Council Assessment Report

2014SYW152

Residential Flat Buildings

348 Hume Highway Bankstown

ITEM	**348 Hume Highway, Bankstown** **Demolition of existing structures and construction of 2 x 3-8 storey residential flat buildings and 1 x 8 storey mixed-use building including 1,560m^2 of showroom space, 230 residential units, with basement parking, extension of Kearns Lane, and associated landscaping and civil works**
FILE	**DA-1036/2014 (JRPP Ref. 2014SYW152)**
ZONING	**3(c) - Business - Enterprise**
DATE OF LODGEMENT	**1 October 2014**
APPLICANT	**Chanine Design Pty Ltd**
OWNERS	**Kiem Dang Investment Pty Ltd and Dang & Nguyen Pty Ltd**
ESTIMATED VALUE	**$59.8 million**
SITE AREA	**9,564m^2**
AUTHOR	**Development Services**

SUMMARY REPORT

This matter is reported to the Sydney West Joint Regional Planning Panel in accordance with the provisions of *State Environmental Planning Policy (State and Regional Development) 2011*. The proposed development has an estimated value of $59.8 million and exceeds the capital investment thresholds for '*general development'* and '*private infrastructure and community facilities – affordable housing*'*.*

DA-1036/2014 proposes to demolish existing structures and remove existing trees, and construct a residential flat development containing 230 apartments across 3 separate buildings with ground floor commercial space fronting Hume Highway, basement carparking, civil and landscaping works, and the extension of Kearns Lane as a public road.

The Development Application has been assessed against *SEPP 55, SEPP 65, SEPP (Affordable Rental Housing) 2009, SEPP (Infrastructure) 2007, Bankstown LEP 2001, Draft Bankstown Local Environmental Plan 2014* and *Part D5* of *Bankstown DCP 2005*. The application fails to comply with controls relating to building height, setbacks and building separation, as well as minor departures concerning solar access and internal building layouts. Despite these non-compliances, the proposed development is considered to represent an appropriate built form for a key site in the Hume Highway corridor.

The proposal was initially advertised and notified for 21 days. A total of 67 objections were received during this period, the majority of which (64) were pro-forma letters, some containing multiple signatures. The application was renotified following the lodgement of amended plans and additional information. One (1) objection was received during this period. The objections made with respect to the proposed development raise concerns relating to density and built form, traffic and parking, amenity impacts, environmental matters, social impacts, and the failure to comply with certain provisions of relevant environmental planning instruments.

POLICY IMPACT

This matter has no direct policy implications. The proposed variations are appropriate in the context of the site, and would not set any undesirable precedent.

FINANCIAL IMPACT

This matter has no direct financial implications.

RECOMMENDATION

It is recommended that:

A – The objection lodged pursuant to *State Environmental Planning Policy No. 1 – Development Standards* to the maximum building heights prescribed by Clause 36A of the *Bankstown Local Environmental Plan 2001* be supported; and

B – The application be approved, subject to the attached conditions.

DA-1036/2014 ASSESSMENT REPORT

SITE & LOCALITY DESCRIPTION

The subject site is known as 348 Hume Highway, Bankstown. It has an area of 9,564m^2, with frontages of 66m to Hume Highway and 55m to George Street. The site contains an existing warehouse/showroom that is occupied by various uses, including a gymnasium, and sports, barbeque and camping supply businesses. Vehicle access to the site is via an existing driveway to George Street, which connects to an at-grade hard stand parking area. There is no existing vehicle access at the Hume Highway end of the site.

Development surrounding the site comprises a mix of residential and commercial uses. Immediately east of the site is the Three Swallows Hotel (licensed premises). Residential development is located opposite the site to the north, and beyond the neighbouring site to the west. South of the site, across Hume Highway, is a school, a fire station, some detached dwellings, and a site that is currently under development for the construction of 100 residential units across 5 separate buildings up to 5 storeys high. Immediately west of the site is an existing warehouse building. Redevelopment of this site was approved at the 16 July 2015 meeting of the JRPP (2014SYW141), for the construction of 290 residential units across 3 buildings up to 8 storeys high.

There are a number of heritage-listed buildings in the vicinity of the site, including 2 former corner shops at the Hume Highway and Meredith Street / The Boulevarde intersection, an existing cemetery within the grounds of La Salle Catholic College on the southern side of Hume Highway, and a former convent and police station to the north on Powell Street.

PROPOSED DEVELOPMENT

DA-1036/2014 proposes the following works:

- Demolition of existing buildings and removal of existing trees.
- Construction of a 3-storey building fronting George Street containing 20 apartments.
- Construction of a 6- to 8-storey 'Central' building containing 119 apartments, with basement parking for 190 cars.
- Construction of a 7-storey building fronting Hume Highway containing 91 apartments and a 1,560m^2 commercial space, with at-grade and basement parking for 154 cars.
- Extension of Kearns Lane to the eastern property boundary as a public road.
- Landscaping and civil works.

SECTION 79C ASSESSMENT

The proposed development has been assessed pursuant to section 79C of the *Environmental Planning and Assessment Act, 1979*.

Environmental planning instruments [section 79C(1)(a)(i)]

State Environmental Planning Policy (Affordable Rental Housing) 2009

Division 1 of the SEPP applies to development for the purposes of '*residential flat buildings*' on land that is located in an '*accessible area*'. According to the SEPP:

*'**accessible area**' means land that is within 400m walking distance of a bus stop used by a regular bus service (within the meaning of the Passenger Transport Act 1990) that has at least one bus per hour servicing the bus stop between 06.00 and 21.00 each day from Monday to Friday (both days inclusive) and between 08.00 and 18.00 on each Saturday and Sunday.*

The subject site has access to a bus stop that meets the required services (Bankstown to Parramatta route 907). Accordingly Division 1 of the SEPP applies. Compliance with the relevant standards is outlined in the table below.

STANDARD	PROPOSED	COMPLIES?
Floor space ratio Up to 2.25:1 is permitted if 50% of the development is proposed for 'affordable housing'.	1.96:1 (hence 21% of the gross floor area must be for 'affordable housing').	Yes.
Site area Minimum 450m^2.	9,564m^2	Yes.
Landscaped area Min. 30% of the site area.	31%	Yes.

Deep soil zones Not less than 15% of the site area with a minimum 3m dimension. At least 2/3 located at the rear of the site.	15% deep soil with a width of 3m, of which at least 2/3 is located toward the 'rear' of the site (i.e. behind the respective building lines).	Yes.
Solar access Living rooms and private open spaces for a minimum 70% dwellings require 3 hours direct sunlight between 9am and 3pm at mid-winter.	**51% of units receive 3hrs** direct solar access between 9am – 3pm midwinter.	**No**. However this increases to 65% if a minimum 2 hours solar access between 8am and 4pm is taken into account, which is appropriate given the site's orientation and urban setting. The percentage is further increased to 70% if upper floor units with skylights are included. While the Code discourages the use of skylights as a primary source of daylight, the applicant is relying on advice from a solar access expert that skylights are an acceptable means of achieving sunlight.
Parking 1 bed – min. 0.5 space/unit 2 bed – min. 1 space/unit 3 bed – min. 1.5 space/unit TOTAL – 226 spaces	271 residential and 47 visitor spaces.	Yes.
Dwelling size 1 bed – min. 50m^2 2 bed – min. 70m^2 3 bed – min. 95m^2	**1 bed – min. 44m^2** 2 bed – min. 70m^2 **3 bed – min. 94m^2**	**No**. A condition of consent is recommended to ensure compliance with this control is achieved.
Affordable housing Must be used as affordable housing for 10 years.	The applicant has provided documentation confirming that a registered community housing provider (Evolve Housing) has agreed to manage the 'affordable housing' component of the development for 10 years according to the SEPP requirements.	Yes.

Division 1 of the SEPP also requires that the design of the proposed development be compatible with the character of the local area. The surrounding locality comprises a mix of land uses, with a commercial core and residential dwellings toward the fringe. Given the framework set out in the relevant planning controls, it is an area that is expected to experience a transition to higher densities. This transition is reflected in the recent approval for redevelopment of the neighbouring site for the construction of 290 residential units across 3 buildings up to 8 storeys high. The proposed development is compatible with the likely future character, and would ensure an appropriate amenity outcome for existing, neighbouring residential dwellings.

State Environmental Planning Policy No. 65 – Design Quality of Residential Flat Development

SEPP 65 applies to the proposed development, and an assessment against the Design Quality Principles and Residential Flat Design Code (RFDC) has been undertaken. The proposal is consistent with the Design Quality Principles and responds appropriately to the site's context. Moreover, the application generally conforms with the key 'rules of thumb' contained in the Residential Flat Design Code, as illustrated in the table below.

'RULE OF THUMB'	**PROPOSED**	**COMPLIES?**
Building depth 10m – 18m is appropriate. If greater than 18m then good solar access and ventilation must be achieved.	Average building depth of the Hume Highway and Central buildings is approximately 18m.	Yes.
Building separation 12m separation between buildings over 3 storeys and up to 4 storeys. 18m separation between buildings over 4 storeys and up to 8 storeys.	30m separation between the Central building and the Hume Highway building. **6m separation** between the Central building and the George Street building.	**No**. The separation between the George Street and Central buildings does not comply. However there are not expected to be any unreasonable or adverse privacy impacts as a result of the reduced setback. This matter is discussed later in this report, in response to the Bankstown DCP requirements.
Communal open space 25% – 30% of the site area is to be communal open space.	30% of the site is designated as communal open space, with areas at ground level (24%) as well as rooftop communal terraces above the Central and Hume Highway buildings (6%).	Yes. The development site is also located in close proximity to a public park (Graf Park), which is on the northern side of George Street.
Apartment layout Single aspect apartments should be no more than 8m from a window. Back of kitchen no more than 8m from a window.	The depth of single aspect apartments is generally 9m. The back of only 42% of kitchens are within 8m of a window, however 100% are within 9m.	Yes. Non-conforming (i.e. 'deepest') parts of affected apartments contain the entry areas and no amenity loss is expected. The back of non-conforming kitchens are within 9m of a window and still achieve the amenity intent of the code.
Apartment size 1 bed – min. 50m^2 2 bed – min. 70m^2 3 bed – min. 95m^2	**1 bed – min. 44m^2** 2 bed – min. 70m^2 **3 bed – min. 94m^2**	**No**. A condition of consent is recommended to ensure compliance with this control is achieved.
Balcony depth Min. 2m depth to primary balconies.	All primary balconies have minimum 2m depth.	Yes.

Floor to ceiling heights Min. 3.3m ground floor and 2.7m for other floors. If variation is sought then satisfactory daylight access must be demonstrated.	Floor-to-ceiling heights are generally **2.6m** and 2.7m. The middle floor of the George Street building has a height of **2.4m** however this level contains bedrooms and bathrooms only.	**No**. However majority of the affected units have a northerly aspect and have satisfactory daylight access.
Internal circulation Max. 8 units accessed from a single corridor.	**16 apartments** accessed from a single corridor in the Central building and **14 apartments** accessed from a single corridor in the Hume Highway building. Upper floor of the George Street building complies, however the ground floor corridor provides access to **13 apartments**.	**No**. However the lifts in the Hume Highway and Central buildings are arranged so that they service a maximum of 8 units each. Corridors in each of these buildings offer clear lines of sight and provide safe and efficient resident access. Although the ground floor of the George Street building does not strictly comply, 7 of these apartments are provided with their own private entry from the street.
Solar access 70% of units should receive 3hrs solar access between 9am – 3pm midwinter.	**51% of units receive 3hrs** direct solar access between 9am – 3pm midwinter.	**No**. However this increases to 65% if a minimum 2 hours solar access between 8am and 4pm is taken into account, which is appropriate given the site's orientation and urban setting. The percentage is further increased to 70% if upper floor units with skylights are included. While the Code discourages the use of skylights as a primary source of daylight, the applicant is relying on advice from a solar access expert that skylights are an acceptable means of achieving sunlight.
Natural ventilation 60% of units to be naturally ventilated. 25% of kitchens to have access to natural ventilation.	90% units are naturally cross-ventilated. 30% of kitchens have access to natural ventilation.	Yes.

State Environmental Planning Policy No. 55 – Remediation of Land

SEPP 55 requires Council to consider whether the development site is contaminated and, if it is, whether it is suitable for the proposed development either in its contaminated state or following remediation works.

An environmental site assessment has been undertaken, which included a Phase 1 study and a limited Phase 2 intrusive investigation of the property. The assessment concludes that:

- *In the absence of identified significant soil contamination and the absence of a significant potential source of groundwater contaminants, an assessment of groundwater is not considered necessary.*

- *The site is considered suitable for the proposed residential development without the requirement for remediation. However it is noted that some areas of the site were not accessible for inspection or sampling (buildings and soils underlying existing structures). Given the age of the buildings, the presence of asbestos containing material is considered likely. Management of asbestos will be required during demolition of these structures and a program of soil validation post demolition is recommended.*

According to these conclusions, the site is suitable for the proposed residential development as required by SEPP 55. It is recommended that the requirement for post demolition soil validation be imposed via conditions of consent, included at Attachment B to this report.

State Environmental Planning Policy (Infrastructure) 2007

Schedule 3 of SEPP (Infrastructure) lists types of developments that are to be referred to Roads and Maritime Services (RMS) due to their size or capacity and the potential for impacts on the local road network (including classified roads).

The proposed development exceeds the thresholds listed in Schedule 3 of the SEPP and initially sought to provide a new driveway at the eastern end of the Hume Highway frontage. Hume Highway which is a classified road and the proposal was accordingly referred to RMS for comment.

RMS reviewed the proposal and advised that the vehicular crossing on Hume Highway would not be supported according to Section 138 of the Roads Act. However Section 138 applies only where there is a new connection to a classified road. The proposed development has been amended to provide access to the non-residential floor space via a right-of-carriageway connection to the approved driveway at the adjoining site 350 Hume Highway. Given that an existing, approved vehicle crossing would be utilised, and given that the nature of its use is not proposed to be intensified (an additional 26 car spaces would utilise the driveway to service non-residential floor space), concurrence from RMS under the Roads Act is not technically required.

Clause 104 of SEPP (Infrastructure) requires that a consent authority must take into consideration any submission that the RMS provides. While the RMS' submission is noted, it would be onerous to prohibit vehicle access to Hume Highway where the existing arrangements are to be utilized and are not proposed to be intensified. Moreover, the use of the vehicle access at 350 Hume Highway for non-residential development has previously been endorsed and supported by RMS.

Clause 101 of SEPP (Infrastructure) requires the consent authority to be satisfied that, where practicable, vehicular access to the land is provided by a road other than a classified road. All residential vehicles (93% of the proposed car parking spaces) are proposed to access the site via Kearns Lane and George Street, neither of which is a classified road.

State Environmental Planning Policy (State and Regional Development) 2011

SEPP (State and Regional Development) states that a regional panel may exercise the consent authority functions of the council, for the determination of applications for development of a class or description included in Schedule 4A of the EP&A Act.

Schedule 4A of the Act includes '*general development that has a capital investment value of more than $20 million*' and '*private infrastructure and community facilities (affordable housing) that has a capital investment value of more than $5 million*'. The proposal has a value of $59.8 million and accordingly the development application is reported to the Sydney West JRPP for determination.

Bankstown Local Environmental Plan 2015

Bankstown LEP 2015 was gazetted on 5 March 2015. Clause 1.8A of the BLEP 2015 states:

'*If a development application has been made before the commencement of this Plan in relation to land to which this Plan applies and the application has not been finally determined before that commencement, the application must be determined as if this Plan had not commenced.*'

Accordingly, the BLEP 2015 does not apply to the subject development application. The relevant planning instrument is the Bankstown LEP 2001 which is discussed below.

Bankstown Local Environmental Plan 2001

The following clauses of the Bankstown LEP 2001 were taken into consideration:

- *Clause 2 Objectives of this plan*

The proposed development is consistent with the objectives of the Bankstown LEP 2001. It is designed to achieve good urban design and concentrates a high density residential development in a location that it accessible to the Bankstown CBD. While representing the emerging form of development contemplated by Council's planning policies, it remains compatible with the suburban character of the locality and would not have any unreasonable impact on neighbouring developments.

- *Clause 11 Development which is allowed or prohibited within a zone*

The table to Clause 11 sets out which development may be carried out in each zone. This table shows that development for the purposes of a '*residential flat building*' is not permitted on land zoned 3(c). There are additional provisions, however, under Clauses 36A and 50A of the LEP, which allow consent to be granted for the proposed '*residential flat building*' at the subject site, despite its 3(c) zoning. These special provisions have been met, and are discussed later in this report.

With respect to the proposed ground floor showrooms fronting Hume Highway, the table to Clause 11 shows that '*bulky goods salesrooms/showrooms*' and '*warehouses*' are both permitted in the 3(c) zone.

- *Clause 20 Trees*

It is proposed to remove all existing trees from the development site. The majority of the existing trees are located at the northern end of the site, in and around an existing asphalt carpark. Council's Tree Management Officer has advised that the trees are large specimens located in small garden beds, which are undersized and there is evidence of cracking in the concrete garden edges. The fact that these trees are in a carpark situation makes it extremely difficult to design around them and works required to restore the asphalt to landscaping would be detrimental to them.

There are 2 large Eucalypts at the southern end of the site that contribute as a feature of the existing streetscape. It has been noted that the substantive redesign would be required to allow for retention of these trees, and redesign on streetscape grounds alone would be onerous. It is recommended that the loss of these trees be offset by the inclusion of advanced replacement specimens in the landscape treatment of the development. This requirement is included as a condition of consent at Attachment B to this report.

- *Clause 24 Airports*

The development site is subject to Bankstown Airport Limited's (BAL) obstacle limitation surface plan, which prescribes a maximum building height of 15.24m. The proposed development exceeds this height and was referred to BAL for concurrence. Because the proposed building is above 51m AHD (the lift overruns on the Hume Highway building reach a proposed height of 81.4m AHD), the assessment by BAL must be supplied to the Commonwealth for review and final approval.

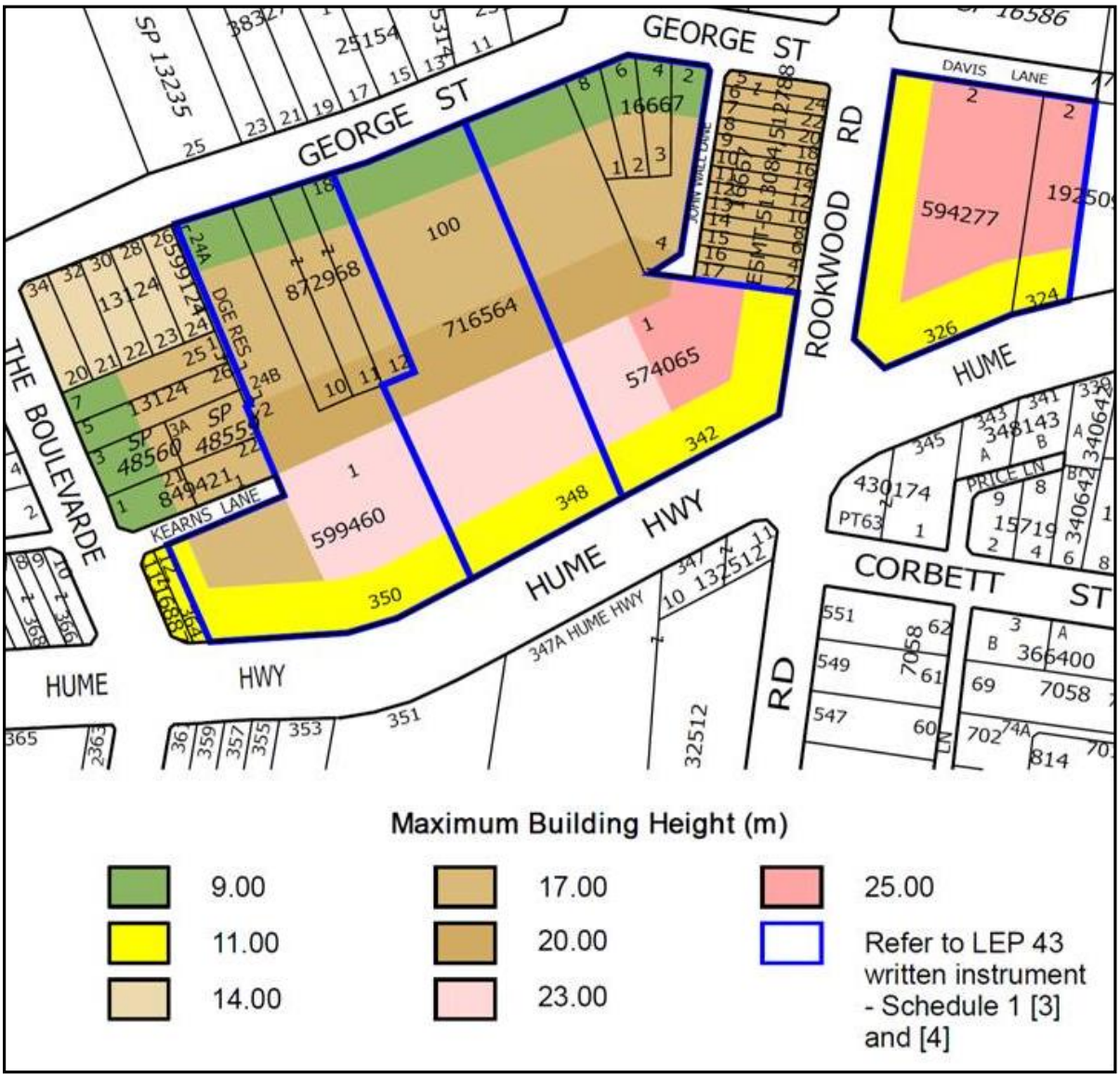
Approval has been granted by the Australian Government Department of Infrastructure and Regional Development for the proposed building, to a maximum height of 84.9m AHD. This approval is subject to certain conditions, including requirements for obstacle lighting and the use of cranes during construction. These requirements are included as conditions of consent at Attachment B to this report.

- *Clause 30 Floor space ratios*

The BLEP prescribes a maximum floor space ratio of 1.75:1 for this site. The proposed development has a gross floor area of 18,793m^2 over a site area of 9,564m^2. This equates to a floor space ratio of 1.96:1 and fails the BLEP control. However, as discussed earlier in this report, the provisions of ARHSEPP 2009 prevail over those contained in the BLEP 2001. The proposed floor space ratio complies with the provisions of the SEPP.

- *Clause 36A Special requirements for particular sites*

Clause 36A of the BLEP applies to the proposed development and states that building heights must not exceed those shown on the accompanying building height map. A copy of the building height map is shown below.



The proposed development does not comply with the maximum building heights allowed by the BLEP. The extent of proposed non-compliance is outlined in the table below.

BUILDING ELEMENT	ALLOWED LEP HEIGHT	ALLOWED RL HEIGHT	PROPOSED HEIGHT	EXTENT OF PROPOSED COMPLIANCE
Hume Hwy – southern end	11m	70.3	63.0 (3.7m)	The proposed RL of the roof at this part of the Hume Highway building is 63.0, which is 2 storeys below the maximum building height.
Hume Hwy – northern end	23m	81.5	80.5 (22m)	The proposed RL of the roof at this part of the Hume Highway building is 80.5, which is 1m below the maximum building height.
Central – southern end	20m	76.3	78.5 (22.2m)	The proposed RL of the roof at this part of the Central building is 78.5, which is less than 1 storey above the maximum building height.
Central – northern end	17m	72.3	75.4 (20.1m)	The proposed RL of the roof at this part of the Central building is 75.4, meaning the upper storey of this part of the building exceeds the maximum height. However the additional height does not adversely impact the overall amenity outcome for dwellings within the development, nor the existing and approved buildings that neighbor the site to the east and to the west.
George Street – western end	9m	63.2	62.2 (8.0m)	The proposed RL of the roof of the eastern part of the George Street building is 62.2, meaning this part of the building sits 1m below the maximum 9m building height.
George Street – eastern end	9m	62.2	62.2 (9.0m)	The proposed RL of the roof of the western part of the George Street building is 62.2, meaning this part of the building sits at the maximum 9m building height.

The proposed development complies with the maximum building heights set by the LEP, except for the proposed Central building. The southern part of the Central building exceeds the maximum height by less than 1 storey (2.2m), while the whole upper storey of the northern part of this building projects above the height plane.

When compared to a building that complies with the maximum building heights, the proposed scheme would not result in any unreasonable additional overshadowing or privacy impacts to neighbouring properties. Moreover, despite the non-compliance the building maintains an appropriate form and still provides a ‘stepping-down’ in building heights across the site, from the Hume Highway building at the south down to the George Street building at the north.

It is noted that the George Street building, which is located in the nearest vicinity to neighbouring residential development, complies with the maximum 9m height limit set for the northern edge of the site. The concentration of a greater portion of the development at the least sensitive part of the development site (i.e. to the south, adjacent Hume Highway and at the centre of the site) is considered to be an appropriate design response for an infill site that is located opposite existing residential dwellings.

Pursuant to *State Environmental Planning Policy No. 1 – Development Standards* the applicant has lodged an objection to the maximum height limits prescribed by the BLEP. The objection submits that compliance with the maximum building heights would be unreasonable or unnecessary in this case for reasons including the following:

- *The proposal has been designed to mirror the approved adjoining development in terms of building envelope and established outcomes and will result in the proposal having similar density, scale and appearance and as such will ensure compatibility with the future built form character of the subject block.*
- *The development proposal is consistent with the intent of the height control with the primary portion of the height non-compliance occurring in parts of Building B* (the Central building) *where the LEP has a transition in height. Building B is located mid-block and not at the street edge and as such absorbing a considerable portion of the building mass where it has least potential to impact of adjoining properties in terms of overshadowing, bulk and scale.*
- *The development proposes a staggered built form that is appropriate in the context of the site and its surroundings.*
- *Detailed shadow analysis has been undertaken to ensure that the overshadowing from Building B does not generate significant impacts.*
- *The minor non-compliance to the height control has no impact on the setting of any items of environmental heritage or view corridors.*
- *The proposed development is in the public interest as it remains consistent with the objectives of the height control and the objectives of the 3(c) zone.*

The applicant's SEPP 1 objection is considered to be well-founded and is supported. The proposed development provides an appropriate arrangement of built forms that accommodate the floor space allowed under the relevant environmental planning instrument, without significantly compromising the amenity of the surrounding locality. The non-conforming building height is confined to the centre of the site, where potential impacts to neighbouring properties are minimised.

Finally, it is noted that the development proposed under this application is generally consistent with the overall height of the development recently approved on the western adjoining property No. 350 Hume Highway, which was subject to the same maximum building heights.

- *Clause 36C Development along arterial roads*

Clause 36C limits vehicle access to arterial roads and requires an assessment of likely road safety and operational impacts. It also discourages noise-sensitive development types (which include residential dwellings) unless appropriate noise mitigation measures are included.

It is proposed to utilise an existing driveway on the neighbouring site 350 Hume Highway for access to the non-residential elements of the development, and for garbage and waste collection. Residential and visitor access for the Hume Highway building is proposed via Kearns Lane, and access to the George Street and Central buildings is proposed via George Street. This arrangement has been reviewed by Council's Traffic Engineer and can be endorsed subject to conditions.

The applicant has submitted an acoustic report which examines potential noise impacts from existing and proposed road traffic noise. The report concludes that, subject to recommended construction treatments, internal noise levels will comply with the relevant noise criteria. However to ensure compliance it would be appropriate to include a condition on any development consent that ensures that the maximum allowable noise levels under the SEPP (Infrastructure) are achieved. This condition is included at Attachment B to this report.

- *Clause 38 Development in the vicinity of heritage items*

There are a number of heritage items in the vicinity of the development site that are listed in the BLEP 2001. These items include:

- 347A Hume Highway (St. Felix cemetery)
- 361 Hume Highway (Corner shop, 1919)
- 363 Hume Highway (Corner shop, 1919)
- 76 Powell Street (House, formerly a convent and police station)

Clause 38 of the BLEP requires consideration of the likely effect of the proposed development on these items, and on their setting.

Council's Heritage Officer has been consulted with respect to the proposal. Although the development is in the vicinity of the listed items, there would not be any significant or unreasonable impact on their context or setting.

- *Clause 48 Objectives of the business zones*

The proposed development is consistent with the objectives of the 3(c) – Business – Enterprise zone. It is designed to achieve a high standard of building design and provides appropriate landscaping. It ensures there would be no unreasonable impacts on the amenity of the surrounding mixed-use locality, and maintains appropriate vehicle access to the development site. Provision is also made for commercial floor space to ensure that a business and employment focus is retained along the Hume Highway corridor.

- *Clause 50A Development in Zone 3(c)*

As noted earlier in this report, Clause 11 of the BLEP prohibits '*residential flat buildings*' at the subject site. However Clause 50A states that despite this prohibition, consent may be granted to development for the purposes of '*residential flat buildings*' provided the allotment has an area of not less than 5,000sq.m, dwellings are set back a minimum 20m from the Hume Highway boundary, and any non-residential development would not detract from the amenity of any dwellings on the allotment.

The development site has an area of 9,564m^2 and dwellings within the proposed Hume Highway building comply with the required 20m setback. The proposed non-residential component of the development is limited to a ground floor showroom space, which would likely accommodate a 'bulky goods' type use and would therefore not have any significant amenity impact on dwellings within the development.

Further to the above, consent cannot be granted to development in zone 3(c) unless it achieves high quality architectural and landscape outcomes that contribute to the character and appearance of the locality and arterial road corridor. The proposal presents a contemporary façade and is articulated to ensure that the bulk and scale of the proposed buildings is appropriately balanced. Each of the buildings respond appropriately to the SEPP 65 guidelines and the overall built form generally follows that contemplated in Council's planning controls for the site. Vehicle access to the development has been arranged to avoid Hume Highway where practicable.

Draft environmental planning instruments [section 79C(1)(a)(ii)]

There are no draft EPI's applicable to the proposal. It should be noted, however, that at the time this current DA was lodged, the BLEP 2015 was in 'draft' form. The proposed development is not inconsistent with the provisions of the draft instrument.

Development control plans [section 79C(1)(a)(iii)]

The following table provides a summary of the development application against the controls contained in Part D5 of *Bankstown Development Control Plan 2005*.

STANDARD	PROPOSED	BDCP 2005 PART D5	
		REQUIRED	COMPLY?
Lot consolidation	The subject site is an existing consolidated allotment, and no adverse effects are expected.	The DCP only applies if all lots are consolidated and there would be no adverse effect on other land in the vicinity.	Yes.
Building height	**3 storeys** for the George Street building. **6 and 8 storeys** for the Central building. **7 storeys** for the Hume Highway building.	2 storeys for the George Street building. 4 and 5 storeys for the Central building. 2, 4, 5 and 6 storeys for the Hume Highway building.	**No**. **No**. **No**.
Hume Highway buffer	A landscape buffer in excess of 5m is provided to Hume Highway.	Min. 5m wide landscape buffer zone to Hume Highway to enhance the Remembrance Driveway corridor.	Yes.

STANDARD	PROPOSED	BDCP 2005 PART D5	
		REQUIRED	COMPLY?
George Street buffer	2m landscape buffer to George Street.	A minimum 2m buffer is to be provided to George Street.	Yes.
Hume Highway setbacks	20m dwelling setback to Hume Highway. The commercial setback to Hume Highway is in excess of 11m.	A dwelling must be set back 20m. A business development must be set back 5m.	Yes. Yes.
Other setbacks	5m setback to George Street, with a point encroachment to **4m**. **7m** to the western boundary and **3m** to the eastern boundary. 12m.	5m to George Street. 12m separation to future buildings on adjoining site to the east and west. 6m from the Central building to the Kearns Lane extension.	**No**. **No**. Yes.
Building separation	Minimum **6m** between balconies and **7m** between building walls.	12m separation between George Street building and Central building.	**No**.
Vehicle access	Access to the George Street and Central buildings is proposed from George Street, and access to the residential component of the Hume Highway building is proposed via Kearns Lane.	Vehicle access may be permitted from George Street and Kearns Lane.	Yes.
Kearns Lane extension	It is proposed to extend Kearns Lane to the eastern end of the property. A condition of consent is recommended to ensure this extends all the way to eth eastern property boundary.	The development must create a shared rear lane for vehicle access and servicing purposes.	Yes.

Building Height

The DCP includes a plan that illustrates maximum building heights, and minimum setbacks, for all buildings within the development site (as well as future buildings on neighbouring properties). The building heights shown on this plan are expressed in storey limits. These storey limits are inconsistent with the maximum building heights shown in the BLEP height map (included earlier in this report) which are expressed in metres above natural ground level. For example, the Hume Highway building is limited under the DCP to 5 and 6 storeys, yet under the LEP a height of 23m is allowed (which equates to between 3.8m and 4.6m per storey). Further, the Central building is limited under the DCP to 4 and 5 storeys, yet under the LEP heights of 17m and 20m are allowed (approximately 4m per storey).

The proposed development still takes the same general form as that illustrated in the DCP, despite breaching the maximum storey limits. Because the provisions of an environmental planning instrument should be preferred over those contained in a DCP, it would be appropriate to allow the LEP height provisions to prevail. An assessment of the proposal against the maximum height limits prescribed by the LEP is provided earlier in this report, which concludes that the proposed heights are appropriate in the context of the site.

Setbacks

The DCP plan referred to above prescribes minimum setbacks to the boundaries of the development site. The proposed development does not comply with these setbacks in 3 separate locations.

The minimum setback to the eastern and western boundaries are not specified, however the DCP plan shows a 12m building separation to future development on the each of these adjoining properties. Assuming this separation is evenly split on both sides of the respective boundaries, minimum setbacks of 6m would be required. The proposed setbacks are 7m to the west and 3m to the east.

To the west, the non-conforming parts of the development are limited to the side elevations of the George Street and Central buildings, which are 15m and 12m long (respectively). Openings on these elevations are limited, and when considered in the context of the development approved on the adjoining site under DA-965/2014 appropriate building separation is maintained.

The proposed eastern setback to the George Street and Central buildings varies from 3m – 4m. This building alignment would not impose an onerous setback on any future 'infill' development on the adjoining site No. 342 Hume Highway.

Building separation

The DCP plan prescribes a minimum separation of 12m between the George Street building and the Central building. The proposed development provides a separation of 7m between building walls, and does not comply. At ground level, potential privacy impacts can be managed through the landscape treatment of the terrace and garden areas located between the buildings. On the upper levels, the Central building presents only 2 small living area windows, and a bathroom window, to the George Street building. The living area windows are 'secondary' kitchen and dining windows and are provided with fixed privacy screens to prevent direct overlooking. The bathroom windows can be obscured or glazed to achieve the same outcome.

Planning agreements [section 79C(1)(a)(iiia)]

There are no planning agreements applicable to the proposed development.

The regulations [section 79C(1)(a)(iv)]

The proposed development is not inconsistent with the relevant provisions of the Environmental Planning and Assessment Regulation, 2000.

The likely impacts of the development [section 79C(1)(b)]

As discussed in this report, the proposed development is acceptable with regard to its likely environmental, social and economic impacts on the locality.

Suitability of the site [section 79C(1)(c)]

The proposed development is permitted with consent at the subject site. The floor space ratio control allowed by the ARHSEPP has been complied with, and the proposed variations to the maximum building heights and setbacks are acceptable in the context of the development. The proposal represents an appropriate built form, and operational and environmental matters have been adequately addressed.

Submissions [section 79C(1)(d)]

The proposal was initially advertised and notified for 21 days. A total of 67 objections were received during this period, the majority of which (64) were pro-forma letters, some containing multiple signatures. The application was renotified following the lodgement of amended plans and additional information. One (1) objection was received during this period.

The objections made with respect to the proposed development raise concerns relating to density and built form, traffic and parking, amenity impacts, environmental matters, social impacts, and the failure to comply with certain provisions of relevant environmental planning instruments. The concerns are summarised and discussed below.

Density and Built Form

- *If the previous development proposal (i.e. 350 Hume Highway) and this current one both get approved, we will have 6 buildings (four of them 8 storeys high) towering right in the heart of our peaceful neighbourhood.*

- *The approved DA at 350 Hume Highway should not be used as a 'benchmark' when considering the proposed departures from the building controls as constantly suggested in the applicant's Statement of Environmental Effects. The current application is not at all comparable with 350 Hume Highway in scale and density.*

- *The disregard of a landscaped buffer for George Street and the disregard of the 2 storeys fronting the street, which is a disregard for those already living here.*

- *Council has a moderate vision and zoned for such so why the departure?*

- *The proposed heights of the buildings exceed the maximum in the Height of Buildings Map under the BLEP. These high-rise buildings will look ugly standing out from the whole low height (less than 2 storeys) neighbourhood.*

Comment:

The proposed development is generally in accordance with the overall built form contemplated by the DCP and LEP controls specific to this site. While there are some non-compliances concerning the height and setback of some elements of the development, it is largely consistent with what has been envisaged. The George Street building does exceed the 2-storey limit prescribed by the DCP, however it sits within the 9m height limit allowed by the prevailing LEP and is of a scale that is compatible with existing and likely future development along George Street. Moreover, the minimum 2m George Street landscape buffer required by the DCP has been complied with.

Although it is agreed that the DA approved on the neighbouring site should not be strictly applied as a benchmark, it represents the emerging character of the area and should be considered where relevant. The current proposal is of comparable building height and site layout, and provides a design response that sits appropriately in the precinct.

Traffic and parking

- *This development will place further traffic congestion on an area already with existing unacceptable levels of traffic build up and lack of any parking areas.*

- *Further increase in local traffic currently impacted by installation of traffic lights at George Street and Rookwood Road with traffic leaving Hume Highway at The Boulevarde at peak hour times to avoid the intersection at Rookwood Road and Hume Highway.*

- *George Street is too narrow to accommodate any increase in traffic flow.*

- *The main vehicle access of the proposed development will be on George Street which will cause a chaotic traffic situation.*

- *Access from Kearns Lane will not be easily accessible as all traffic coming from the city has no option but to access via George Street as there is no right turn available into The Boulevarde from Hume Highway.*

- *During peak hours vehicles will find it hard to turn right into Kearns Lane from The Boulevarde due to its close proximity to the traffic lights on Hume Highway.*

- *There will be major traffic congestions every day on George Street and The Boulevarde, thus giving rise to a range of issues, including difficulty for residents to enter or exit their complex, noise, dust, and a dangerous road situation for children. If further consideration of street parking is taken into account, the road situation on George Street will deteriorate even more.*

- *No parking for sporting events at Graf Park. Local residents have difficulty on entering and leaving their properties. This problem will only increase with added vehicular traffic.*

- *There will only be 50 visitor parking on basement levels 1 and 2 and 26 commercial parking at ground level. If we take consideration of 245 households plus a total commercial area of 1,560sq.m, on a busy weekend there will be a major shortage of visitor parking spaces.*

- *The designated residential parking will not be enough as most households are likely to have 2 cars on average. There could also be situations where owners infringe upon visitor/commercial parking, which will further limit the parking capacity.*

- *Parents and children attending Graf Park sports games will have to park further away. This will create traffic and parking problems for the surrounding neighbouring communities as well.*

Comment:

Traffic and parking studies have been undertaken by the applicant, to examine existing traffic conditions and assess the transport implications of the proposed development. These studies included traffic generated by the development approved on the neighbouring site 350 Hume Highway. Traffic flows on Hume Highway, The Boulevarde, Meredith Street, Rookwood Road, George Street and Kearns Lane have been analysed, as well as the operation of the intersections at Hume Highway / The Boulevarde, Rookwood Road / George Street, The Boulevarde / George Street, and The Boulevarde / Kearns Lane. The studies conclude that the proposed development would not result in any adverse traffic impacts to the local road network.

Using figures derived using the traffic generation rates prescribed in the RMS *Guide to Traffic Generating Developments*, the proposal would generate 81 and 113 vehicle trips per hour during weekday morning and afternoon peak hours respectively. When this additional traffic is taken into account, the reporting finds that the intersections around the site would continue to operate satisfactorily. The only change in the 'Level of Service' (LoS) at intersections around the site would occur at Hume Highway and Meredith Street, where the LoS would shift from 'C' to 'D'. This is a signalised intersection, at which a LoS 'D' indicates it would be operating near capacity, however no further study or control modes are required.

The potential implications for access and queuing at Kearns Lane has also been examined, with the applicant undertaking a separate analysis for the intersection with The Boulevarde. This analysis included queue blockages on The Boulevarde in both directions (from the Hume Highway intersection and the George Street intersection) and concluded that there would only be a minimal increase in queues on Kearns Lane (an increase to approximately 1 vehicle).

The proposed development includes provision for 344 car parking spaces, split across 2 separate basement car parks with 190 spaces for the George Street and Central buildings, and 154 spaces for the Hume Highway building. This parking provision exceeds the minimum requirements of the ARHSEPP and is therefore deemed appropriate.

Amenity impacts

- *The development will endanger our living environment and even destroy the sense of community forever.*

- *There is a lack of communal and recreational space. The surrounding neighbourhood will have to accommodate this and share the existing public amenities.*

- *Loss of sunlight to existing homes in George Street.*

- *Noise levels will increase adding to local residents' loss of their right to live in peace and quiet.*

Comment:

The proposed development would not have any adverse or unreasonable impact on the level of solar access provided to neighbouring dwellings, including those on the southern side of George Street. Similarly, noise generated within the development is not expected to have any significant impact, given that the elements of the proposal that are oriented toward neighbouring dwellings are residential in nature.

The site has access to a public reserve, being located directly across George Street from Graf Park. Public open space is available to all residents, whether they be existing residents or new to the area. It is noted, however, that the proposed development does not rely on this access in order to comply with open space requirements.

Environmental matters

- *Stormwater runoff increase will run from George Street down into Emery Avenue and beyond. During large storm events Emery Avenue has previously flooded. Will the existing infrastructure cope with the added increase?*

- *The block already has a 5m landscaped area with mature trees which not only gives visual green look to the street but will soften any impact by developments, so why has it been destroyed along with the trees present there?*

Comment:

The proposed stormwater concept plan has been reviewed by Council's Development Engineers. It has been found to be acceptable with respect to the requirements of Council's Development Engineering Standards, and is supported subject to conditions included at Attachment B to this report.

Existing landscaping at the George Street end of the site includes a number of large trees. Council's Tree Management Officer advises that these trees are located in small, undersized garden beds in a carpark, which makes retention extremely difficult. The proposed development includes a landscape buffer to the George Street frontage that complies with the requirements of the DCP, and it is recommended that the loss of existing trees from the site be offset by the inclusion of advanced replacement specimens in the landscape treatment of the development.

Social impacts

- *Due to the fact that a hotel is next door, residents of this proposal will have ready access to alcohol and gambling and further add to the discomfort of existing home owners especially increased noise levels at night.*

- *Even criminals in jails have more space and amenities provided than these people living like rabbits have here.*

Comment:

Occupants of the development would have the same access to services as existing residents. It therefore cannot be reasonably held that new residents would bring any increased likelihood of alcohol- or gaming-related issues to the area.

The proposed apartment sizes are generally compliant with the requirements of the ARHSEPP and SEPP 65. The few exceptions can be resolved through minor plan amendments.

Compliance with relevant Environmental Planning Instruments

- *The zoning of this land is 3(c) – Business Enterprise under the BLEP. However, the proposed development is predominantly residential. 85.5% of the development will be residential and only 11.5% for business/showroom.*

- *The proposed development will not be 'improving the character and appearance of the locality' as required by Clause 50A of the BLEP.*

- *Clause 50A of the BLEP stipulates that 'development on an allotment of land within Zone 3(c) must have a minimum 20 metres setback from any boundary of the allotment that adjoins an arterial road or a road related area adjoining or associated with an arterial road'. There are portions of the building line encroaching upon the 20m front setback on Hume Highway and the setback from George Street is only 3m.*

- *The proposed development does not comply with the SEPP 65 requirements for building heights, building separation, deep soil zones, landscape design and communal open space. The application argues these non-compliances by repeatedly stating that the development is appropriate for land within a commercial context, however the percentage of commercial only accounts for 11.5% of the whole development so we are not sure how could the development be called within a 'commercial context'?*

- *The proposed unit sizes do not comply with the ARHSEPP. This is another reflection of the high density nature of the proposed development.*

- *The ARHSEPP requires '70% of the dwellings of the dwellings receive a minimum of 3 hours direct sunlight between 9am and 3pm in mid-winter. Only 62% of units achieve the required 3 hours of solar access. This is another example of the overwhelming high density.*

Comment:

The proposed development includes 1,500m^2 commercial / showroom space along the Hume Highway frontage, which is considered appropriate to meet the objectives of the 3(c) zone. The development does comprise a large proportion of residential floor space, however '*residential flat buildings*' are permitted with consent under the provisions of the BLEP. According to Clause 50A, the minimum 20m setback is only relevant to '*dwellings*' and is measured to the boundary of an arterial road. The proposal complies with this requirement.

While the proposed development does not strictly comply with the SEPP 65 'rules of thumb', it is agreed that it represents an appropriate response to the controls on this particular site which, while not purely commercial in context, does contain a mix of commercial and residential uses. The proposed departures from the 'rules of thumb' are deemed to be justified and supportable, as discussed earlier in this report.

The measure of solar access to the proposed apartments does not fully comply with the specific provisions of the ARHSEPP (which are the same as those prescribed by SEPP 65). However the amount of sunlight proposed (which includes having regard to a broader range of hours across the day) is still sufficient to satisfy the intent of the control, and is consistent with that supported for the neighbouring development. A number of the proposed apartment sizes also fail, however this can be addressed through minor design amendments.

The public interest [section 79C(1)(e)]

The proposed development would not contravene the public interest. The proposed development responds appropriately to the provisions of the relevant environmental planning instruments, including *State Environmental Planning Policy (Affordable Rental Housing) 2009* and the *Bankstown Local Environmental Plan 2001*, the requirements of the *SEPP 65 Residential Flat Design Code*, and the site-specific development controls contained in the *Bankstown Development Control Plan 2005*. Matters raised in public submissions have been satisfactorily addressed, and there would be no unreasonable impacts on the locality.

CONCLUSION

The Development Application has been assessed in accordance with the provisions of Section 79C of the *Environmental Planning and Assessment Act 1979*.

The proposed development represents an appropriate built form for the site. Relevant planning controls have been appropriately responded to and no significant or unresolved matters have been raised in public submissions.

Approval of this application would facilitate the development of a key site in the Rookwood Road redevelopment precinct of the Hume Highway Corridor, without having any unacceptable or unreasonable impacts on the surrounding locality.

Plans

2014SYW152

Residential Flat Buildings

348 Hume Highway Bankstown

1 DA300 **SITE PLAN**
1 : 200

REFERENCES

DRAWINGS TO BE READ IN CONJUNCTION WITH BUT NOT LIMITED TO ALL STRUCTURAL ENGINEERS, STORMWATER ENGINEERS, LANDSCAPE ARCHITECTS, FIRE PROTECTION, ESSENTIAL ELECTRICAL SERVICES AND MECHANICAL SERVICES PLANS & OTHER ASSOCIATED PLANS & REPORTS

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revision

Rev.	Date	Description
A	01.10.14	Issue for Council
B	25.05.15	Amended as per council letter dated 27th March 2015

notes

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date MAY 2015 | drawn PY

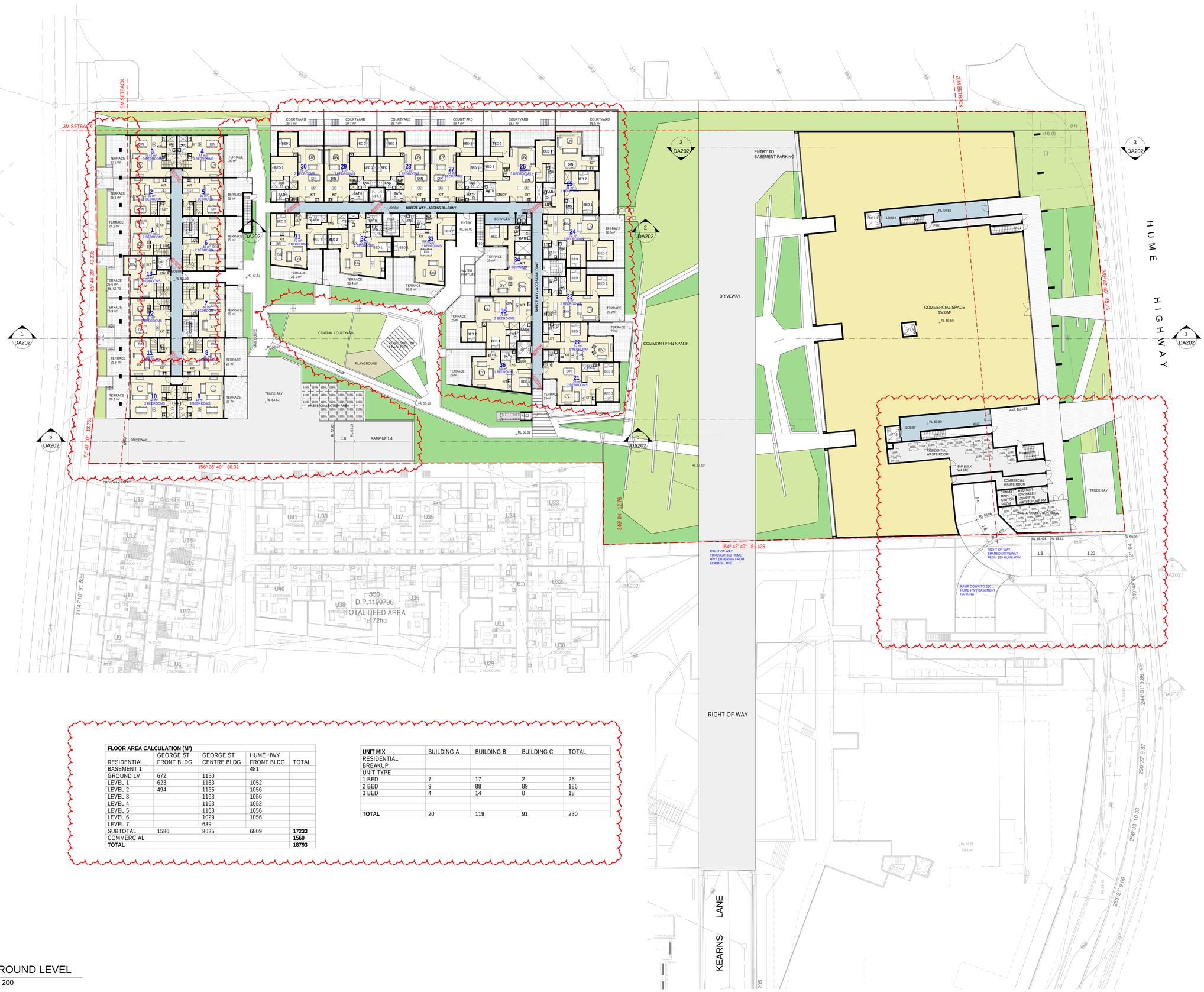
project
PROPOSED MIXED USE DEVELOPMENT
348 HUME HWY BANKSTOWN

LGA: BANKSTOWN

drawing title
SITE PLAN

FOR DA APPROVAL

job no.	drawing no.	rev.
J14226	DA300	B



FLOOR AREA CALCULATION (M²)				
RESIDENTIAL	GEORGE ST FRONT BLDG	GEORGE ST CENTRE BLDG	HUME HWY FRONT BLDG	TOTAL
BASEMENT 1			481	
GROUND LV	672	1150		
LEVEL 1	623	1163	1052	
LEVEL 2	494	1165	1056	
LEVEL 3		1163	1056	
LEVEL 4		1163	1052	
LEVEL 5		1163	1056	
LEVEL 6		1029	1056	
LEVEL 7		639		
SUBTOTAL	1586	8635	6809	**17233**
COMMERCIAL				**1560**
TOTAL				**18793**

UNIT MIX	BUILDING A	BUILDING B	BUILDING C	TOTAL
RESIDENTIAL				
BREAKUP				
UNIT TYPE				
1 BED	7	17	2	26
2 BED	9	88	89	186
3 BED	4	14	0	18
TOTAL	20	119	91	230

1 / DA103 GROUND LEVEL
1 : 200

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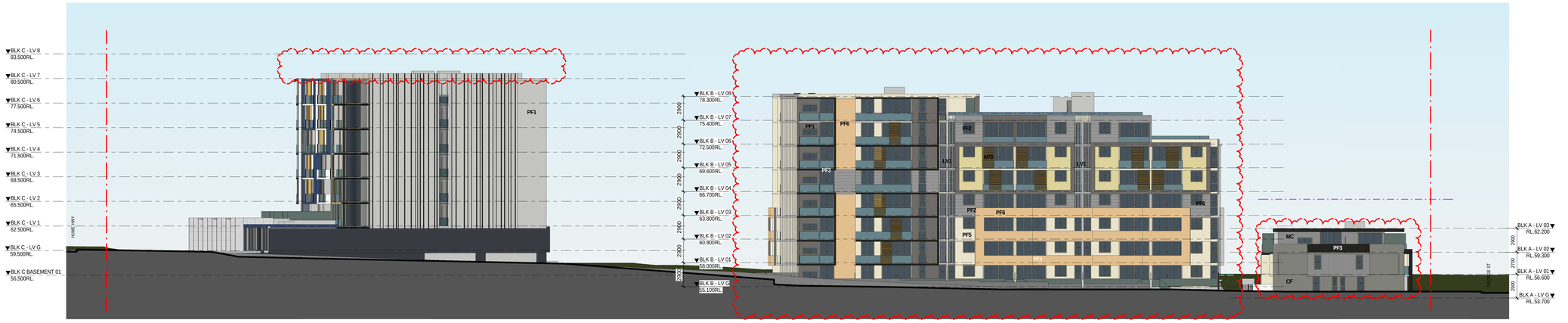
348 HUME HWY BANKSTOWN

LGA: BANKSTOWN

drawing title
GROUND LEVEL

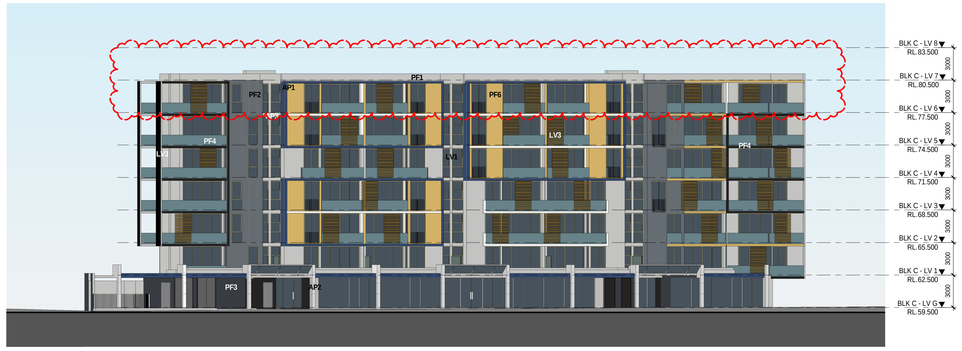
FOR DA APPROVAL

job no. J14226 | drawing no. DA103 | rev. B



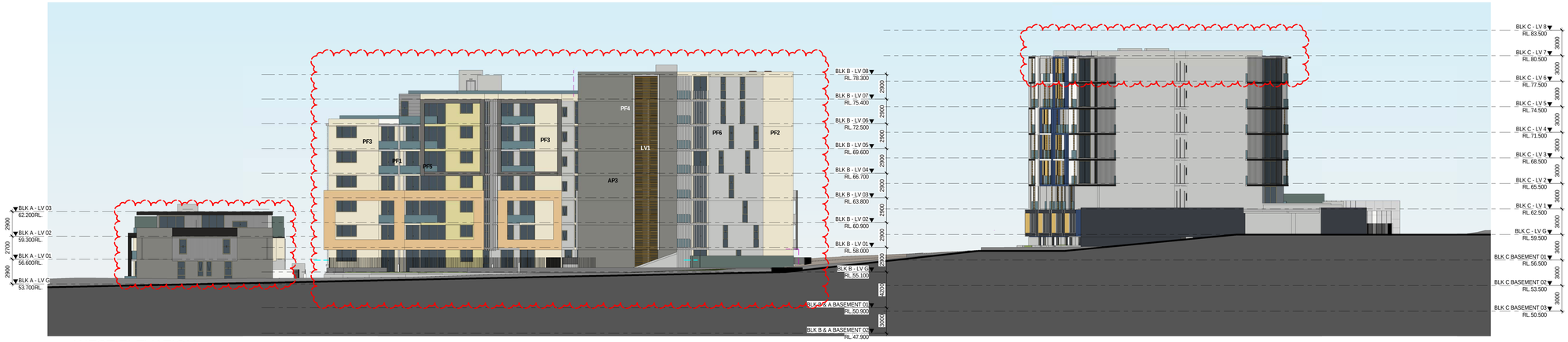
3 DA200 EAST ELEVATION

1 : 200



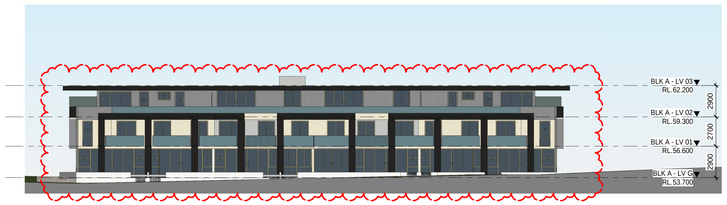
1 DA200 SOUTH ELEVATION - HUME HWY

1 : 200



2 DA200 WEST ELEVATION

1 : 200



4 DA200 NORTH ELEVATION - GEORGE ST

1 : 200

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MATERIAL SCHEDULE

- PF1 RENDERED FINISH TYPE A TRANQUIL RETREAT - DULUX
- PF2 RENDERED FINISH TYPE B GUILD GREY - DULUX
- PF3 RENDERED FINISH TYPE C LEADMAN - DULUX
- PF4 RENDERED FINISH TYPE D BLACK - DULUX
- PF5 RENDERED FINISH TYPE E MANORBURN - DULUX
- PF6 RENDERED FINISH TYPE F WAX WAY - DULUX
- AP1 ALUMINIUM PANEL TYPE A UNION BLUE - ALPOLIC
- AP2 ALUMINIUM PANEL TYPE B SILVER GRAY METALLIC - ALPOLIC
- AP3 ALUMINIUM PANEL PRISMATIC COPPER - ALPOLIC
- LV1 VERTICAL LOUVRES TYPE A BLACK SATIN - POWDERCOAT
- LV3 VERTICAL LOUVRES TYPE B BLACK SATIN - POWDERCOAT
- MC METAL CLADDING
- CF POLISH CONCRETE FINISH
- TP ENTRY - TIMBER PANEL

ALUMINIUM WINDOW FRAME (BRIGHT SILVER METALIC- COLORBOND)

NOTE:
-all windows & external sliding doors to be aluminum powder coated
-all glass to bath, ens. & w.c. windows shall be frosted glass
-unless the door is a sanitary room swings out or slide, where distance between the face of door swing and toilet suit less than 1.2 m, the door must be installed with a removable hinge
-all windows and doors to balconies/terraces/courtyards to be fitted with deadlock mechanisms to allow for windows/doors to be locked in an open position 100mm opening
-external glass used shall have a reflectivity index of less than 20%.

revision

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drawn PY

project
PROPOSED MIXED USE DEVELOPMENT
348 HUME HWY BANKSTOWN

LGA: BANKSTOWN

drawing title
ELEVATIONS

FOR DA APPROVAL

job no. J14226

drawing no. DA200

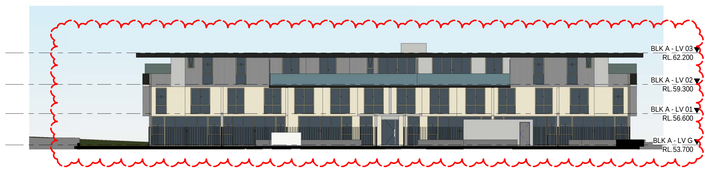
rev. B

4 DA201 SOUTH ELEVATION GEORGE ST CENTRE BLDG

1 : 200

2 DA201 NORTH ELEVATION HUME HWY BLDG

1 : 200



1 DA201 SOUTH ELEVATION GEORGE ST FRONT BLDG

1 : 200

3 DA201 NORTH ELEVATION - GEORGE ST CENTRE BLDG

1 : 200

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J14226 job no.

DA201 drawing no.

B rev.

Detailed Site Investigation Report

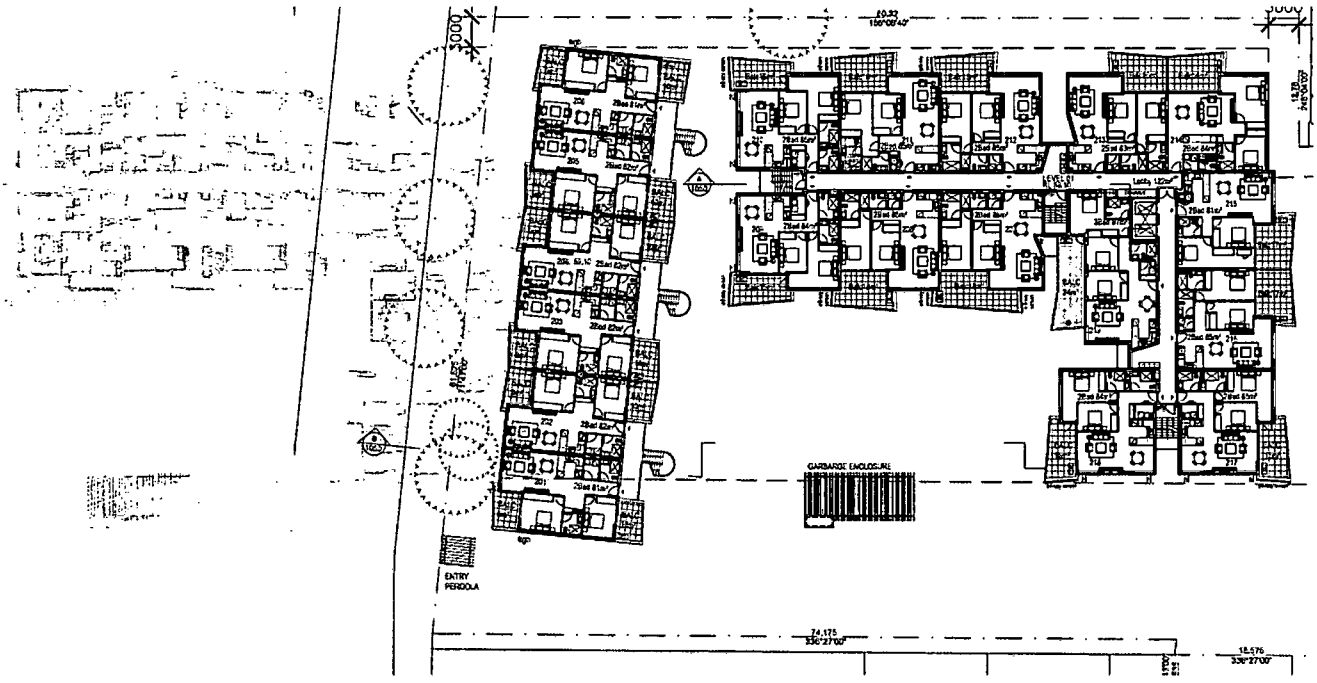
2014SYW152

Residential Flat Buildings

348 Hume Highway Bankstown

HUME 88 PTY LTD

DETAILED SITE INVESTIGATION REPORT
18 GEORGE STREET, YAGOONA NSW



Report E22241 AA
28 April 2015

Environmental Investigations Australia
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REPORT DISTRIBUTION

Detailed Site Investigation Report
18 George Street, Yagoona NSW

EI Report No.: E22241 AA
Date: 28 April 2015

Copies		Recipient
1	Soft Copy (PDF – Secured, issued by email)	Hume 88 Pty Ltd
2	Hard Copies (sent by Express Courier)	Level 1, 74 Macquarie Street, Parramatta NSW
	Original (Saved to Digital Archives)	Environmental Investigations Suite 6.01, 55 Miller Street, PYRMONT NSW 2009

Author	Technical Reviewer
DANIEL SOLIMAN	**TONY GUIRGUIS**
Environmental Engineer	Senior Project Engineer

Revision	Details	Date	Amended By
0	Original		

EXECUTIVE SUMMARY

Hume 88 Pty Ltd engaged Environmental Investigations Australia Pty Ltd (EI) to conduct a Detailed Site Investigation Report (DSI) for 18 George Street, Yagoona NSW ('the site'). This environmental assessment was completed as part of a development application process to allow site development for mixed, multi-storey, commercial and residential land uses.

The objectives of the environmental investigation were to complete an evaluation of the site in order to:

- Define the nature, extent and sources of any soil, vapour and groundwater impacts onsite;
- Target potentially-impacted areas identified in the EIS Phase 1 PSI (summarised in this report);
- Understand the influence of site specific, geologic and hydrogeological conditions on the fate and transport of any impacts that may be identified;
- Identify potential risks that identified impacts may pose to human health and the environment; and
- Provide data to assist in the selection and design of appropriate corrective action options.

The work conducted was consistent with NSW EPA guidelines, the results of which indicated the following:

- Site geology was found to contain silty topsoil material, underlain by residual stiff clay, underlain by low-strength shale bedrock;
- Analysis of soil samples reported no exceedances of any human health criteria for medium-high density residential settings with minimal access to soil with the exception of Asbestos being detected in fill in one sample, being sample BH6-1;
- Groundwater is inferred to flow in a north easterly direction towards Cooks River, situated approximately 2.2km north east of the site;
- Groundwater samples were found to be in excess of the adopted Groundwater Investigation Levels for heavy metals Cadmium, Copper, Lead, Nickel and Zinc;
- A qualitative risk assessment identified the following threatened or potentially threatened receptors:
  - Aquatic ecosystems
  - Future site workers earthworks and construction

Based on the findings of the DSI, EI concludes that:

- The past and current activities on the site were not considered to have impacted soil or groundwater in excess of the adopted environmental investigation levels;
- With consideration of the Statement of Limitations discussed in **Section 12**, EI concludes that widespread contamination was not identified at the site. Concentrations exceeding the human health based SILs for asbestos (BH6) was limited to the fill material found at the central portion of the site. It is concluded that all fill

material within the site, including those impacted by asbestos, must be excavated and disposed of off-site in accordance with the relevant waste classification guidelines to allow the site to be site to be made suitable for the proposed development; and

- The site can be made suitable for mixed commercial and residential use, by implementing the following recommendations:
  - Commencement of a second round of groundwater sampling to further assess the nature of high heavy metals concentrations identified in the first GME
  - Subsequent to the removal of vegetative cover across the site and prior to the removal of any on-site soils:
    - Fill soils in the vicinity of BH6 are to be excavated and stockpiled for classification and off-site disposal. The walls and base of the excavated pit are to be validated for asbestos;
    - An in-situ waste classification of fill, including bulk asbestos sampling, is to be undertaken for the removal of the remaining on-site fill soils;
  - All virgin excavated natural material or VENM (natural clay or shale) designated for off-site disposal must be classified for off-site disposal in accordance the NSW EPA (2014) Waste Classification Guidelines by a qualified environmental consultant.
  - Any material being imported to the site should be assessed for potential contamination in accordance with NSW EPA guidelines as being suitable for the intended use and be classified as VENM.
  - Validate that the excavated areas are left free of contamination by comparing analytical results for excavation surfaces and any backfill material, against the respective DECC/EPA thresholds.
  - Preparation of a final site validation report by a qualified environmental consultant, certifying site suitability for the proposed development.

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APPENDICES

1. INTRODUCTION

1.1 BACKGROUND AND PURPOSE

Mr Joe Ayoub of Dyldam Developments Pty Ltd engaged Environmental Investigations Australia Pty Ltd (EI) to conduct a Detailed Site Investigation Report (DSI) for site characterisation purposes pertaining to 18 George Street, Yagoona NSW ('the site').

As shown in **Figure 1**, the site is located approximately 16km southwest of the Sydney central business district comprising Lot 350 D.P. 1190796. The site is situated within the Local Government Area of Bankstown City Council with the investigation area covering a total area of approximately 0.51 hectares (5,100m^2), as depicted in the sampling location plan presented in **Figure 2**. The assessment area makes up part of a larger development estate, fronting George Street and Hume Highway, the total area of which is approximately 1.2 hectares (12,000m^2)

This assessment was conducted to support of a Development Application (DA) to Bankstown City Council for proposed redevelopment of the property.

A Geotechnical Investigation was also prepared by EI, the results of which are presented separately in EI Report: E22241 GA, dated 22 September 2014.

1.2 PROPOSED DEVELOPMENT

The development has been designated for the construction of two, multi-storey mixed commercial/residential apartment buildings with associated basement car parking facilities, as illustrated in the proposed ground level development plans attached as **Appendix A**. The northern structure

1.3 REGULATORY FRAMEWORK

The following regulatory framework and guidelines were considered during the preparation of this report:

- ANZECC & ARMCANZ (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Australian and New Zealand Environment and Conservation Council / Agriculture and Resource Management Council of Australia and New Zealand, October 2000;
- DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination*, NSW Department of Environment and Conservation (DEC, later renamed OEH), March 2007;
- DEC (2006) *Guidelines for the NSW Site Auditor Scheme (2nd Edition), NSW DEC*, April 2006;
- EPA (1995) *Sampling Design Guidelines, NSW Environmental Protection Authority*, September 1995;
- EPA (2014) *Technical Note: Investigation of Service Station Sites*, NSW EPA, April 2014;
- NEPC (2013) *Schedule B(1) Guideline on Investigation Levels for Soil and Groundwater*, National Environment Protection (Assessment of Site Contamination) Measure 1999 – Amendment 2013, National Environment Protection Council, May 2013;

- NEPC (2013) *Schedule B(2) Guideline on Site Characterisation, National Environment Protection (Assessment of Site Contamination) Measure 1999 – Amendment 2013*, National Environment Protection Council, May 2013;
- NSW EPA (1997) *Contaminated Land Management Act*; and
- OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites*, NSW Office of Environment and Heritage (OEH), August 2011.

1.4 PROJECT OBJECTIVES

The primary objectives of this DSI were to:

- Evaluate the potential for site contamination on the basis of historical land uses, anecdotal and documentary evidence of possible pollutant sources; and
- Investigate the degree of any potential contamination by means of limited intrusive sampling and laboratory analysis, for relevant contaminants.

1.5 SCOPE OF WORKS

In order to achieve the above objectives and in keeping the project cost-effective while generally complying with the OEH (2011) guidelines for consultants reporting on contaminated sites, the scope of works was as follows:

1.5.1 Field Work

- A detailed site walkover inspection;
- Construction of test boreholes at thirteen locations (BH1 – BH13) distributed in an approximate grid pattern across accessible areas of the site. We note that two additional borehole locations (BH14 & BH15) forming part of the EI geotechnical assessment (GA E22241) are included in the this assessment for the description of site geology;
- Multiple level soil sampling down to natural soils;
- Four (4) bores converted to groundwater monitoring wells for groundwater sampling purposes;
- One groundwater monitoring event involving groundwater sampling from the four monitoring wells;
- Laboratory analysis of selected soil samples and the groundwater samples for relevant analytical parameters, as determined from the site history survey and field observations during the investigation program; and
- Data interpretation and reporting.

1.5.2 Data Analysis and Reporting

The final task of this assessment involved the preparation of a DSI report to document investigation works, methodologies used, test bore logs and monitoring well construction details, with discussion of all data search

findings and laboratory analytical results in regards to potential risks to human health, the environment and the aesthetic enjoyment of the land.

2. SITE DESCRIPTION

2.1 PROPERTY IDENTIFICATION, LOCATION AND PHYSICAL SETTING

The site identification details and associated information are presented in **Table 2-1**, while the site locality is shown in **Figure 1**.

Table 2-1 Site Identification, Location and Zoning

Attribute	Description
Street Address	18 George Street, Yagoona NSW
Location Description	Approx. 18km south west of Sydney CBD, bound by George Street to the north, a commercial property to the east, Hume Highway to the south and residential properties to the west. Southeast corner of site: GDA94-MGA56 Easting: 318292.112, Northing: 6246426.97 (Source: http://maps.six.nsw.gov.au)
Site Investigation Area	Approximately 5,100m^2 (part of larger allotment)
Site Owner	Dyldam Developments Pty Ltd
Lot and Deposited Plan (DP)	Lot 350 D.P. 1190796
State Survey Marks	A registered Permanent Mark is situated within the site boundary, approximately 37m directly west of the south, eastern corner of the site. Mark No: PM6973D
Local Government Authority	Bankstown City Council
Parish	Bankstown
County	Cumberland
Current Zoning	B4 – Mixed Use (Bankstown Local Environment Plan, 2012)

2.2 LOCAL LAND USE

The site is situated within an area of mixed use and current uses on surrounding land are described in **Table 2-2.**

Table 2-2 Local Land Use

Direction Relative to Site	Land Use Description
North	George Street, followed by low density residential properties and park land
East	Commercial properties followed by Rookwood Road and further commercial properties
South	Hume Highway, followed by St Felix Primary School, followed by low-medium density residential properties
West	Residential properties

2.3 REGIONAL SETTING

Local ground topography, geology, soil landscape and hydrogeological information are summarised in **Table 2-3.**

Table 2-3 Topographical, Geological, Soil Landscape and Hydrogeological Information

Attribute	Description
Topography	Site topography is relatively flat, with a slight overall grade to the north west.
Site Drainage	Surface water is inferred to drain from the south western corner, where the site is capped/covered by existing commercial store, to the north eastern corner. It is expected that the majority of surface water runoff is to be collected in the undeveloped part of the allotment, at which point it will drain into the subsurface. All excess runoff is expected to drain on to George Street, where it is inferred to be collected in the municipal stormwater system.
Regional Geology	The site is likely underlain by Bringelly Shale (Rwb) comprising Shale, carbonaceous claystone, laminite, fine to medium-grained lithic sandstone, rare coal (Ref 1:100,000 Sydney Geological Series Sheet 9130, 1983).
Soil Landscapes	The soil landscape at the site likely comprises the Disturbed (xx), Glenorie (gn) and Blacktown (bt) Landscapes. The Glenorie landscape typically includes undulating to rolling low hills on Wianamatta Group shales. It generally comprises red, brown and yellow podzolic soils. Disturbed Terrains are those characterised by level to hummocky terrain, extensively disturbed by human activity including complete disturbance, removal or burial of soil. The Blacktown landscape typically comprises shallow to moderately deep (< 1.0 m) red and brown podsols on crests, upper slopes and well-drained areas; deep (1.5 m to 3.0 m) yellow podsols and soloths on lower slopes and in areas of poor drainage.
Acid Sulphate Soil Risk	With reference to the Botany Bay Acid Sulfate Soil Risk Map (1:25,000 scale; Murphy, 1997), the subject land lies within the map class description of *Disturbed Terrain.* The Bankstown Local Environmental Plan 2012- Acid Sulfate Soils Risk Class 1:1,000 scale Map indicates that the site lies within an area of no known occurrence.
Soil Salinity Risk	The *Salinity Potential In Western Sydney 2002* map indicates that the site lies in an area with moderate soil salinity potential. Soils are moderate to well-drained due to their high elevated position in the landscape.
Nearest Surface Water Feature	Cooks River is located approximately 2.2km North East of the site and is considered to be a marine feature as it is tidally influenced.
Groundwater Flow Direction	Groundwater is inferred to flow towards the nearest surface water receptor, being the Cooks River situated 2.2km northeast of the site.

2.4 NRATLAS GROUNDWATER BORE SEARCH

An online search conducted using the NSW Natural Resource Atlas (NR Atlas), which records relevant information pertaining to all licensed water bores for the state of New South Wales revealed seven (7) registered, monitoring bores located within 1 km of the site. All seven bores were located in one area to the east of the proposed development. Only two (2) of these bore records showed standing water levels. A review of groundwater bore records for bores within 1 km of the site with standing water levels is summarised in **Table 2-4.**

Table 2-4 Summary of NR Atlas registered Groundwater Bores

Bore No.	Drilled Date / Bore Depth (mBGL)	SWL (m BGL)	Authorised Bore Purpose
GW109734	2003 / 4.00	1.80	Monitoring Bore
GW109735	2003 / 11.00	9.10	Monitoring Bore

2.5 SITE WALKOVER INSPECTION

With reference to the site photographs presented in **Appendix B**, a number of observations were made during a detailed walkover inspection of the site on 1 July 2014. A summary of site observations along with buildings/infrastructure are summarised below.

- The site investigation area comprised a predominantly undeveloped grass area, with a concrete pavement driveway running along the western perimeter;
- The site topography was flat, with a general slope towards the north-east;
- The investigation area was bound by George Street to the north, a commercial property to the east, residential properties to the west, and onsite commercial facilities to the south.
- Vegetation appeared to be in good condition, with no observable evidence of distress;
- Concrete paved driveway appeared to be in good condition, with no signs of chemical erosion or severe wear. Joints appeared to be in good condition. Driveway serviced light vehicles, trucks and moving equipment (such as forklifts). Minimal cracking was noted, with some surficial staining observed where vehicle parking was also observed;
- Shipping containers and wooden crates were observed along either side of the concrete driveway;
- General refuse was found scattered throughout the grassed area of the site, and locally concentrated in the south eastern corner of the property;
- Evidence of Underground Petroleum Storage Systems (i.e. USTs, Vent pipes, etc.) were not observed onsite during the site walkover; and
- Surface ponding was also not observed.

3. PREVIOUS INVESTIGATIONS

Two previous environmental investigations were conducted on the site by Environmental Investigation Services (EIS) in 2012. EIS investigations were documented in two reports entitled:

- *Stage 1 Preliminary Environmental Site Assessment at 18 George Street, Yagoona* (Ref. EIS Report No. E25268KPrpt1.2DA1, March 2012); and
- *Stage 2 Preliminary Environmental Site Assessment at 18 George Street, Yagoona* (Ref. EIS Report No. E25268KPrpt2, December 2012).

A summary and detail of the key findings of the previous investigations completed by EIS is outlined in **Table 3-1**.

Table 3-1 Summary of Previous Investigation Works and Findings

Assessment Details	Project Tasks and Findings
EIS Stage 1 Preliminary Environmental Site Assessment (2012)	
Work Objectives	The primary objectives of the Stage 1 ESA were to: • Assess the potential risk of significant, widespread soil and groundwater contamination at the site; and • Prepare a Stage 1 preliminary ESA report presenting the results of the assessment, generally in accordance with the NSW EPA Guidelines for Consultants Reporting on Contaminated Sites (19971) and State Environmental Planning Policy No.55 – Remediation of Land (19982).
Scope of Works	The scope of work for the investigation included a site history review of available records and a site walkover inspection.
Site History Summary	The Stage 1 preliminary ESA undertaken for the proposed residential development was designed to assess the potential risk of significant, widespread soil and groundwater contamination at the site. The site inspection and the information reviewed for this assessment has indicated the following: • Historical aerial photographs indicate that the site was predominantly developed for residential land uses; • The land title information indicated that the site was owned by individuals most likely associated with residential occupation. The site was owned by commercial companies from around the mid 1980's; • The central/eastern portion of the site remained was used for residential purposes until at least 1994; • There are no recorded notices listed on the NSW EPA registers; and • WorkCover have no records of USTs or licenses to store dangerous goods at the site.

Assessment Details	Project Tasks and Findings
Summary for Potential Site Contamination	Based on the findings of the Stage 1 preliminary ESA, EIS are of the opinion that the potential for significant, widespread soil and/or groundwater contamination at the site is moderate.: • Potential asbestos and lead contamination associated with demolition of the former site buildings/sheds; • Potential pesticide contamination associated with maintenance of the grassed and vegetated areas of the site; • Potentially contaminated fill material used to backfill the existing sub-surface pipe associated with the drainage easement at the site; and • Potential contamination migration from the former off-site service station which occupied the property directly south of the site from approximately 1958 to 1968. Based on the moderate potential for site contamination, a detailed Stage 2 environmental site assessment should be undertaken to characterise the soil and groundwater contamination conditions. The detailed Stage 2 investigation will be required to meet the requirements of SEPP55 and the Guidelines for Consultants Reporting on Contaminated Sites 1997.
EIS Stage 2 Preliminary Environmental Site Assessment (2012)	
Work Objectives	• Make a preliminary assessment of the soil and groundwater contamination conditions at the site, targeting the area that was formerly leased to Caltex; and • Assess the potential for human health or environmental risks posed by the contaminants.
Scope of Works	The scope of work included: • A review of the previous Stage 1 preliminary ESA report prepared for the site by EIS; • Field sampling and laboratory analysis program in accessible areas of the site; • A ground penetrating radar (GPR) scan of accessible areas in the south section of the site; • Interpretation of the analytical results; and • Preparation of a report presenting the results of the ESA. Groundwater was not encountered during the investigation and therefore groundwater sampling and analysis was not undertaken.
Conclusions and Recommendations	• Additional investigation work will be required to meet the minimum sampling density specified in the NSW EPA Sampling Design Guidelines 1995. The investigation could be undertaken once better site access is available (i.e. when the building is vacant or demolished). • A remedial action plan (RAP) should be prepared for the site in accordance with SEPP55 and the Reporting Guidelines 1997. • Validation of the underlying natural soils prior to construction of the basement floor slab.

N.B. EI Acknowledges that the lots identified as Lot 1 DP 599460, Lot 10 – Lot 12 DP 872968 in Both EIS Reports listed have since been consolidated into Lot 350 DP 1190796.

4. PRELIMINARY CONCEPTUAL SITE MODEL

In accordance with Schedule B2 – Guideline on Site Characterisation of the National Environmental Protection (Assessment of Site Contamination) Measure 1999 Amendment 2013 (NEPM 2013) and to aid in the assessment of data collection for the site, EI developed a preliminary conceptual site model (CSM) assessing plausible pollutant linkages between potential contamination sources, migration pathways and receptors, as shown in . The CSM provides a framework for the review of the reliability and useability of the data collected and to identify data gaps in the existing site characterisation.

4.1 DATA GAPS

On the basis of historical and current, on-site activities, intrusive investigations were considered warranted in order to characterise potential, adverse environmental impacts resulting from:

- Importation of fill material of unknown quality and origin;
- Potentially contaminating activities from surrounding commercial land uses, particularly the Caltex Lease;
- Potential pesticide use in vegetated part of site;
- Remnant hazardous materials from the demolition of residential dwellings occupying the assessment area;
- Potential soil and groundwater impacts from on and offsite contamination sources.

Table 4-1 Preliminary Conceptual Site Model

Contamination Source	Transport Mechanism	Exposure Pathway	Sensitive Receptor	Potential Risk of Exposure
Soils	Direct exposure to contaminated soils during construction works and post construction in accessible soil areas	Ingestion and dermal contact, inhalation of asbestos fibres during site redevelopment or during maintenance works / soil disturbance post-development	**Construction Workers**	**Moderate Risk** – Fill of unknown origin may be present on site, or may contain residual building material from uncontrolled demolition of residential dwellings
			Maintenance Workers, Commercial Workers/users and Residents	**Low Risk** – Site is understood to be excavated to a nominal depth of 3m below ground level for a basement car parking facility. Therefore all site soils are inferred to be removed prior to construction of the new development.
	Volatilisation of VOC vapours from contaminated soils and rock	Inhalation of VOC vapours during excavation works, and during maintenance works / soil disturbance post-development, vapour ingress into building and basement	**Construction Workers, Maintenance Workers, Basement Users.**	**Moderate Risk** – Vapours may be released during excavation of basement car park. Vapour intrusion through cracks in concrete walls/floor may occur post-construction.
			Commercial Workers/users, Residents:	**Low Risk** – Vapour intrusion unlikely to pose threat to ground-level receptors
	Migration of VOCs though utility / service trenches and volatilisation of VOC vapours (onsite and offsite)	Inhalation of VOC vapours during excavation works, and during maintenance works, vapour ingress into building and basement	**Construction Workers**	**Moderate Risk** – Vapours may be released during excavation of basement car park.
			Maintenance Workers, Commercial Workers/users, Residents, Basement Users:	**Low Risk** – Service trenches likely to be re-routed during excavation of basement car park.
Groundwater	Direct exposure to contaminated groundwater (onsite)	Dermal contact and ingestion of contaminated groundwater during redevelopment and via groundwater ingress into basements post construction	**Construction Workers**	**Moderate Risk** – Dewatering of basement excavations is likely. Seepage into excavated area may occur. Groundwater is deep in the vicinity of the site.
			Maintenance Staff, Commercial Workers, Basement Users:	**Low Risk** – Groundwater is deep in the vicinity of the site.
	Migration of contaminated groundwater (offsite)	Contaminants in groundwater discharging into surface water bodies - dermal contact and ingestion of contaminated water	**Aquatic organisms, Recreational water users:**	**Low Risk** – Nearest aquatic receptor is over 2km from the site. Any contamination from on-site sources is likely to attenuate before reaching the receptor.
		Dermal contact and ingestion of contamination groundwater via irrigation and domestic groundwater bores, dewatering of excavations, and groundwater ingress into basement	**Construction Workers**	**Moderate Risk** –Depends on scope of surrounding works,
			Maintenance Staff, Commercial Workers, Car park Users, Groundwater Users	**Low Risk** – Groundwater seepage into surrounding basements unlikely, however risk still exists through cracks and joints. There are no existing beneficiaries of groundwater use in the vicinity of the site
		Inhalation of VOC vapours emanating from groundwater during excavation works, dewatering of excavations, and vapour ingress into buildings and basements	**Construction Workers, Car park Users:**	**Moderate Risk** – Vapours may be released during excavation of basement car park. Vapour intrusion through cracks in concrete walls/floor may occur post construction.
			Residents, Commercial Workers:	**Low Risk** – Vapour intrusion unlikely to pose threat to ground-level receptors

5. SAMPLING, ANALYTICAL AND QUALITY PLAN (SAQP)

The SAQP plays a crucial role in ensuring that the data collected as part of this, and ongoing environmental works carried out at the site are representative, and provide a robust basis for site assessment decisions. This SAQP includes the following:

- Data quality objectives, including a summary of the objectives of the ESA;
- Investigation methodology including media to be sampled, details of analytes and parameters to be monitored and a description of intended sampling points;
- Sampling methods and procedures;
- Field screening methods;
- Analysis Methods;
- Sample handling, preservation and storage; and
- Analytical QA/QC.

5.1 DATA QUALITY OBJECTIVES (DQO)

In accordance with the USEPA (2006) *Data Quality Assessment* and the DEC (2006) *Guidelines for the NSW Site Auditor Scheme*, the process of developing Data Quality Objectives (DQO) was used by the EI assessment team to determine the appropriate level of data quality needed for the specific data requirements of the project. The DQO process that was applied for this assessment is documented in **Table 5-1**.

Table 5-1 Summary of Project Data Quality Objectives

DQO Steps (NSW DEC, 2006)	US EPA (2006) (modified)	Details	Comments (changes during investigation)
1. State the Problem Summarise the contamination problem that will require new environmental data, and identify the resources available to resolve the problem; develop a conceptual site model	Give a concise description of the problem Develop a conceptual model of the environmental hazard to be investigated. Identify resources available.	The site is to be developed for residential land use with basement car parking. Historical information and previous investigation results indicated that site soils may have been impacted by historical contaminating activities. Based on this based on this there is the potential for the site to be impacted by contaminants of concern to an extent that the site is unsuitable for redevelopment in its current state. The **Error! Reference source not found.** is provided in **Section** Error! Reference source not found.	The work has been undertaken in conjunction with Stage 1 and 2 ESA reports compiled by EIS, who assessed the southern half of the site (350 Hume HWY)
2. Identify the Goal of the Study (Identify the decisions) Identify the decisions that need to be made on the contamination problem and the new environmental data required to make them	Identify principal study question(s). Consider alternative outcomes or actions that may result from answering the question(s). For decision problems, develop decision statement(s), organise multiple decisions. For estimation problems, state what needs to be estimated and key assumptions.	Based on the objectives outlined in **Section** Error! Reference source not found. the decisions that need to be made are • Has the nature, extent and source of any soil, vapour and/or groundwater impacts onsite been defined? • What impact do the site specific, geologic and hydrogeological conditions have on the fate and transport of any impacts that may be identified? • Does the level of impact coupled with the fate and transport of identified contaminants represent an unacceptable risk to identified human environmental receptors on and off site? • Does the collected data provide sufficient information to allow the selection and design of an appropriate remedial strategy if necessary?	

DQO Steps (NSW DEC, 2006)	US EPA (2006) (modified)	Details	Comments (changes during investigation)
3. Identify Information Inputs (Identify inputs to decision) Identify the information needed to support any decision and specify which inputs require new environmental measurements	Identify types and sources of information needed to resolve decisions or produce estimates. Identify the basis of information that will guide or support choices to be made in later steps of the DQO Process. Select appropriate sampling and analysis methods for generating the information.	• A list of informational inputs needed to resolve the decision statement • A list of environmental variables or characteristics that will be measured • The information required to allow informed, defensible decisions to be made and decisions that need to be made to resolve decision statements • Identification of the media, such as fill, soil, groundwater, sediments, surface water and air, that need to be collected • Identification of the site criteria for each medium of concern • Identification of the analytical methods that are required for chemicals of potential concern so that assessment can be made relative to the site criteria • Defining the basis for any decisions that are to be made from field screening, such as from PID data, what action to be taken if a defined concentration is attained • Stage 1 and Stage 2 ESA Reports compiled by EIS in 2012.	
4. Define the Boundaries of the Study Specify the spatial and temporal aspects of the environmental media that the data must represent to support decision	Define the target land-use and receptors of interest and its relevant spatial boundaries. Define what constitutes a sampling unit. Specify temporal boundaries and other practical constraints associated with sample/data collection. Specify the smallest unit on which decisions or estimates will be made.	**Lateral** – the investigation area comprised of the vacant lot identified as 18 George St, Yagoona. This lot was part of a larger site area which included 350 Hume Highway, Yagoona; **Vertical** – from the existing ground level to at least the base of the proposed excavations at approximately 4 mBGL; **Temporal** – One round of groundwater sampling was undertaken.	

DQO Steps (NSW DEC, 2006)	US EPA (2006) (modified)	Details	Comments (changes during investigation)
5. Develop the Analytic Approach (Develop a decision rule) To define the parameter of interest, specify the action level, and integrate previous DQO outputs into a single statement that describes a logical basis for choosing from alternative actions	Specify appropriate land-use parameters for making decisions or estimates. For decision problems, choose a workable Action Level and generate an "If then else" decision rule which involves it: For estimation problems, specify the methodology and the estimation procedure.	The decision rules for the investigation were: If the concentrations of contaminants in the soils data exceed the land use criteria; then an assessment of the need for further investigations would be undertaken. The waste classification for off-site disposal of excavated materials is determined on the basis of soil sampling and laboratory analysis for a relevant suite of analytical parameters. Decision criteria for QA/QC measures are defined by the Data Quality Indicators (DQI) in **Table 5-2.**	
6. Specify Performance or Acceptance Criteria (Specify limits on decision errors) Specify the decision-maker's acceptable limits on decision errors, which are used to establish performance goals for limiting uncertainties in the data	For decision problems, specify the decision rule as a statistical hypothesis test, examine consequences of making incorrect decisions from the test, and place acceptable limits on the likelihood of making decision errors. For estimation problems, specify acceptable limits on estimation uncertainty.	Specific limits for this project were in accordance with the appropriate guidance made by the NSW EPA, appropriate indicators of data quality and standard procedures for field sampling and handling. This should include the following points to quantify tolerable limits: A decision can be made based on a probability that 95% Upper Confidence Limits (UCL) of the data will satisfy the given site criteria. Therefore a limit on the decision error will be 5% that a conclusive statement may be incorrect. A decision can be made based on the probability that a contamination hotspot of a certain circular diameter will be detected with 95% confidence using a selected density of systematic data points. The decision error will be limited to a probability of 5% that a contamination hotspot may not be detected. No groundwater contamination is detected.	
7. Develop the Detailed Plan for Obtaining Data (Optimise the design for obtaining data) Identify the most resource-effective sampling and analysis design for general data that are expected to satisfy the DQOs	Compile all data and outputs generated in Steps 1 to 6. Use this information to identify alternative sampling designs that fit your intended use Select and document a design that will yield data to best achieve your data quality.	Written instructions will be issued to guide field personnel in the required fieldwork activities. Soil samples would be collected in the source zones identified in previous contamination assessments and further sampling and analysis would be undertaken to characterise the material for waste disposal. Additional soil samples would be collected if contamination. Soil sampling procedures and methodologies that would be implemented to optimise data collection for achieving the DQOs.	

5.2 DATA QUALITY INDICATORS

To ensure that the investigation data collected was of an acceptable quality, the investigation data set was assessed against the data quality indicators (DQI) outlined in **Table 5-2**, which related to both field and laboratory-based procedures. The data quality assessment is discussed in **Section 8**.

Table 6-2 Data Quality Indicators

QA/QC Measures	Data Quality Indicators
Precision – A quantitative measure of the variability (or reproducibility) of data	Data precision would be assessed by reviewing the performance of blind field duplicate sample sets, through calculation of relative percentage differences (RPD). Data precision would be deemed acceptable if RPDs are found to be less than 30%. RPDs that exceed this range may be considered acceptable where: • Results are less than 10 times the limits of reporting (LOR); • Results are less than 20 times the LOR and the RPD is less than 50%; or • Heterogeneous materials or volatile compounds are encountered.
Accuracy – A quantitative measure of the closeness of reported data to the "true" value	Data accuracy would be assessed through the analysis of: • Method blanks, which are analysed for the analytes targeted in the primary samples; • Matrix spike and matrix spike duplicate sample sets; and • Laboratory control samples.
Representativeness – The confidence (expressed qualitatively) that data are representative of each medium present onsite	To ensure the data produced by the laboratory is representative of conditions encountered in the field, the laboratory would carry out the following: • Blank samples will be run in parallel with field samples to confirm there are no unacceptable instances of laboratory artefacts; • Review of relative percentage differences (RPD) values for field and laboratory duplicates to provide an indication that the samples are generally homogeneous, with no unacceptable instances of significant sample matrix heterogeneities; and • The appropriateness of collection methodologies, handling, storage and preservation techniques will be assessed to ensure/confirm there was minimal opportunity for sample interference or degradation (i.e. volatile loss during transport due to incorrect preservation / transport methods).
Completeness – A measure of the amount of useable data from a data collection activity	Analytical data sets acquired during the assessment will be evaluated as complete, upon confirmation that: • Standard operating procedures (SOPs) for sampling protocols were adhered to; and • Copies of all COC documentation are presented, reviewed and found to be properly completed. It can therefore be considered whether the proportion of "useable data" generated in the data collection activities is sufficient for the purposes of the land use assessment.
Comparability – The confidence (expressed qualitatively) that data may be considered to be equivalent for each sampling and analytical event	Given that a reported data set can comprise several data sets from separate sampling episodes, issues of comparability between data sets are reduced through adherence to SOPs and regulator-endorsed or published guidelines and standards on each data gathering activity. In addition the data will be collected by experienced samplers and NATA-accredited laboratory methodologies will be employed in all laboratory testing programs.

6. ASSESSMENT METHODOLOGY

6.1 SAMPLING RATIONALE

With reference to the preliminary CSM described in **Section 4**, soil investigation works were planned in accordance with the following rationale:

- Sampling fill and natural soils from five test bore locations located systematically across the site using a grid-based sampling pattern to characterise in-situ soils;
- Laboratory analysis of representative soil and groundwater samples for the identified chemicals of concern.

6.2 INVESTIGATION CONSTRAINTS

The placement and depth of test bores drilled and during the investigation phase achieved the planned investigation scope described in **Section 6.1**. Four test bores were proposed to be drilled beneath the concrete driveway along the western boundary, but were moved into grass verges and planter boxes due to incoming and outgoing traffic for the adjacent commercial property.

6.3 ASSESSMENT CRITERIA

The assessment criteria proposed for this project are outlined in **Table 6-1**. These were selected from available published guidelines that are endorsed by national or state regulatory authorities, with due consideration of the exposure scenario that is expected for various parts of the site, the likely exposure pathways and the identified potential receptors.

Table 6-1 Adopted Investigation Levels for Soil and Groundwater

Environmental Media	Adopted Guidelines	Rationale
Soil	NEPM, 2013 Soil HILs, EILs, HSLs, ESLs & Management Limits for TPHs	**Soil Health-based Investigation Levels (HILs)** Samples to be assessed against the NEPM 2013 HIL-B thresholds for residential sites with minimal access to soils, as these areas would be under slabs. **Soil Health-based Screening Levels (HSLs)** The NEPM 2013 Soil HSL-A&B thresholds for low-high density residential sites for vapour intrusion would be applied to assess for potential human health impacts from residual vapours resulting from petroleum, BTEX & naphthalene. Soils asbestos results to be assessed against the NEPM 2013 Soil HSL thresholds for "all forms of asbestos". **Ecological Investigation Levels (EILs), Ecological Screening Levels (ESLs) & Management Limits for Petroleum Hydrocarbons** Soil samples from BH4 would also be assessed against the NEPM 2013 EILs for arsenic, copper, chromium (III), nickel, lead, zinc, DDT and naphthalene, which have been derived for protection of terrestrial ecosystems. Samples are to be assessed against the NEPM 2013 ESLs for selected petroleum hydrocarbons & TPH fractions for protection of terrestrial ecosystems. Should the ESLs and HSLs be exceeded for petroleum hydrocarbons, soil samples would also assessed against the NEPM 2013 *Management Limits* for the TPH fractions F1 – F4 to assess propensity for phase-separated hydrocarbons (PSH), fire and explosive hazards & adverse effects on buried infrastructure. EI Notes that the majority of the site is to be excavated to a nominal depth of 3m for the construction of a one-storey basement car parking facility.
Groundwater	NEPM, 2013 GILs for Marine Waters	**Groundwater Investigation Levels (GILs) for Marine Water** NEPM 2013 provides GILs for typical, slightly-moderately disturbed aquatic ecosystems, which are based on the ANZECC & ARMCANZ 2000 Trigger Values (TVs) for the 95% level of protection of aquatic ecosystems; however, the 99% TVs were applied for the bio-accumulative metals *cadmium* and *mercury*. The marine criteria were considered relevant as the closest, potential surface water receptor was Cooks River, located 2.2km north east of the site and understood to be tidally influenced.
Vapour	NEPM, 2013 Groundwater HSLs for Vapour Intrusion	**Health-based Screening Levels (HSLs)** The NEPM 2013 groundwater HSLs for vapour intrusion were used to assess for potential human health impacts from residual vapours resulting from petroleum, BTEX and naphthalene impacts. The *HSL A* and *HIL B* thresholds for low and medium-density residential sites were applied for groundwater sampled.

For the purposes of this contamination investigation, the adopted soil assessment criteria are referred to as the Soil Investigation Levels (SILs) and the adopted groundwater assessment criteria are referred to as the Groundwater Investigation Levels (GILs). SILs and GILs are presented alongside the analytical results in the corresponding summary tables, which are discussed in **Section 7**.

6.4 SOIL INVESTIGATIONS

The soil investigations conducted at the site are described in **Table 6-2**. Test bore locations are illustrated in **Figure 2**.

Table 6-2 Summary of Soil Investigation Methodology

Activity/Item	Details
Fieldwork	The site investigation was conducted on 1 June 2014. Thirteen test bores were scheduled to be installed at various locations to characterise site soil conditions. Two further test bores were proposed for a geotechnical investigation.
Drilling Method & Investigation Depth	Test bores BH1-BH15 were drilled by HartGeo using a ute-mounted, 100 mm diameter solid-flight auger rig until natural soils were reached.(at depths of approximately 1.2-2.0m bgl) except at the four monitoring well locations, where drilled depths extended to 8m bgl.
Soil Logging	Drilled soils were classified in the field with respect to lithological characteristics and evaluated on a qualitative basis for odour and visual signs of contamination. Soil classifications and descriptions were based on Unified Soil Classification System (USCS) and Australian Standard (AS) 4482.1-2005. Bore logs are presented in **Appendix C**.
Field Observations (including visual and olfactory signs of potential contamination)	A summary of field observations is provided, as follows: • No dark staining was observed during drilling and sampling; • No odours were identified, however rootlets were observed in topsoil material; • Fibre cement sheet fragments were not observed in any drilling cuttings; and • No signs of brick, ash or charcoal materials were detected in any of the drilled boreholes.
Soil Sampling	Soil samples were collected using grab/dry methods & placed into laboratory-supplied, acid-washed, solvent-rinsed glass jars using dedicated nitrile gloves.
Decontamination Procedures	The drilling rods were decontaminated between sampling locations with potable water until the augers were free of all residual materials.
Sample Preservation	Samples were stored in a refrigerated (ice-filled) chest, whilst on-site and in transit to the laboratory. All samples were submitted and analysed within the required holding period, as documented in laboratory reports discussed in a later section.
Management of Soil Cuttings	Soil cuttings were used as backfill for completed boreholes.
Quality Control & Laboratory Analysis	A number of soil samples were submitted for analysis of previously-identified COPC by SGS Laboratories (SGS). QA/QC testing comprised intra-laboratory duplicates ('field duplicates') tested blind by SGS and an inter-laboratory field duplicate tested blind by Envirolab Services (Envirolab). All samples were transported under strict Chain-of-Custody (COC) conditions and COC certificates and laboratory sample receipt documentation were provided to EI for confirmation purposes, as discussed in **Section 8**.
Soil Vapour Screening	Screening for potential VOCs in collected soil samples was not conducted using a Photo-ionisation Detector (PID), as volatile odours were not detected at any sampling location during the course of the fieldwork.

6.5 GROUNDWATER INVESTIGATIONS

The groundwater investigations conducted at the site are described in **Table 6-3**. Monitoring well locations are illustrated in **Figure 2**.

Table 6-3 Summary of Groundwater Investigation Methodology

Activity/Item	Details
Fieldwork	Groundwater monitoring wells were installed and developed on 15 July 2014; whereas, water level gauging, well purging, field testing and groundwater sampling was conducted on 12.12.2013.
Well Construction	Test bores were converted to groundwater monitoring wells as follows: • Three 8m deep, onsite, up-gradient wells identified as MW1, MW2 and MW2 • one, 8 m deep, onsite, down-gradient well identified as MW4. Drilled by HartGeo using a ute-mounted, 100 mm diameter solid-flight auger rig. Well construction details are tabulated in **Table 7-2** and documented in the bore logs presented in **Appendix C**. All wells were installed to screen the shale aquifer within the interval 5.0 to 8.0 m bgl and were seated in shale.
Well Construction (continued)	Well construction was in general accordance with the standards described in NUDLC, 2012 and involved the following: • 50 mm, Class 18 uPVC, threaded, machine-slotted screen and casing, with slotted intervals in shallow wells set to screen to at least 500 mm above the standing water level to allow sampling of phase-separated hydrocarbon product, if present; • base and top of each well was sealed with a uPVC cap; • annular, graded sand filter was used to approximately 500mm above top of screen interval; • granular bentonite was applied above annular filter to seal the screened interval; • drill cuttings were used to backfill the bore annulus to just below ground level; and • surface completion comprised 1m well stickup.
Well Development	Well development was conducted for each well directly following installation. This involved agitation within the full length of the water column using a dedicated, HDPE, disposable bailer, followed by removal of water and accumulated sediment using a 12V, HDPE submersible bore pump. Pumping was continued until no further reduction in suspended sediment was observed (i.e. after removal of several well volumes).
Well Gauging	Monitoring wells MW1, MW2, MW3 and MW4 were gauged for standing water level (SWL, depth to groundwater) prior to well purging at the commencement of the GME on 15 July 2015. A transparent HDPE bailer was used to visually assess for the presence PSH prior to the commencement of well purging at the wells. PSH was not detected in either well.
Well Purging & Field Testing	No volatile organic odours were detected during any stage of well purging. Measurement of water quality parameters was conducted repeatedly during well purging and were recorded onto field data sheets (**Appendix D**) once water quality parameters stabilised. In all wells, groundwater was initially observed to be brown in colour with suspended sediments (SS). Field measurements for Dissolved Oxygen (DO), Electrical Conductivity (EC) and pH of the purged water were also recorded during well purging. Purged water volumes removed from each well and field test results are summarised in **Table 8-3**.
Groundwater sampling	Once three consecutive field measurements were recorded for the purged waters to within ± 10% for DO, ± 3% for EC and ± 0.05 for pH, this was considered to indicate that representative groundwater quality had been achieved and final physico-chemical measurements were recorded. Groundwater samples were then collected using a transparent, dedicated, HDPE bailer fitted with a low-flow, discharge valve for sample decanting. The low-flow discharge method is used to minimise potential loss of volatile compounds; however, no volatile organic odours were detected during well purging or groundwater sampling.
Decontamination Procedure	Decontamination was not required as sampling equipment was dedicated to each individual well. The water level probe and water quality kit probes were washed in a solution of potable water and Decon 90 and then rinsed with potable water between measurements/wells.

Activity/Item	Details
Sample Preservation	Sample containers were supplied by the laboratory with the following preservatives: • one, 1 litre amber glass, acid-washed and solvent-rinsed bottle; • two, 40ml glass vials, pre-preserved with dilute hydrochloric acid, Teflon-sealed; and • one, 250mL, HDPE bottle, pre-preserved with dilute nitric acid (1 mL). Samples for metals analysis were field-filtered using 0.45 µm pore-size filters. All containers were filled with sample to the brim then capped and stored in ice-filled chests, until completion of the fieldwork and during sample transit to the laboratory.
Quality Control & Laboratory Analysis	All groundwater samples were submitted for analysis of previously-identified chemicals of concern by SGS Laboratories (SGS). QA/QC testing comprised intra-laboratory duplicates ('field duplicates') tested blind by SGS and an inter-laboratory field duplicate tested blind by Envirolab Services (Envirolab). All samples were transported under strict Chain-of-Custody (COC) conditions and COC certificates and laboratory sample receipt documentation were provided to EI for confirmation purposes.
Sample Transport	After sampling, refrigerated sample chests were transported to SGS Australia Pty Ltd using strict Chain-of-Custody (COC) procedures. Inter-laboratory duplicate (ILD) samples were forwarded to Envirolab Services Pty Ltd (Envirolab) for QA/QC analysis. A Sample Receipt Advice (SRA) was provided by each laboratory to document sample condition upon receipt. Copies of SRA and COC certificates are presented in **Appendix E**.

7. RESULTS

7.1 SOIL INVESTIGATION RESULTS

7.1.1 Site Geology and Subsurface Conditions

The general site geology encountered during the drilling of the soil investigation boreholes, installation of monitoring wells may be described as a layer of anthropogenic filling overlying clay and shale, with siltstone and shale at depth. The geological information obtained during the investigation is summarised in **Table 7-1** and borehole logs from these works are presented in **Appendix C.**

Table 7-1 Generalised Subsurface Profile (m bgl)

Unit	Material	Depth (mBGL) to Top of Unit [1]	Observed Thickness (m)	Material Description [1]	Comments
1	Fill	0	0.5 to 0.7	SAND	Light vegetation overlying fine grained sand. Fill is inferred to be topsoil.
2	Residual Soil	0.5 to 0.7	2.3 to 4.0	CLAY and SHALE	Stiff to very stiff, high plasticity clay with trace fine sub-angular ironstone gravel, grading into extremely weathered, extremely low strength shale.
3	Extremely Weathered Bedrock	3.0 to 4.5	4.41 to 6.0	SILTSTONE and SHALE	Extremely to distinctly weathered, extremely low to very low strength siltstone and shale.
4	Weathered Bedrock	8.91 to 9.0	N/A [2]	SHALE and LAMINITE	Distinctly weathered to fresh, low to medium strength shale and laminite.

Notes:

1 Approximate depth below ground level at the time of our investigation. More detailed descriptions of subsurface conditions are available in the borehole logs in **Appendix C.** Depths may vary across the site.
2 Observed up to borehole termination depth in BH1, BH3 and BH5.

7.1.2 Field Observations and PID Results

Soil samples were obtained from the test bores at various depths ranging between 0.0 m to 8.0 m bgl. All soil samples were evaluated on a qualitative basis for odour and visual signs of contamination (e.g. hydrocarbon odours, oil staining, petrochemical filming, asbestos fragments, ash, charcoal) and the following observations were noted:

- No visual or olfactory evidence of hydrocarbon impacts were noted at any of the borehole locations investigated during this assessment;
- No fibrous cement sheeting, ash, charcoal or slag was observed in any of the examined fill soils; and
- VOC concentrations as screened by a handheld Photoionisation Detector (PID) were all zero.

7.2 GROUNDWATER INVESTIGATION RESULTS

7.2.1 Monitoring Well Construction

A total of four groundwater monitoring wells were installed across the site, with the wells MW1, MW2, MW3 and MW4 seated in shale. Well construction details for the installed groundwater monitoring wells are summarised in **Table 8-2.**

Table 7-2 Monitoring Well Construction Details

Well ID	Bore Depth (m bgl)	RL (GL)	RL (TOC)	Screen Interval (m bgl)	Lithology Screened
MW1	7.95	–	–	4.95-7.95	Shale
MW2	7.1	–	–	4.1-7.1	Shale
MW3	8.0	–	–	5.0-8.0	Shale
MW4	7.95	–	–	4.95-7.95	Shale

Notes:
m bgl = metres below ground level.
RL = Reduced Level – Surveyed elevation in metres relative to Australian Height Datum (m AHD).
TOC = top of well casing (Note: Ground Level = TOC for the wells MW110, MW112 and MW114).
RL (TOC) = Surveyed elevation at TOC in m AHD.

7.2.2 Field Observations and Water Test Results

A single GME was conducted on all wells on 15 July 2014. On this date, standing water levels (SWLs) were measured within each well prior to well purging, the results of which were recorded with well purge volumes and field-based water test results. A summary of the recorded field data is presented in **Table 7-3** and copies of the completed Field Data Sheets are included in **Appendix D.**

Table 7-3 Groundwater Levels, Field Water Test Results and Observations

Well ID	SWL (m BTOC)	RL (TOC)	WL† (m AHD)	Purge Volume (L)	DO (mg/L)	Field pH	Field EC (µS/cm)	Temp (°C)	Redox (mV)	Odours / Turbidity
MW1	4.77	-	-	25	Field Data Sheet Damaged					No / Mod
MW2	5.84	-	-	15	3.11	6.83	28.3	19.82	-3.8	No / Mod
MW3	2.95	-	-	30	0.94	6.82	20.42	18.99	0.1	No / Mod
MW4	3.34	-	-	30	1.5	4.78	28.08	19.4	109.4	No / Mod

Notes:
GME – Groundwater monitoring event.
SWL – Standing Water Levels as measured from TOC (top of well casing) prior to groundwater sampling.
m BTOC – metres below top of well casing (Note: Ground Level = TOC for the wells MW110, MW112 and MW114).
RL (TOC) – Reduced Level, elevation at TOC in metres relative to Australian Height Datum (m AHD).
† WL = Calculated groundwater level, in m AHD (calculated as RL – SWL) Note: these values were used for groundwater contouring analysis.
L – litres (referring to volume of water purged from the well prior to groundwater sample collection).
EC – groundwater electrical conductivity as measured onsite using portable EC meter.
µS/cm – micro Siemens per centimetre (EC units).
DO – Dissolved Oxygen in units of milligrams per litre (mg/L)
All groundwater parameters (pH, EC and DO) were tested on site.
* Well not found, presumed damaged.

With reference to **Table 7-3**, the field pH data indicated that the groundwater was slightly acidic (pH ranged from 4.78 to 6.8) with reducing conditions present. Electrical Conductivity (EC) measurements were recorded in the range 20.42 – 28.30 µS/cm indicating that the groundwater was fresh to marginal in terms of water salinity.

7.3 LABORATORY ANALYTICAL RESULTS

7.3.1 Soil Analytical Results

A summary of laboratory results showing test sample quantities, minimum/maximum analyte concentrations and samples found to exceed the SILs, is presented in **Table 7-4**. More detailed tabulations of results showing the tested concentrations for individual samples alongside the adopted soil criteria are presented in **Tables T1** to **T5** at the end of this report. Completed documentation used to track soil sample movements and laboratory receipt (i.e. COC and SRA forms) are copied in **Appendix E** and all laboratory analytical reports for tested soil samples are presented in **Appendix F**.

Table 7-4 Summary of Soil Analytical Results

No. of primary samples	Analyte	Min. Conc. (mg/kg)	Max. Conc. (mg/kg)	Sample locations exceeding investigation levels
Hydrocarbons				
20	TPH F1	<25	<25	None
20	TPH F2	<25	<25	None
20	TPH F3	<90	170	None
20	TPH F4	<120	<120	None
20	Benzene	<0.1	<0.1	None
20	Toluene	<0.1	<0.1	None
20	Ethyl benzene	<0.1	<0.1	None
20	Total xylenes	<0.3	<0.3	None
20	Benzo(α)pyrene	<0.1	2.0	None
20	Total Phenols			
OCPs				
13	Aldrin & Dieldrin	<0.1	<0.2	None
13	Chlordane	<0.2	<0.2	None
13	DDT+DDD+DDE	<0.3	<0.3	None
13	Heptachlor	<0.1	<0.1	None
Heavy Metal				
20	Arsenic	6	13	None
20	Cadmium	<0.3	0.6	None
20	Chromium (Total)	12	30	None
20	Copper	12	48	None
20	Lead	14	100	None
20	Mercury	<0.01	0.24	None
20	Nickel	1.4	18	None
20	Zinc	12	170	None
PCBs				
13	Total PCBs	<1	<1	None
Asbestos				
13	Asbestos	<0.01	>0.01	BH6-1

Heavy Metals

With reference to **Table T1**, all heavy metals concentrations were below the corresponding health based SILs for residential settings with accessible soils.

TPHs

As shown in **Table T2**, all total recoverable hydrocarbons (TRH) concentrations were below the corresponding NEPM 2013 health-based HSL-A and -B levels, which were the adopted SILs for TPHs.

BTEX and Naphthalene

As shown in **Table T2**, BTEX compounds were not identified in any of the tested samples. All laboratory PQLs were also within the corresponding SILs.

PAHs and Phenols

As summarised in **Table T3**, there were no exceedances of adopted HILs in any of the analysed samples. All laboratory PQLs were also within the corresponding SILs. Benzo(α)pyrene was detected in two fill samples; BH9-1 and BH10-1 at concentrations of 0.2 mg/kg and 2.0 mg/kg, respectively. Whilst these sampling locations were located within the proposed basement excavation footprint, a statistical analysis of contaminant spread was warranted. A 95% UCL calculation indicated that, with 95% confidence, the average concentration at any point on the site will not exceed 0.58 mg/kg.

OCPs, OPPs and PCBs

With reference to **Table T4**, no detectable concentration of any of the screened OCP, OPP and PCB compounds was identified in any of the tested samples. All laboratory PQLs were also within the corresponding SILs.

Asbestos

As summarised in **Table T5**, asbestos was reported in sample BH6-1. No detectable asbestos concentrations or traces of respirable fibres were identified in any other of the tested soil samples.

7.4 GROUNDWATER ANALYTICAL RESULTS

Laboratory analytical results for groundwater samples are summarised in **Table T6**, which also include the adopted GILs. Completed documentation used to track groundwater sample movements and laboratory receipt (COC and SRA forms) are copied in **Appendix E**. Copies of the laboratory analytical reports are attached in **Appendix F**.

Heavy Metals

With reference to **Table 7-5**, there were a number of exceedances of heavy metal GILs.

Table 7-5 Summary of Groundwater Analytical Results

Analyte	Sample in exceedance	Concentration (µg/L)
Cadmium (GIL 0.7µg/L)	MW1-1	0.5
	MW2-1	0.5
	MW3-1	0.3
	MW4-1	3.3
Copper (GIL 1.3 µg/L)	MW1-1	25
	MW2-1	3
	MW3-1	3
	MW4-1	37
Lead (GIL 4.4 µg/L)	MW4-1	19
Nickel (GIL 7 µg/L)	MW1-1	61
	MW2-1	8
	MW3-1	13
	MW4-1	200
Zinc (GIL 15 µg/L)	MW1-1	250
	MW3-1	29
	MW4-1	600

8. DATA QUALITY ASSESSMENT

The assessment of data quality is defined as the scientific and statistical evaluation of environmental data to determine if these data meet the objectives of the project (Ref. USEPA 2006). Data quality assessment includes an evaluation of the compliance of the field sampling and laboratory analytical procedures and an assessment of the accuracy and precision of these data from the laboratory quality control measurements obtained.

The data quality assessment process for this assessment included a review of analytical procedures to confirm compliance with established laboratory protocols and an assessment of the accuracy and precision of analytical data from a range of quality control measurements. The QC measures generated from the field sampling and analytical program were as follows:

- suitable records of fieldwork observations including borehole logs;
- relevant and appropriate sampling plan (density, type, and location);
- use of approved and appropriate sampling methods;
- preservation and storage of samples upon collection and during transport to the laboratory;
- complete field and analytical laboratory sample COC procedures and documentation;
- sample holding times within acceptable limits;
- use of appropriate analytical procedures and NATA-accredited laboratories; and
- required LOR (to allow for comparison with adopted IL);
- frequency of conducting quality control measurements;
- laboratory blanks;
- field duplicates;
- laboratory duplicates;
- matrix spike/matrix spike duplicates (MS/MSDs);
- surrogates (or System Monitoring Compounds);
- analytical results for replicated samples, including field and laboratory duplicates and inter-laboratory duplicates, expressed as Relative Percentage Difference (RPD); and
- checking for the occurrence of apparently unusual or anomalous results, e.g. laboratory results that appear to be inconsistent with field observations or measurements.

The findings of the data quality assessment in relation to the soil and groundwater investigations at the site are discussed in detail in **Appendix G**.

On the basis of the analytical data validation procedure employed the overall quality of the soil and groundwater analytical data produced for the site were considered to be of an acceptable standard for interpretive use.

9. SITE CHARACTERISATION DISCUSSION

9.1 CONCEPTUAL SITE MODEL

On the bases of investigation findings presented above, the preliminary CSM discussed in **Section 4** was considered generally appropriate for identifying contamination sources, migration mechanisms and exposure pathways, as well as potential onsite and offsite receptors. Some of the previously known data gaps, as outlined in **Section 4.1** have been addressed; however, the following remaining data gaps need to be addressed in subsequent works;

- Asbestos was detected in the fill layer at BH6. The source of the asbestos is unknown; however EI notes that the investigation area was previously occupied by a number of residential dwellings. Asbestos was not detected in any of the other fill samples. It is therefore inferred that any asbestos impacts on the site are likely the result of uncontrolled demolition of site structures or dumping of rubbish rather than imported and uncontrolled fill. Thus, asbestos impacts are likely to be isolated in the silty sandy topsoil and not in deeper residual soils;

- Benzo(α)pyrene was detected in two fill samples; being BH9-1 and BH10-1. The recorded concentration of the latter was found to be above the ecological screening level for Urban Residential/Public open space. EI notes, however, that the location of the detected exceedance is within the basement excavation footprint, and therefore impacted soils are likely to be removed. The source of the B(α)P is unknown, however due to the nature of the detection (i.e. isolated and in low concentrations), it is inferred that it has been left in fill as a result of poor demolition control or dumping of rubbish;

- Residual Petroleum Hydrocarbons were not detected in any of the fill or natural samples analysed during the investigation. The former Caltex Lease is therefore inferred to have little to no impact on the environmental health or aesthetic enjoyment of the site;

- Hydrocarbons and Volatile compounds were not identified in any of the analysed groundwater samples. Groundwater was reported to be high in heavy metals in all analysed samples.

9.2 ASBESTOS RISK

Asbestos was reported in fill the fill layer at one sampling location, being BH6-1. It is considered to pose a moderate risk to on-site receptors, particularly site workers during demolition and excavation phases of works. The location of the asbestos detection lies within the basement excavation footprint, therefore the impacted material is to be removed for bulk excavation and will pose no threat to occupants.

9.3 PAHS IN SOIL

Fill was reported to be impacted with Benzo(α)pyrene at concentrations that exceeded the ecological based screening level (ESL) of 0.7mg/kg. The concentration detected in BH10-1 was 2.0mg/kg. However, the site is considered to pose a low risk to onsite and offsite receptors for the following reasons:

- Based on the adopted sampling plan, benzo(α)pyrene was not a widespread contamination issue on the site, being identified in the fill at two sampling locations;

- Observations during field inspection and intrusive sampling did not report any occurrence of phase-separated material, coal tar, or significantly odorous soil (tar-like) and there was no history of use of the site as a gas works;
- The vegetative cover (grass) across the site was observed to be well established, in good condition with no evidence of stress, worn areas or exposed soil;
- BaP was detected in fill material, all of which is likely to be removed off-site for the excavation of the one-level basement car park. This is likely to mitigate any potential exposure pathways that may be present; and
- A 95% UCL Calculation was undertaken to assess the probability of exceedance of BaP. The probabilistic assessment indicated that the average concentration, with 95% confidence, of detected BaP will not exceed 0.58 mg/kg, below the ecological threshold of 0.7mg/kg.

9.4 GROUNDWATER CONDITIONS

- Review of laboratory results of tested groundwater samples MW1-1, MW2-1, MW3-1 and MW4-1 revealed all samples were reported below the detection limits for TRHs, PAHs, BTEX and VOCs. The metals cadmium, copper, lead, nickel and zinc all groundwater samples were reported above the ANZECC marine criteria. The origin of these heavy metal concentrations are unlikely to be from on-site contamination sources;
- The likelihood of impacts reaching the sensitive aquatic receptors is improbable as elevated heavy metal concentrations are likely to attenuate prior to reaching the identified point of exposure, being Georges River located 4km west of the site. Therefore, whether these results are treated as exceedances of ANZECC marine criteria, or representative of urban background groundwater conditions, the identified groundwater concentrations are unlikely impact on down gradient aquatic receptors.
- The likelihood of impacts reaching on-site receptors is far more likely, however a second round of groundwater sampling is necessary to assess the likelihood of anomalous results and to assess the migration of background (off-site) contamination sources. It is noted that there are no beneficiaries of groundwater in the immediate vicinity of the site.

10. CONCLUSIONS

The property located at 18 George Street, Yagoona NSW was the subject of a Phase 2 Detailed Site Investigation Report in order to assess the potential for on-site contamination associated with the identified current and former land uses. Based on the findings of this assessment it was concluded that:

- The site The site was bound by George Street to the north, commercial properties to the east, Hume Highway to the south and residential properties to the west, and encompassed an area of approximately 5,100m^2;
- The site was free of statutory notices issued by the NSW EPA/DECC;
- Soil sampling and analysis were conducted at thirteen (13) targeted test bore locations (BH1-BH13) down to a maximum depth of 8.0 mBGL. Sampling regime and density were considered to be appropriate for detailed investigation purposes and comprised judgemental and systematic (triangular grid) sampling patterns, with allowance for structural obstacles;
- The sub-surface layers comprised of dark brown to brown silty sandy fill, underlain by residual silty clay, underlain by Shale;
- Results of soil samples collected from all soil test boreholes reported concentrations of the screened heavy metals, recoverable hydrocarbons, pesticides and volatile organic compounds to be below the adopted human health based SILs;
- Sample BH6-1 was found to contain a small fibrous cement fragment containing non-respirable asbestos and bundled fibres of non-respirable asbestos;
- Four bore holes, being BH1, BH4, BH10 and BH13 were converted to monitoring wells MW1, MW2, MW3 and MW4, respectively;
- Groundwater was observed at depths ranging between 1.95m and 3.94m below ground level;
- All groundwater samples were reported to contain various heavy metals in excess of the adopted groundwater investigation levels.

On review of the Preliminary Conceptual Site Model (CSM) developed as part of this DSI, it was concluded that the model remains valid for the proposed development. A number of the data gaps identified in **Section 4.1** have been addressed, however heavy metals in groundwater remain an issue that require attention in subsequent works.

11. RECOMMENDATIONS

It is assumed that during the proposed construction of a basement level car park as part of the development, all fill and residual soil materials will be removed from the assessed site area, therefore in view of the above findings and in accordance with the NEPM 2013 guidelines, it is considered that the site can be made suitable for the proposed residential development on completion of the following:

1. Commencement of a second round of groundwater sampling to further assess the nature of high heavy metals concentrations identified in the first GME;

2. Subsequent to the removal of vegetative cover across the site and prior to the removal of any on-site soils:

    a. Fill soils in the vicinity of BH6 are to be excavated and stockpiled for classification and off-site disposal. The walls and base of the excavated pit are to be validated for asbestos;

    b. An in-situ waste classification of fill, including bulk asbestos sampling, is to be undertaken for the removal of the remaining on-site fill soils;

3. All virgin excavated natural material or VENM (natural clay or shale) designated for off-site disposal must be classified for off-site disposal in accordance the NSW EPA (2014) Waste Classification Guidelines by a qualified environmental consultant.

4. Any material being imported to the site should be assessed for potential contamination in accordance with NSW EPA guidelines as being suitable for the intended use and be classified as VENM.

5. Validate that the excavated areas are left free of contamination by comparing analytical results for excavation surfaces and any backfill material, against the respective DECC/EPA thresholds.

6. Preparation of a final site validation report by a qualified environmental consultant, certifying site suitability for the proposed development.

12. STATEMENT OF LIMITATIONS

The findings presented in this report are the result of discrete and specific sampling methodologies used in accordance with best industry practices and standards. Due to the site-specific nature of soil sampling from point locations, it is considered likely that all variations in subsurface conditions across a site cannot be fully defined, no matter how comprehensive the field investigation program.

While normal assessments of data reliability have been made, EI assumes no responsibility or liability for errors in any data obtained from previous assessments conducted on site, regulatory agencies (e.g. Council, EPA), statements from sources outside of EI, or developments resulting from situations outside the scope of works of this project.

Despite all reasonable care and diligence, the ground conditions encountered and concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. In addition, site characteristics may change at any time in response to variations in natural conditions, chemical reactions and other events, e.g. groundwater movement and or spillages of contaminating substances. These changes may occur subsequent to EI's investigations and assessment.

EI's assessment is necessarily based upon the result of the site investigation and the restricted program of surface and subsurface sampling, screening and chemical testing which was set out in the proposal. Neither EI, nor any other reputable consultant, can provide unqualified warranties nor does EI assume any liability for site conditions not observed or accessible during the time of the investigations.

This report was prepared for the above named client and no responsibility is accepted for use of any part of this report in any other context or for any other purpose or by other third parties. This report does not purport to provide legal advice.

This report and associated documents remain the property of EI subject to payment of all fees due for this assessment. The report shall not be reproduced except in full and with prior written permission by EI.

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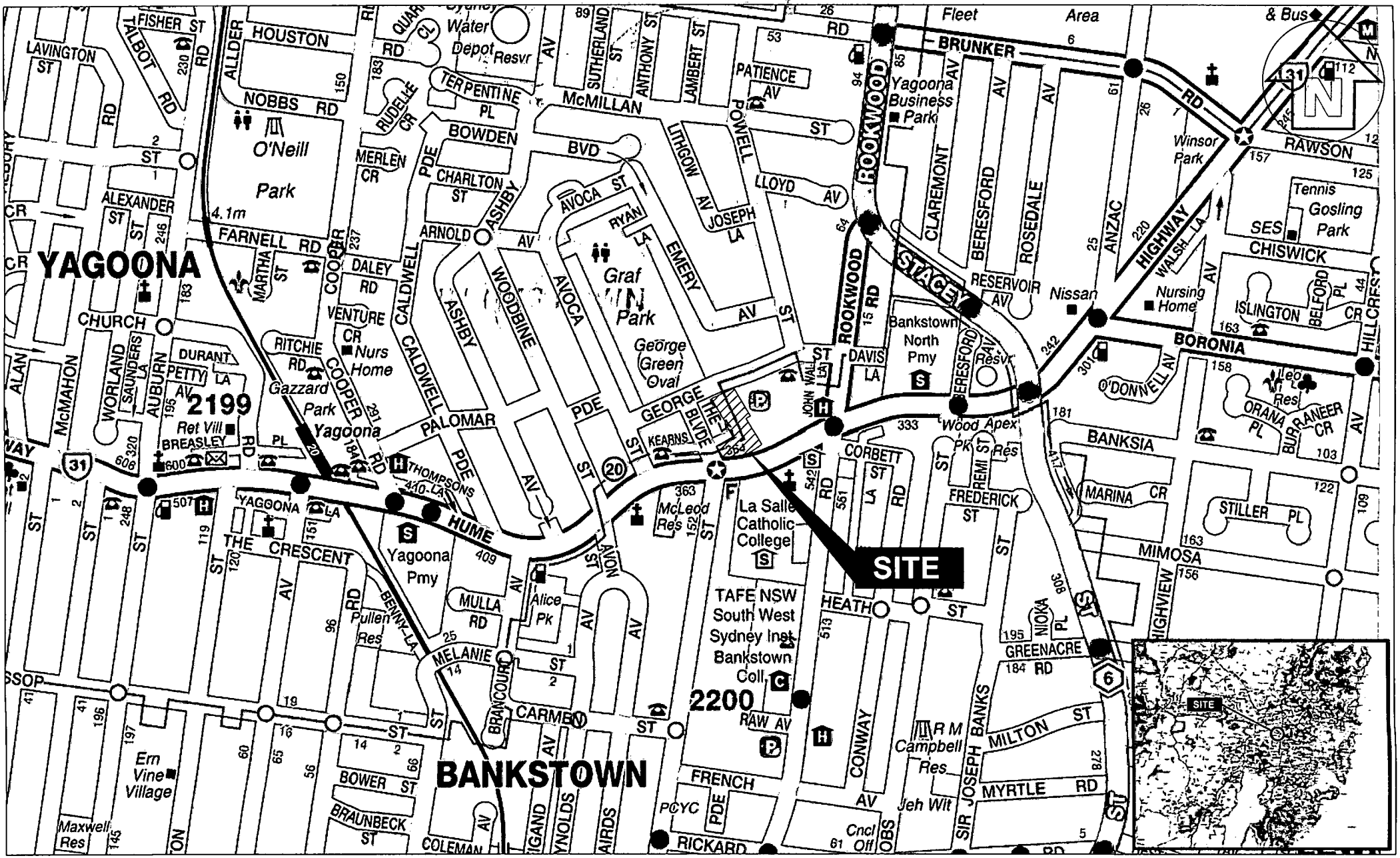
ABBREVIATIONS

AECs	Areas of Environmental Concern
AHD	Australian Height Datum
ASS	Acid sulfate soils
ANZECC	Australian and New Zealand Environment Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
B(α)P	Benzo(α)Pyrene
BFD	Blind Field Duplicate (QA/QC sample, tested by the primary laboratory)
bgl	Below Ground Level
BH	Borehole
BM	Building Manager
BTEX	Benzene, Toluene, Ethyl benzene, Xylene
COC	Chain of Custody
CSM	Cutter Soil Mix
DEC	Department of Environment and Conservation, NSW
DECC	Department of Environment and Climate Change, NSW (formerly DEC)
DA	Development Application
DO	Dissolved Oxygen
DP	Deposited Plan
EC	Electrical Conductivity
Eh	Redox potential
EI	Environmental Investigations (trading name of Environmental Investigations Australia Pty Ltd)
EPA	Environment Protection Authority
EPIC	Emerald Park Project
EPA NSW	Environment Protection Authority, New South Wales
EMP	Environmental Management Plan
F1	TPH C6 – C10 less the sum of BTEX concentrations
F2	TPH >C10 – C16 less the concentration of naphthalene
GIL	Groundwater Investigation Level
GME	Groundwater monitoring event
HIL	Health-based Investigation Level
HSL	Health-based Screening Level
IFD	Inter-laboratory Field Duplicate (QA/QC sample, tested by the secondary laboratory)
J&E	Predictive model for estimating vapour intrusion rates into buildings
km	Kilometres
m	Metres
mAHD	Metres relative to Australian Height Datum
mbgl	Metres below ground level
mg/m3	Milligrams per cubic metre
mg/L	Milligrams per litre
µg/L	Micrograms per litre
mV	Millivolts

MW	Monitoring well
NATA	National Association of Testing Authorities, Australia
NEPC	National Environmental Protection Council
NSW	New South Wales
OEH	Office of Environment and Heritage, NSW (formerly DEC, DECC, DECCW)
PAHs	Polycyclic Aromatic Hydrocarbons
pH	Measure of the acidity or basicity of an aqueous solution
ppbv	Parts per billion by volume
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance / Quality Control
RISC5	Risk-Integrated Software for Clean-ups, Version 5
RAC	Remediation Acceptance Criteria
RAP	Remediation Action Plan
SRA	Sample receipt advice (document confirming laboratory receipt of samples)
SWL	Standing Water Level
TDS	Total dissolved solids (a measure of water salinity)
TCE	Trichloroethylene (also known as Trichloroethene)
TCLP	Toxicity Characteristics Leaching Procedure
TPHs	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds (including VOCCs)
VOCCs	Volatile Organic Chlorinated Compounds

FIGURES



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DYLDAM DEVELOPMENTS

DETAILED SITE INVESTIGATION
18 GEORGE STREET/350 HUME HIGHWAY,
YAGOONA NSW
SITE LOCALITY PLAN

Figure:
1

Project: E22241 AA

TABLES

Table T1 – Summary of Soil Investigation Results for Heavy Metals

Sample ID	Arsenic	Cadmium	Chromium (Total)	Copper	Lead	Mercury	Nickel	Zinc
BH1-1	7	0.5	23	16	39	0.03	11	91
BH1-2	11	0.5	30	13	19	0.01	4.2	27
BH1-3	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
BH2-1	7	0.3	19	19	63	0.04	8.8	76
BH3-1	7	<0.3	14	16	43	0.05	6.4	60
BH3-2	10	<0.3	17	17	15	<0.01	1.4	16
BH4-1	8	0.3	17	9.3	24	0.04	4.8	22
BH5-1	7	<0.3	19	7.9	19	<0.01	2.4	13
BH5-2	7	<0.3	17	12	14	<0.01	1.7	12
BH6-1	5	<0.3	15	12	22	<0.01	5.9	24
BH7-1	13	0.6	26	24	65	0.04	6.8	150
BH7-2	8	<0.3	12	14	18	<0.01	1.4	15
BH8-1	10	0.4	29	11	18	0.01	2.2	14
BH9-1	8	0.6	24	18	37	0.04	8.1	53
BH9-2	9	0.4	24	13	22	0.02	4	25
BH10-1	8	0.4	20	48	100	0.24	18	170
BH11-1	7	0.3	17	14	16	<0.01	1.9	18
BH11-2	9	0.3	19	12	18	<0.01	1.4	13
BH12-1	7	<0.3	19	12	16	<0.01	2.5	17
BH13-1	6	0.3	19	14	36	0.03	5.3	38
BH13-2	11	0.6	28	13	34	0.03	3.5	25
BH13-3	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
SILs								
HIL B[1]	500[2]	150	N.A.	30,000	1,200[3]	120	1,200	60,000
EILs[6]	110	NA	420	210	1200	NA	40	280

Notes:	All results are reported in mg/kg unless stated otherwise
SIL	Soil investigation Levels.
HIL	Health-based investigation levels (mg/kg) as per NEPM 1999 Schedule B1 2013 Amendment.
EIL	Ecological Investigation Levels (mg/kg) as per NEPM. EILs incorporate soil physiochemical properties (pH, CEC & clay content) tested on samples TP11-2 & TP18-2 to calculate ABC (ambient background concentrations).
N.R.	No Recommended soil assessment criteria are currently available for the indicated parameter(s).
N.A.	Not analysed.
1	HIL B - Residential with minimal opportunities for soil access; includes dwellings with fully and permanently paved yard space such as high-rise buildings and apartments.
2	Arsenic - HIL assumes 70% oral bioavailability. Site-specific bioavailability may be important and should be considered where appropriate (refer to NEPM 1999 Schedule B7 2013 Amendment).
3	Lead - HIL is based on blood lead models (IEUBK for HILs A, B and C and adult lead model for HIL D where 50% oral bioavailability has been considered. Site-specific bioavaila
4	Value shown is representative of inorganic mercury as provided in Table 1A(1) (refer to NEPM 1999 Schedule B1 2013 Amendment).
6	EIL values are for urban residential and public open space.
7	Aged values are applicable to arsenic contamination present in soil for at least two years. For fresh contamination refer to NEPM 1999 Schedule B5c 2013 Amendment.
9	Commercial/industrial, includes premises shuch as shops, offices, factories and industrial sites.
	Indicate concentration exceeds Human Health Based Criteria
	Indicate concentration exceeds Ecological Based Criteria

Table T2 – Summary of Soil Investigation Results for TPH, BTEX and Naphthalene

Sample ID	Depth (m)	Total Petroleum Hydrocarbons (mg/kg)				Benzene (mg/kg)	Toluene (mg/kg)	Ethyl benzene (mg/kg)	Total Xylenes (mg/kg)	Naphthalene* (mg/kg)
		F1[1]	F2[2]	F3[3]	F4[4]					
BH1-1	0.1-0.3	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH1-2	0.4-0.5	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH1-3	1.5-1.6	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
BH2-1	0.1-0.2	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH3-1	0.1-0.2	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH3-2	0.3-0.5	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH4-1	0.1-0.3	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH5-1	0.1-0.3	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH5-2	0.4-0.5	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH6-1	0.1-0.3	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH7-1	0.1-0.3	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH7-2	0.4-0.5	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH8-1	0.1-0.3	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH9-1	0.1-0.3	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH9-2	0.5-0.6	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH10-1	0.1-0.2	<25	<25	170	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH11-1	0.1-0.2	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH11-2	0.3-0.4	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH12-1	0-0.1	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH13-1	0.1-0.2	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH13-2	0.5-0.6	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1
BH13-3	1.1-1.2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
SILs										
HSL A & B (Sand)	0 m to <1 m	45	110	N.R.	N.R.	0.5	160	55	40	3
	1 m to <2 m	70	240	N.R.	N.R.	0.5	220	N.R.	60	N.R.
	2 m to <4 m	110	440	N.R.	N.R.	0.5	310	N.R.	95	N.R.
	4 m +	200	N.R.	N.R.	N.R.	0.5	540	N.R.	170	N.R.
HSL A & B (Clay)	0 m to <1 m	50	280	N.R.	N.R.	0.7	480	N.R.	110	5
	1 m to <2 m	90	N.R.	N.R.	N.R.	1	N.R.	N.R.	310	N.R.
	2 m to <4 m	150	N.R.	N.R.	N.R.	2	N.R.	N.R.	N.R.	N.R.
	4 m +	290	N.R.	N.R.	N.R.	3	N.R.	N.R.	N.R.	N.R.
ESLs[5]	Coarse grained	180*	120	300	2800	50	85	70	105	170
	Fine grained			1300	5600	65	105	125	45	
Management Limits[6]	Coarse grained	700	1000	2500	10000	N.R.	N.R.	N.R.	N.R.	N.R.
	Fine grained	800		3500		N.R.	N.R.	N.R.	N.R.	N.R.

Notes:

SIL	Soil investigation Level.
HSL	Health screening levels (w/w) based on Residential developments. HSL A&B criteria applied in the absence of HSL C values.
ESL	Ecological screening levels (mg/kg), shown values are based for urban residential and public open space developments.
Management limits	As per Table 1 B(7) in NEPM 1999 Schedule B1 2013 Amendment.
N.R.	No Recommended soil assessment criteria are currently available for the indicated parameter(s).
N.A.	Not analysed.
*	Results reported are semi volatile Naphthalene.
1	To obtain F1 subtract the sum of BTEX concentrations from the C_6-C_{10} fraction.
2	To obtain F2 subtract naphthalene from the >C_{10}-C_{16} fraction.
3	F3 refers to Total Recoverable Hydrocarbon >C_{16}-C_{34}.
4	F4 refers to Total Recoverable Hydrocarbon >C_{34}-C_{40}.
5	ESLs are of low reliability except where indicated by * which indicates that the ESL is of moderate reliability. Shown values are for urban residential and public open space.
6	Management limits are applied after consideration of relevant ESLs and HSLs.

Indicate concentration exceeds Human Health Based Criteria

Indicate concentration exceeds Ecological Based Criteria

Table T3 – Summary of Soil Investigation Results for PAH

Sample	Polyaromatic Hydrocarbons (mg/kg)			
ID	Carcinogenic PAHs (as Benzo[a]pyrene TEQ)	Benzo(a)pyrene	Total PAHs	Total Phenols
BH1-1	<0.3	<0.1	<0.8	<0.1
BH1-2	<0.3	<0.1	<0.8	N.A.
BH1-3	N.A.	N.A.	N.A.	N.A.
BH2-1	<0.3	<0.1	<0.8	<0.1
BH3-1	<0.3	<0.1	<0.8	<0.1
BH3-2	<0.3	<0.1	<0.8	N.A.
BH4-1	<0.3	<0.1	<0.8	<0.1
BH5-1	<0.3	<0.1	<0.8	<0.1
BH5-2	<0.3	<0.1	<0.8	N.A.
BH6-1	<0.3	<0.1	<0.8	<0.1
BH7-1	<0.3	<0.1	<0.8	<0.1
BH7-2	<0.3	<0.1	<0.8	N.A.
BH8-1	<0.3	<0.1	<0.8	<0.1
BH9-1	0.3	0.2	1.6	<0.1
BH9-2	<0.3	<0.1	<0.8	N.A.
BH10-1	2.9	2	22	<0.1
BH11-1	<0.3	<0.1	<0.8	0.1
BH11-2	<0.3	<0.1	<0.8	N.A.
BH12-1	<0.3	<0.1	<0.8	0.1
BH13-1	<0.3	<0.1	<0.8	0.1
BH13-2	<0.3	<0.1	<0.8	N.A.
BH13-3	N.A.	N.A.	N.A.	N.A.
SILs				
HIL B[1]	4	NR	400	45 000
ESLs[2]	NR	0.7	NR	

Notes:

SIL	Soil investigation Level.
HIL	Health-based investigation levels (mg/kg).
ESL	Ecological screening levels (mg/kg), shown values are based for urban residential and public open space developments.
N.R.	No Recommended soil assessment criteria are currently available for the indicated parameter(s).
N.A.	Not analysed.
1	HIL A - Residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake (no poultry), also includes childcare preschools and primary schools.
2	Shown ESL values are for urban residential and public open space.
	Indicate concentration exceeds Human Health Based Criteria
	Indicate concentration exceeds Ecological Based Criteria

Table T4 – Summary of Soil Investigation Results for OCPs, OPPs & PCBs

Sample	OCPs								Total OPPs (mg/kg)	Total PCBs (mg/kg)
ID	Aldrin (mg/kg)	Dieldrin (mg/kg)	Endrin (mg/kg)	Chlordane (mg/kg)	Heptachlor (mg/kg)	DDT (mg/kg)	DDD (mg/kg)	DDE (mg/kg)		
BH1-1	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	N.D	<1
BH1-2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.D	N.A.
BH1-3	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.D	N.A.
BH2-1	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	N.D	<1
BH3-1	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	N.D	<1
BH3-2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.D	N.A.
BH4-1	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	N.D	<1
BH5-1	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	N.D	<1
BH5-2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.D	N.A.
BH6-1	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	N.D	<1
BH7-1	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	N.D	<1
BH7-2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.D	N.A.
BH8-1	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	N.D	<1
BH9-1	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	N.D	<1
BH9-2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.D	N.A.
BH10-1	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	N.D	<1
BH11-1	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	N.D	<1
BH11-2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.D	N.A.
BH12-1	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	N.D	<1
BH13-1	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	N.D	<1
BH13-2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.D	N.A.
BH13-3	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.D	N.A.
SILs										
HIL A[8]	Total 6		10	50	6	Total 240			N.R.	1
HIL B[1]	Total 10		20	90	10	Total 600			N.R.	1
HIL C[5]	Total 10		20	70	10	Total 400			N.R.	1
HIL D[9]	Total 45		100	530	50	Total 3,600			N.R.	7
EIL[2]	N.R.	N.R.	N.R.	N.R.	N.R.	180	N.R.	N.R.	N.R.	N.R.

Notes:

SIL	Soil investigation Level.
HIL	Health-based investigation levels (mg/kg).
EIL	Ecological investigation levels (mg/kg), shown values are based for urban residential and public open space developments.
N.R.	No Recommended soil assessment criteria are currently available for the indicated parameter(s).
N.A.	Not analysed.
N.D.	Not detected.
8	HIL A - Residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake (no poultry), also includes childcare centres, preschools and primary schools.
2	Shown EIL values are for urban residential and public open space.
1	HIL B - Residential with minimal opportunities for soil access; includes dwellings with fully and permanently paved yard space such as high-rise buildings and apartments.
5	HIL C - Public open space such as parks, playgrounds, playing fields (e.g. ovals) secondary schools and footpaths. Does not include undeveloped public open space.
9	Commercial/industrial, includes premises shuch as shops, offices, factories and industrial sites.

Indicate concentration exceeds Human Health Based Criteria

Indicate concentration exceeds Ecological Based Criteria

Table T5 – Summary of Soil Investigation Results for Asbestos

Sample ID	Asbestos Detection Status	Asbestos (% w/w)
BH1-1	No	<0.01
BH1-2	N.A.	N.A.
BH1-3	N.A.	N.A.
BH2-1	No	<0.01
BH3-1	No	<0.01
BH3-2	N.A.	N.A.
BH4-1	No	<0.01
BH5-1	No	<0.01
BH5-2	N.A.	N.A.
BH6-1	Yes	>0.01
BH7-1	No	<0.01
BH7-2	N.A.	N.A.
BH8-1	No	<0.01
BH9-1	No	<0.01
BH9-2	N.A.	N.A.
BH10-1	No	<0.01
BH11-1	No	<0.01
BH11-2	N.A.	N.A.
BH12-1	No	<0.01
BH13-1	No	<0.01
BH13-2	N.A.	N.A.
BH13-3	N.A.	N.A.
HSL		
Residential B[1]		0.04%
Recreational C[2]		0.02%
FA and AF[3]		0.001%

Notes:

HSL	Health screening levels (w/w)
1	Residential B with minimal access to soils; includes dwellings with fully and permanently paved yard space such as high rise buildings and apartments
2	Recreational C includes public open space such as parks, playgrounds, playing fields (e.g. ovals) secondary schools and unpaved footpaths.
3	The screening level of 0.001% w/w asbestos in soil for FA and AF (i.e. non-bonded / friable asbestos) only applies where the FA and AF are able to be quantified by gravimetric procedures, this does not apply to free fibres.
	indicates concentration exceeds HSL.

Table T6 – Summary of Groundwater Investigation Results (sampled 15 July 2014)

Sample ID	Heavy Metals								BTEX					TRHs				1,2,4-trimethylbenzene	Total PAHs
	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Benzene	Toluene	Ethylbenzene	o-xylene	m/p-xylene	F1*	F2**	F3 (>C_{16}-C_{34})	F4 (>C_{34}-C_{40})		
MW1-1	<1	0.5	<1	25	2	<0.0001	61	250	<0.5	0.5	<0.5	<1	<0.5	<50	<60	<500	<500	0.8	<1
MW2-1	2	0.5	<1	3	<1	<0.0001	8	11	<0.5	0.5	<0.5	<1	<0.5	<50	<60	<500	<500	0.5	<1
MW3-1	<1	0.3	<1	3	<1	<0.0001	13	29	<0.5	<0.5	<0.5	<1	<0.5	<50	<60	<500	<500	<0.5	<1
MW4-1	3	3.3	<1	37	19	<0.0001	200	600	<0.5	<0.5	<0.5	<1	<0.5	<50	<60	<500	<500	<0.5	<1
GIL (Marine Waters)	N.R.	0.7	27 (Cr III) 4.4 (Cr VI)	1.3	4.4	0.1[3]	7	15[1]	5000	N.R.[2]	N.R.[2]	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R

Notes: All results are in units of µg/L.

GIL Groundwater Investigation Level. All GIL values sourced from *National Environment Protection (Assessment of Site Contamination) Measure 1999 – Amendment 2013*, *Schedule (B1)* - Guideline on

N.R. No current publish criterion.

N.D. Not Detected.

N.A. Not analysed.

* To obtain F1 subtract the sum of BTEX concentrations from the C6-C10 fraction.

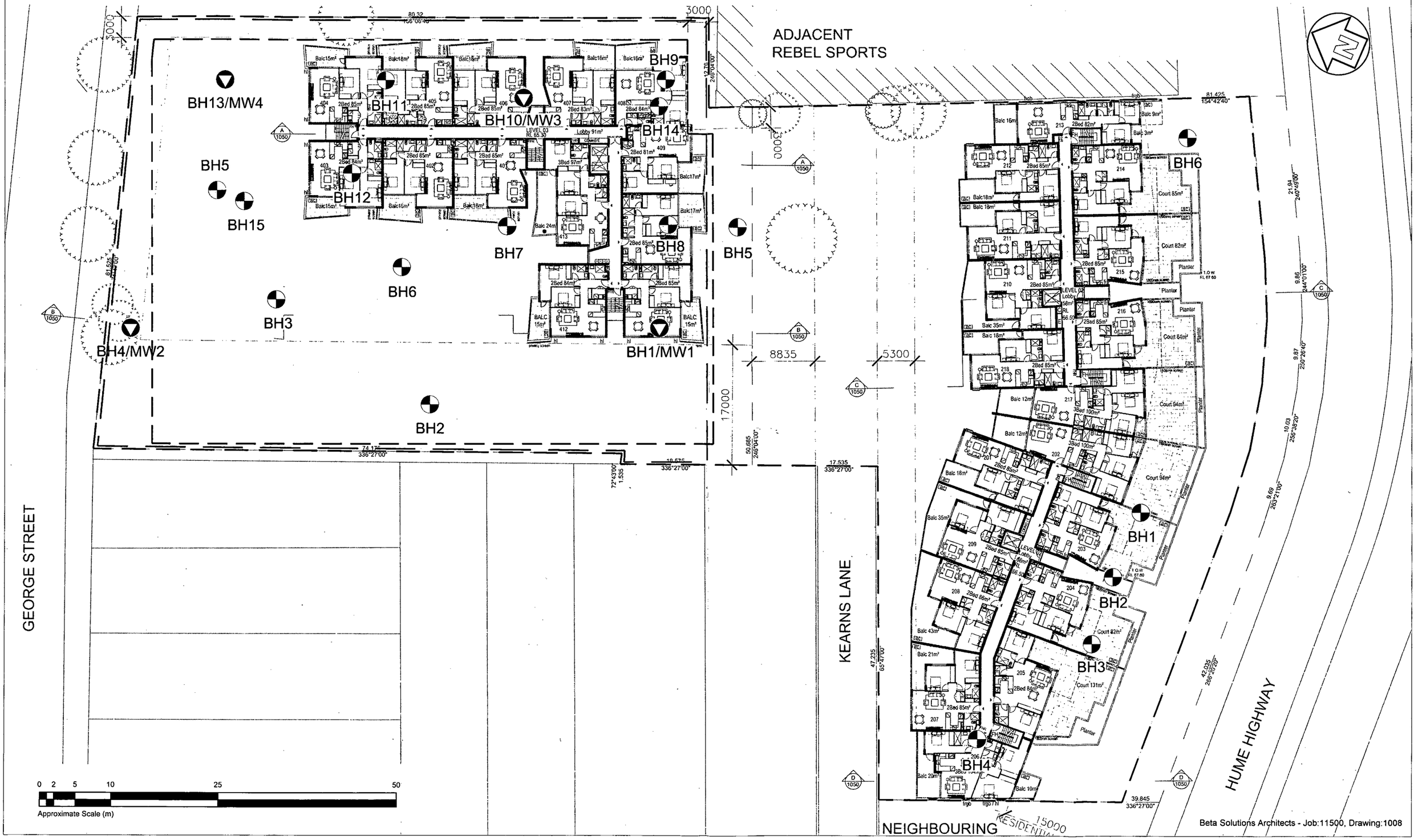
** To obtain F2 subtract Naphthalene from the >C10-C16 fraction.

1 Indicated threshold value may not protect key species from chronic toxicity, refer to ANZECC & ARMCANZ (2000) for further guidance.

2 NEPM (2013) Table 1A(4) Groundwater HSL A & HSL B for vapour intrusion in clay at the contaminant source depth ranges in sands 2m to <4m, considered most representative of site conditions.

3 Chemical for which possible bioaccumulation and secondary poisoning effects should be considered, refer to ANZECC & ARMCANZ (2000) for further guidance.
Note: Laboratory reporting limit for Mecury dissolved in water is 0.1 µg/L.

[ ] indicates concentration value exceeding the adopted GIL.



LEGEND

- Approximate Basement Excavation Footprint
- Approximate Assessment Boundary
- Approximate Site Boundary
- Approximate Sampling Location (EIS 2012)
- Approximate Monitoring Well Location (EI 2014)
- Approximate EI Geotechnical Borehole Location (EI 2014)
- Approximate Sampling Location (EI 2014)

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Drawn:	D.S.
Approved:	N.F.
Date:	30-01-15
Approx Scale:	1:500@ A3

DYLDAM DEVELOPMENTS PTY LTD
Detailed Site Investigation
18 George Street,
Yagoona NSW
Sampling Location Plan

Figure: 2

Project: E22241 AA