



Douglas Partners

Geotechnics • Environment • Groundwater

Integrated Practical Solutions

**REPORT
on
PHASE 1 CONTAMINATION ASSESSMENT**

**PROPOSED REDEVELOPMENT
WAHROONGA ESTATE**

**Prepared for
JOHNSON PROPERTY GROUP and
AUSTRALASIAN CONFERENCE ASSOCIATION**

**Project 45569.01
November 2008**



Douglas Partners
Geotechnics • Environment • Groundwater

REPORT
on
PHASE 1 CONTAMINATION ASSESSMENT

PROPOSED REDEVELOPMENT
WAHROONGA ESTATE

Prepared for
JOHNSON PROPERTY GROUP and
AUSTRALASIAN CONFERENCE ASSOCIATION

Project 45569.01
November 2008

Douglas Partners Pty Ltd
ABN 75 053 980 117

96 Hermitage Road
West Ryde NSW 2114
Australia

PO Box 472
West Ryde NSW 1685

Phone (02) 9809 0666
Fax (02) 9809 4095
sydney@douglaspartners.com.au



EXECUTIVE SUMMARY

This report details the results of a Phase 1 contamination study for the proposed redevelopment of the Wahroonga Estate at the intersection of Fox Valley Road and Comenarra Parkway, Wahroonga. The assessment was carried out at the request of the developer and project manager on behalf of the site owners, Australasian Conference Association (SCA).

The scope of work included a site walkover, the identification of the properties (street address and real property descriptions), review of the historical aerial photos, search of the Contaminated Land Register for Orders or Notices issued under the *Contaminated Land Management Act 1997* and a search of the NSW WorkCover database for Dangerous Goods Licence records.

The Estate is an irregular shaped area of some 62 ha located on undulating land. The site is divided into two sections by Coups Creek running approximately south-westerly through the centre of the site. North of the creek is known as the Mt Pleasant precinct which has been developed along the northern and north-western sections of the site. The other precinct is the larger of the two and is located on both sides (east and west) of Fox Valley Road. Structures on the site include a number of residential dwellings, Seventh-day Adventist Churches, Sydney Adventist Hospital with specialist clinics, a primary school, office blocks of the Pacific Regional Headquarters of the Adventist Church, Media Network Centre and the Adventist Development and Relief Agency.

Studies undertaken showed that the site has had, and continues to have, a mix of residential, religious, open space (including bushland), educational, commercial and health-based uses. The earliest use was a hospital which has had a presence since 1903 when the Sydney Sanatorium was officially opened on a site of 32 ha (80 acres), purchased in 1899. Other uses (historic) included orchards, market gardens and dairying.

Fill has been identified at a number of locations across the site and the significant areas recorded. The fill is usually associated with providing a level platform for construction of buildings and carparks. The potential for contamination arises from importing fill from contaminated sites. The potential for contamination of selected fill areas on the site has

been investigated by Coffey Environments and, for the areas investigated, the fill has not been found to be contaminated. It should be noted that whilst contamination has not been identified, contaminants such as asbestos can be present but not confirmed during such an investigation due to the sporadic nature of the distribution within the fill.

The natural soils at the site are derived from weathered sandstone on the side slopes and shale on the crest of the site. The depth to groundwater is likely to be heavily influenced by the Coups Creek valley and will probably be at a significant depth. Shallower seepage flows are likely to occur in the bedding planes and joints of the sandstone mass. Given the residential nature of the surrounding land and within the Estate, contamination and migration of contaminated groundwater onto the site, is considered to be a low risk.

Houses are frequently termite treated, particularly the older timber-framed houses, and the organo-chlorine pesticides (OCP) that were used for this purpose, such as Aldrin and Dieldrin, are persistent and, if formerly used, can still be present within the building footprint. Any houses or commercial structures that are to be demolished should be tested for the presence of OCP. The presence of OCP presents a potential cost risk if it is present at elevated concentrations (>50 mg/kg) at which point it becomes a Scheduled Waste if disturbed (at concentrations lower than 50 mg/kg disposal at a NSW landfill is possible). Remediation options for Scheduled Wastes are limited and it involves shipment to WA or Queensland for treatment and disposal. Other options, such as, on-site containment are potentially possible where the material is not disturbed, however, this strategy would result in a notation on the title with potentially adverse affects. In addition, old houses were frequently painted using lead-based paints and made from asbestos-cement sheet (fibro). Elevated lead levels in the surrounding soil, particularly within the building curtilage, can result in lead contaminated soil or soil impacted by the disposal of fibro on the site resulting in asbestos contamination .

There are a lot of registered dangerous goods depots at the Hospital. Most of these are small package depots with a potentially low risk to impact the soil and groundwater. The gas depots do not present a risk. One small package store associated with pesticides beneath the health centre did, however, show signs of spillage and/or leakage. The UST and ASTs present a potential higher level of risk, particularly the UST and some long term investigation/monitoring bores could be installed as a due diligence measure.

Garden markets and orchards are classified as contaminating activities and, therefore, in the context of this site, areas used for market gardens and orchards would be an Area of Environmental Concern (AEC). The potential contaminants would include heavy metals and pesticides and asbestos from the use of asbestos-containing material in any associated buildings/structures and irrigation pipework. Two areas within the Hospital precinct, and one area on the eastern side of Fox Valley Road were identified as having market garden and/or orchard uses. The areas used for market gardens and orchards have since been developed for buildings and carparks. It is likely that the disturbance of the soil during the redevelopment of all these areas would have reduced the potential contamination (by mixing with other soils during earthworks and/or removal as being unsuitable from a geotechnical perspective). The potential for contamination with respect to market gardens and orchards is therefore considered to be low.

Livestock pens have been identified where shown on the drawings. Interpretation of the aerial photographs is difficult, however, the implied presence of a dairy herd appears to be the most likely. The potential for contamination is based on the presence of pathogens and aesthetic considerations, with respect to animal wastes. The risk is considered to be low given that the area has been developed for buildings (Jacaranda Building) and carparks which would have reduced the potential for contamination (through earthworks and/or removal as being unsuitable from a geotechnical perspective).

The incinerator was present and general hospital wastes were burnt. This appears to have ceased *circa* 1970. The method of disposal of bottom ash is not known. Possibilities include off-site disposal to a landfill or on-site disposal in a trench or pit though there is no evidence to suggest that either method was employed.

Asbestos was used in the hospital for pipe lagging etc and a replacement programme has been adopted. The potential for asbestos sourced from within the Hospital buildings is considered to be low (other than in the sub-floor area). There is the potential for asbestos to be present in the soil fill, as discussed above, in material imported to the site or from the demolition of structures in times when informal burial disposal was common practice.

The sewer system should be considered to be an AEC given the presence of the nuclear medicine facility. Until sufficient testing has been carried out to confirm its current status it should be deemed to be potentially impacted.

In summary the AEC associated with the site are as follows;

- Footprints of buildings to be demolished, particularly timber or timber framed buildings;
- Areas of fill;
- Sewer lines;
- Underground fuel storage tanks;
- Above-ground fuel storage tanks;
- Pesticide store;
- Small areas of waste disposal on the bushland fringe.

The contamination status of the above AEC should be confirmed by intrusive sampling and analysis.

The Contaminants of Concern associated with the AEC are;

- Total petroleum hydrocarbons;
- Polycyclic aromatic hydrocarbons;
- Aromatic hydrocarbons (benzene, toluene, ethyl benzene and xylene);
- Heavy metals;
- Phenols;
- Organochlorine Pesticides;
- Radiation impacts from radio isotopes used;
- Asbestos.

The Estate is considered to have a low potential for contamination of the soil and groundwater, based on the current study and subject to the investigation of the above AEC. Council may require this confirmation prior to submission of the Development Application (DA) and is probably unlikely to condition the DA in this regard given the size and importance of the project. However, this could be confirmed with Council. It may be prudent to carry out the investigations to provide support to the DA. This would provide greater certainty to all parties.

It is assessed that the site can be made suitable for the proposed various land uses including residential with gardens and accessible soil subject to the appropriate verification/attenuation/remediation of the AEC.

TABLE OF CONTENTS

	Page
1. INTRODUCTION	1
1.1 General	1
1.2 Scope of Work	2
1.2.1 Site Description and History of Use	2
1.2.2 Site Inspection and Site Interview	2
2. SITE DESCRIPTION and proposed development	3
2.1 Site Description	3
2.2 Proposed Development	4
3. STUDIES UNDERTAKEN	5
3.1 Real Property Details	5
3.2 Site Walk-over	5
3.3 WorkCover Licences	7
3.4 Land Titles	9
3.5 Statutory Notices and Licences	9
3.6 Historical Aerial Photographs	10
3.7 Drainage, Geology and Hydrogeology	12
3.7.1 Drainage	12
3.7.2 Geology	12
3.7.3 Hydrogeology	13
3.8 Interview with Hospital Staff	14
3.9 Utility Services	15
3.10 Council Records and Section 149 Certificate	16
4. PREVIOUS FILL Contamination Assessment Report	17
5. DISCUSSION AND CONCLUSION	18
5.1 Discussion	18
5.2 Conclusion	22
6. LIMITATIONS	22
APPENDIX A - Site Drawings	
APPENDIX B - Aerial Photographs	
APPENDIX C - Site Photographs	
APPENDIX D - WorkCover Licence Search Records	
APPENDIX E - Historical Land Titles Summary	
APPENDIX F - Historical Photographs	
APPENDIX G - Groundwater Bore Data	
APPENDIX H - Sydney Water Hazard Alert	
APPENDIX I - Council Correspondence	
APPENDIX J - Coffey Environments Pty Ltd report (part only)	

LR:jlb
Project 45569.01
25 November 2008

**REPORT ON
PHASE 1 CONTAMINATION ASSESSMENT
PROPOSED REDEVELOPMENT
WAHROONGA ESTATE, WAHROONGA**

1. INTRODUCTION

1.1 General

This report details the results of a desktop study for the proposed redevelopment of the Wahroonga Estate at the intersection of Fox Valley Road and Comenarra Parkway, Wahroonga. The plan and location of the Site is shown in Drawing 1, Appendix A. The redevelopment is to accommodate the expansion of the Sydney Adventist Hospital together with the provision of new educational and community facilities, residential dwellings and a village centre with increased recreation and commercial opportunities. The assessment was carried out at the request of the Johnson Project Group, joint developers and project managers for Australasian Conference Association (SCA).

It is understood that redevelopment of the site has been declared a major project and a Part 3A concept plan is to be submitted to the NSW Government Department of Planning. The current study, a Phase 1 Assessment, was carried out to provide preliminary information on the potential contamination status of the site for the preparation of Part 3A concept plan only.

Once the desk top studies have been completed (in conjunction with a site walk-over), an assessment of the potential areas of environmental concern (AECs) and the potential contaminants of concern (COCs), if any, can be made. The sampling and analysis of soil and

groundwater was not a part of the scope of this report and may form the basis for Phase 2 investigations if deemed necessary by the current investigations.

1.2 Scope of Work

Douglas Partners undertook the following principle tasks:

1.2.1 Site Description and History of Use

- Identification of the properties - street address and real property description(s).
- Search of the historical aerial photos to identify land uses and changes in the land that may indicate potential for contamination;
- Search of the Contaminated Land Register for Notices issued under the *Contaminated Land Management Act 1997*;
- Search of the NSW WorkCover database records for Dangerous Goods Licence records.

1.2.2 Site Inspection and Site Interview

The site was inspected by walk-over and, where possible, observations made of situations that indicated the potential for contamination including the following:

- Identification of present and past land uses and specific site features and their locations on site;
- Identification of current waste disposal practices and signs of chemical spills;
- Identification of signs of earthmoving activities and the likely location of any filled areas;
- Presence of disturbed or discoloured soil;
- Presence of disturbed or affected vegetation;
- Presence of chemical containers, holding tanks, chemical odours;
- Proximity to surface waters and groundwater;
- Presence of possible asbestos-based products;
- Presence of underground fuel tanks or similar storages; and

- Discussions with site personnel including their dangerous goods storage and waste disposal practices.

In addition, a brief description of the following local features have been provided as required by the NSW EPA's publication *Guidelines for Consultants Reporting on Contaminated Sites*:

- Geology,
- Soil types,
- Topography,
- Hydrogeology, and
- Drainage.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 Site Description

The Estate is an irregular shaped area of some 62 ha located on undulating land. The site is divided into two sections by Coups Creek running approximately south-westerly through the centre of the site. The creek is located in a well vegetated valley some 20 – 30 m deep and about 150 m wide.

North of the creek is known as the Mt Pleasant precinct which has been developed along the northern and north-western sections of the site. There are residential houses located on along the northern boundary and Normanhurst Adventist Retirement Village in the north-western corner of the precinct. Site levels tend to fall to Coups Creek to the south and also to the east.

The other precinct is the larger of the two and is located on both sides (east and west) of Fox Valley Road. On the western side of the road from north to south are a number of residential dwellings, Seventh-day Adventist Churches, Sydney Adventist Hospital with specialist clinics and a primary school. The eastern side of the road is occupied from north to south by residential dwellings, office blocks of the Pacific Regional Headquarters of the Adventist Church and Media Network Centre and the Adventist Development and Relief Agency, then more

residential buildings. There is a gentle fall in surface levels in a southerly direction of some 10 m over 600 m. To the east of the developed area, there is bushland. East of Fox Valley Road, surface levels dips some 60 m towards a gully in the south-eastern corner of the site.

As part of the existing developments on the site, there are some areas of cut and fill mainly associated with the office blocks and the hospital buildings and carparks.

The survey plan of the site is given in Appendix A as Drawing 2.

2.2 Proposed Development

The proposed development (Drawing 6, Appendix A) is planned to upgrade and expand the health facilities and services, provide additional dwellings and retirement living facilities including independent living, a hostel and nursing home; provide expanded retail, educational, commercial and recreational opportunities and to retain quality open space and bushland.

It is understood that the Coups Creek corridor including the surrounding bushland is reasonably constrained for development and will be largely retained.

3. STUDIES UNDERTAKEN

3.1 Real Property Details

The Site comprises a total of 71 full and partial Lots within the Estate (the redevelopment site) and occupies approximately 62.07 hectares. A summary of the street addresses, Volumes and Folios are included as Appendix E. All but a few of the Lots are in Ku-ring-gai Council area with the Lot B in Deposited Plan 316271 and Lots 46-53 in Deposited Plan 15946 situated within Hornsby Council area.

3.2 Site Walk-over

A site walk-over was conducted on 12 May 2008 following roads, carparks and footpaths around the developed parts of the site and the principal walking tracks within the bushland areas.

The redevelopment site comprises a number of developed areas and a significant amount of bushland. The principal elements of the existing development include housing and a retirement village at Mt Pleasant Avenue in the north-west, Sydney Adventist Hospital in the centre of the site, a public school, housing and a church on the Comenarra Parkway and Fox Valley Road. The bushland includes incised valleys with steep valley sides and small sandstone cliff lines characterised by Coups Creek valley (flowing north-east to south-west through the centre of the site) and, mainly, more gentle slopes and less incised valleys to the east of Fox Valley Road.

DP's observation was that there appeared to be no contamination issues associated with the bushland except at the margins where the bush meets the developed areas and/or cleared as discussed below.

The walk-over was conducted with the objective of identifying areas of environmental concern (AEC). AEC are parts of the site where activities, former or current, have had the potential to adversely impact on the soil and/or groundwater by causing chemical contamination.

The existing development in the north-west includes standard residential housing on the northern side of Mount Pleasant Avenue and retirement housing on Waratah Way which is a private loop road leading off the southern side of Mount Pleasant Avenue. Both types of housing are typical suburban developments with houses and gardens and present no issues with respect to AEC with the minor exception of a small stockpile of waste materials (mainly soil) that has been dumped approximately 270 m from the western intersection of Mount Pleasant Avenue and Waratah Way. The stockpile(s) are shown located on Plate B7 in Appendix B.

The hospital precinct is fringed with open space (passive recreational areas) and car parks to the west and north of the main hospital buildings. These areas are located on the top of the Coups Creek Valley and, as such, the ground is falling to the west. In order to provide a level platform for parking and building platforms significant fill has been imported or won from cut on the site. Large fill batters, mainly grassed, can be seen on the western edge, adjacent to the bushland, and concrete, terracotta, asphalt can be seen embedded in the fill. A fragment of asbestos was also observed on the ground surface.

There are areas of minor impact within the bush in the same area where there has been small scale dumping of waste materials including an empty 200 litre (approximately) heating oil tank, patches of concrete, brick bats and asphalt fragments. The fill and some of the waste materials are shown in Photos 1-8, Plates C1-C4, Appendix C and located on Plate B7, Appendix B. An empty, disconnected kerosene tank was located at the southern end of the Centre for Health and Fitness on the eastern side of Fox Valley Road.

In the Hospital precinct there are a number of workshops near the incinerator block and there are a number of licensed Dangerous Goods Depots in the workshops. These are mainly small packaged goods depots which are small, steel cabinets with the appropriate signage. A typical small package depot and gas depot are shown in Photos 4-5, Plate C5, Appendix C and the location of the workshops and depots are shown in Drawing 3, Appendix A.

An underground fuel storage tank (UST) was noted where shown on Drawing 3, Appendix A, as Depot 15. Nearby was an inspection pit to access the top of the tank. There was no bowser near the fill point. The dangerous goods register indicates that the UST contains diesel (possibly installed circa 1995, refer to WorkCover records Appendix D).

3.3 WorkCover Licences

The WorkCover database of current and historical licences to store scheduled dangerous goods (DG) was accessed and searched. The results of the search identified 20 licensed stores containing a range of products, including;

- Class 2 gases (oxygen, petroleum gases);
- Class 3 Combustible Liquids (diesel, heating oil);
- Pesticides;
- Acids;
- Motor spirit.

Correspondence from WorkCover is included in Appendix D.

DP understands that the schedule and plan of DG depots obtained during the interview with the Engineering Manager and Works Coordinator is the current register of dangerous goods rather than the one supplied by WorkCover. The current, updated register is shown in Table 1 and the depots are located on Drawing 3, Appendix A.

Table 1 – List of Dangerous Goods Stores

Dangerous Good Store	UN Number	Class	Type of storage location or process	Packaging Group	Maximum Quantity	Unit	Typical/Average Quantity	Unit
DG 1	1073	2.2	Above Ground Tank		12,500.0	L		
DG 2	1075	2.1	Cylinder Store		108.0	kg		
DG 5		8	Roofed Store		240.0	L		
	1791			II				
	1789			II				
DG 6	1202	C 1	Above Ground Tank		20,000.0	L		
DG 7	1202	C 1	Above Ground Tank		15,000.0	L		
DG 8	1791	8	Roofed Store	II	100.0	L		
DG 9	1013	2.2	Above Ground Tank		180.0	L		
DG 10	1073	2.2	Above Ground Tank		2,500.0	L		
DG 11	1170	3	Roofed Store	II	500.0	L		
DG 12	1075	2.1	Cylinder Store		120.0	kg		
DG 13	1046	2.2	Cylinder Store		7.3	m ³		
DG 14		2.2	Cylinder Store		1,000.0	m ³		
	1046						12.0	m ³
	1070						200.0	m ³
	1066						80.0	m ³
	1013						120.0	m ³
	1002						200.0	m ³
	1072						100.0	m ³
	2156						3.0	m ³
DG 15		C 1	Underground Tank		12,000.0	L		
DG 16	1170	3	Flammable Goods Cabinet	II	160.0	L		
DG 17		2.2	Cylinder Store		75.0	m ³		
	1072						20.0	m ³
	1013						15.0	m ³
	1001						15.0	m ³
	1006						15.0	m ³
DG 18	1075	2.1	Cylinder Store		90.0	kg		
DG 20	1203	3	Flammable Goods Cabinet	II	250.0	L		
DG 21		6.1	Toxic Liquids Cabinet		120.0	L		
	3017			III				
	3010			II				
DG 22	1202	C 1	Above Ground Tank		2,500.0	L		
DG 23		2, 3	Roofed Store		1,000.0	L		
	1263	3		II			500.0	L
	1299	3		III			205.0	L
	1950	2					20.0	L
	1170	3		II			20.0	L

With respect to the potential to impact soil and groundwater, the underground storages are the most important (depot 15) followed by the above-ground storages of hydrocarbons such as diesel and heating oil (depots 1, 6, 7, 9, 10, 22) and roofed stores (depots 5, 8, 11, 23). Gas storage depots will not impact the soil and groundwater. Pesticides are noted to be stored in depot 21. A similar pesticide store was also evident in the basement of one building east of Fox Valley Road (Centre for Health and Fitness Studies). This latter depot was observed to have suffered some leakage onto the concrete floor.

Old records (dated 1982) shows one existing and one proposed 15,000 L petrol UST located to the rear of the Hospital. The plan provided does not locate the tank(s) with any certainty. The Engineering Manager has advised (email dated 4 June, 2008) that both tanks were installed but that they have both been decommissioned and documented although the documentation was not provided for review.

3.4 Land Titles

Current land title descriptions were provided to DP and a summary is included in Appendix E. Determination of the ownership or occupancy of the property, including company names, can assist in the identification of previous land uses and therefore assist in establishing potentially contaminating activities. The current owner is described as the Australasian Conference Association Ltd. Given the length of time that the Estate has been in the current ownership (since circa 1899), the overall residential nature of the surrounding neighbourhood, the nature of the Wahroonga Estate (non-industrial uses), the large number of titles that make up the Estate and a review of historical aerial photographs, research into the historical titles was not considered warranted and was not undertaken.

3.5 Statutory Notices and Licences

The Department of Environment and Climate Change's (DECC's) Register of Notices issued under the *Contaminated Land Management Act, 1997*, was searched on 16 May, 2008. There have been no Notices or Orders issued by the DECC with respect to the Lots which form the Wahroonga Estate.

A search of the NSW DECC public register of Licences, Applications and Notices on the DECC website indicated that the Hospital has a Licence for Hazardous, Industrial or Group A waste generation or storage up to 100-500 tonnes under S. 308 of the *Protection of the Environment Operations (POEO) Act 1997* (Licence No. 6546). No breaches or Notices have been issued under Licence No. 6546.

3.6 Historical Aerial Photographs

Selected historical aerial photographs were reviewed to establish the changes to the physical features of the Site over the years that photography was available. The photos are included as Plates B1-B7 in Appendix B.

1943 - Plate B1

The photograph shows the hospital, much smaller than today, surrounded by large areas of cleared land. To the west of the hospital and on the edge of the cleared land, adjacent to the bushland, is a circular structure. This may be the sewage treatment plant that was discussed with the Works Coordinator (refer to Section 3.8). We understand from the heritage consultant to the project (Australian Museum Business Services) that there was also an incinerator located at the site (as shown on Plate B1). The buildings to the north of the incinerator are probably a farmhouse and dairy also noted in the same discussion with the Works Coordinator. The pale coloured feature to the east of the treatment plant may be an associated pond, however, there is a similar feature, both in colour and shape, on the eastern side of Fox Valley Road in the north-east of the photograph which is considered unlikely to be pond. In this case, these features cannot be identified with certainty.

An apparent cultivated plot of land is noted on the eastern side of Fox Valley Road, broadly opposite the Hospital. The other development of note is the housing on both sides of Fox Valley Road at the northern end of the site. There is little or no on-site housing along the site boundaries fronting the Comenarra Parkway, Mt Pleasant Avenue or Waratah Way (the latter two had not yet been constructed). The Comenarra Parkway appears to be a gravel road and is a cul-de-sac.

1951 - Plate B2

There has been an expansion of the hospital. The treatment plant, dairy and incinerator buildings are still existing. There appears to be small areas of cultivation to the west of the hospital buildings, possibly including orchards. Historical photographs supplied by the Australian Museum Services showed significant orchards present in a photograph dated 1921. The cultivation looks typically like market gardens (possibly for hospital consumption?) and this is confirmed by the historical photograph in Plate F1, Appendix F. Similar cultivation can also be seen in two large Lots on the eastern side of Fox Valley Road (at the same location of the cultivated plot noted in Plate B2) which is also confirmed by the historical photograph in Plate F2, Appendix F. Housing development can be seen to be increasing in the surrounding suburbs although there are only small increases in housing along Fox Valley Road. Possible livestock (dairy cows?) are evident in the northern end of the cleared land. Plate F3, Appendix F, shows the cows in this area. Further photographic evidence (Australian Museum Services) indicates the dairy herd was there from as early as 1921 until at least 1964.

1961 - Plate B3

The hospital had not expanded very much since 1951. The treatment plant, dairy and incinerator buildings are still present. There are indications that the cultivation had expanded to the north of the hospital with a small number of fields or allotments evident. Housing had marginally increased along Fox Valley Road and Comenarra Parkway. Mt Pleasant Avenue and Waratah Way were not yet constructed. Livestock and livestock pens are evident north of the hospital and are probably related to dairy cows.

1970 – Plate B4

The hospital appeared to be similar to the way it was in 1961. The housing and developments along Fox Valley Road had expanded significantly. The market gardens evident in the earlier years on the eastern side of Fox Valley Road had now been developed on the northern half of the field. Market gardens around the hospital were still evident, as were the treatment plant, incinerator and dairy buildings. The livestock pens and livestock were evident. Mt Pleasant Avenue had been cleared but not constructed. Waratah Way was not yet constructed.

1982 – Plate B5

Significant changes to the hospital had occurred including new buildings and carparks. The treatment plant had been demolished and carparks had been constructed over part of the former

market gardens. The market gardens had expanded northwards and a cultivated field was evident on the western edge of the cleared land. The livestock pens and livestock were no longer evident. The incinerator may have become the current gas fired boiler. Mt Pleasant Avenue had been constructed and some houses were evident. Waratah Way was not yet constructed but the first building had been built. Development along Fox Valley Road and Comenarra Parkway were similar to that of today.

1994 – Plate B6

There had been continued expansion of the hospital with additional buildings and carparks. The former dairy buildings and livestock pens had all been demolished. Mt Pleasant Avenue had been constructed and most houses appeared to have been built. Waratah Way was not yet constructed but additional buildings had been built since 1982.

2005 – Plate B7

The site in 2005 was very similar to that in 2008. Waratah way was constructed together with most or all of the retirement housing built.

3.7 Drainage, Geology and Hydrogeology

3.7.1 Drainage

West of Fox Valley Road the site drains to Coups Creek whilst east of Fox Valley Road the site drains towards Twin Creeks Reserve. Both systems drain into the Lane Cove River which ultimately drains to the Parramatta River. The Hospital Site has several stormwater detention basins that controls the release of stormwater to Coups Creek.

3.7.2 Geology

The site is mapped on the Sydney 1:100,000 Series Geological Sheet indicates that the site is underlain by Ashfield Shale on the higher levels and Hawkesbury Sandstone on the lower levels. Ashfield Shale typical comprises black to dark grey shale and laminite. Hawkesbury Sandstone typically comprises medium to coarse grained quartz sandstone with very minor shale and laminate bands. An excerpt from the Geological Series sheet is shown superimposed on the a site plan on Drawing 4, Appendix A.

The Soil Conservation Service of NSW Soil Landscape Series Sheet for Sydney indicates that the site is underlain by Glenorie soil landscape group on the higher levels, Hawkesbury soil landscape group in the creek valley and possibly some West Pennant Hills soil landscape group on the eastern side of the site. Drawing 5, Appendix A reproduces the relevant section of the Landscape Series Sheet.

The Glenorie landscape is described as undulating to rolling low hills on the Wianamatta Group shales with soils on the crests of this landscape unit described as comprising about 1 m of red podzolic soils. The upper slopes of the landscape unit comprises red and brown podzolic soils while on the lower slopes the unit comprises yellow podzolic soils and humic clays. Soil characteristics include high soil erosion, localized impermeable highly plastic subsoil and moderately reactive.

The Hawkesbury landscape is described as rolling to very steep hills on Hawkesbury sandstone. The slopes are moderately inclined to precipitous with rock outcrops and broken scarps up to 10 m high. Boulders and cobbles cover up to 50% of the ground surface. Valleys are narrow and incised. The soils are described to comprise loose, coarse quartz sand or earthy, yellow brown sandy clay loam. On sideslopes and benches, the soils are generally discontinuous and comprise 100 – 300 mm of sand over bedrock while on the outside of benches there may be 50 – 150 mm of sand overlying 500 mm clay.

The West Pennant Hills Hawkesbury landscape is described as steep, narrow, generally south-west facing, hill slopes on the Hornsby Plateau on the Wianamatta Group shales. Steep slopes with colluvial benches with southerly and south-westerly aspects are dominant landforms elements. The dominant soils material comprise friable dark brown clay loam, whole coloured strongly pedal clays and mottled light grey, highly plastic clays. On upper slopes and midslopes, the typical profile comprises up to 500 mm of clay loam overlying more than 1 m pedal clay with some highly plastic clay and shale at depth. Common soil depth is generally greater than 2 m. Characteristics include steep slopes, an erosion hazard, seasonal waterlogging and moderately to highly reactive soils.

3.7.3 Hydrogeology

Groundwater is expected to be well below the surface, with seepage along weathered bedding planes and joints being present closer to the surface.

A search of the Department of Water and Energy's bore data base shows that there is one registered bore present within the site which was constructed in 2005 for 'recreation' purposes (assumed to be for watering playing fields). The bore is 180 m deep mainly through sandstone lithology with water bearing zones noted at various depths between 73 m and 156.5 m. The location plan and Groundwater Works Summary is included as Appendix G.

3.8 Interview with Hospital Staff

Discussions were held with the manager of Engineering and Infrastructure and the Works Coordinator. The Works Coordinator has been a long term employee at the Hospital for about 20 years.

A current register of Dangerous Goods stores was made available (*Dangerous Goods and Combustible Liquids Manifest*) and is included in Appendix D (refer also to Section 3.8 for discussion). The plan showing the location and store number is shown in Drawing 3.

A report prepared by Airsafe, occupational health consultants, *Hazardous Material Identification and Evaluation Report, Sydney Adventist Hospital, Fox Valley Road, Wahroonga, NSW*, dated February 2002 was made available. This document records the presence of asbestos-based products, synthetic mineral fibres and polychlorinated biphenyls (in light fittings) within the hospital buildings, presents a Hazard Rating with respect asbestos and provides recommendations for all materials. Several high risk items involving asbestos materials, particularly asbestos lagging, were recommended for removal. Less urgent items were recommended for removal during refurbishment. An updated report dated 2006 lists most of the necessary items have been removed with only the 'Remove if refurbishing items' still pending. Whilst disposal dockets have not been sighted, it is understood that a contractor with an appropriate AS1 licence was used for the removal works. In this event the asbestos and other hazardous materials should not have adversely impacted the site soils outside of the building footprint.

Part of the Estate used to be part of a dairy, as discussed above, and the Works Coordinator advised that the farm house and dairy sheds were demolished when the Jacaranda Lodge was

built. Based on an overlay of the 1943 photograph with the 2008 photograph the concurrent position of the former dairy buildings and the Jacaranda Lodge is confirmed. It was thought that the buildings were of brick construction with, possibly, fibro (asbestos-cement) eaves. No trace of these former structures are apparent. The location is shown in Drawing Plates B1- B3, Appendix B, and is discussed further in Section 3.6.

The Works Coordinator also advised that there was formerly an incinerator at the site that has been demolished. The location indicated by the Works Coordinator was marginally inside the bushland. However, this conflicts with the location of the former incinerator identified on the 1943 by the heritage consultant for the project (Australian Museum Business Services) and is shown in Plates B1-B3 and discussed further in Section 3.6. Based on an overlay with the 2008 photograph the position of the incinerator and the current hot water system boiler are concurrent. The incinerator operated until *circa* 1970 for the incineration of hospital grade wastes at which time this practice stopped and waste was then disposed by licensed contractors. The method and location of the disposal of the generated ash is not known.

It was also advised that there had been a sewage treatment plant in the vicinity of the former incinerator. This likely to be the circular structure shown on the 1943 photograph to the west of the incinerator and on the margins of the bushland as it was then. Whilst not raised during the discussion it is considered that the square-shaped feature, close to and to the east of the sewage plant which can be seen on the 1943 photograph, is possibly a sewage treatment pond.

It was known that fill was imported to the site from a shopping centre development on or near to Pennant Hills Road. The nature (classification) of the fill is not known.

The hospital necessarily generates a lot of contaminated waste and this is collected and disposed of by Veolia.

3.9 Utility Services

The Estate is supplied with all necessary utilities. Sydney Water have supplied a plan to Hyder Consulting (civil engineers for the project) which shows a main trunk sewer within the hospital precinct and in the Coups Creek valley. The plan carries the following wording in respect to this

sewer, 'Sydney Adventist Hospital discharge hazard effected refer SWC Hazard Alert 2-2007'. Enquiries with Sydney Water have determined that Hazard Alert 2-2007 (Appendix H) is in relation to the discharge of Iodine 131 into the sewer system and the precautions for workers who have to work on sewer lines and pumping stations where this element is discharged until holding tanks are constructed to hold the waste at the nuclear medicine facility. Iodine 131, a strong gamma emitter, has a half life of 8.02 days and it is now a requirement that the waste holding tanks are constructed within nine months of the date of the alert (dated June 2007). DP was advised that due to the cost of the tanks they were not constructed and that the use of I 131 was therefore discontinued. Sydney Water considered that the risk of exposure to workers was low (reference Hazard Alert) and therefore the risk after a prolonged time must be considered to be very low. Notwithstanding, DP considers it prudent for any work which is associated with the sewer to be checked by a radiological health professional in the first instance.

3.10 Council Zoning and Advice

The Estate is primarily located within the Ku-ring-gai Council local government area for planning matters. A very small portion on the northern boundary is within the adjacent Hornsby Council area.

The majority of the Estate is zoned Special Use 5(a) – Hospital. Other zonings include Residential 2(c), Special Use 5(a) – Church, Recreation 6(a) – Public and Recreation 6(a) – Private. Land within Hornsby Council is zoned Residential 2(a). Many of the current uses pre-date the Ku-ring-gai planning scheme of 1971 and therefore have 'existing use rights'.

Council was contacted to provide advice on whether Council was aware of any contamination issues relating to the site. Council responded by letter dated 20 August 2008. The letter to Council and their response are included as Appendix I. A search of Council records did not identify any contamination issues, however, their advice was that potentially contaminating activities had occurred on the site including agricultural and horticultural activities including service stations. Clarification of the service station use was sought and Council verbally advised that this issue was raised based on the presence of an underground storage tank on the hospital precinct and was not, *per se*, in relation to an actual service station.

4. PREVIOUS FILL CONTAMINATION ASSESSMENT REPORT

In May 2008, Coffey Environments Pty Ltd prepared a report, *Contamination Assessment, Sydney Adventist Hospital, 185 Fox Valley Road, Wahroonga NSW* for Taylor Thomson Whitting in relation to the proposed construction of four buildings within the Hospital site. The report is attached as Appendix J (Appendix J includes the text, figures and tables and excludes the report appendices). The report included a review of site history (in part overlapping with/complementary to the current study by DP) and intrusive soil sampling within the proposed building footprints. A total of 28 boreholes were drilled (partly as a requirement for geotechnical investigations and partly for environmental purposes) and up to 63 samples selected for analysis. The bore logs showed that fill was identified at depths ranging from 0.2 m to a maximum recorded depth of 6.9 m (note that this may not be the maximum depth of fill on the site). A groundwater assessment was not part of the Coffey study. The analytical scheme that was adopted included a wide range of potential organic and inorganic contaminants as follows:

- Heavy metals;
- Petroleum hydrocarbons;
- Benzene, toluene, ethyl benzene and xylene;
- Organ-chlorine pesticides;
- Polychlorinated biphenyls;
- Polycyclic aromatic hydrocarbons;
- Asbestos.

However, not all samples were selected for analysis for all contaminants. For example, 63 samples were analysed for heavy metals whilst only 15 samples were analysed for organochlorine pesticides and seven samples were analysed for polychlorinated biphenyls and asbestos. Whilst solvents may have been used on the site, no analysis of volatile organic compounds was undertaken.

The results showed heavy metals were generally low, PCB, organochlorine pesticides, petroleum hydrocarbons and BTEX compounds were below the limit of reporting, benzo(a)pyrene and polycyclic aromatic hydrocarbons were detected at concentrations below the criteria for a commercial or industrial land use. Asbestos was also not detected in the samples analysed. The report concluded that, *Based on the results of this study, it is considered that the potential for areas assessed to be affected by land contamination that would adversely affect the proposed development is low and therefore the areas are considered*

suitable for the proposed commercial use. The report also concluded that the waste soil classification for off-site disposal was as General Solid Waste.

5. DISCUSSION AND CONCLUSION

5.1 Discussion

The site has had, and continues to have, a mix of residential, religious, open space (including bushland), educational, commercial and health-based uses. The earliest use was a hospital which has had a presence since 1903 when the Sydney Sanatorium was officially opened on a site of 32 ha (80 acres), purchased in 1899. Other uses (historic) include market gardens, orchards and dairying.

Large parts of the site have been maintained as bushland, particularly the steep-sided valley of Coups Creek and the steeper slopes on the eastern side of Fox Valley Road. Gradual development has occurred since 1903 at the hospital and as strip residential, educational and religious development along Fox Valley Road (both sides) and the Comenarra Parkway (north side). Residential development on Mt Pleasant Avenue and Waratah Way, was developed most recently from the bushland since 1970s and 1990s respectively. Housing includes a variety of construction methods including brick, timber and fibro (asbestos-containing cement sheets). Anecdotal evidence (*pers com* hospital Works Coordinator) indicates that some fibro garden sheds were demolished and removed from the rear of some Comenarra Parkway properties. Removal was apparently carried out by a licensed asbestos removal contractor (AS1 licence). Similar structures still exist in the back gardens of some of the older style Fox Valley Road houses. Bushland and housing have a low to very low potential for land contamination although pest control, building painting practices and waste disposal practices (including demolition debris left on the ground surface) on some residential sites may have a limited impact (see below). This is also true, in part, for the commercial and religious uses of the site (pest control, building painting practices) depending on the age of the structures. No other significant issues have been identified through the site inspection, discussions, aerial photographs or other sources associated directly with these two land uses.

Fill has been identified at a number of locations across the site and the significant areas identified on the drawings (Drawing 2). The fill is usually associated with providing a level platform for construction of buildings and carparks. Fill may also exist at other, unidentified locations as it is not always possible to identify such areas. Some fill may be sourced from the site, such that occurs during 'cut and fill' operations generated from on- or off-site, or imported from off-site sources. The potential for contamination arises from the use of contaminated source sites which could be from an on-site AEC or because of the land use of the off-site source. The potential for contamination of selected fill sites has been investigated by Coffey Environments and, for the areas investigated, the fill has not been found to be contaminated. It should be noted that whilst contamination has not been identified, contaminants such as asbestos can be present but not confirmed during such an investigation due to the sporadic distribution within the fill. In this regard, a single fibro fragment along with concrete, asphalt and other demolition type wastes were observed, during the walk-over, on the fill batter slope of the Hospital carpark. Inclusion of fibro within the fill can result in the classification of soil waste as a Special Waste (Asbestos Contaminated) rather than the General Solid Waste classification currently applying. Whilst the results of the Coffey investigation give a degree of comfort in relation to the quality of the fill on the site, variations within the fill may exist and the results cannot be extrapolated to all fill zones. Other fill zones would need to be investigated to confirm the status of the fill material.

The natural soils at the site are derived from weathered sandstone on the side slopes and shale on the crest of the site. The depth to groundwater is likely to be heavily influenced by the Coups Creek valley and will probably be at a significant depth with seepage flows likely to occur in the bedding planes and joints of the sandstone mass at a shallower depth. Given the residential nature of the surrounding land and within the Estate, contamination of and migration of contaminated groundwater onto the site is considered to be a low risk.

Houses are frequently termite treated, particularly the older timber-framed houses, and the organo-chlorine pesticides (OCP) that were used for this purpose, such as Aldrin and Dieldrin, are persistent and, if previously used, can still be present within the building footprint. Any houses or commercial structures that are to be demolished should be tested for the presence of OCP. The presence of OCP presents a potential cost risk if it is present at elevated concentrations (>50 mg/kg) at which point it becomes a Scheduled Waste if disturbed (at concentrations lower than 50 mg/kg disposal at a NSW landfill is possible). Remediation options

for Scheduled Wastes are limited and it involves shipment to WA or Queensland for treatment and disposal. Other options, such as, on-site containment are potentially possible where the material is not disturbed, however, this strategy would result in a notation on the title with potentially adverse affects. In addition, old houses were frequently painted using lead-based paints and made from asbestos-cement sheet (fibro). Elevated lead levels in the surrounding soil, particularly within the building curtilage, can result in lead contaminated soil or soil impacted by the disposal of fibro on the site resulting in asbestos contamination .

There are a lot of registered dangerous goods depots at the Hospital. Most of these are small package depots with a potentially low risk to impact the soil and groundwater. The gas depots do not present a risk. One small package store associated with pesticides beneath the health centre did, however, show signs of spillage and/or leakage. The UST and ASTs present a potential higher level of risk, particularly the UST and some long term investigation/monitoring bores could be installed as a due diligence measure.

Garden markets and orchards are classified as a potentially contaminating activity and, therefore, in the context of this site, areas used for market gardens and/or orchards would be an AEC. The potential contaminants would include heavy metals and pesticides in accordance with the NSW DEC publication *Guidelines for the Assessing Former Orchards and Market Gardens*, 2005, and the use of asbestos-containing material in the associated buildings/structures and irrigation pipework. Two areas within the Hospital precinct, and one area on the eastern side of Fox Valley Road were identified as having market garden and/or orchard uses. The areas used for market gardens and orchards have since been developed for buildings and carparks. It is likely that the disturbance of the soil during the redevelopment of all these areas would have reduced the potential contamination (by mixing with other soils during earthworks and/or removal as being unsuitable from a geotechnical perspective). The potential for contamination with respect to market gardens and orchards is therefore considered to be low.

Livestock pens have been identified where shown on the drawings. Interpretation of the aerial photographs is difficult, however, the implied presence of a dairy herd appears to be the most likely (refer to historic photographs Appendix F). The potential for contamination is based on the presence of pathogens and aesthetic considerations, with respect to animal wastes. The risk is considered to be low given that the area has been developed for buildings (Jacaranda Building)

and carpark which would have reduced the potential for contamination (through earthworks and/or removal as being unsuitable from a geotechnical perspective).

The incinerator was present and general hospital wastes were burnt. This appears to have ceased circa 1970 (Coffey 2008). The method of disposal of bottom ash is not known. Possibilities include off-site disposal to a landfill or on-site disposal in a trench or pit though there is no evidence to suggest that either method was employed.

Asbestos was used in the hospital for pipe lagging etc and a replacement programme has been adopted were this was recommended by the consultant who prepared the *Hazardous Material Identification and Evaluation Report* and associated Asbestos Register. The potential for asbestos sourced from within the Hospital buildings is considered to be low (other than in the sub-floor area). There is the potential for asbestos to be present in the fill, as discussed above, in material imported to the site or from the demolition of structures in times when informal burial disposal was common practice.

The sewer system should be considered to be an AEC given the presence of the nuclear medicine facility. Until sufficient testing has been carried out to confirm its current status it should be deemed to be potentially impacted.

In summary the AEC associated with the site are as follows;

- Footprints of buildings to be demolished, particularly timber or timber framed buildings;
- Areas of fill;
- Sewer lines;
- Underground fuel storage tanks;
- Above-ground fuel storage tanks;
- Pesticide store;
- Small areas of waste disposal on the bushland fringe.

The contamination status of the above AEC should be confirmed by intrusive sampling and analysis.

The Contaminants of Concern associated with the AEC are;

- Total petroleum hydrocarbons;
- Polycyclic aromatic hydrocarbons;
- Aromatic hydrocarbons (benzene, toluene, ethyl benzene and xylene);
- Heavy metals;
- Phenols;
- Organochlorine Pesticides;
- Radiation impacts from radio isotopes used; and
- Asbestos.

5.2 Conclusion

The Estate is considered to have a low potential for contamination of the soil and groundwater, based on the current study and subject to the investigation of the above AEC. The AEC do not appear to be crucial to the

It is assessed that the site can be made suitable for the proposed various land uses including residential with gardens and accessible soil subject to the appropriate verification / attenuation / remediation of the AEC.

6. LIMITATIONS

DP have performed investigation and consulting services for this project in accordance with current professional and industry standards for a Phase 1 land contamination investigation. Whilst every effort has been made to accurately describe the site conditions, conditions may differ to those identified. Therefore DP, nor any other reputable consultant, cannot provide unqualified warranties nor does DP assume any liability for site conditions not observed or accessible during the time of the investigations.

Despite all reasonable care and diligence, the conditions encountered may not be representative of actual conditions. In addition, site characteristics may change over 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 DP's investigations and assessment.

No site investigations can be thorough enough to provide absolute confirmation of the presence or absence of substances which may be considered contaminating, hazardous or polluting. Similarly, the level of investigation undertaken cannot be considered to unequivocally characterise the degree or extent of contamination on the site. In addition, regulatory or guideline criteria for the evaluation of environmental soil and groundwater quality are frequently being reviewed and concentrations of contaminants which are considered acceptable in the present may in the future be considered unacceptable.

This report has been prepared only for the use of the Johnson Property Group and Australasian Conference Association Ltd; any reliance assumed by other parties on this report shall be at such parties own risk. Any ensuing liability resulting from use of the report by other parties cannot be transferred to DP.

DOUGLAS PARTNERS PTY LTD

Lindsay Rockett
Senior Associate

Reviewed by



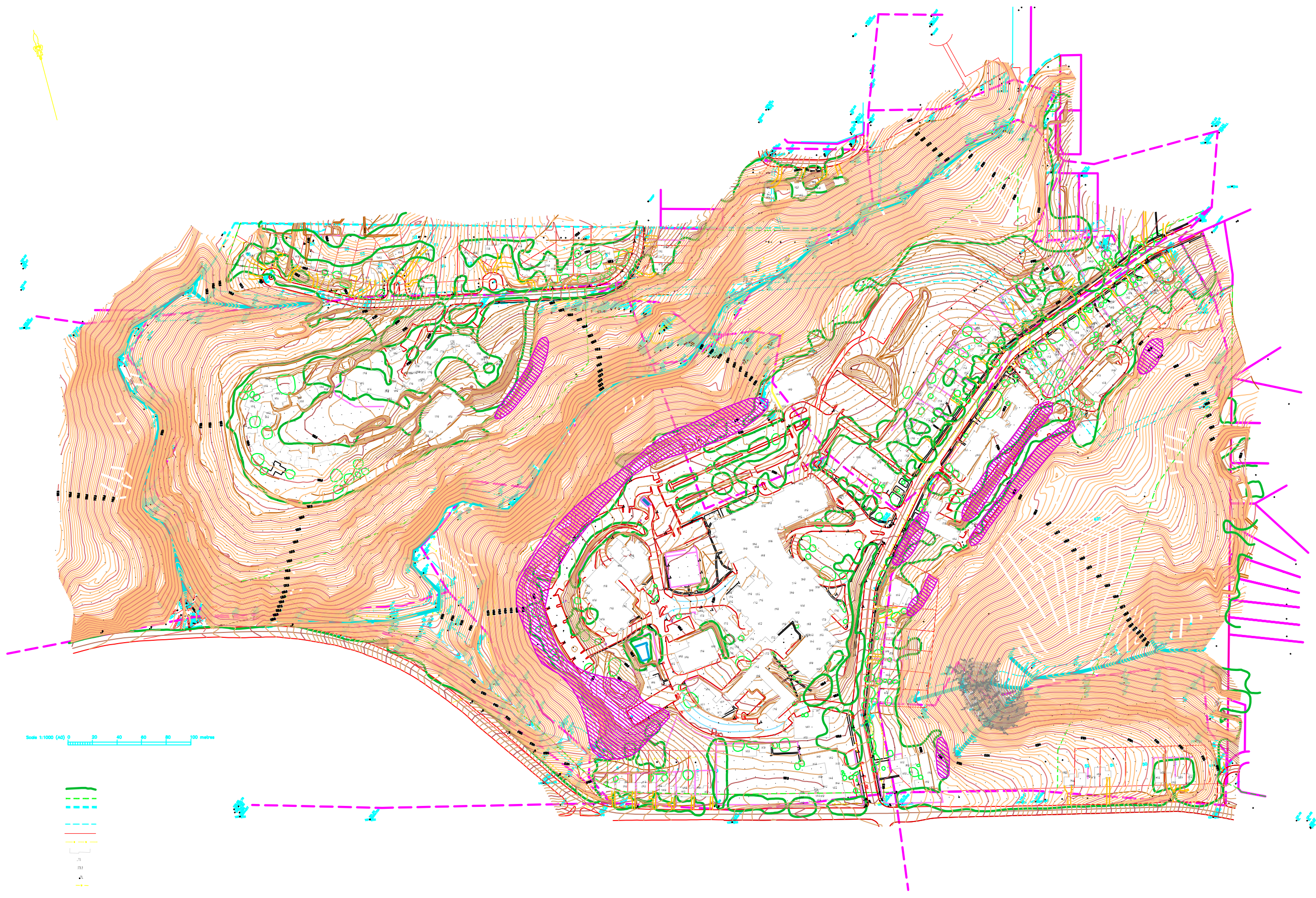
R Tong
Principal

APPENDIX A
Drawings



Source: Bligh Voller Nield 2008

Project Title	Wahroonga Estate, Location of Site	Project	June	Drawing
Project Address	148 Fox Valley Road	45569.01	2008	1
Project Suburb/Location	Wahroonga NSW 2076			



Scale 1:1000 (A0) 0 20 40 60 80 100 metres



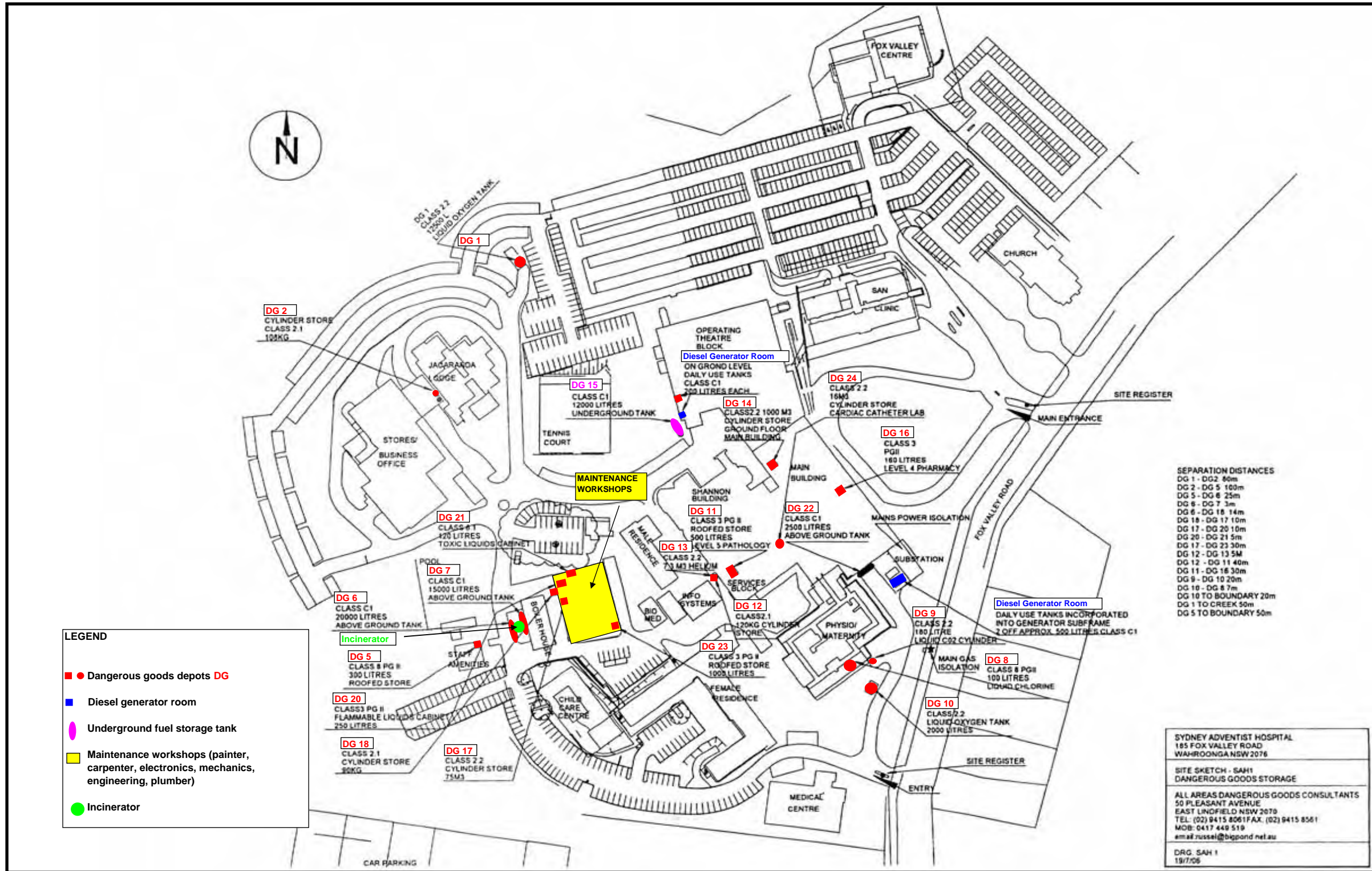
LEGEND
 FILL AREA



CLIENT:	Johnston Property Group	OFFICE:	SYDNEY
PROJECT No:	45569.00	DRAWN BY:	PSCH
DATE:	27.5.2008	SCALE:	1:4000@A3 Approx.
		APPROVED BY:	

TITLE: **Survey Plan
 Wahroonga Estate
 Fox Valley Road
 WAHROONGA**

DRAWING No:
2

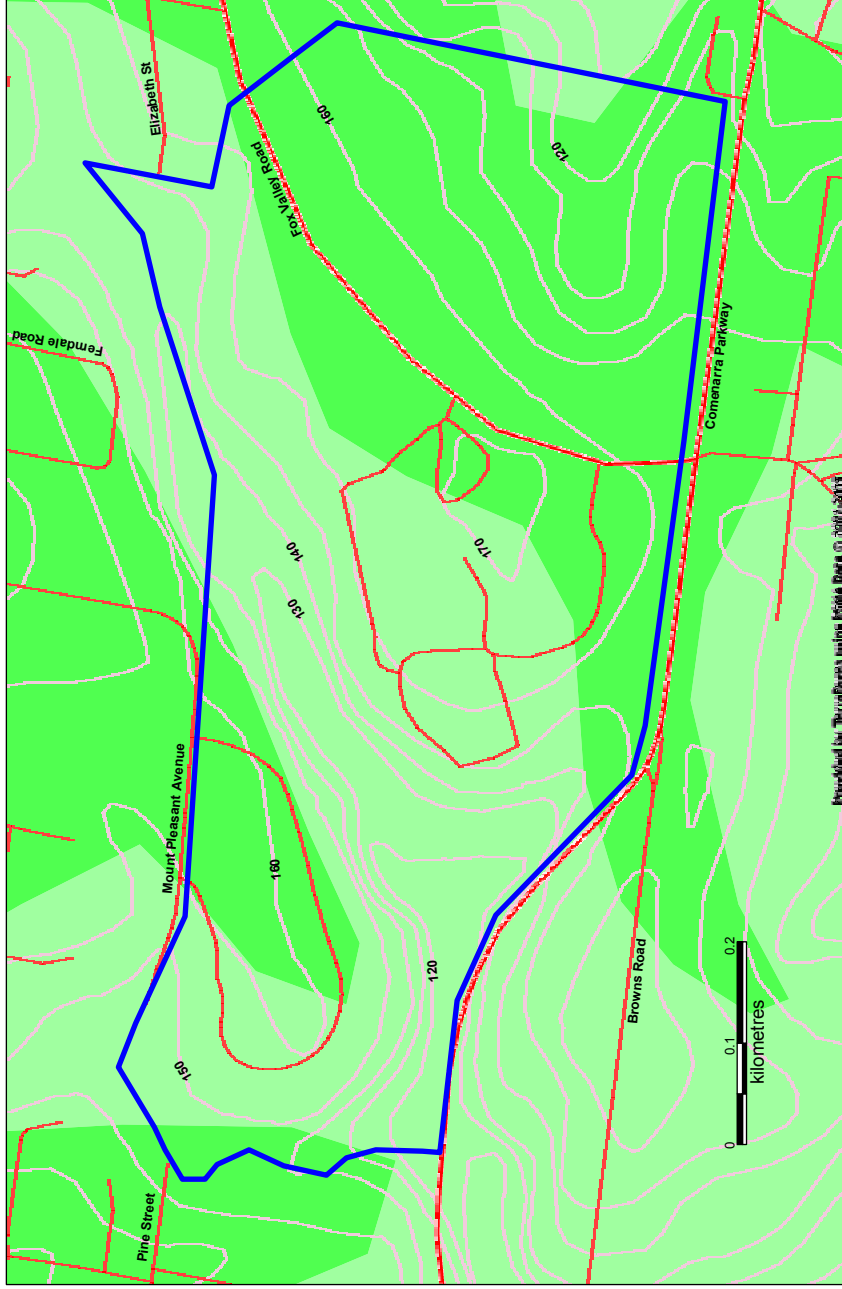


Wahoonga Estate, Location of workshops and dangerous goods depots (DPG)
 148 Fox Valley Road
 Wahoonga NSW 2076

Project
 45569.01




June
 2008

Drawing
 3



NOTES: Contour and road data obtained from TerraPages WMS service; geological data is from Sydney 1:100,000 Geology Sheet, 1983

LEGEND

-  Approximate Site Boundary
-  Rwa - Ashfield Shale: black to dark-grey shale and laminite
-  Rh - Hawkesbury Sandstone: medium to coarse grained quartz sandstone, very minor shale and laminite lenses



Douglas Partners
Geotechnics . Environment . Groundwater

Title: **GEOLOGY MAP**
 WAHROONGA ESTATE
 FOX VALLEY ROAD, WAHROONGA NSW

Client: JOHNSON PROPERTY GROUP

Drawn by: ALT Scale: 1:7,500@A3

Approved by:

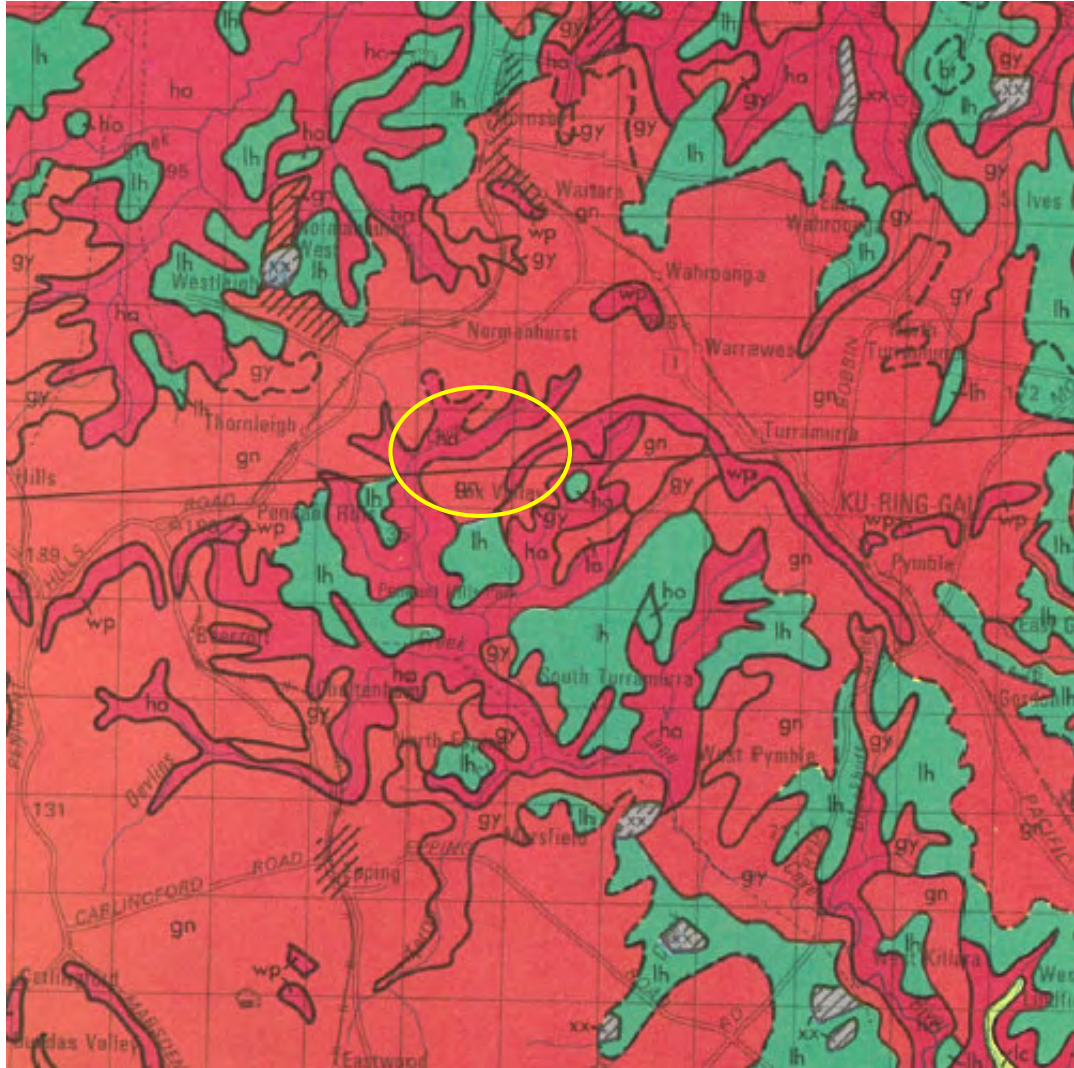
Office: Sydney

Project Number: 45569.00

Date: 21 MAY 2008

Drawing No: 4

Sydney, Newcastle, Brisbane, Wollongong, Campbelltown,
 Melbourne, Perth, Wyong, Townsville, Cairns, Darwin, Canberra



Douglas Partners
Geotechnics, Environment, Groundwater

Sydney, Newcastle,
Brisbane, Melbourne,
Perth, Wyong, Canberra

Campbelltown, Townsville,
Wollongong, Darwin, Cairns
Gold Coast, Sunshine Coast

TITLE: **Soil Landscape Sheet**
Wahroonga Estate, Fox Valley Road, WAHROONGA NSW

CLIENT: Johnson Property Group

OFFICE: SYDNEY

DRAWN BY: PSCH

SCALE: As shown

PROJECT No: 45569.00

DRAWING No: 5

APPROVED BY:

DATE: 27.5.2008



Source: Bligh Voller Nield 2008

Wairoonga Estate, Proposed Development
148 Fox Valley Road
Wairoonga NSW 2076

Project
45569.01

June
2008

Drawing
6

APPENDIX B
Aerial Photographs

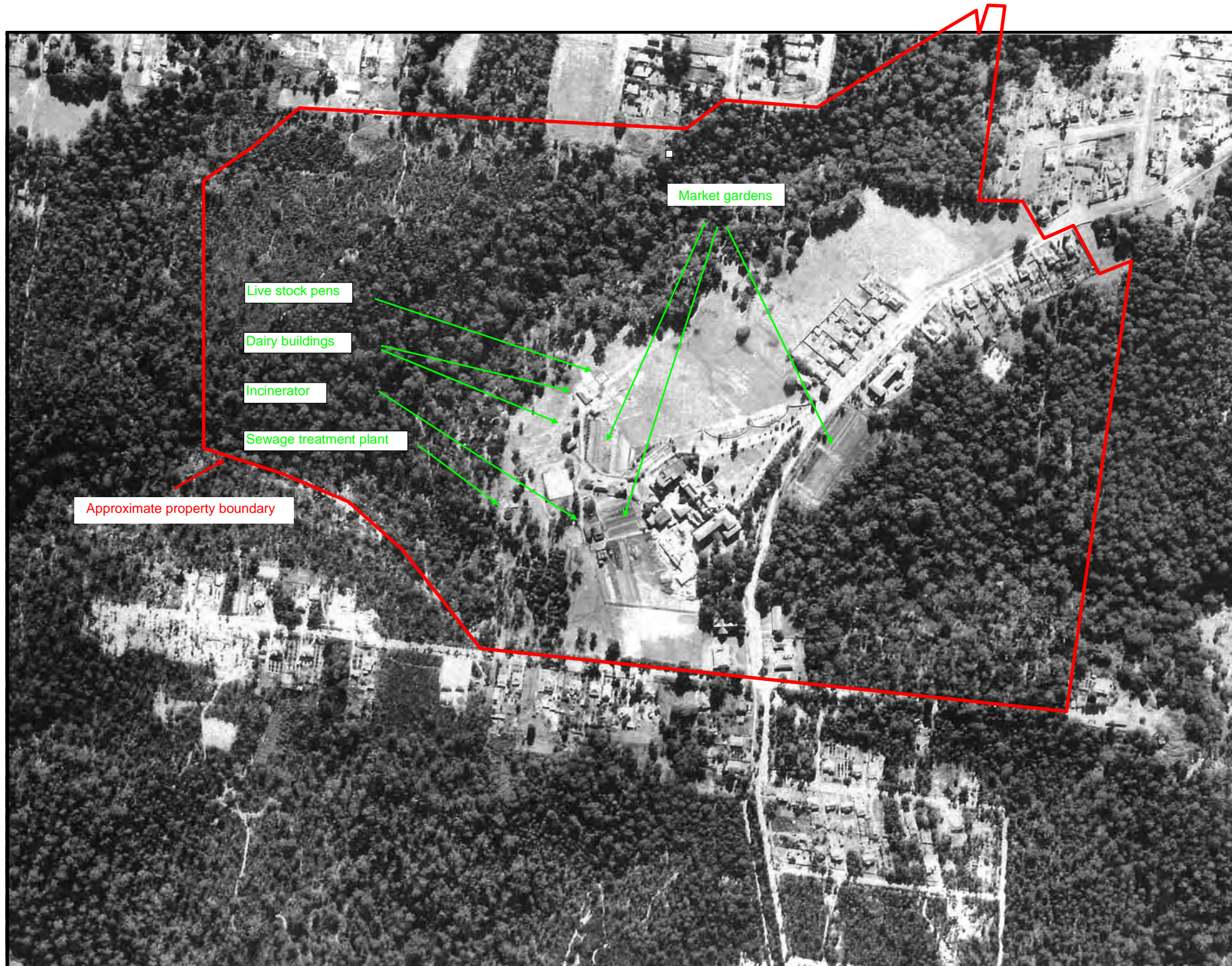


Wahroonga Estate: Phase 1 Contamination Assessment, Aerial Photograph 1943
148 Fox Valley Road
Wahroonga NSW 2076

Project
45569.01

June
2008

Plate
B 1



Wairoonga Estate: Phase 1 Contamination Assessment, Aerial Photograph 1951
148 Fox Valley Road
Wairoonga NSW 2076

Project
45569.01

June
2008

Plate
B 2



Wahroonga Estate: Phase 1 Contamination Assessment, Aerial Photograph 1961
148 Fox Valley Road
Wahroonga NSW 2076

Project
45569.01

June
2008

Plate
B 3