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Report on
Phase 1 Contamination Investigation with Limited Sampling

Proposed
Comprehensive Cancer and Blood Disorder Centre
Prince of Wales Hospital, Randwick

Prepared for
Health Infrastructure

Project 72505.01
March 2012

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	72505.01	Document No.	1
Document title	Report on Phase 1 Contamination Investigation with Limited Sampling, Proposed Cancer and Blood Disorder Centre (CCBDC)		
Site address	Prince of Wales Hospital, Corner Avoca and High Streets, Randwick		
Report prepared for	Health Infrastructure		
File name	P:\72505.01 RANNDWICK, Phase 1 with Limited Sampling NSA\Docs\Reporting\Final Report\72505.01_POWRandwick_FINAL-28032012.doc		

Document status and review

Revision	Prepared by	Reviewed by	Date issued
0	Kate Sargent	Paul Gorman	28 March 2012

Distribution of copies

Revision	Electronic	Paper	Issued to
0	1		Mr Bruce Greenwood of Health Infrastructure
			Mr Matthew Owen of Thinc Projects Australia Pty Ltd

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
Author		28 March 2012
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Executive Summary

This report presents the results of a Phase 1 contamination investigation with limited sampling, undertaken for the proposed development of a Cancer and Blood Disorder Centre (CCBDC) at The Prince of Wales Hospital, corner of Avoca and High Streets, Randwick, New South Wales.

It is understood that the development will include the construction of a three storey building with two levels of basement. The investigation was required for planning purposes and to address the requirements of SEPP 55.

The objectives of the current Phase 1 investigation were to assess the potential for contamination of the site based on past and present site use, and to comment on the need for further investigation and/or management of contamination (if required).

It is noted that the environmental and geotechnical works were conducted concurrently. Geotechnical results will be provided in a separate report.

The scope of the current assessment comprised a desktop study of site history information supported by limited soil and groundwater sampling and testing.

Prince of Wales Hospital (Hospital) is situated approximately 8 km to the south east of the Sydney CBD (see Site Plan, Appendix A) and occupies a total area of approximately 13.5 hectares (ha). The investigation conducted by Douglas Partners (DP) is focused on the north eastern portion of the Hospital, hereafter referred to as “the site”.

A groundwater bore search found that thirteen groundwater bores were located within a 2 km radius of the site. Four bores were noted to be used for recreation purposes, however two had been abandoned. Two bores were used for commercial or industrial purposes, while two bores were used for domestic purposes. Three bores were noted to be used for groundwater remediation. The remaining two bores were noted as test bores. Standing water levels (SWL) in these registered bores were noted to be between 2.71 m bgl and 27.00 m bgl.

Randwick Council’s Acid Sulphate Soils Map (March 2007), indicates that the site is in an area of no known acid sulphate soil.

Historical information indicated that the site was used by The Society for Destitute Children from 1858. A dairy farm was maintained on the site in the 1870s. A cemetery was also located on the site. In 1915 the NSW Government converted the institution into a military hospital, known as The Fourth Australian Repatriation Hospital. In 1953 it was no longer required for this use and became known as the Prince of Wales Hospital. In 1994 the huts associated with the repatriation hospital were demolished to make way for construction of new buildings.

A number of dangerous goods were found in the surrounding area of the site; however none were located directly in the area of question.

The site was not found to be listed on the CLM or POEO registers.

Identified areas of environmental concern include the potential for contamination due to imported fill, or use of hospital waste for levelling purposes, historical agricultural (dairy farming) contamination to

surface soils from fertiliser or pesticide application, chemicals associated with radiation treatment at the institute and hydrocarbons from potential / unknown USTs or vehicle use.

Results of the limited field investigation indicated fill at all five bore locations to a maximum depth of 0.5 m bgl. Fill across the site comprised brown, fine to medium grained silty sand fill. Slag and ash were noted in at several locations. Natural soil was encountered underlying the fill and was noted to comprise yellow / brown fine grained sand and some clay. Sandstone bedrock was encountered at all locations.

The results of the soil analyses indicate that the organic and inorganic contaminant concentrations in all but one analysed soil sample were within the adopted site assessment criteria (SAC) for parks, recreational open space and playing fields, including secondary schools, land use. Sample BH1/0.2-0.25 was found to have a B(a)P concentration of 3.2 mg/kg, which was above the adopted criteria (2 mg/kg).

Tested samples were also assessed against the NSW *Waste Classification Guidelines* (2009) in order to make a preliminary determination as to the potential classification of soils should bulk excavation occur across the site. Test results on fill samples indicated that the fill would most likely classify as **General Solid Waste (non putrescible)** for disposal purposes.

Three groundwater monitoring wells were installed across the site to enable the sampling and analysis of groundwater. The majority of samples recorded results below the laboratory PQL and thus generally within the GIL. The following locations reported exceedances:

- BH2: zinc (40 µg/L)
- BH4: arsenic (7 µg/L), copper (7 µg/L), lead (5 µg/L), zinc (78 µg/L) and TPH C_6-C_9 (170 µg/L); and
- BH5 and duplicate BD1/220711: arsenic (5 µg/L) and copper (10 µg/L and 11 µg/L respectively).

The heavy metal results are not considered to be significant and are probably indicative of 'background' levels for the site. The source of the TPH C_6-C_9 exceedance was unknown since WorkCover records did not indicated any underground storage tanks (USTs) within the site or Hospital grounds. The soil results indicated no detectable concentrations of TPH. There was the potential that the exceedance is from an off-site source, such as an up gradient service station.

Based on the groundwater results, DP conducted a second round of testing on all three bores for volatile organic compounds and TPH. The results indicated that TPH concentrations in all groundwater samples were below the adopted investigation levels, suggesting the initial detected TPH may have been an anomaly.

As previously mentioned, the current assessment was undertaken for planning purposes and to address the requirements of SEPP55. Given the operational status of the site and associated access constraints, a Phase 1 contamination assessment with limited soil sampling (from five test bores) and groundwater sampling (from three groundwater monitoring wells) was considered to be an appropriate level of assessment at this stage. This staged approach is in line with the provisions of the SEPP55.

Based on the Phase 1 contamination investigation with limited sampling, preliminary results indicate that there is generally a low risk of soil or groundwater contamination within the site. The site is

generally considered to be environmentally suitable for continued hospital use. However, given the limited nature of the investigation undertaken, the following recommendations are provided:

- Any filling or natural soils / bedrock requiring removal from the site must be initially waste classified in accordance with the NSW *Waste Classification Guidelines* (2009). This should preferably be completed *ex situ*;
- A hazardous materials inspection should be carried out on the buildings to be demolished and/or renovated as part of the project; and
- Upon demolition of the existing buildings, an inspection of the ground surface should be carried out by a qualified occupational hygienist or environmental consultant to assess the potential for asbestos contamination.

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1. Introduction

This report presents the results of a Phase 1 contamination investigation with limited sampling, undertaken for the proposed development of a Cancer and Blood Disorder Centre (CCBDC) at The Prince of Wales Hospital, corner of Avoca and High Streets, Randwick, New South Wales. The investigation was commissioned by Mr Matthew Owen of Thinc Projects Australia Pty Ltd, on behalf of Mr Bruce Greenwood of Health Infrastructure – NSW Health, in an email dated 8 July 2011. Work was undertaken in accordance with Douglas Partners' proposal dated 1 July 2011.

It is understood that the development will include the construction of a three storey building with two levels of basement. The investigation was required for planning purposes and to address the requirements of SEPP 55.

The objectives of the current Phase 1 investigation were to assess the potential for contamination of the site based on past and present site use, and to comment on the need for further investigation and/or management of contamination (if required).

The investigation included utilising information and samples obtained from five bores conducted as part of the geotechnical investigation. Please note that the results of the geotechnical investigation will be presented in a separate report. The details of the environmental field work are presented in this report, together with comments and recommendations.

2. Scope of Works

The scope of the current assessment comprised:

2.1 Desktop Study

- Identification of the property – street address and property description(s), name and address of the owner;
- Search of current and historical titles and deposited plans to identify previous owners and potentially contaminating activities;
- Review of historical aerial photographs;
- Search of the Contaminated Lands Register for notices issued under the *Contaminated Lands Management Act* 1997;
- Conduct a groundwater bore search in the vicinity of the site;
- Search WorkCover database records for records of any Dangerous Goods Licences;

- Conduct a council records search and review of records. Council did not make any of these records available to DP at the time of the assessment;
- Obtain and review Section 149 (2) and (5) certificates for the lot that forms the site; and
- Review general site information, including geological and hydrogeological information.

2.2 Fieldwork

- Conduct a site walkover and record observations;
- Utilise five of the geotechnical bores to collect environmental soil samples. For environmental sampling the bores were extended to a depth of 1.0 m below ground level (bgl), 0.5 m into natural soils, or prior refusal (whichever is the lesser). The bore depths may have been extended for geotechnical purposes;
- Collection of soil samples from the test bores at broadly regular intervals and based on potential indicators of contamination, such as staining or olfactory signs;
- Screening of all samples using a photo-ionisation detector (PID) for volatile organic compounds;
- Despatch of 10 samples to a NATA accredited laboratory for analysis of the contaminants of potential concern (COPC):
    - Heavy Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc) – 10 samples;
    - Polycyclic Aromatic Hydrocarbons (PAH) – 10 samples;
    - Total Petroleum Hydrocarbons (TPH) – 10 samples;
    - Monocyclic Aromatic Hydrocarbons (BTEX – benzene, toluene, ethylbenzene, total xylene) – 10 samples;
    - Organochlorine pesticides (OCP) – 5 samples;
    - Total Phenols – 5 samples;
    - Polychlorinated biphenyls (PCB) – 5 samples;
    - Asbestos – 5 samples;
    - Toxicity Characteristic Leaching Procedure (TCLP) for preliminary waste classification purposes – 1 sample; and
    - One intra-laboratory soil sample for heavy metals and TPH;
- Three of the bores were converted to groundwater monitoring wells to a maximum depth of 9 m bgl (BH2, BH4 and BH5). The wells were developed and sampled, including collection of field parameters such as pH, dissolved oxygen, turbidity, temperature and electrical conductivity;
- A total of three (3) groundwater samples were sent to a NATA accredited laboratory for quantitative analysis. The following potential contaminants were assessed:
    - Priority heavy metals: arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc – 3 samples;
    - Polycyclic aromatic hydrocarbons (PAH) – 3 samples;

  - Total petroleum hydrocarbons (TPH) and benzene, toluene, ethyl benzene and total xylenes (BTEX) – 3 samples;
  - Organochlorine pesticides (OCP) and polychlorinated biphenyls (PCB) – 3 samples;
  - Total phenols – 3 samples;
  - Hardness – 3 samples; and
- Collection and analysis of one intra-laboratory groundwater QA/QC sample for heavy metals and TPH; and
- A second round of groundwater development and sampling was conducted on the three wells following an unexpected detection of TPH in one of the wells. Laboratory analysis was conducted for TPH and Volatile Organic Compounds (VOCs).

2.3 Reporting

A phase 1 contamination investigation report has been prepared, detailing the findings of the investigation with limited soil sampling and preliminary waste classification assessment, field work methodology, results of the assessment, a discussion of the analytical results and recommendations for further work if required. The report is prepared in general accordance with the published Office of Environment (OEH) endorsed guidelines.

3. Site Identification and Location

3.1 Site Location

Prince of Wales Hospital (Hospital) is situated approximately 8 km to the south east of the Sydney CBD (see Site Plan, Appendix A). The Hospital is bordered by High Street to the north, Avoca Street to the east, Barker Street to the south and Hospital Road to the west. The Hospital is currently occupied by numerous multi-storey buildings, a number of car parks, and open space and courtyard areas. Buildings across the Hospital include the Sydney Children's Hospital and Ronald McDonald House, The Prince of Wales Public and Private Hospitals including patient wings, operating theatres and palliative care, and campus services such as staff residences, ambulance station, and childcare facilities. The hospital occupies a total area of approximately 13.5 hectares (ha).

The investigation conducted by DP is largely focused on the north eastern portion of the Hospital, hereafter referred to as "the site".

The land uses surround the Hospital include:

- *North* – High Street is present to the north, beyond which is a mixture of residential and commercial properties. At the intersection of High and Avoca Streets and Belmore Road is a convenience store to the north and a street based shopping centre. Further to the north east is Randwick shopping centre complex.
- *East* – Avoca Street is located to the east. Beyond this is open space parkland, located at the junction of Avoca Street and Belmore Road. Residential properties are also located to the east of

Avoca Street. Further east is Brigidine College, comprising a number of multi-storey buildings and open space areas.

- *South* – Barker Street is located to the south of the hospital. Mixtures of residential and commercial properties line the southern side of Barker Street. Properties include a veterinary surgery adjacent to Hospital Road, a Laundromat further to the west on the corner of Barker and Jane Streets, beyond which is a 7 Eleven service station on the corner of Barker Street and Botany Road. A number of commercial properties appear to be unoccupied. Towards the eastern end of Barker Street is Randwick Girls High School with associated buildings and grounds.
- *West* – Hospital Road is located to the west. The area beyond Hospital Road appears to be predominantly residential, with a small number of commercial premises associated with the hospital. Further to the west is the campus of the University of New South Wales.

4. Geology, Topography and Hydrogeology

Reference to the Sydney 1:250,000 Series Geological Sheet indicates that the Randwick area is located mainly on Quaternary aged alluvium, gravel, sand silt and clay, with some areas also being located on Triassic aged Hawkesbury Sandstone, comprising sandstone and quartz with some shale.

The topography of the site appears to be relatively flat.

The Tasman Sea lies to the east of the site. Eastlakes and Mill Pond lie to the south west of the site, leading into Botany Bay. The anticipated groundwater flow direction from the site is west to south west.

4.1 Groundwater Bore Search

A groundwater bore search of the Department of Water and Energy website database (previously held by the Department of Natural Resources) was conducted on 11 July 2011. Thirteen groundwater bores were located within a 2 km radius of the site. Work summaries were available for all of the bores. Details are provided in Appendix B. Four bores were noted to be used for recreation purposes (GW108971, GW110240, GW108861 and GW040224); however the latter has become abandoned. Two bores were used for commercial or industrial purposes (GW017851 and GW072463 respectively), while two bores were used for domestic purposes (GW106158 and GW110524). Three bores were noted to be used for groundwater remediation (GW109679, GW109680 and GW109681). The remaining two bores were noted as test bores (GW104947 and GW057008).

Standing water levels (SWL) were noted to be between 2.71 m bgl (GW104947) and 27.00 m bgl (GW108971). Drillers logs supplied indicated that the lithology across the area was generally comprised of topsoil or fill, followed by either sand or clay, and sandstone. Coffee rock and peat was noted at some locations.

5. Acid Sulphate Soils

Based on Randwick Council's Acid Sulphate Soils Map (March 2007), it appears that the site is in an area of no known acid sulphate soil. The nearest area with an unknown potential for acid sulphate soils is located approximately 1.4 km east of the site. The site is also located more than 500 m from an area mapped as having an elevated risk of acid sulphate soils.

Therefore it is considered that there is a low likelihood that acid sulphate soils will occur across the site.

6. Site History

A review of the site history was based on historical aerial photographs, historical title deeds, a WorkCover Dangerous Goods database search, a search for regulatory notices (issued under the *Contaminated Lands Management Act* 1997 (CLM Act) and *Protection of the Environment Operations Act* (1997 (POEO Act)), and a review of Council Section 149(2) and (5) certificates. Council did not provide any records to DP for review at the time of the assessment.

6.1 Prince of Wales Hospital Timeline

Based on information available on the NSW Department of Health – South Eastern Sydney and Illawarra Area Health Service website, the following table indicates the timeline of events that have occurred across the POW Hospital site.

Table 1: Timeline of Events – Prince of Wales Hospital, Randwick

Date*	Event
1852	An institution known as *The Society for Destitute Children* was formed "for the reception of abandoned and destitute children of both sexes under the age of eight". The original asylum was established in Paddington.
1854	The first Mayor of Randwick secured a grant of 60 acres of land on Avoca Street, Randwick. Construction of the asylum began after obtaining an inheritance of £11,000.
1856	The foundation stone for the asylum was laid in May. The building was designed to hold 400 children, and was to be constructed of Hawkesbury sandstone.
1858	The *Asylum for Destitute Children* was occupied on the 21 March.
By 1868	An additional wing for 400 more children was built. There was a daily average of 700 children living at the asylum.
1870	Catherine Hayes Hospital opens.
1870s	A dairy farm was maintained on the site by boys. Schooling and apprenticeships were provided to the older boys.
1883	A 'boarding out' system was introduced accommodating wayward children. Asylum numbers decreased to 250 by 1886. Numbers continue to decline through the 1890s.
1915	The NSW Government converts the institution to a military hospital, which is renamed *The Fourth Australian Repatriation Hospital*.
1915–1953	The Fourth Australian Repatriation Hospital is used variously as a military or repatriation hospital until the repat patients' move to Concord Repatriation Hospital in 1953.
1953	The facility is renamed *The Prince of Wales Hospital* and is managed as part of Sydney Hospital.
1961	The Prince Henry and Prince of Wales Hospitals restructure under the one board. A Chief Executive is appointed to run both hospitals in 1964.
1976	The Prince of Wales Children's Hospital is established.
1993	A $160 million upgrade is announced for hospital services for Eastern Sydney. Redevelopment of the Randwick campus begins.
1994	Huts built as part of the Repatriation Hospital were demolished (with the exception of 'Hut U') to make way for the new construction.
1995	The Heritage Council of NSW endorsed a plan to excavate the original site of the Destitute Children's Asylum and the cemetery in July. The original hyperbaric chamber located at Prince Henry Hospital was transferred to Randwick.
1996	The Prince Henry Hospital Emergency and Gastroenterology Departments relocated to Randwick in July and October respectively.
1997	The Royal Hospital for Women is transferred to Randwick. Nineteen operating theatres opened in October.
1998	The Sydney Children's Hospital was redeveloped.

* Sourced from the NSW Health Department, Timeline: History of the Prince of Wales Hospital on 14 July, 2011. www.sesiahs.health.nsw.gov.au/powh/history/powhistory.asp last updated March 26, 2008.

6.2 Aerial Photograph Record

Historical aerial photographs for the years 1943, 1961, 1970, 1986, 2000 and 2011 were obtained from the NSW Department of Lands Office, Google Earth, Nearmap and SIX Viewer websites. These photographs were studied in order to identify the likely past uses and changes to the site, particularly those of a potentially contaminating nature. The findings are summarised below and provided in Appendix C.

1943 The site comprises what appears to be open space with tree cover. Numerous buildings occupy the remainder of the Hospital grounds. High Street and Avoca Street border the site to the north and east respectively.

1961 The site appears to contain a small cottage like structure, surrounded by some open space. To the east is a smallish rectangular building and open space. To the south is a square shaped building with a courtyard space in the middle. Some smaller buildings are further to the west. To the north is High Street, beyond which appears to be residential and commercial properties. To the east is Avoca Street, followed by a road reserve. Beyond this are Belmore and Perouse Roads, and mainly residential properties. Bridgidine College is also located to the east. Two rows of ten rectangular buildings (likely to be wards) are present to the south of the Hospital site.

1970 The site has been further developed since 1961. The small cottage like structure in the north eastern corner of the site is still present, and is surrounded by other apparent small buildings. There is no significant change to the appearance of the remainder of the Hospital.

1986 There is no noted significant change to the appearance of the site or the remainder of the Hospital in general.

2000 There is no noted significant change to the appearance of the site or the Hospital grounds in close proximity to the site.

2011 The site appears relatively unchanged since the 2000 image.

6.3 Historical Title Deeds Search

A historical title deeds search was undertaken for the Hospital. Searches were undertaken by Mark Groll of Service First Registration Pty Ltd. Table 2 summarises the reported title deed information. A full copy is also provided in Appendix D.

Table 2: Lot 1 DP 870720 (excluding the part formerly comprising Lots A, B and C, DP 433525)

Date of Acquisition and term held	Owner / Occupier	Possible Site Use
1854	Appropriated as Site for Destitute Children's Asylum	Destitute Children's Home
1916	Transferred to and vested in the Crown, to be used as a Hospital for invalided and wounded soldiers and sailors or such other purposes as the Governor may determine.	Hospital
30.08.1917 (Commonwealth Government Gazette)	Requisitioned by Commonwealth for Hospitals & Convalescent accommodation from 25.08.1915 until 12 months after the termination of the war	Hospital and accommodation
20.01.1933	Reserved from sale or Lease generally (R 63752) (NSW Government Gazette)	Hospital
03.02.1933	Revocation of Reserve R 63752. (NSW Government Gazette)	Hospital
15.08.1941	Reserved from sale or Lease generally (R 70221) (NSW Government Gazette)	Hospital
29.08.1941	Revocation of Reserve R 70221. (NSW Government Gazette)	Hospital
19.12.1941	Dedicated for Ambulance Station site. (NSW Government Gazette). (Revoked 21.02.1947)	Hospital
30.08.1946	Reserved from sale or Lease generally (R 72023) (NSW Government Gazette) (Revoked 21.02.1947)	Hospital
21.02.1947	Revocation of dedication for Ambulance Station site. (NSW Government Gazette)	Hospital
21.02.1947	Dedicated for Ambulance Station site. (NSW Government Gazette) (Revoked 21.04.1967)	Hospital
21.02.1947	Reserved from sale or Lease generally (R 72182 & R 72183) for Hospital. (NSW Government Gazette)	Hospital
29.06.1967	Addition to Reserve R 72182 for Hospital. (NSW Government Gazette)	Hospital
15.10.1997	Vested in South Eastern Sydney Area Health Service. (NSW Government Gazette)	Hospital
01.12.1997	Creation of Title Folio Identifier 1/870720	Hospital
20.06.2011 (2011 to date)	# South Eastern Sydney Local Health Network	Hospital

# Denotes current registered proprietor

6.4 NSW WorkCover Dangerous Goods Database

A search of the NSW WorkCover Dangerous Goods Database indicated that there were several dangerous goods storage depots across the Hospital grounds. The closest stores to the site are as follows:

- POW-FLC5: Flammable liquid cabinet, Class 3 PG II, 250 L volume. Located in the Anatomical Pathology Hospital Block 4 – OTB level 1;
- POW-FLC6A: Flammable liquid cabinet, Class 3 PG I, 100 L volume. Located in the Clinical Chemistry Hospital Building 3, level 2;
- POW-FLC6B: Flammable liquid cabinet, Class 3 PG II, 140 L volume. Located in the Clinical Chemistry Hospital Building 3, level 2;
- POW-FLC7: details unknown;
- POW-FLC11: Flammable liquid cabinet, Class 3 PG I, 140 L volume. Located in the Gastroenterology section of the Edmund Blackett Building, south wing 1-22;
- POW-FLC12: Flammable liquid cabinet, Class 3 PG I, 250 L volume. Located in the Gastroenterology section of the Edmund Blackett Building, south wing near G51;
- POW-FLC13: Flammable liquid cabinet, Class 3 PG II, 140 L volume. Located in the Gastroenterology section of the Edmund Blackett Building, south wing near G52;
- SEALS-FLC19: Flammable liquid cabinet, Class 3 PG II, 140 L volume. Located in the Haematology General Laboratory, Hospital Block 3 level 2;
- SEALS-FLC20: Flammable liquid cabinet, Class 3 PG II, 250 L volume. Located in the Haematology General Laboratory, Hospital Block 3 level 2, G31.

The closest above ground storage tank to the site was noted to be located between Buildings 5 and 8 (near the Edmund Blackett Building). The tank was identified to be in Depot LN01, Class 2.2 with a 6,000 L capacity. The tank contains liquid nitrogen for cryogenic processes.

WorkCover search documentation is attached in Appendix E.

6.5 Council Section 149(2) and (5) Certificates

The Section 149 Planning Certificates for the Hospital were obtained from Randwick City Council and are dated 18 July 2011 (provided in Appendix F). The Section 149 indicated that Lot 1 in Deposited Plan 870720 under the Randwick Local Environmental Plan 1998 is zoned 5 – Special Uses.

The Hospital is affected by a Contaminated Land Policy, however the subject site is not identified as contaminated. The site is not listed as having matters arising under Section 59(2) of the Contaminated Land Management Act 1997.

The Hospital is located in a heritage conservation area and as a heritage item under the provisions of Randwick Local Environmental Plan 1998 (Consolidation). The land is not listed on the State Heritage Register under the Heritage Act 1977.

The land is not subject to a Tree Order under the Trees (Disputes Between Neighbours) Act 2006.

The land is not subject to a Property Vegetation Plan under the Native Vegetation Act 2003.

The land is also not listed as biodiversity certified land within the meaning of Part 7AA of the Threatened Species Conservation Act 1995.

6.6 Regulatory Notices Search

The NSW Office of Environment and Heritage (OEH, formerly DECCW) publishes records of contaminated sites under Section 58 of the CLM Act 1997 on a public database accessed via the internet. The Notices relate to investigation and/or remediation of site contamination considered to pose a significant risk of harm under the definition in the CLM Act. More specifically, the Notices cover the following:

- Actions taken by the EPA under section 15, 17, 19, 21, 23, 26 or 28 of the CLM Act;
- Actions taken by the EPA under section 35 or 36 of the Environmentally Hazardous Chemicals Act 1985;
- Site audit statements provided to the EPA under section 52 of the CLM Act on sites subject to an in-force declaration order.

A search of the public database on 12 July 2011 revealed that the Hospital is not listed.

One notice was listed for property in the area, that being 128 Barker Street, Randwick (a 7 Eleven service station). It was indicated that a notice existed for an agreed voluntary remediation proposal (26119) and a declaration of a remediation site (21125). It is noted that this service station is located approximately 530 m from the site, to the south west in a presumed hydraulically down gradient position with respect to the site.

It should be noted that the OEH record of Notices for Contaminated Land does not provide a record of all contaminated land in NSW. At the time of preparing this report a total of 291 sites in NSW were registered in the database.

The NSW OEH also issues environmental protection licences to the owners or operators of various industrial premises under the *Protection of Environment Operations Act* 1997 (POEO Act). Licence conditions relate to pollution prevention and monitoring, and cleaner production through recycling and reuse and the implementation of best practice.

The NSW OEH has made available a public register of licences under Section 308 of the POEO Act. The register contains:

- Environment protection licences;
- Applications for new licences and to transfer or vary existing licences;
- Environment protection and noise control notices;
- Convictions in prosecutions under the POEO Act;

- The result of civil proceedings;
- Licence review information;
- Exemptions from provisions of the POEO Act or Regulations;
- Approvals granted under Clause 9 of the POEO (Control of Burning) Regulation;
- Approvals granted under Clause 7a of the POEO (Clean Air) Regulation.

A search of the public register indicates that no licences were listed for the Hospital. Additionally, no notices were issued for properties within Randwick.

7. Site Inspection

The inspection undertaken by an Environmental Scientist from Douglas Partners (DP) on 11 July, 2011 indicated that the site is located in the north eastern corner of the Prince of Wales Hospital, which is situated approximately 8 km to the south east of the Sydney CBD. The site is bordered by High Street to the north, Avoca Street to the east and other hospital buildings and car parking areas to the south and west. The site is currently occupied by the Institute of Oncology building which is an irregular shaped building occupying the majority of the western portion of the site. The remaining areas are occupied by a small heritage listed building (known as the Medical Super's Cottage) to the north of the site, grassed and landscaped areas, car parking areas, courtyard areas, as well as a small temporary civil works compound in the north eastern corner of the site. The site is situated on a hill and slopes down to the west and the south.

8. Areas of Environmental Concern

At the time of the investigation the site was being used as part of the Institute of Oncology and the Medical Super's Cottage. The site was mainly covered by buildings, with some grassed areas and hardstand areas used for vehicle parking and access roads.

Potential contamination at the site may be due to imported fill, or use of hospital waste for levelling purposes, historical agricultural (dairy farming) contamination to surface soils from fertiliser or pesticide application, and chemicals associated with radiation treatment at the institute.

A building assessment for asbestos containing materials was not conducted as part of this scope of works.

Importation of Fill Material

The site has been used for residential and agricultural purposes prior to use as a hospital. There is the potential that historical fibre cement materials potentially containing asbestos may have been used in buildings. Any demolition or importation of fill has the potential to contain fibre cement waste. At the time of the investigation no fibre cement material was observed in the samples collected and analysed.

It is noted that the extent of fill in the areas sampled was generally low. However, based on the limited sampling regime the extent of fill used across the site for formation processes and levelling is unknown.

Agricultural Land Use

Site history indicates that part of the site was used for dairy farming. It is unknown if any of the area was used for market garden purposes.

It is possible that contamination from fertilisers or pesticides could remain on site. Common pesticide contaminants include organochlorine pesticides (OCPs) and organophosphate pesticides (OPPs). A range of heavy metals can also be associated with pesticides and fertilisers. These contaminants would be mainly concentrated in the surficial, topsoil horizon.

Based on the development history of the site, bulk soil disturbance during any construction works may have occurred since the former use of the site for agriculture and residential. The disturbance would mitigate the potential for residual contamination, as any topsoil that would have been impacted would probably been excavated and taken off site as it is an unsuitable medium for construction purposes.

Laboratory results have indicated that no pesticides were identified in the soil or groundwater samples analysed.

Chemicals Associated with the Institute of Oncology

While chemicals are noted to be associated with radiation treatment, it is considered that their use is likely to be inside the building and surficial soils would not be impacted. DP assumes that their use and disposal is controlled and licensed, and that suitable disposal practices are implemented. These practices would reduce the likelihood of contamination to sewer, stormwater or surficial soils.

In the event that chemicals are disposed into sinks, the water may enter into dilution pits. If not, there is the potential for contaminated water and sediment to enter into the sewage system.

Laboratory results have indicated that generally only background levels of contaminants were found in the groundwater samples analysed.

Hydrocarbons

There is the potential for hydrocarbon contamination to be associated with any unknown USTs, in soil or groundwater. It is noted that DP have been unsuccessful at gaining access to Randwick Council documents, however WorkCover documents provided have indicated that no USTs are located in the area of concern. There may be off site impacts contributing to hydrocarbons in groundwater, since the site gradient is inferred to be south to south west.

B(a)P concentrations in soil may be due to past bushfires or burning conducted on the site.

9. Fieldwork

Environmental fieldwork was conducted on the 11, 12, 13 and 19 July, 2011, simultaneously with the geotechnical investigation. Results for the geotechnical investigation are presented in a separate report. Fieldwork included drilling and soil sampling on these dates. In addition, groundwater monitoring well development was conducted for the first round of sampling on the 11, 13 and 19 July, while groundwater sampling was conducted on 19 and 22 July 2011. The second round of groundwater sampling was conducted on 25 August 2011 (development) and 30 August 2011 (for sampling). Boreholes and wells are referenced as BH.

The environmental investigation utilised the five geotechnical bores that were being conducted across the site. Three of these geotechnical bores (BH2, BH4 and BH5) were converted to groundwater monitoring wells. Since the proposed development will comprise deep excavations, with soil/fill requiring excavation and removal from the site, DP has conducted a 'limited' soil sampling regime with a preliminary waste classification assessment.

On this basis, the soil sampling regime was therefore not in compliance with the NSW EPA (now OEH) *Sampling Design Guidelines*, 2005, although was considered appropriate for the current phase 1 investigation.

9.1 Data Quality Objectives

The scope of works has been devised broadly in accordance with the seven step data quality objective process, as defined in Australian Standard *Guide to the Sampling and Investigation of Potentially Contaminated Soil Part 1: Non-volatile and semi-volatile compounds* (AS 4482.1 – 2005). The DQO process is also described in NSW EPA (2006) *Guidelines for the NSW Site Auditor Scheme* 2nd Edition, and US EPA (2000) *Guidance for the Data Quality Objective Process and Data Quality Objectives Process for Hazardous Waste Site Investigations*. The seven step DQO process is as follows:

- State the Problem
- Identify the Decision
- Identify Inputs into the Decision
- Define the Boundary of the Assessment
- Develop a Decision Rule
- Specify Acceptable Limits on Decision Errors
- Optimise the Design for Obtaining Data

9.1.1 State the Problem

The Hospital has historically been used as an asylum housing destitute children from 1856 to approximately 1915. During this time a dairy farm was run on the Hospital grounds. The first hospital was established on the site in 1870, however, the Hospital was not used exclusively as a hospital and repatriation centre until 1915. The repatriation centre was moved in 1953. Hereafter, the land was used wholly as a hospital. A cemetery has also been present on the Hospital. As such, there may

have been a number of potentially contaminating activities and processes associated with hospital use and farming. There is also the potential for some areas of the Hospital to have been built up on imported fill of unknown origin.

9.1.2 Identify the Decision

The north eastern corner of the Hospital is potentially to be redeveloped with a three storey building, with two levels of basement. Bulk excavation for the basement area will involve excavating and off site disposal of spoil. The site will continue to be used as part of the Hospital.

Based on this desktop study it is considered that the potential contaminants of concern were heavy metals, TPH, BTEX, PAH, OCP, PCB, phenols and asbestos. As part of the assessment, a preliminary waste classification is also being conducted, in order to determine the type of material likely to be removed from site.

The soil analytical data is to be compared to the site assessment criteria (SAC) for a commercial / industrial land use (HIL F). The optimal situation is for soil/fill remaining on the site to be within the adopted SAC, therefore forming a suitable substrate without requiring management. The soil health-based investigation levels (HILs) sourced from the DECC publication *Guidelines for the NSW Site Auditor Scheme* (2006), Appendix II, Column 4, are adopted as the primary SAC and are summarised in Table 7, Section 10.

The applicable guidelines for groundwater are the NSW DECC (2007) *Guidelines for the Assessment and Management of Contaminated Groundwater.* The DECC (2007) guidelines state that the concentrations *must be compared against the existing generic GILs (Groundwater Investigation Levels), if available, which protect the following environmental values:*

- *Aquatic Ecosystems (ANZECC & ARMCANZ, 2000).*

With respect to the protection of aquatic environments, the nearest water body to the site is Eastlakes and Mill Pond to the south west, which leads into Botany Bay and the Tasman Sea to the west. As a conservative measure, the appropriate GILs are therefore considered to be the ANZECC *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (2000) trigger values for toxicants in marine waters for the protection of 95% of species (where available).

Given that no drinking water bores were registered in close proximity to the site (i.e. through the registered bore search) and the region surrounding the site is mixed residential / commercial, it is considered unlikely that the regional groundwater would be utilised for drinking purposes. Use of the groundwater irrigation is considered a possibility, however, the threshold levels applicable to this use are typically higher than for other beneficial uses. On this basis, the *Drinking Water (Australian Drinking Water Guideline (NHMRC & NRMMC, 2004) guidelines were not adopted.*

The GILs adopted for the site are shown in Table 8, Section 11.

9.1.3 Identify Inputs into the Decision

The primary inputs into assessing the site for the continued hospital land use purpose and associated development are:

- Available site information regarding activities undertaken on the site and the surrounding area;
- The local geology, topography and hydrology;
- Potential contaminants;
- Published guidelines for assessing soil and groundwater quality; and
- Field observations/measurements and analytical results from the current assessment.

9.1.4 Define the Boundary of the Assessment

The site, for the purpose of this assessment, is the north eastern corner of the Hospital, as depicted on Drawing 1A, Appendix A.

9.1.5 Develop a Decision Rule

The decision rule is the comparison of the analytical results against relevant published guideline criteria for soil and groundwater. These assessment criteria are addressed in Sections 10 and 11. Exceedance of these criteria, however, triggers further assessment rather than remediation.

Laboratory test results will be accepted and considered useable for this assessment under the following conditions:

- All laboratories used are accredited by NATA for the analyses undertaken;
- All practical quantitation limits (PQL) set by the laboratories fall below the assessment criteria adopted, or indicate across the board lack of detection (i.e. some of the GIL are difficult to achieve routinely by NATA accredited laboratories);
- The reported concentrations of analytes in the replicate sample pairs are within accepted limits; and
- The quality assurance / quality control (QA/QC, see Appendix G) protocols and results reported by the laboratories comply with the requirements of the NEPM 1999 "*Guideline on Laboratory Analysis of Potentially Contaminated Soils*" and Australian and New Zealand Environment and Conservation Council (ANZECC)-1996 "*Guidelines for the Laboratory Analysis of Contaminated Soils*".

9.1.6 Specify Acceptable Limits on Decision Errors

In order to ensure the quality of the soil and groundwater data, appropriate and adequate quality assurance and quality control (QA/QC) measures and evaluations should be incorporated into the sampling and analysis regime.

A field and laboratory QA/QC regime, comprising the collection and analysis of intra – laboratory replicate samples was implemented to meet the requirements associated with the following data quality indicators (DQIs):

- Conformance with specified holding times;
- Accuracy of spiked samples within the laboratory's acceptable range (typically 70-130% for inorganic contaminants and greater for some organic contaminants;
- Field and laboratory duplicates and replicate samples will have a precision average of +/- 30% relative percentage difference (RPD) for inorganic analytes and +/- 50% RPD for organic analytes; and
- Field replicates were collected at a frequency of at least 10% of all samples.

The sampling numbers adopted were based on a limited sampling regime, which was deemed suitable for this assessment.

The analyte selection is based on the potential for contamination identified by the contamination investigation.

The SAC and GIL adopted from the guidelines stated in Sections 10 and 11 have risk probabilities already incorporated.

9.1.7 Optimise the Design for Obtaining Data

The sampling locations were designed to gain a general understanding of the sub-surface profile for geotechnical purposes. As such, these locations may not be optimum for targeting areas of environmental concern. Having said this, the identified areas of environmental concern primarily relate to general filling, pesticide use, hospital buildings, and vehicular use, all of which are potential related to broad areas rather than known point sources. The sampling locations are presented in Drawing 1A, Appendix A.

Groundwater monitoring wells were positioned so as to provide coverage across the site. One up gradient well (BH5) was placed in the north western vicinity of the investigation, while the other two were placed down gradient of the High Street site boundary (BH2 and BH4).

Procedures for the collection of environmental samples were developed prior to undertaking the fieldwork, and were in line with NSW OEH guidelines and current industry practice. DP employs NATA accredited analytical laboratories to conduct sample analysis.

To optimise the selection of soil samples for analysis, soil samples were screened using a calibrated photo-ionisation detector (PID). The results of the PID readings are provided in the borehole logs in Appendix H.

9.1.8 Data Quality Objectives

The performance of the assessment in achieving the DQO will be assessed through the application of Data Quality Indicators (DQI), defined as follows:

- **Precision**: A quantitative measure of the variability (or reproducibility) of data;
- **Accuracy**: A quantitative measure of the closeness of reported data to the "true" value;
- **Representativeness**: The confidence (expressed qualitatively) that data are representative of each media present on the site;
- **Completeness**: A measure of the amount of useable data from a data collection activity;
- **Comparability**: The confidence (expressed qualitatively) that data can be considered equivalent for each sampling and analytical event.

Table 3 summarises the DQIs and the procedures designed to enable achievement of the DQIs. For reference purposes, relevant sections of the report are also identified.

Table 3: Date Quality Indicators

DQI	Achievement Evaluation Procedure
Documentation completeness	Completion of borehole report sheets, and field and laboratory chain-of-custody documentation in Appendices H and I, respectively
Data completeness	The limited sampling density is based on DP's proposal and designed only to obtain preliminary information.
Data comparability	Use of NATA accredited laboratories, use of consistent sampling techniques (Appendix I)
Data representativeness	Sampling on a broad scale (but limited) basis to obtain reasonably representative data (Section 9)
Precision and accuracy for sampling and analysis	Achievement of 30% RPD for inorganic replicate analysis and 50% for organic replicate analysis, acceptable levels for laboratory QC criteria (Appendix G)

9.2 Field Quality Assurance and Quality Control

The field QC procedures for sampling, as prescribed in Douglas Partners *Field Procedures Manual* were followed during the assessment. Field QC sampling comprised replicate sampling, at a rate of approximately one replicate sample for every twenty samples. The comparative results of analysis are summarised in Appendix G.

9.3 Laboratory QA/QC

The analytical laboratory, accredited by NATA, is required to conduct in-house QA/QC procedures. These are normally incorporated into every analytical run and include reagent blanks, spike recovery, surrogate recovery and duplicate samples. These results are included in the laboratory reports in Appendix I.

The results of the DP assessment of laboratory QA/QC are shown in Appendix G, with the full laboratory reports included in Appendix I.

9.4 Sample Location and Rationale

On the basis of the EPA's publication *Sampling Design Guidelines*, a minimum of 11 sampling locations are required to 'characterise' a site of 0.4 hectares. Given the operational nature of the site and the preliminary nature of the assessment, a limited sampling regime was considered suitable for the assessment. This staged approach is in line with the requirements of the requirements of the *State Environmental Planning Policy 55* (SEPP55).

Soil samples were collected from each of the borehole locations on 11, 12, 13 and 19 July, 2011. Selected samples were analysed for a range of analytes, as described in Section 9. These samples were selected based on site observations (odour, staining etc), PID readings and their position within the borehole (i.e. fill or natural).

The wells were positioned across the site in order to ascertain the inferred groundwater direction. One well was placed up gradient on the site (BH5) and two wells were placed down gradient (BH2 and BH4). Based on the groundwater levels and levels of the groundwater wells, the groundwater flow is inferred to be west to south west.

The soil and groundwater sampling locations are shown on Drawing 1A, Appendix A.

9.5 Soil Sampling Procedures

Environmental sampling was performed according to standard operating procedures outlined in the DP *Field Procedures Manual*. All sampling data was recorded on DP chain-of-custody (COC) sheets. The general soil sampling procedure comprised:

- Decontamination of all re-usable sampling equipment using a 3% solution of phosphate free detergent (Decon 90) and distilled water prior to collecting each sample or use of disposable sampling equipment;
- Transfer of samples into laboratory-prepared glass jars and capping immediately with Teflon lined lids;
- Collection of at least 10% replicate samples for QA/QC purposes;
- Labelling of sample containers with individual and unique identification, including project number, sample location and sample depth; and

- Placement of the sample jars and replicate sample bags into a cooled, insulated and sealed container for transport to the laboratory.

Envirolab Services Pty Ltd, accredited by NATA, was employed to conduct the primary sample analysis. The laboratory is required to carry out in-house QC procedures.

9.6 Groundwater Monitoring Well Construction and Sampling Details

Three groundwater monitoring wells (BH2, BH4 and BH5), were installed across the site to a maximum depth of 9 m bgl. Wells BH2 and BH4 were located up gradient, while BH5 was located in the south western corner of the site (refer to Drawing 1A). Groundwater monitoring well installation details are provided in the borehole logs (Appendix H).

The groundwater monitoring well was constructed using 50 mm diameter, acid washed, class 18 PVC casing and machine slotted well screen intervals. Joints were screw threaded, thereby avoiding the use of glues and solvents which may contaminate the groundwater. The well was completed with a gravel pack and, thence, a bentonite plug of at least 0.5 m thickness. The well was capped and a Gatic cover installed level with the current ground surface.

An inspection of the groundwater wells was conducted on 19 and 22 July 2011, and 25 and 30 August 2011, using an electronic interface probe which confirmed the presence of water within the wells. The electronic interface probe can detect the presence of separate phase liquid in the water column (such as light non-aqueous phase liquids [LNAPL] including petroleum hydrocarbons) and determine water level. Well details are provided in Table 4 below.

Table 4: Groundwater Monitoring Well Construction, Development and Purge Details

Bore ID	Location of Well	Bore Depth (m bgl)	AHD (m)	Screen Interval (m bgl)	Pre-development SWL (m bgl)	Well Volume (L)	Volume Developed (L)	Pre-purge SWL (m bgl)	Purging Method
Groundwater Investigation									
BH2	NE corner, Avoca and High Streets	9.1	63.3	9.1 – 1.1	-	25	dry	1.7*/1.65[a]	twister pump
BH4	NW corner, High Street	6.1	60.0	6.1 – 0.8	-	25	dry	4.03*/3.97[a]	twister pump
BH5	SW corner	9.0	59.77	9.0 – 1.0	-	25	dry	4.63*/4.93[a]	twister pump

* First round of sampling, July

[a] Second round of sampling, August

Subsequent to installation, the groundwater monitoring wells were developed by removing a minimum of 3 well volumes (or pumped until dry) using a twister pump. The bores were allowed to stabilise between 2 to 6 days prior to sampling. Before sampling, the depth to groundwater was determined using the electronic interface dip-meter.

Samples were collected from the wells using a Geopump, with dedicated disposable tubing used for each well. Water quality parameters were collected as part of the process.

Groundwater samples were filtered in the field for heavy metal analysis on the same day as sampling. Sample handling and transport procedures were as set out below:

- Sample containers were labelled with individual and unique identification, including project number and sample number;
- Samples were placed in insulated containers and maintained at a temperature of approximately 4^{o}C until transported to the analytical laboratory; and
- Chain of custody documentation was maintained at all times and countersigned by the receiving laboratory on transfer of samples.

All samples were dispatched to Envirolab Services, a NATA accredited laboratory, for analysis.

9.7 Analytical Rationale

The analytical scheme was designed to obtain an indication of the potential presence and possible distribution of common contaminants that may also be attributed to past and present activities and features within the site, as discussed in Section 6. The primary contaminants associated with past and present site uses included metals and various hydrocarbons (e.g. TPH, BTEX, PAH). Metals and pesticides are also associated with past agricultural uses. A common analytical suite applied to anthropogenic materials such as fill of unknown origin includes metals, hydrocarbons, pesticides, phenols, PCB and Asbestos.

The analytical scheme adopted is presented in Table 5 for soil and Table 6 for groundwater.

Table 5: Analytical Scheme for soils

Sample ID (Location – Depth)	Heavy Metals	TPH/ BTEX	PAH	PCB	OCP	Phenols	Asbestos
BH1/0.1-0.2							
BH1/0.2-0.25	✓	✓	✓	✓	✓	✓	✓
BH1/0.6-0.7	✓	✓	✓				
BH2/0.1-0.2							
BD2/110711							
BH2/0.25-0.3	✓	✓	✓	✓	✓	✓	✓
BH2/0.3-0.4	✓	✓	✓				
BH3/0.1-0.2	✓	✓	✓	✓	✓	✓	✓
BH3/0.5-0.6	✓	✓	✓				
BD/110711	✓	✓	✓				
BH3/0.8-0.9							
BH4/0.1-0.2							
BH4/0.4-0.5	✓	✓	✓	✓	✓	✓	✓
BH4/1.0-1.1	✓	✓	✓				
BH5/0.1-0.2	✓	✓	✓	✓	✓		✓
BH5/0.4-0.5	✓	✓					
BH5/0.65-0.7							
BH5/0.8-0.9							

Table 6: Analytical Scheme for groundwater

Sample ID (Location)	Heavy Metals	TPH/ BTEX	PAH	PCB	OCP	VOC	Phenols	Hardness
BH2	✓	✓	✓	✓	✓	✓	✓	✓
BH4	✓	✓	✓	✓	✓	✓	✓	✓
BH5	✓	✓	✓	✓	✓	✓	✓	✓
BD1/220711 (BH5)	✓	✓						

10. Site Assessment Criteria

10.1 Soil Investigation Levels

The significance of the results in regards to the levels of contaminants in the soils with respect to the site's suitability for the continued hospital use is based on the threshold concentrations given in Table 7 below. The SAC have been sourced from the following guidelines:

- NSW DECC *Guidelines for the NSW Site Auditor Scheme*, 2nd Edition (2006); and
- NSW EPA *Guidelines for Assessing Service Station Sites* (1994).

Table 7: Site Acceptance Criteria for Soil

Contaminant	SAC (mg/kg)	Rationale
TPH[a]		[a] NSW EPA (now DECCW) Contaminated Sites *Guidelines for Assessing Service Station Sites* (1994) threshold concentrations for sensitive land use-soils.
$C_6 – C_9$	65	
$C_{10} – C_{36}$	1000	
BTEX[a]		
Benzene	1	
Toluene	1.4	
Ethylbenzene	3.1	
Xylene	14	
Metals	**HIL E**	NSW DEC (now DECCW) Contaminated Sites *Guidelines for the NSW Site Auditor Scheme* (2nd edition) (2006) Appendix II, Soil Investigation Levels for Urban Redevelopment Sites in NSW Heath-based investigation levels for commercial / industrial land use (HIL Column 4).
Arsenic (total)	200 mg/kg	
Cadmium	40 mg/kg	
Chromium	24%	
Copper	2,000 mg/kg	
Lead	600 mg/kg	
Mercury	30 mg/kg	
Nickel	600 mg/kg	
Zinc	14,000 mg/kg	
Total Phenols	17,000	
PAH		
Total	40	
Benzo(a)Pyrene	2	
PCB	20	
OCP		
aldrin + dieldrin	20	
chlordane	100	
DDT (including DDD, DDE, DDT)	400	
Heptachlor	20	
Asbestos	No asbestos present in soil at the surface	Correspondence from NSW EPA (now OEH) Director of Contaminated Sites to Accredited Site Auditors

For analytes in which there are no listed SAC, the laboratory PQL will be taken as the trigger level, above which further assessment will be required.

10.2 Waste Classification Guidelines

Soil samples collected were compared against the NSW DECC's (Department of Environment and Climate Change, now OEH) *Waste Classification Guidelines* 2008 (Revision July 2009). The waste classification should be considered as preliminary in nature, and in the event that bulk excavation is to occur on the site, additional waste classification sampling may be required.

11. Groundwater Investigation Levels

The levels of contaminants in groundwater were assessed against Groundwater Investigation Levels (GILs) adopted from applicable guidelines, specifically, the ANZECC (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. As the receiving body for groundwater at the site is likely to be a marine water body (i.e. Botany Bay or the Tasman Sea), the Trigger Values (where available) for the protection of 95% of marine water species, as stipulated in the ANZECC (2000), were considered relevant.

Given that no drinking water bores were registered in close proximity to the site (i.e. through the registered bore search) and the region surrounding the site is mixed residential / commercial, it is considered unlikely that the regional groundwater would be utilised for drinking purposes. Use of the groundwater irrigation is considered a possibility, however, the threshold levels applicable to this use are typically higher than for other beneficial uses. On this basis, the Trigger Values (where available) for the protection of 95% of marine water species were adopted as the primary GILs.

The *Airports (Environment Protection Regulations)* criteria have been adopted for TPH C_6 – C_{36} contaminants, due to the absence of high reliability NSW EPA or ANZECC Guidelines for TPH.

The levels of contaminants in the groundwater are assessed against the GILs shown in Table 8.

Table 8: Groundwater Investigation Levels (GILs) - Marine

Contaminant	Adopted Criteria (GIL, µg/L)	Source
TPH		*Airport (Environment Protection) Regulations (1997), Schedule 2 Water Pollution Accepted Limits: Table 1.03 – Accepted limits of contamination* have been adopted as screening thresholds [adopted due to the absence of high reliability NSW EPA or ANZECC guidelines for TPH]*
$C_6 – C_9$	150	
$>C_9$	600	
BTEX		NSW EPA Contaminated Sites *Guidelines for Assessing Service Station Sites* (1994) *Threshold concentrations for sensitive land use*.
Benzene	300	
Toluene	300	
Ethylbenzene	140	
Xylene	380	
Metals		*ANZECC (2000) Australian Water Quality Guidelines* for the protection of 95% of marine water species
Arsenic (III)	2.3	
Cadmium	5.5	
Chromium	4.4[1]	
Copper	1.3	
Lead	4.4	
Mercury	0.4	
Nickel	70	
Zinc	15	
OCP		*ANZECC (2000) Australian Water Quality Guidelines* for the protection of 95% of marine water species.
Heptachlor	0.0004[2]	
Aldrin	0.003[2]	
Lindane	0.007[2]	
Chlordane (trans + cis)	0.001[2]	
Dieldrin	0.01[2]	
DDE	0.0005[2]	
DDT	0.0004[2]	
Endrin	0.008	
alpha Endosulphan	0.0002[2]	
beta Endosulphan	0.007[2]	
Methoxychlor	0.004[2]	
PCB		*ANZECC (2000) Australian Water Quality Guidelines* for the protection of 95% of marine water species.
Arochlor 1016	0.009[2]	
Arochlor 1221	1[2]	
Arochlor 1232	0.3[2]	
Arochlor 1242	0.6[2]	
Arochlor 1248	0.03[2]	
Arochlor 1254	0.03[2]	
Arochlor 1260	25[2]	
Phenols		*ANZECC (2000) Australian Water Quality Guidelines* for the protection of 95% of marine water species.
phenol	400	
pentachlorophenol	22	

Contaminant	Adopted Criteria (GIL, µg/L)	Source
PAH		
Total	Not specified	*ANZECC (2000) Australian Water Quality Guidelines* for the protection of 95% of marine water species.
Benzo(a)Pyrene	0.1[2]	
Naphthalene	70	
Anthracene	0.01[2]	
Phenanthracene	0.6[2]	
Fluoranthene	1[2]	

Notes to Table 8:

* Other than a 'low reliability' final chronic value of 7 µg/L for petroleum hydrocarbon, which is not routinely achievable by NATA laboratories due to inability to meet the required detection limits.

1 Low reliability trigger value for chromium (III) (Section 8.3.7 of ANZECC 2000)

2 Low reliability trigger value (Section 8.3.7 of ANZECC 2000). Insufficient data for reliable trigger value. Interim working value or low reliability value used for screening purposes.

The laboratory practical quantitation limits (PQL) are taken as the initial screening level for VOCs. Should there be detected concentrations of VOC, then ANZECC, 2000 low reliability trigger values will be used (where available). In the absence of such trigger levels, appropriate national or international guidelines will be referenced.

12. Results

12.1 Field Observations - Soil

Fill was observed at all five bore locations to a maximum depth of 0.5 m bgl (BH1). Fill across the site comprised brown, fine to medium grained silty sand fill. Slag and ash were noted in soil from BH1, BH2 and BH4. Crushed yellow sandstone was observed at BH4, which was located adjacent to High Street. No odour was observed from any of the samples.

Natural soil was encountered underlying the fill and was noted to comprise yellow / brown fine grained sand. Clayey sand was encountered at BH2, while fill was found to overlie sandstone at BH4. Sandstone bedrock was encountered at all locations.

Reference should be made to the bore logs in Appendix H.

12.2 Soil Field Testing Results

Replicate samples were collected in plastic bags, and were allowed to equilibrate under ambient temperatures before screening for Total Photoionisable Compounds (TOPIC), using a calibrated Photoionisation Detector (PID). Results of the samples screening indicated that all samples had concentrations below 1ppm. The low readings collected are indicative of Australian soil background levels.

12.3 Field Observations - Groundwater

Groundwater levels were measured prior to purging on 19 and 22 July and 25 and 30 August 2011. The well depths and depth to groundwater are listed in Table 4, Section 9.6. No free phase product was detected by the interface dip-meter during sampling. At the time of purging, no odour was observed in the groundwater.

12.4 Laboratory Results

The laboratory results are summarised in the following Tables 9 and 10. The NATA accredited full laboratory certificates are provided in Appendix I.

Table 9: Results of Soil Analysis (All results in mg/kg unless otherwise stated)

Sample ID	Sampling Date	Heavy Metals																Polycyclic Aromatic Hydrocarbons (PAH)				Total Petroleum Hydrocarbons (TPH)				Monocyclic Aromatic Hydrocarbons (BTEX)								Organochlorine Pesticides (OCP)[4]		PCB		Total Phenolics		Asbestos
		Arsenic		Cadmium		Chromium[3]		Copper		Lead		Mercury		Nickel		Zinc		Benzo(a)pyrene		Total PAH[2]		C6-C9		C10-C36		Benzene		Toluene		Ethyl- benzene		Total Xylene								
		SCC	TCLP	SCC	TCLP	SCC	TCLP	SCC	TCLP	SCC	TCLP	SCC	TCLP	SCC	TCLP	SCC	TCLP	SCC	TCLP	SCC	TCLP	SCC	TCLP	SCC	TCLP	SCC	TCLP	SCC	TCLP	SCC	TCLP	SCC	TCLP	SCC	TCLP	SCC	TCLP	
		mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/kg	mg/L	
72505.01 - Prince of Wales Hospital, Randwick																																						
BH1/0.2-0.25	7/12/2011	5	-	<0.5	-	10	-	48	-	270	0.1	0.1	-	22	-	130	-	3.2	<0.001	29.1	<PQL	<25	-	120	-	<0.2	-	<0.5	-	<1.0	-	<2.0	-	<PQL	-	<PQL	-	<5.0	-	NAG
BH1/0.6-0.7	7/12/2011	<4	-	<0.5	-	1	-	2	-	4	-	<0.1	-	<1.0	-	2	-	<0.05	-	<PQL	-	<25	-	<PQL	-	<0.2	-	<0.5	-	<1.0	-	<2.0	-	-	-	-	-	-	-	-
BH2/0.25-0.3	7/11/2011	<4	-	<0.5	-	13	-	29	-	51	-	<0.1	-	20	-	48	-	1.9	-	22	-	<25	-	<PQL	-	<0.2	-	<0.5	-	<1.0	-	<2.0	-	<PQL	-	<PQL	-	<5.0	-	NAG
BH2/0.3-0.4	7/11/2011	11	-	<0.5	-	31	-	6	-	26	-	<0.1	-	3	-	10	-	0.2	-	1.9	-	<25	-	<PQL	-	<0.2	-	<0.5	-	<1.0	-	<2.0	-	-	-	-	-	-	-	-
BH3/0.1-0.2	7/11/2011	4	-	<0.5	-	9	-	16	-	28	-	<0.1	-	6	-	63	-	0.35	-	3.65	-	<25	-	<PQL	-	<0.2	-	<0.5	-	<1.0	-	<2.0	-	<PQL	-	<PQL	-	<5.0	-	NAG
BH3/0.5-0.6	7/11/2011	<4	-	<0.5	-	3	-	3	-	9	-	<0.1	-	2	-	15	-	0.07	-	0.77	-	<25	-	<PQL	-	<0.2	-	<0.5	-	<1.0	-	<2.0	-	-	-	-	-	-	-	-
BH4/0.4-0.5	13/07/11	<4	-	<0.5	-	5	-	14	-	16	-	<0.1	-	9	-	29	-	0.59	-	7.09	-	<25	-	<PQL	-	<0.2	-	<0.5	-	<1.0	-	<2.0	-	<PQL	-	<PQL	-	<5.0	-	NAG
BH4/1.0-1.1	13/07/11	<4	-	0.6	-	29	-	64	-	10	-	<0.1	-	4	-	45	-	0.1	-	0.8	-	<25	-	<PQL	-	<0.2	-	<0.5	-	<1.0	-	<2.0	-	-	-	-	-	-	-	-
BD1/110711	7/11/2011	<4	-	<0.5	-	4	-	4	-	16	-	<0.1	-	2	-	13	-	0.41	-	5.71	-	<25	-	<PQL	-	<0.2	-	<0.5	-	<1.0	-	<2.0	-	-	-	-	-	-	-	-
BH5/0.1-0.2	19/7/2011	4	-	<0.5	-	12	-	29	-	200	-	0.1	-	6	-	210	-	1.0	-	9.9	-	<25	-	<PQL	-	<0.2	-	<0.5	-	<1.0	-	<2.0	-	<PQL	-	<PQL	-	-	-	NAG
BH5/0.4-0.5	19/7/2011	<4	-	<0.5	-	8	-	2	-	20	-	<0.1	-	<1.0	-	29	-	0.05	-	0.05	-	<25	-	<PQL	-	<0.2	-	<0.5	-	<1.0	-	<2.0	-	-	-	-	-	-	-	-
PQL		4	-	0.5	-	1	-	1	-	1	-	0.1	-	1	-	1	-	0.05	-	0.1	-	25	-	250	-	0.5	-	0.5	-	1	-	3	-	0.1	-	1	-	5		-
Site Assessment Criteria (SAC)																																						
HILs for Commercial / Industrial [6]		50	-	100	-	500	-	5000	-	1500	-	75	-	3000	-	35000	-	5	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	50/50/250/1000	-	5	-	42500	-	-
NSW EPA Service Station Guidelines[2]		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	65	-	1000	-	1	-	1.4	-	3.1	-	14	-	-	-	-	-	-	-	NAG
Waste Classification Criteria [1]																																						
General Solid Waste CT1 (mg/kg)		100	-	20	-	100	-	-	-	100	-	4.0	-	40	-	-	-	0.8	-	-	-	650	-	10000	-	10	-	288	-	600	-	1000	-	<50[5]	-	<50[7]	-	-	-	NAD
Restricted Solid Waste (mg/kg)		400	-	80	-	400	-	-	-	400	-	16.0	-	160	-	-	-	3.2	-	-	-	2600	-	40000	-	40	-	1152	-	2400	-	4000	-	<50[5]	-	<50[7]	-	-	-	NAD
General Solid Waste SCC1 (mg/kg) & TCLP1 (mg/L)		500	5.0	100	1.0	1900	5.0	-	-	1500	5.0	50	0.2	1050	2.0	-	-	10	0.04	-	-	-	-	-	-	18	0.5	518	14.4	1080	30	1800	50	-	-	-	-	-	-	-
Restricted Solid Waste SCC2 (mg/kg) & TCLP2 (mg/L)		2000	20	400	4.0	7600	20.0	-	-	6000	20	200	0.8	4200	8.0	-	-	23	0.16	-	-	-	-	-	-	72	2	2073	57.6	4320	120	7200	200	-	-	-	-	-	-	-

Notes

1	NSW DECC (2008) Waste Classification Guidelines, revised July 2009
2	All PQLs are 0.1, with the exception of benzo(b+k)fluoranthene where PQL is 0.2
3	All Chromium are assumed to exist in the stable Cr(III) oxidation state, as Cr(VI) will be too reactive and unstable under the normal environment
4	Aldrin+Dieldrin/Chlordane/ DDD+DDE+DDT/Heptachlor
5	as listed Scheduled Chemicals
6	NSW DEC Contaminated Sites: *Guidelines for the NSW Site Auditors Scheme 2nd edition, 2006* . Health-based guidelines for commercial or industrial (Column 4)
-	Not Tested
NAD	No Asbestos Detected at the reporting limit of 0.1g/kg
(<0.001)	TCLP concentrations

Table 10: Results of Groundwater Analysis (All results in µg/L unless otherwise stated)

Sample ID	Sampling Date	Heavy Metals[4]								Polycyclic Aromatic Hydrocarbons (PAH)[4]			Total Petroleum Hydrocarbons (TPH)		Monocyclic Aromatic Hydrocarbons (BTEX)				Volatile Organic Compounds (VOC)																								Organochlorine Pesticides (OCP)[4]										PCB[4]							Total Phenols[4]
		Arsenic	Cadmium	Chromium[1]	Copper	Lead	Mercury	Nickel	Zinc	Benzo (a) pyrene	Naphthalene	Total PAH[2]	C6-C9	C10-C36	Benzene	Toluene	Ethyl- benzene	Total Xylene	chloroform	1,2-dichloroethane	1,1,1-trichloroethane	carbon tetrachloride	1,2-dichloropropane	cis-1,3-dichloropropene	trans-1,3-dichloropropene	1,1,2-trichloroethane	1,3-dichloropropane	1,1,2,2-tetrachloroethane	1,3-dichlorobenzene	1,4-dichlorobenzene	1,2-dichlorobenzene	1,2,3-trichlorobenzene	Heptachlor	Aldrin	Lindane	Chlordane trans + cis	dieldrin	DDE	DDT	Endrin	alpha Endosulphan	beta Endosulphan	Methoxychlor	Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260	
72505.01 - Prince of Wales Hospital, Randwick																																																						
BH2	19/7/2011	2	<0.1	3	<1.0	1	<0.1	3	**40**	<0.1	<0.1	<PQL	17	<PQL	<1.0	<1.0	<1.0	<2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.001	<0.001	**<0.002**	<0.002	**<0.001**	**<0.001**	<0.002	**<0.002**	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05
BH2	30/8/2011	-	-	-	-	-	-	-	-	-	-	-	23	<PQL	<1.0	<1.0	<1.0	<1.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH4	19/7/2011	**7**	0.3	1	**7**	**5**	<0.1	11	**78**	<0.1	0.5	0.8	**170**	80	140	<1.0	5	73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.001	<0.001	**<0.002**	<0.002	**<0.001**	**<0.001**	<0.002	**<0.002**	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05
BH4	30/8/2011	**-**	-	-	-	-	-	-	-	-	-	-	<10	<PQL	<1.0	<1.0	<1.0	<1.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH5	22/7/2011	**5**	<0.1	1	**10**	<1.0	<0.1	1	1	<0.1	0.1	0.2	<10	<PQL	<1.0	<1.0	<1.0	<2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.001	<0.001	**<0.002**	<0.002	**<0.001**	**<0.001**	<0.002	**<0.002**	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05
BD1/220711	22/7/2011	**5**	<0.1	2	**11**	<1.0	<0.1	1	1	-	-	-	<10	<PQL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH5	30/8/2011	**-**	-	-	-	-	-	-	-	-	-	-	<10	<PQL	<1.0	<1.0	<1.0	<1.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PQL		1	0.1	1	1	1	0.1	1	1	0.1	0.1	0.1	10	250	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.001	0.001	0.001	0.002	0.002	0.001	0.001	0.002	0.002	0.002	0.1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.05
Trigger Values - Marine Water GIL 95% Level of Protection		2.3	5.5	4.4	1.3	4.4	0.4	70	15	0.1	70	NA	150 [2]	600 [2]	300 [3]	300 [3]	140 [3]	380 [3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0004*	0.003*	0.007*	0.001*	0.01*	0.0005*	0.0004*	0.008	0.0002*	0.007*	0.004*	0.009*	1*	0.3*	0.6*	0.03*	0.03*	25*	NA

Notes

*	Low reliability trigger value (section 8.3.7 of ANZECC 2000). Insufficient data for reliable trigger value. Interim working value used for screening purposes.
1	Low reliability trigger value (section 8.3.7 of ANZECC 2000) for chromium III
2	Airport (Environment Protection) Regulations (1997), Schedule 2 Water Pollution Accepted Limits: Table 1.03 - Accepted Limits of contamination.
3	NSW EPA Contaminated Sites *Guidelines for Assessing Service Station Sites* (1994), threshold concentrations for sensitive land use.
4	ANZECC (2000) *Australian Water Quality Guidelines* for the protection of 95% of marine water species.
-	Not Tested
NA	Not Applicable
BOLD	Exceedence of Groundwater Investigation Level (GIL)

13. Discussion

13.1 Soil Investigation

A series of soil samples, collected by DP, were analysed as part of the investigation of the site for organic and inorganic contaminants. The results are summarised on Table 9, Section 12.4.

The results of the soil analyses indicate that the organic and inorganic contaminant concentrations in all but one analysed soil sample were within the adopted SAC for parks, recreational open space and playing fields, including secondary schools, land use.

Sample BH1/0.2-0.25 was found to have a B(a)P concentration of 3.2 mg/kg, which was above the adopted criteria (2 mg/kg).

Based on the results, it is suggested that there is only a low potential for significant or broad scale soil contamination within the site. The results do not preclude, however, the potential for localised contamination between sampling locations.

13.2 Preliminary Waste Classification

Soil samples collected by DP were compared to the NSW *Waste Classification Guidelines* (2009) in order to make a preliminary determination as to the potential classification of soils should bulk excavation occur across the site. Test results on fill samples indicated that the majority of potential contaminants of concern were classified as General Solid Waste, with TCLP testing. The following samples were classified as restricted waste without TCLP testing:

- BH1/0.2 – 0.25: lead 270 mg/kg, within the restricted solid waste criteria, B(a)P 3.2 mg/kg, within the restricted solid waste criteria; and
- BH2/0.25 – 0.3: B(a)P 1.9 mg/kg, within the restricted solid waste criteria of 0.8 mg/kg.

TCLP results indicated that the filling would most likely classify as **General Solid Waste** for disposal purposes.

Test results on the limited number of natural soil samples analysed indicate that natural soils (including sandstone bedrock) would most likely classify as virgin excavated natural material (VENM).

13.3 Groundwater Investigation

Three groundwater monitoring wells were installed across the site to enable the sampling and analysis of groundwater. During the first round of sampling, the majority of samples recorded results below the laboratory PQL and thus generally within the GIL. The following locations reported exceedances:

- BH2: zinc (40 µg/L)
- BH4: arsenic (7 µg/L), copper (7 µg/L), lead (5 µg/L), zinc (78 µg/L) and TPH C_6-C_9 (170 µg/L); and

- BH5 and duplicate BD1/220711: arsenic (5 µg/L) and copper (10 µg/L and 11 µg/L respectively).

The heavy metal results are not considered to be significant and are probably indicative of 'background' levels for the site.

The source of the TPH C_6-C_9 exceedance was unknown since WorkCover records have not indicated any underground storage tanks (USTs) within the site or Hospital grounds. The soil results indicated no detectable concentrations of TPH. There is the potential that the exceedance is from an off-site source, such as an up gradient service station.

A silica gel cleanup was conducted by the laboratory, and did not indicate a potential source for the TPH.

Due to the exceedence, a second round of sampling and laboratory analysis was conducted on the three wells for TPH and VOCs. The results indicated that all samples were within the GIL, suggesting that the initial concentration may have been an anomaly.

The results are summarised on Table 10, Section 12.4.

14. Conclusion and Recommendations

The current assessment was undertaken for planning purposes and to address the requirements of SEPP55. Given the operational status and associated access constraints, a Phase 1 contamination assessment with limited soil sampling (from five test bores) and groundwater sampling (from three groundwater monitoring wells) was considered to be an appropriate level of assessment at this stage. This staged approach is in line with the provisions of the SEPP55.

Based on the Phase 1 contamination investigation with limited sampling, preliminary results indicate that there is generally a low risk of soil or groundwater contamination within the site. The site is generally considered to be environmentally suitable for continued hospital use. However, given the limited nature of the investigation undertaken, the following recommendations are provided:

- Any filling or natural soils / bedrock requiring removal from the site must be initially waste classified in accordance with the NSW *Waste Classification Guidelines* (2009). This should preferably be completed *ex situ*;
- A hazardous materials inspection should be carried out on the buildings to be demolished and/or renovated as part of the project;
- Upon demolition of the existing buildings, an inspection of the ground surface should be carried out by a qualified occupational hygienist or environmental consultant to assess the potential for asbestos contamination; and
- It appears based on the second round of testing that the initial TPH C_6-C_9 exceedence was an isolated result (an anomaly). The exceedence may have been due to a transient off site source.

15. Limitations

Douglas Partners (DP) has prepared this report for a project at the Prince of Wales Hospital, corner of Avoca and High Streets, Randwick, NSW in accordance with DP's proposal dated 1 July 2011 and acceptance received from Mr Matthew Owen of Thinc Projects Australia Pty Ltd on behalf of Mr Bruce Greenwood of Health Infrastructure – NSW Health, in an email dated 8 July 2011. The report is provided for the exclusive use of Thinc Projects and their client, Prince of Wales Hospital for this project only and for the purpose(s) described in the report. It should not be used for other projects or by a third party. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions only at the specific sampling or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of anthropogenic influences. Such changes may occur after DP's field testing has been completed.

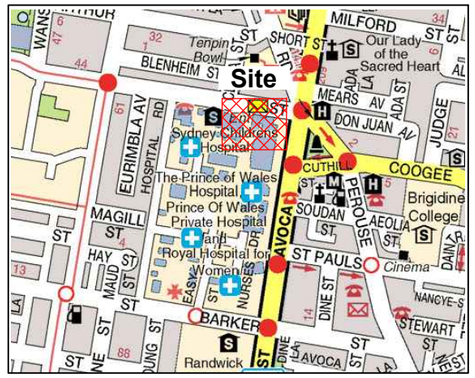
DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be limited by undetected variations in ground conditions between sampling locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached notes and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion given in this report.

Douglas Partners Pty Ltd

Appendix A

Drawings



Locality Plan

SITE BOUNDARY

1

D.P. 870720

NO ACCESS TO REAR OF BUILDING DUE TO CONSTRUCTION SITE

"EDMUND BLACKET BUILDING" 2 STOREY STONE BUILDING SLATE TILE ROOF

3 STOREY BRICK & CONCRETE BUILDING LEVEL 1 FL 68.01 (APPROX.) GROUND LEVEL FL 64.40 LOWER GROUND LEVEL FL 60.73 (APPROX.)

2 STOREY BRICK & CONCRETE BUILDING

"ADOLESCENT SERVICES" 2 STOREY STONE BUILDING SLATE TILE ROOF LEVEL 1 FL 69.60 GROUND LEVEL FL 65.90

1 STOREY BRICK METAL ROOF

1 STOREY METAL ROOF FIBRO

BRICK BUILDING

BRICK GARAGE

METAL PLANT ROOM

BRICK RETAINING WALL

BH1

BH2

BH3

BH4

BH5

BITUMEN CARPARK

PAVERS & CONCRETE

LAWN

GARDENS

PAVED COURTYARD

GARDEN

BITUMEN RAMP

NSW PUBLIC WORKS SITE SHEDS (NOT SHOWN)

AVOCA STREET

HIGH STREET

LEGEND

- Test Bore Location
- Groundwater Monitoring Well Location

0 5 10 15 20 30 40 50m

1:500 @ A3

NOTE:
Base drawing from Denny Linker & Co Pty Ltd (Drawing 11530, dated 24.5.2011)

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Health Infrastructure		TITLE: **Location of Boreholes & Groundwater Wells**	PROJECT No: 72505.01
OFFICE: Sydney	DRAWN BY: PSCH	**Proposed Comprehensive Cancer & Blood Disorder Centre**	DRAWING No: 1
SCALE: As shown	DATE: 11.8.2011	**Prince of Wales Hospital, RANDWICK**	REVISION: A

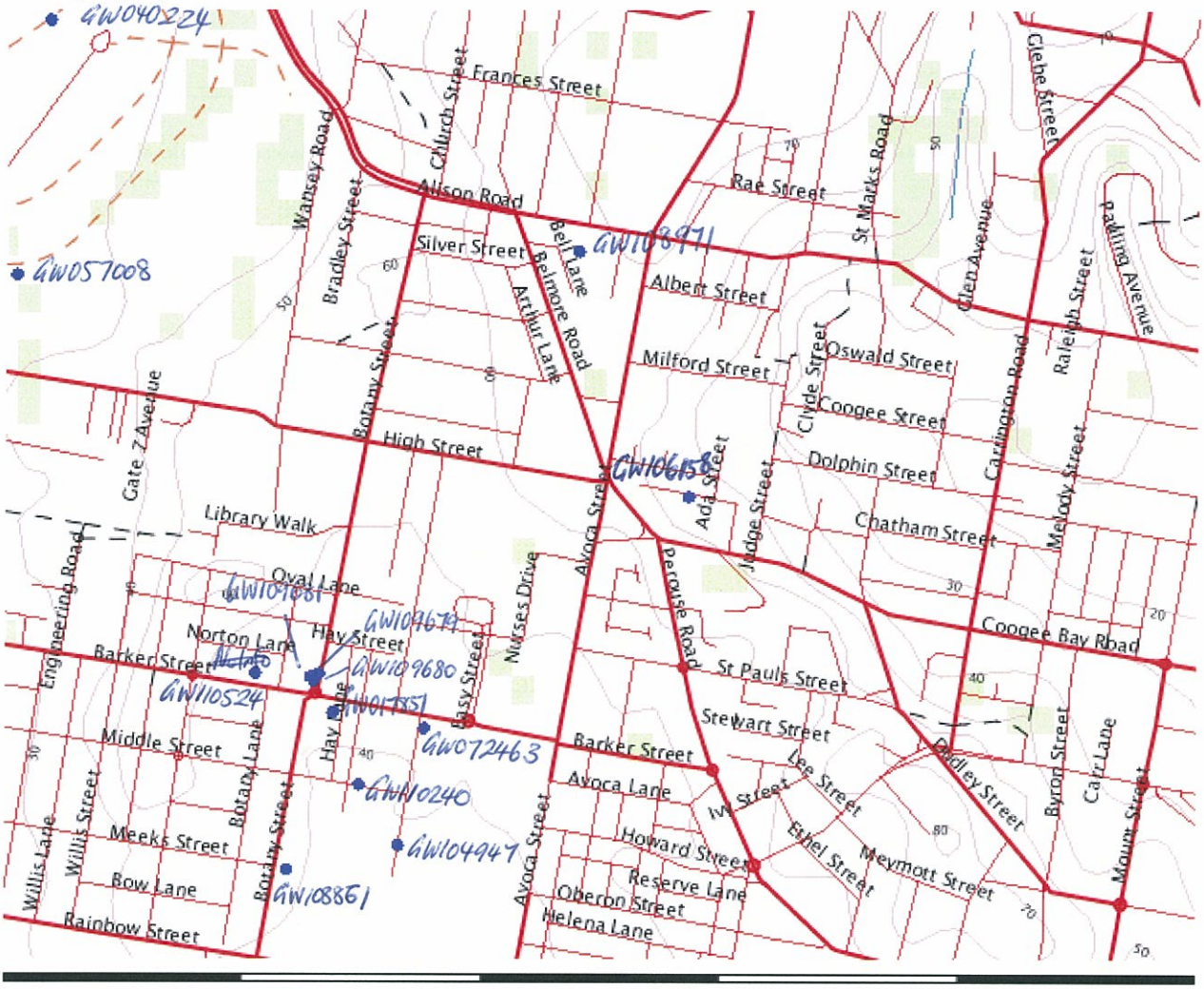
Appendix B

Groundwater Bore Search

Prince of Wales Hospital

Map created with NSW Natural Resource Atlas - http://www.nratlas.nsw.gov.au

Monday, July 11, 2011



Legend

Symbol	Layer	Custodian
	Cities and large towns renderImage: Cannot build image from features	
Cowra	Populated places renderImage: Cannot build image from features	
	Towns	
	Groundwater Bores	
	Catchment Management Authority boundaries	
	Major rivers	
	Topographic base map	

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, July 11, 2011

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW108971

Works Details (top)

GROUNDWATER NUMBER	GW108971
LIC-NUM	10BL602256
AUTHORISED-PURPOSES	RECREATION (GROUNDWATER)
INTENDED-PURPOSES	RECREATION (GROUNDWATER)
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	Rotary Air
OWNER-TYPE	Other Govt
COMMENCE-DATE	
COMPLETION-DATE	2008-06-27
FINAL-DEPTH (metres)	216.00
DRILLED-DEPTH (metres)	216.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	ALISON PARK
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	27.00
SALINITY	
YIELD	0.05

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6246132.00
EASTING	337350.00
LATITUDE	33 54' 46"
LONGITUDE	151 14' 26"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A (top)

COUNTY CUMBERLAND
PARISH ALEXANDRIA
PORTION-LOT-DP 30 1116355

Licensed (top)

COUNTY CUMBERLAND
PARISH ALEXANDRIA
PORTION-LOT-DP 30 1116355

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter; ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	12.00	200			Rotary Air
1		Hole	Hole	12.00	216.00	153			Rotary Air
1	1	Casing	PVC Class 6	0.30	18.00	153			Riveted and Glued; Driven into Hole

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
60.00	60.10	0.10						0.50	
186.00	186.20	0.20		27.00		0.05		0.50	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.30	0.30	TOPSOIL		
0.30	1.80	1.50	SANDY CLAY		
1.80	3.50	1.70	WHITE CLAY		
3.50	9.00	5.50	COLOURED SANDSTONE		
9.00	39.00	30.00	WHITE SANDSTONE		
39.00	41.00	2.00	BLACK SANDSTONE		
41.00	208.00	167.00	WHITE SANDSTONE		

208.00	216.00	8.00	GREY SHALE

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, July 11, 2011

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW106158

Works Details (top)

GROUNDWATER NUMBER	GW106158
LIC-NUM	10BL162658
AUTHORISED-PURPOSES	DOMESTIC
INTENDED-PURPOSES	
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	
COMMENCE-DATE	
COMPLETION-DATE	2005-06-29
FINAL-DEPTH (metres)	
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	GIDDINGS
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	213 - SYDNEY COAST - GEORGES RIVER
AREA-DISTRICT	
CMA-MAP	9130-3S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6245607.00
EASTING	337556.00
LATITUDE	33 55' 3"
LONGITUDE	151 14' 34"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	PT1 73744

Licensed (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	PT1 73744

Water Bearing Zones (top)

no details

Drillers Log (top)

no details

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, July 11, 2011

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW072463

Works Details (top)

GROUNDWATER NUMBER	GW072463
LIC-NUM	10BL156227
AUTHORISED-PURPOSES	INDUSTRIAL
INTENDED-PURPOSES	INDUSTRIAL
WORK-TYPE	Bore
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	Rot. Rev. Circ. Air
OWNER-TYPE	
COMMENCE-DATE	
COMPLETION-DATE	1994-11-14
FINAL-DEPTH (metres)	
DRILLED-DEPTH (metres)	43.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	NEWMARKET STABLE NO 1
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6245100.00
EASTING	337093.00
LATITUDE	33 55' 19"
LONGITUDE	151 14' 16"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	A//330407

Licensed (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	A 330407

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter; ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	43.00	150			Rotary
1	1	Casing	Steel	0.00	10.00	168	156		Driven into Hole

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
18.00	21.00	3.00		8.60	9.10	1.87	43.00	4.00	Good

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	7.00	7.00	GREY SAND		
7.00	8.00	1.00	GREY CLAY		
8.00	10.50	2.50	BROWN SANDSTONE		
10.50	11.00	0.50	BROWN SOFT SANDSTONE		
11.00	17.00	6.00	GREY SANDSTONE		
17.00	17.50	0.50	GREY CLAY		
17.50	43.00	25.50	WHITE SANDSTONE		

should be sought in interpreting and using this data.

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, July 11, 2011

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW110240

Works Details (top)

GROUNDWATER NUMBER	GW110240
LIC-NUM	10BL602332
AUTHORISED-PURPOSES	RECREATION (GROUNDWATER) STOCK
INTENDED-PURPOSES	RECREATION (GROUNDWATER)
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	Down Hole Hammer
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2008-11-12
FINAL-DEPTH (metres)	150.00
DRILLED-DEPTH (metres)	150.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	WILLIAM INGLIS & SON LIMITED
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	16.50
SALINITY	100.00
YIELD	0.50

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6244976.00
EASTING	336979.00
LATITUDE	33 55' 23"
LONGITUDE	151 14' 11"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	3 1102370

Licensed (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	3 1102370

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter; ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	18.00	200			Down Hole Hammer
1		Hole	Hole	18.00	150.00	161			Down Hole Hammer
1	1	Casing	PVC Class 9	-0.30	24.00	160	148		Riveted and Glued; Driven into Hole

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
58.00	58.20	0.20		16.50		0.50			
122.00	122.10	0.10				0.60			
140.00	140.10	0.10				0.50		2.00	100.00

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.50	0.50	TOPSOIL		
0.50	10.70	10.20	SAND COLOURED		
10.70	17.00	6.30	SOFT SANDSTONE		

17.00	150.00	133.00	HARD SANDSTONE

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, July 11, 2011

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW104947

Works Details (top)

GROUNDWATER NUMBER	GW104947
LIC-NUM	10BL160513
AUTHORISED-PURPOSES	TEST BORE
INTENDED-PURPOSES	TEST BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	
COMMENCE-DATE	
COMPLETION-DATE	2002-02-21
FINAL-DEPTH (metres)	5.00
DRILLED-DEPTH (metres)	5.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	RANDWICK BOYS & GIRLS HIGH SCH
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	2.71
SALINITY	210.00
YIELD	0.65

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	213 - SYDNEY COAST - GEORGES RIVER
AREA-DISTRICT	
CMA-MAP	9130-3S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6244847.00
EASTING	337052.00
LATITUDE	33 55' 27"
LONGITUDE	151 14' 14"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	LT1738 DP48445

Licensed (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	1 121453

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	5.00	150			Cable Tool
1	1	Casing	Steel	0.00	3.50	150	142		Screwed; Driven into Hole
1	1	Opening	Slots	3.50	5.00	130			Steel

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
2.71	4.80	2.09		2.71	4.36	0.65		4.00	210.00

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.30	0.30	TOPSOIL		
0.30	1.20	0.90	WHITE SAND		
1.20	1.40	0.20	ROCK COFFEE		
1.40	4.80	3.40	YELLOW SAND MG.		
4.80	5.00	0.20	YELLOW SILTY SAND		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, July 11, 2011

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW108861

Works Details (top)

GROUNDWATER NUMBER	GW108861
LIC-NUM	10BL601893
AUTHORISED-PURPOSES	RECREATION (GROUNDWATER)
INTENDED-PURPOSES	RECREATION (GROUNDWATER)
WORK-TYPE	Bore
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	Rotary Air
OWNER-TYPE	Local Govt
COMMENCE-DATE	
COMPLETION-DATE	2008-05-08
FINAL-DEPTH (metres)	114.00
DRILLED-DEPTH (metres)	114.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	PAINE RESERVE
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	20.00
SALINITY	
YIELD	2.21

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6244791.00
EASTING	336854.00
LATITUDE	33 55' 29"
LONGITUDE	151 14' 6"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	1532 752011

Licensed (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	1532 752011

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter; ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	12.00	200			Rotary Air
1		Hole	Hole	12.00	114.00	152			Rotary Air
1	1	Casing	PVC Class 6	-0.30	18.00	152			Screwed and Glued; Driven into Hole

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
37.00	37.30	0.30		20.00		1.10		0.50	
63.00	63.10	0.10		20.00		0.40		0.50	
98.00	98.50	0.50		20.00		0.30		0.50	
105.00	105.50	0.50		20.00		0.41		0.50	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.10	0.10	TOPSOIL		
0.10	0.80	0.70	SANDY CLAY		
0.80	0.90	0.10	GREY CLAY		
0.90	4.00	3.10	RED YELLOW SANDSTONE		
4.00	114.00	110.00	WHITE SANDSTONE		

Warning To Clients: This raw data has been supplied to the Department of Infrastructure, Planning and Natural Resources (DIPNR) by drillers, licensees and other sources. The DIPNR does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, July 11, 2011

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW017851

Works Details (top)

GROUNDWATER NUMBER	GW017851
LIC-NUM	10BL008581
AUTHORISED-PURPOSES	COMMERCIAL
INTENDED-PURPOSES	COMMERCIAL
WORK-TYPE	Bore
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	Cable Tool
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1958-03-01
FINAL-DEPTH (metres)	4.50
DRILLED-DEPTH (metres)	4.60
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	N/A
GWMA	603 - SYDNEY BASIN
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	213 - SYDNEY COAST - GEORGES RIVER
AREA-DISTRICT	
CMA-MAP	9130-3S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6245131.00
EASTING	336929.00
LATITUDE	33 55' 18"
LONGITUDE	151 14' 9"
GS-MAP	0055A4

AMG-ZONE	56
COORD-SOURCE	GD.,PR. MAP
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	380

Licensed (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	380

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1	1	Casing	(Unknown)	0.00	3.60	38			(Unknown)
1	1	Opening	Screen	3.60	4.50	0		1	Copper Alloy; SL: 0mm; A: 0mm

Water Bearing Zones (top)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
3.00	3.90	0.90	Unconsolidated						(Unknown)

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	4.57	4.57	Sand Water Supply		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, July 11, 2011

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW110524

Works Details (top)

GROUNDWATER NUMBER	GW110524
LIC-NUM	10BL601622
AUTHORISED-PURPOSES	DOMESTIC
INTENDED-PURPOSES	DOMESTIC
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2009-11-18
FINAL-DEPTH (metres)	1.50
DRILLED-DEPTH (metres)	1.50
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	UTHAPPA
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6245213.00
EASTING	336790.00
LATITUDE	33 55' 15"
LONGITUDE	151 14' 4"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	1//310365

Licensed (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	1 310365

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL DETAIL
1		Hole	Hole	0.00	1.50	100		

Water Bearing Zones (top)

no details

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.50	1.50	ROCK		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, July 11, 2011

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW109679

Works Details (top)

GROUNDWATER NUMBER	GW109679
LIC-NUM	10BL602763
AUTHORISED-PURPOSES	GROUNDWATER REMEDIATION
INTENDED-PURPOSES	GROUNDWATER REMEDIATION
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	Auger - Solid Flight
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2008-10-13
FINAL-DEPTH (metres)	6.00
DRILLED-DEPTH (metres)	6.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	R G WITHERS NOMINEES P/L
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6245214.00
EASTING	336903.00
LATITUDE	33 55' 15"
LONGITUDE	151 14' 8"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A (top)

COUNTY CUMBERLAND
PARISH ALEXANDRIA
PORTION-LOT-DP 1//226586

Licensed (top)

COUNTY CUMBERLAND
PARISH ALEXANDRIA
PORTION-LOT-DP 1 226586

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	6.00	100			Auger - Solid Flight

Water Bearing Zones (top)

no details

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.10	0.10	CONCRETE		
0.10	1.00	0.90	FILL, MOIST,SAND, GRAVEL		
1.00	4.00	3.00	SAND, MOIST GREY BROWN		
4.00	6.00	2.00	SANDSTONE,ORANGE BROWN		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, July 11, 2011

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW109680

Works Details (top)

GROUNDWATER NUMBER	GW109680
LIC-NUM	10BL602763
AUTHORISED-PURPOSES	GROUNDWATER REMEDIATION
INTENDED-PURPOSES	GROUNDWATER REMEDIATION
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	Auger - Solid Flight
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2008-10-14
FINAL-DEPTH (metres)	5.50
DRILLED-DEPTH (metres)	5.50
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	R G WITHERS NOMINEES P/L
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6245207.00
EASTING	336888.00
LATITUDE	33 55' 15"
LONGITUDE	151 14' 8"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	1//226586

Licensed (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	1 226586

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	5.50	100			Auger - Solid Flight

Water Bearing Zones (top)

no details

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.50	0.50	CONCRETE		
0.50	0.70	0.20	FILL,PALE,ORANGE		
0.70	1.50	0.80	SAND		
1.50	1.90	0.40	SANDSTONE		
1.90	3.90	2.00	SAND		
3.90	5.50	1.60	SANDSTONE,MOIST,PALE,GREY		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, July 11, 2011

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW109681

Works Details (top)

GROUNDWATER NUMBER	GW109681
LIC-NUM	10BL602763
AUTHORISED-PURPOSES	GROUNDWATER REMEDIATION
INTENDED-PURPOSES	GROUNDWATER REMEDIATION
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	Auger - Solid Flight
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2008-10-13
FINAL-DEPTH (metres)	6.00
DRILLED-DEPTH (metres)	6.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	R G WITHERS NOMINEES P/L
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6245198.00
EASTING	336894.00
LATITUDE	33 55' 16"
LONGITUDE	151 14' 8"
GS-MAP	

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	1//226586

Licensed (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	1 226586

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	6.00	100			Auger - Solid Flight

Water Bearing Zones (top)

no details

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.00	1.00	CONCRETE,FILL,MOIST ORANGE		
1.00	1.30	0.30	SAND		
1.30	2.10	0.80	SANDSTONE,MOIST,DARK		
2.10	3.50	1.40	SAND,WET,PALE		
3.50	6.00	2.50	SANDSTONE,SLIGHLY MOIST,WEATHERED		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Monday, July 11, 2011

Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW057008

Works Details (top)

GROUNDWATER NUMBER	GW057008
LIC-NUM	10BL124553
AUTHORISED-PURPOSES	TEST BORE
INTENDED-PURPOSES	INDUSTRIAL
WORK-TYPE	Bore
WORK-STATUS	Test Hole
CONSTRUCTION-METHOD	Cable Tool
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1981-10-01
FINAL-DEPTH (metres)	30.00
DRILLED-DEPTH (metres)	30.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	N/A
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	213 - SYDNEY COAST - GEORGES RIVER
AREA-DISTRICT	
CMA-MAP	9130-3S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6246064.00
EASTING	336347.00
LATITUDE	33 54' 47"
LONGITUDE	151 13' 47"
GS-MAP	0055A4

AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	99999

Licensed (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	UNKNOWN FROM HYDSYS

Water Bearing Zones (top)

no details

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.20	0.20	Topsoil		
0.20	3.00	2.80	Sand Grey		
3.00	13.50	10.50	Sand		
13.50	18.30	4.80	Sand Grey		
13.50	18.30	4.80	Peat Seams Clay Bands		
18.30	27.50	9.20	Sand Yellow		
27.50	30.00	2.50	Clay Grey		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
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Print Report

Works Details Site Details Form A Licensed Construction Water Bearing Zones Drillers Log

Work Requested -- GW040224

Works Details (top)

GROUNDWATER NUMBER	GW040224
LIC-NUM	
AUTHORISED-PURPOSES	
INTENDED-PURPOSES	RECREATION (GROUNDWATER)
WORK-TYPE	Spear
WORK-STATUS	Abandoned Bore
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	
FINAL-DEPTH (metres)	7.00
DRILLED-DEPTH (metres)	0.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	
GWMA	
GW-ZONE	
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	213 - SYDNEY COAST - GEORGES RIVER
AREA-DISTRICT	
CMA-MAP	9130-3S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	R.L. at Surface
NORTHING	6246613.00
EASTING	336394.00
LATITUDE	33 54' 30"
LONGITUDE	151 13' 49"
GS-MAP	0055A4

AMG-ZONE	56
COORD-SOURCE	Surveyed
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	ALEXANDRIA
PORTION-LOT-DP	1//130234

Licensed (top)

no details

Construction (top)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	7.00	40			

Water Bearing Zones (top)

no details

Drillers Log (top)

no details
