	8	---	---	---	---
Cadmium	7440-43-9	1	mg/kg	<1	---	---	---	---
Chromium	7440-47-3	2	mg/kg	51	---	---	---	---
Copper	7440-50-8	5	mg/kg	6	---	---	---	---
Lead	7439-92-1	5	mg/kg	12	---	---	---	---
Nickel	7440-02-0	2	mg/kg	6	---	---	---	---
Zinc	7440-66-6	5	mg/kg	13	---	---	---	---
<b>EG035T: Total Recoverable Mercury by FIMS</b>								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	---	---	---
<b>EP068A: Organochlorine Pesticides (OC)</b>								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	---	---	---	---
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	---	---	---	---
beta-BHC	319-85-7	0.05	mg/kg	<0.05	---	---	---	---
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	---	---	---	---
delta-BHC	319-86-8	0.05	mg/kg	<0.05	---	---	---	---
Heptachlor	76-44-8	0.05	mg/kg	<0.05	---	---	---	---
Aldrin	309-00-2	0.05	mg/kg	<0.05	---	---	---	---



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S6	S7	---	---	---
				28-MAY-2014 12:45	28-MAY-2014 12:45	---	---	---
Compound	CAS Number	LOR	Unit	ES1411942-006	ES1411942-007	---	---	---
<b>EP068A: Organochlorine Pesticides (OC) - Continued</b>								
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	---	---	---	---
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	---	---	---	---
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	---	---	---	---
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	---	---	---	---
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	---	---	---	---
Dieldrin	60-57-1	0.05	mg/kg	<0.05	---	---	---	---
4.4'-DDE	72-55-9	0.05	mg/kg	<0.05	---	---	---	---
Endrin	72-20-8	0.05	mg/kg	<0.05	---	---	---	---
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	---	---	---	---
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	---	---	---	---
4.4'-DDD	72-54-8	0.05	mg/kg	<0.05	---	---	---	---
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	---	---	---	---
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	---	---	---	---
4.4'-DDT	50-29-3	0.2	mg/kg	<0.2	---	---	---	---
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	---	---	---	---
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	---	---	---	---
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	---	---	---	---
^ Sum of DDD + DDE + DDT	----	0.05	mg/kg	<0.05	---	---	---	---
<b>EP068B: Organophosphorus Pesticides (OP)</b>								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	---	---	---	---
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	---	---	---	---
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	---	---	---	---
Dimethoate	60-51-5	0.05	mg/kg	<0.05	---	---	---	---
Diazinon	333-41-5	0.05	mg/kg	<0.05	---	---	---	---
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	---	---	---	---
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	---	---	---	---
Malathion	121-75-5	0.05	mg/kg	<0.05	---	---	---	---
Fenthion	55-38-9	0.05	mg/kg	<0.05	---	---	---	---
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	---	---	---	---
Parathion	56-38-2	0.2	mg/kg	<0.2	---	---	---	---
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	---	---	---	---
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	---	---	---	---
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	---	---	---	---
Edaphos	22224-92-6	0.05	mg/kg	<0.05	---	---	---	---



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S6	S7	---	---	---
				28-MAY-2014 12:45	28-MAY-2014 12:45	---	---	---
Compound	CAS Number	LOR	Unit	ES1411942-006	ES1411942-007	---	---	---
<b>EP068B: Organophosphorus Pesticides (OP) - Continued</b>								
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	---	---	---	---
Ethion	563-12-2	0.05	mg/kg	<0.05	---	---	---	---
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	---	---	---	---
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	---	---	---	---
<b>EP075(SIM)B: Polynuclear Aromatic Hydrocarbons</b>								
Naphthalene	91-20-3	0.5	mg/kg	---	<0.5	---	---	---
Acenaphthylene	208-96-8	0.5	mg/kg	---	<0.5	---	---	---
Acenaphthene	83-32-9	0.5	mg/kg	---	<0.5	---	---	---
Fluorene	86-73-7	0.5	mg/kg	---	<0.5	---	---	---
Phenanthrene	85-01-8	0.5	mg/kg	---	<0.5	---	---	---
Anthracene	120-12-7	0.5	mg/kg	---	<0.5	---	---	---
Fluoranthene	206-44-0	0.5	mg/kg	---	<0.5	---	---	---
Pyrene	129-00-0	0.5	mg/kg	---	<0.5	---	---	---
Benz(a)anthracene	56-55-3	0.5	mg/kg	---	<0.5	---	---	---
Chrysene	218-01-9	0.5	mg/kg	---	<0.5	---	---	---
Benzo(b+j)fluoranthene	205-99-2	0.5	mg/kg	---	<0.5	---	---	---
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	---	<0.5	---	---	---
Benzo(a)pyrene	50-32-8	0.5	mg/kg	---	<0.5	---	---	---
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	---	<0.5	---	---	---
Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg	---	<0.5	---	---	---
Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg	---	<0.5	---	---	---
^ Sum of polycyclic aromatic hydrocarbons	---	0.5	mg/kg	---	<0.5	---	---	---
^ Benzo(a)pyrene TEQ (zero)	---	0.5	mg/kg	---	<0.5	---	---	---
^ Benzo(a)pyrene TEQ (half LOR)	---	0.5	mg/kg	---	0.6	---	---	---
^ Benzo(a)pyrene TEQ (LOR)	---	0.5	mg/kg	---	1.2	---	---	---
<b>EP080/071: Total Petroleum Hydrocarbons</b>								
C6 - C9 Fraction	---	10	mg/kg	---	<10	---	---	---
C10 - C14 Fraction	---	50	mg/kg	---	<50	---	---	---
C15 - C28 Fraction	---	100	mg/kg	---	<100	---	---	---
C29 - C36 Fraction	---	100	mg/kg	---	<100	---	---	---
^ C10 - C36 Fraction (sum)	---	50	mg/kg	---	<50	---	---	---
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013</b>								
C6 - C10 Fraction	C6_C10	10	mg/kg	---	<10	---	---	---



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				S6	S7	---	---	---
				28-MAY-2014 12:45	28-MAY-2014 12:45	---	---	---
				ES1411942-006	ES1411942-007	---	---	---
Compound	CAS Number	LOR	Unit					
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 - Continued</b>								
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	---	<10	---	---	---
>C10 - C16 Fraction	>C10_C16	50	mg/kg	---	<50	---	---	---
>C16 - C34 Fraction	---	100	mg/kg	---	<100	---	---	---
>C34 - C40 Fraction	---	100	mg/kg	---	<100	---	---	---
^ >C10 - C40 Fraction (sum)	---	50	mg/kg	---	<50	---	---	---
^ >C10 - C16 Fraction minus Naphthalene (F2)	---	50	mg/kg	---	<50	---	---	---
<b>EP080: BTEXN</b>								
Benzene	71-43-2	0.2	mg/kg	---	<0.2	---	---	---
Toluene	108-88-3	0.5	mg/kg	---	<0.5	---	---	---
Ethylbenzene	100-41-4	0.5	mg/kg	---	<0.5	---	---	---
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	---	<0.5	---	---	---
ortho-Xylene	95-47-6	0.5	mg/kg	---	<0.5	---	---	---
^ Sum of BTEX	---	0.2	mg/kg	---	<0.2	---	---	---
^ Total Xylenes	1330-20-7	0.5	mg/kg	---	<0.5	---	---	---
Naphthalene	91-20-3	1	mg/kg	---	<1	---	---	---
<b>EP068S: Organochlorine Pesticide Surrogate</b>								
Dibromo-DDE	21655-73-2	0.1	%	72.4	---	---	---	---
<b>EP068T: Organophosphorus Pesticide Surrogate</b>								
DEF	78-48-8	0.1	%	88.0	---	---	---	---
<b>EP075(SIM)S: Phenolic Compound Surrogates</b>								
Phenol-d6	13127-88-3	0.1	%	---	104	---	---	---
2-Chlorophenol-D4	93951-73-6	0.1	%	---	114	---	---	---
2,4,6-Tribromophenol	118-79-6	0.1	%	---	95.5	---	---	---
<b>EP075(SIM)T: PAH Surrogates</b>								
2-Fluorobiphenyl	321-60-8	0.1	%	---	106	---	---	---
Anthracene-d10	1719-06-8	0.1	%	---	116	---	---	---
4-Terphenyl-d14	1718-51-0	0.1	%	---	105	---	---	---
<b>EP080S: TPH(V)/BTEX Surrogates</b>								
1,2-Dichloroethane-D4	17060-07-0	0.1	%	---	74.2	---	---	---
Toluene-D8	2037-26-5	0.1	%	---	78.4	---	---	---
4-Bromofluorobenzene	460-00-4	0.1	%	---	82.5	---	---	---



## Analytical Results

### Descriptive Results

Sub-Matrix: **SOIL**

<i>Method: Compound</i>	<i>Client sample ID - Client sampling date / time</i>	<i>Analytical Results</i>
<b>EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples</b>		
EA200: Description	S1 - 28-MAY-2014 12:45	Mid brown clay soil with a trace of vegetation.
EA200: Description	S5 - 28-MAY-2014 12:45	Mid brown clay soil with a trace of vegetation.



### Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
<b>EP066S: PCB Surrogate</b>			
Decachlorobiphenyl	2051-24-3	39	149
<b>EP068S: Organochlorine Pesticide Surrogate</b>			
Dibromo-DDE	21655-73-2	49	147
<b>EP068T: Organophosphorus Pesticide Surrogate</b>			
DEF	78-48-8	35	143
<b>EP075(SIM)S: Phenolic Compound Surrogates</b>			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2,4,6-Tribromophenol	118-79-6	40	138
<b>EP075(SIM)T: PAH Surrogates</b>			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
<b>EP080S: TPH(V)/BTEX Surrogates</b>			
1,2-Dichloroethane-D4	17060-07-0	72.8	133.2
Toluene-D8	2037-26-5	73.9	132.1
4-Bromofluorobenzene	460-00-4	71.6	130.0



FDC Construction & Fitout Pty Ltd  
ABN 44 120 295 034

22 - 24 Junction Street  
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Sydney | Canberra | Melbourne | Adelaide | Brisbane | Perth

# WASTE MANAGEMENT PLAN

## PREPARED FOR DEMOLITION AND CONSTRUCTION ACTIVITIES

### Outline of Proposal

**Site Address:** Proposed Lot 3105, Lord Sheffield Circuit, Thornton

**Buildings and other structures currently on the site:**

Vacant

### Brief Description of Proposal:

Residential Flat Building (State Environmental Planning Policy – Affordable Rental Housing – 2009)

*The details provided on this form are the intentions for managing waste relating to this project.*

**Name of Applicant:** Affordable Community Housing Limited (trading as Evolve Housing) – C:/ FDC Construction and Fitout Pty Ltd

**Applicant's address:** 22 – 24 Junction Street, Forest Lodge NSW 2037

**Phone:** 8117 5104

**Fax:** 9566 2900

Tim Bainbridge, Planning and Development Manager  
FDC Construction and Fitout  
15<sup>th</sup> January 2015



# CONSTRUCTION & FITOUT - WASTE MANAGEMENT PLAN



FDC Construction & Fitout Pty Ltd  
NSW 2145 0295 034

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## SECTION ONE - DEMOLITION STAGE

Project: Residential Flat Building Thornton

Sydney | Canberra | Melbourne | Adelaide | Brisbane | Perth

MATERIALS ON-SITE		DESTINATION		
Type of Material	Estimated Volume (m <sup>3</sup> )	REUSE AND RECYCLING		DISPOSAL
		ON-SITE * proposed reuse or on-site recycling methods	OFF-SITE * specify contractor and recycling unit	* specify contractor and landfill site
Excavation Material	1000m <sup>3</sup>	Equal cut to fill on site proposed		Contractor to remove fill as General Solid Waste. Fill to be removed to licensed facility – receipts to be maintained on site.
Green Waste	Nil			
Bricks	Nil			
Concrete	Nil			
Timber – Please specify	Nil			
Plasterboard	Nil			
Metals – Please specify	Nil			
Other – Please specify	Nil		General site preparation waste to be removed by contractor and sorted off site for disposal or reuse.	

To be removed by appropriately qualified contractor and removed to licensed facility. Balance of waste to landfill

**SECTION TWO - CONSTRUCTION STAGE**

**Project: Residential Flat Building - Thornton**

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MATERIALS ON-SITE		DESTINATION		
Expected Waste Materials	Estimated Volume (m <sup>3</sup> )	REUSE AND RECYCLING		DISPOSAL
		ON-SITE * specify proposed reuse or on-site	OFF-SITE * specify contractor and recycling outlet	specify contractor and landfill site
Excavation Material (topsoil)	Nil	Fill to be reused on site		
Green Waste	5m <sup>3</sup>		Via waste skip to sorting depot - recycled	
Bricks / Blocks	15m <sup>3</sup>		Via waste skip to sorting depot - recycled	
Concrete	5m <sup>3</sup>		Via waste skip to sorting depot – recycled	
General Construction Waste	110m <sup>3</sup>		Recyclable matter recycled	Contractor – TBA
Timber	15m <sup>3</sup>		Recycled via waste transfer depot (site rubbish skip services)	Balance of waste to landfill
Plasterboard	12m <sup>3</sup>		Recycled via waste transfer depot (site rubbish skip services)	
Metals	7m <sup>3</sup>		Recycled via waste transfer depot (site rubbish skip services)	
Putrescible Waste	10m <sup>3</sup>			Enviroguard Landfill via waste skip.
Non recyclable Waste	26m <sup>3</sup>			Enviroguard Landfill via waste skip.
Cardboard / Packaging	45m <sup>3</sup>		Recycled via waste transfer depot (site rubbish skip services)	

**SECTION THREE - USE OF PREMISES**

**Project: Residential Flat Building - Thornton**

FDC Construction & Fitout Pty Ltd  
 ABN 14 002 956 290

22 - 24 Junction Street  
 Forest Hill NSW 1513  
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**DESTINATION**

TYPE OF WASTE TO BE GENERATED	PROPOSED ON-SITE STORAGE AND TREATMENT FACILITIES	DESTINATION
Please specify. For example: glass, paper, food waste, offcuts, etc.	For example: * waste storage and recycling area * garbage chute * on-site composting * compaction equipment	* recycling * disposal Sydney   Canberra   Melbourne   Adelaide   Brisbane   Perth * specify contractor

Residential waste to be stored on site within designated waste storage areas. Waste removed weekly in accordance with standard Council policies and procedures with regard to recycling and disposal.

# MEMORANDUM

DATE: 18 DECEMBER 2014

---

TO: BEN DODWELL – FOLKESTONE

---

FROM: JOHN FERRARIN

---

REGARDING: PROPOSED RESIDENTIAL DEVELOPMENT  
LOT 3105, THORNTON ESTATE, NORTH PENRITH  
PRELIMINARY BUDGET ESTIMATE

As requested, we have prepared a Preliminary Budget Estimate for this project and advise you that the estimated construction cost at rates current in December 2014 is \$70,550,000 exclusive of Contingency and GST (\$77,605,000 inclusive of GST) as shown in the attached Main Summary of Costs. We also suggest that you allow a 3% Design Contingency.

The estimate has been based on architectural drawings A000 Rev 7, A100 – A131 Rev 8, A132 – A133 Rev 7 and A200 – A204 Rev 8 prepared by HBO EMTB Architects.

We attach our Executive Summary Report for your reference which includes the following:

- Main Summary of Costs;
- Schedule of Areas;
- Schedule of Apartments;
- Schedule of Exclusions.

We draw your attention to the Schedule of Exclusions on page 4 of the attached report which identifies items that have been excluded from the estimate and which should be considered separately in the overall feasibility study, where applicable.

We outline below a number of assumptions and qualifications made in the preparation of the estimate:

1. We have not allowed for the handling/ removal of contaminated spoil assuming the site does not require removal of contaminated or GSW material;
2. We have included a Provisional Allowance of \$600,000 (Excl GST) for piling to foundations. Although the Geotechnical Investigation Report does not outline a requirement for piling, our experience from another project at nearby site indicates that piled foundations may be required;
3. We have allowed for undertaking the project in 2 stages;

4. We have not allowed for car park space caging/garage doors to the residential car parks;
5. We have assumed that the retail tenancy will be a 'shell only' therefore we have included for fire sprinklers, provision for power and cold water points, however, we have excluded fit out such as finishes, ceilings etc;
6. We have assumed that the façade will generally be a painted brick veneer. We have made some allowance for façade features;
7. We have generally allowed for a base level specification with regards to the finishes, fixtures and fittings to the apartments. We note we have not allowed for hard finishes to the apartment living areas;
8. We have not allowed for plasterboard ceilings to apartment living and bedroom areas;
9. We have allowed for one wall mounted air conditioning unit to each apartment. We have assumed that the condensers will be located on the balconies;
10. We have assumed mirrored cabinets to all bathrooms;
11. We have not allowed for clothes washers and/ or refrigerators to the apartments;
12. We have allowed for 50% of the apartments to be affordable. We have allowed for the remaining 50% of the apartments to have upgraded finishes, fixtures and fittings;
13. We have included a provisional allowance \$400,000 (Excl GST) for 2No 100kVA substations. Based on our experience we consider the allowance of \$200,000 – \$250,000 as outlined in UAE's email dated 20 November 2014 to be low;
14. We have not allowed for external service connections and onsite detention tanks;
15. The estimated cost does not include an escalation allowance for the Stage 2 component of the Project;
16. Design and Consultant Fees are excluded.

We also note that we have made a number of assumptions for undefined / undesigned aspects of the design, particularly in relation to structure, footings, finishes and engineering services. We therefore recommend that prior to finalising feasibility studies a detailed estimate be prepared from further developed design documentation.

Should you require any further information or wish to discuss any aspect of the attached, please do not hesitate to contact us.

Regards,

**WT PARTNERSHIP**

**JOHN FERRARIN**  
Director

DRAFT

## A MAIN SUMMARY OF COSTS

	\$
DEMOLITION	N/A
SITE CLEARING, BULK EARTHWORKS	300,000
SITE REMEDIATION	EXCL.
PILING TO FOUNDATIONS	750,000
CAR PARK – 197 No. CARS	3,940,000
RETAIL	380,000
RESIDENTIAL APARTMENTS;	
BUILDING 1 – 99 No. APARTMENTS	19,600,000
BUILDING 2 – 99 No. APARTMENTS	18,720,000
BUILDING 3 – 104 No. COMMERCIAL APARTMENTS	23,170,000
UPGRADE TO 50% OF APARTMENTS	1,810,000
EXTERNAL WORKS	380,000
EXTERNAL SERVICES – PROVISIONAL ALLOWANCE	500,000
WORKS OUTSIDE SITE BOUNDARY	EXCL.
STAGING COSTS- PROVISIONAL ALLOWANCE	1,000,000
<b>SUGGESTED BUDGET AT DECEMBER 2014 RATES</b>	<b>\$70,550,000</b>
DESIGN CONTINGENCY – 3%	2,120,000
DESIGN & CONSULTANT FEES	EXCL.
AUTHORITY FEES	EXCL.
PROVISION FOR ESCALATION	EXCL.
<b>ESTIMATED CONSTRUCTION COST AT DECEMBER 2014 RATES (Excl. GST)</b>	<b>\$72,670,000</b>
GOODS & SERVICES TAX – 10%	7,267,000
<b>ESTIMATED CONSTRUCTION COST AT DECEMBER 2014 RATES (Incl. GST)</b>	<b>\$79,936,000</b>

**B SCHEDULE OF AREAS**

Level	FECA (m <sup>2</sup> )	UCA (m <sup>2</sup> )	GFA (m <sup>2</sup> )
<b>Car Park</b>			
Ground Floor	3,622	1,031	4,653
Level 1	1,610	324	1,934
	<u>5,232</u>	<u>1,355</u>	<u>6,587</u>
<b>Retail</b>			
Ground Floor	121	-	121
Level 1	133	-	133
	<u>254</u>	<u>-</u>	<u>254</u>
<b>Residential Building 1</b>			
Ground Floor	225	-	225
Level 1	1,018	120	1,138
Level 2	1,018	119	1,137
Levels 3 & 4 (2 levels)	2,036	244	2,280
Level 5	1,018	127	1,145
Level 6	1,018	123	1,141
Level 7	1,018	120	1,138
Level 8	1,018	125	1,143
	<u>8,369</u>	<u>978</u>	<u>9,347</u>
<b>Residential Building 2</b>			
Ground Floor	193	-	193
Level 1	973	123	1,096
Levels 2 – 8 (7 levels)	6,811	833	7,644
	<u>7,977</u>	<u>956</u>	<u>8,933</u>

**Residential Building 3**

Ground Floor	383	-	383
Level 2	1,247	302	1,549
Levels 3 & 4 (2 levels)	2,494	306	2,800
Levels 5 – 8 (4 levels)	4,988	576	5,564
	<u>9,112</u>	<u>1,184</u>	<u>10,296</u>
<b>Total Residential</b>	<u>24,458</u>	<u>3,118</u>	<u>28,576</u>
<b>TOTAL GFA (m2)</b>	<u>29,944</u>	<u>4,473</u>	<u>34,417</u>

**C SCHEDULE OF APARTMENTS**

	1 BED (No.)	2 BED (No.)	TOTAL (No.)
<b>Building 1</b>			
Ground Floor	2	1	3
Levels 1 – 8 (8 typical levels)	16	80	96
	<u>18</u>	<u>81</u>	<u>99</u>
<b>Building 2</b>			
Ground Floor	3	-	3
Levels 1 – 8 (8 typical levels)	16	80	96
	<u>19</u>	<u>80</u>	<u>99</u>
<b>Building 3</b>			
Ground Floor	6	-	6
Levels 2 – 8 (7 typical levels)	14	84	98
	<u>20</u>	<u>84</u>	<u>104</u>
<b>TOTAL (NO.)</b>	<u>57</u>	<u>245</u>	<u>302</u>

## D SCHEDULE OF EXCLUSIONS

The Estimate excludes allowances for the following and it is suggested that separate provision be made in the feasibility study, where applicable:

1. Land Costs, Stamp Duty and Taxes, Legal Fees;
2. Interest/Finance Charges, Holding Costs;
3. DA & CC fees and charges, Levies and/or Council Contributions, Licenses and permit fees, Long Service Leave Levy, Headwork Charges;
4. Design and Consultant fees, Project & Development Management fees;
5. Removal of contaminated spoil including asbestos and/or hazardous materials;
6. Fitout of retail tenancies (cold shell allowed);
7. Paint finish to columns and external perimeter wall in basement carpark;
8. Division screens and garage doors to resident parking spaces;
9. Fire sprinklers to residential areas;
10. Plasterboard ceilings to apartments living areas and bedrooms;
11. Hard floor finishes to apartment living areas;
12. C-BUS/ smart home control technology to apartments;
13. Blinds/curtains, artwork, refrigerators and washing machines to apartments;
14. Built in joinery to living areas;
15. Additional bathroom to 2 bedroom apartments in buildings 1 and 2;
16. Upgrade of lift car finishes;
17. Amplification of existing services infrastructure and connection of incoming services to the site;
18. On site detention tanks;
19. Works outside site boundary;
20. Sales &/or marketing costs, prototype &/or mock-up apartments;
21. Costs to deal with Latent Conditions, delay costs due to contamination removal etc;
22. Construction and Development Contingencies; and
23. Escalation in construction costs/changes in market conditions beyond December 2014.