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MONA VALE GOLF CLUB LIMITED

PROPOSED ABOVE GROUND FUEL STORAGE TANK INSTALLATION 1 GOLF AVENUE, MONA VALE

PRELIMINARY CONTAMINATION ASSESSMENT

REPORT NO 12593/1-AAR1 19/01/2012

PITTWATER COUNCIL CONSTRUCTION CERTIFICATE
Number: CC0325/12
This is a copy of submitted plans, documents or Certificates associated with the issue of the Construction Certificate.
Endorsed by:
Date: 06 DEC 2012

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Job No: 12593/1
Our Ref: 12593/1-AAR1

19 January 2012

Mona Vale Golf Club Ltd
1 Golf Avenue
MONA VALE NSW 2103

Attention: Mr A Thompson

Dear Sir

re: **Proposed Above Ground Fuel Storage Tank Installation**
Mona Vale Golf Club – 1 Golf Avenue, Mona Vale
Preliminary Contamination Assessment

Please find herewith our *Preliminary Contamination Assessment* report for an area that covers two (2) underground fuel storage tanks (UFST), one (1) underground waste motor oil tank (UWMOT) and 1 bowser, as shown on the attached Drawing No 12593/1-AA1, hereafter known as the site, within the Mona Vale Golf Club, located at 1 Golf Avenue, Mona Vale.

It is understood that a new above ground fuel storage tank (AFST) to be located to the east of the site is proposed.

The objective of the assessment was to address the following requirements of State Environmental Protection Policy No. 55:

- Whether the land is contaminated and
- If the land is contaminated, whether the site will be suitable for the proposed development, after remediation.

Reference should be made to Sections 14.0 and 15.0 of the report for the conclusion, recommendations and limitations of this assessment.

If you have any questions, please do not hesitate to contact the undersigned.

Yours faithfully
GEOTECHNIQUE PTY LTD

AN NGUYEN
Environmental Scientist

Reviewed by

JOHN XU
Associate
BE, MEngSc, MIEAust

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EXECUTIVE SUMMARY

This executive summary presents a synopsis of a preliminary contamination assessment for an area that covers two (2) underground fuel storage tanks (UFST), one (1) underground waste motor oil tank (UWMOT) and 1 bowser, as shown on the attached Drawing No 12593/1-AA1, hereafter known as the site, within the Mona Vale Golf Club, located at 1 Golf Avenue, Mona Vale.

It is understood that a new above ground fuel storage tank (AFST) to be located to the east of the site is proposed.

The objective of the assessment was to address the following requirements of State Environmental Protection Policy No. 55:

- Whether the land is contaminated and
- If the land is contaminated, whether the site will be suitable for the proposed development, after remediation.

In order to achieve the objective of this assessment, the scope of work included a review of historical aerial photographs and records of NSW WorkCover and Environment Protection Authority (EPA) record of Notices for Contaminated Land, geological and hydrogeological information, soil sampling and testing, as well as installation of one groundwater monitoring well.

At the time of inspection during field work on 16 November 2011, the site was part of Mona Vale Golf Club and located in a designated area that is used by green keepers and mechanics. The site was concrete covered. There were 1 unleaded petrol UFST, 1 diesel UFST, 1 UWMOT and 1 bowser located within the site. The estimated extents of the tanks were marked on the ground by GBG Australia (GBGA) during the recent geophysical survey of the underground tanks.

The site is bound by a mechanical workshop to the north, green keeper shed to the north east, a concrete area / former gravel storage area to the east, by a bitumen driveway to the south and a roofed area, a wash bay and a cart shed to the west.

The aerial photographs reveal that the site was vacant and possibly forming part of a driveway leading to the greenkeeper's area for the golf club as early as 1951. The ground surface of the site might have been disturbed in the late 1970s and covered with concrete in the early 1980s. Since then, the site remained essentially unchanged. Major features of the surround areas include some large sheds, trees and a built-up platform.

WorkCover NSW records reveal 2 UFST (with capacity of 2000L and 5000L for unleaded petrol and diesel fuel respectively) and 1 UWMOT (with capacity of 1000L for waste lubricant oil / formerly petrol) located within the site. The UFST and UWMOT might have been in use since early 1980s.

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The NSW EPA records reveal no EPA notices issued for the site. There is however, one listed contaminated land located approximately 800m to the north-east of the subject site. *Voluntary Remediation Proposal: EPA Agreement* (Notice No. 26046) issued by NSW EPA on 3 September 2003, which remains current, indicates that EPA declares the site known as Caltex Service Station located at 79 Brrenjoey Road, Mona Vale and the neighbouring sites, to be a remediation land under the Contaminated Land Management Act 1997. The groundwater and the soil at the land is contaminated with petroleum hydrocarbons (TPH) and monoaromatic hydrocarbons including Benzene, Toluene, Ethyl Benzene and Xylenes (BTEX) in such a way as to present a significant risk of harm.

Based on the information provided by Mr A Thompson, it is understood that there is only very general history relating to the club and the course in the early days. There is no information regarding the area where the present underground fuel tanks are located. The club does not have records of when the existing tanks were installed and from enquiries made from the long time members it seems they would have been installed over 30 years ago.

The soils landscape map reveals that the site is possibly located in disturbed terrain, commonly consisting of a turfed fill area or waste materials.

Fill, underlain by natural clayey soil of relatively low permeability, was encountered at all five borehole locations during field sampling.

During the field work on 16 November 2011, diesel staining was noted and weak to distinct petroleum product odour detected in some fill layers in BH1 and MW1. Photo-Ionised Detector (PID) readings in the recovered soil samples were ranging from 0ppm to 240ppm.

No visual evidence of asbestos-cement pieces or other indicators of potential contamination, such as ash materials or other foreign matter were noted in recovered soil samples.

Water (possibly seepage) was encountered at depth of about 4.5 metres (m) in MW1 below existing ground level (EGL).

The available historical information, existing conditions and field work suggest potential contamination (refer to Table 1 on page 9) in the following areas:

- The site occupied by 2 UFST, 1 UWMOT, 1 bowser and associated pipelines.
- The fill encountered during field sampling for this PCA, possibly imported from unknown sources.
- Potential groundwater contamination resulted from soil contamination in the site.
- Potential soil and/or groundwater contamination beneath the site resulting from off-site migration of contaminants from the nearby green keeper shed and the mechanical workshop.

It was understood from discussion between Mr A Thompson of The Mona Vale Golf Club Ltd and James Ngu of our office that Caltex Service Station is located topographically lower than the subject site. As such, impact of the contaminated groundwater from the concerned Caltex Service Station on the subject site is unlikely.

As part of the contamination assessment, a sampling and testing plan was implemented to address the potential contamination concerns. Five (5) boreholes (BH1 to BH4 and MW1) were located (refer to the attached Drawing No 12593/1-AA1) as close as possible to the tanks and bowser.

One single-level monitoring well was installed at MW1 and terminated on sandstone bedrock at depth of about 6.0m below the EGL.

A number of soil samples were recovered and selected for chemical testing of a combination of analytes including metals {arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni) and zinc Zn)}, Total Petroleum Hydrocarbons (TPH), BTEX (Benzene, Toluene, Ethyl Benzene and Xylenes), Polycyclic Aromatic Hydrocarbons (PAH), Organochlorine Pesticides (OCP), Polychlorinated Biphenyls (PCB), Total Phenols and Total Cyanides.

The assessment criteria adopted were the available Health-based Investigation Levels (HBILs) / Health Investigation Levels (HILs) for *parks, recreational open space and playing fields* development (NEHF 'E' / HILs 'E'), the provisional phytotoxicity based investigation levels (PPBILs) / Ecological Investigation Levels (EILs) and the suggested Levels in the EPA service station guidelines.

The majority of the laboratory results satisfied the criteria for stating that the analytes selected are either not present (i.e. concentrations less than Limits of Reporting), or present in the sampled soils at concentrations that do not pose a risk of hazard to human health or the environment, under the conditions for *parks, recreational open space or playing fields* use.

However, a number of locations in the vicinity of unleaded underground fuel storage tank (UFST), underground waste motor oil tank (UWMOT) and bowser, as shown and tabulated on the attached Drawing No 12593/1-AA2 were identified to have As, Hg, Zn, TPH and Total PAH concentrations of concern. Soil contaminated with Hg, TPH and Total PAH at those locations will pose a risk of harm to human health if the soil is to be exposed in the future. The concentrations of As, Hg and Zn might present a potential hindrance to the growth of some plant species if the soil is to be exposed in the future.

It is our opinion that the site will be suitable for the proposed development, subject to implementation of the following works:

1. Assessment of the soil in the area for the proposed above ground fuel storage tank (AFST) will be required in order to ascertain the contamination status of the soil.
2. The unleaded UFST, the UWMOT and the bowser should be decommissioned, removed and disposed of at a licensed facility by a licensed contractor.

   Validation assessment will be required following the removal of the tanks and the bowser in order to ensure the complete removal of the contaminated soil.
3. No contamination was identified in the analysed soil samples recovered from two (2) borehole locations close to the diesel UFST. Additional soil sampling and testing will be required in order to ascertain the contamination status of soil in the vicinity of the diesel UFST.

   Alternatively, the diesel UFST could be decommissioned, removed and disposed of at a licensed facility, together with the unleaded UFST, the UWMOT and the bowser by a licensed contractor. Validation assessment will be required following the removal of the tank.
4. Detailed assessment to delineate the extent of contamination in the vicinity of the locations of concern, as shown on Drawing No 12593/1-AA2 will be required.

5. Assessment of the possible seepage water within the installed monitoring well MW1 will be required in order to determine the contamination status of the water.
6. Waste classification will be required for the contaminated soil that requires landfill disposal.
7. Preparation of a remedial action plan (RAP) will be required to provide guidance on a suitable remediation and validation methodology.
8. Groundwater assessment might be required depending on the outcomes of the above mentioned works.

It is our opinion that:

1. The proposed additional work (Point 1) must be undertaken prior to the installation of the proposed AFST.
2. The proposed additional works (Points 2 to 7) as mentioned above can be undertaken during / after removal of the tanks and the concrete slab at and in the vicinity of locations/areas of concern.

Reference should be made to Section 15.0 of the report, which sets out details of the limitations of the assessment.

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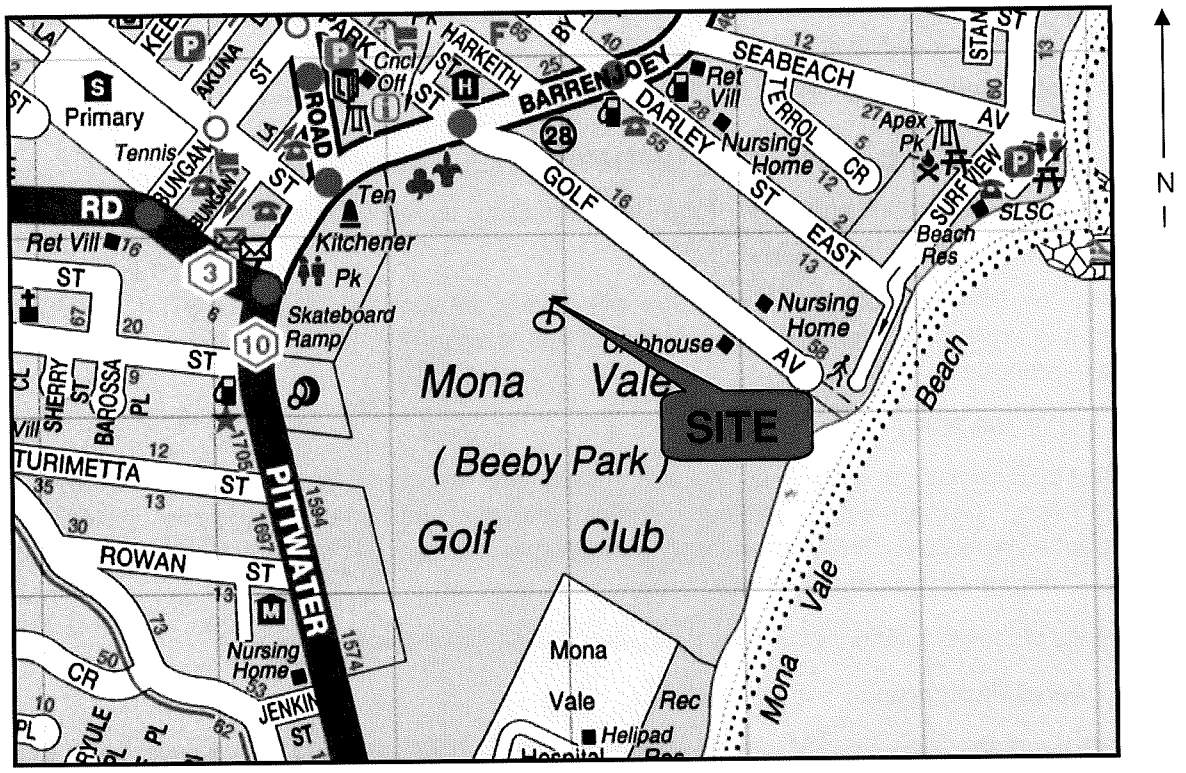
1.0 INTRODUCTION

This report presents the results of a preliminary contamination assessment (PCA) completed for an area, that covers two (2) underground fuel storage tanks (UFST), one (1) underground waste motor oil tank (UWMOT) and 1 bowser, hereafter known as the site, within the Mona Vale Golf Club, located at 1 Golf Avenue, Mona Vale, as indicated on Figure 1 below.

FIGURE 1



The objective of the assessment was to address the following requirements of State Environmental Protection Policy No. 55:

- Whether the land is contaminated and
- If the land is contaminated, whether the site will be suitable for the proposed development, after remediation.

2.0 SCOPE OF WORK

In order to achieve the objective of this assessment, the following scope of work was conducted in accordance with our proposal dated 14 November 2011 (Reference JN/Q5573R1):

- A desktop study of the following to assist in identification of potential contamination issues:
  - Historical aerial photographs
  - WorkCover NSW records pertaining to storage of dangerous goods
  - NSW Environment Protection Authority (EPA) record of Notices for Contaminated Land
- Review of soils and geological maps.
- Acquisition of groundwater bore information for the region.
- An inspection by the writer to identify current site activities, site features and any visible or olfactory indicators of potential contamination.

- Soil sampling by the writer from five (5) boreholes close to the UFST, UWMOT and bowser.
- Chemical analysis by National Association of Testing Authorities (NATA) accredited testing laboratories, in accordance with chains of custody (COC) prepared by Geotechnique Pty Ltd (Geotechnique).
- Implementation of industry standard quality assurance (QA) and quality control (QC) measures. QC samples were also forwarded to the testing laboratories.
- Assessment of the laboratory analytical results against current applicable guidelines.
- Assessment of field and laboratory QA and QC.
- Assessment of the contamination status of the soil.

3.0 SITE IDENTIFICATION AND PROPOSED DEVELOPMENT

The subject site is located within the Mona Vale Golf Club, on the southern side of Golf Avenue, Mona Vale, in the local government area of Pittwater.

As shown on Drawing No 12593/1-AA1, the site covers an area including 2 UFST, 1 UWMOT and 1 bowser. It is understood that a new above ground fuel storage tank (AFST) to be located to the east of the site is proposed.

4.0 SITE HISTORY

In order to formulate a picture of the site history and to assist in identification of any potential contamination, Geotechnique obtained and/or reviewed information including historical aerial photographs, WorkCover NSW information pertaining to storage of dangerous goods and NSW EPA records of notices for contaminated land.

The results of the information review are presented in the following sub-sections.

4.1 Aerial Photographs

Aerial photographs taken in 1951, 1961, 1970, 1978, 1986, 1994 and 2005 were examined. Copies of the aerial photographs are kept in the offices of Geotechnique and are available for examination upon request. The writer made the following observations. Due to the scale, some of the listed observations are best interpretations only.

1951, 1961 and 1970	The site appears to be vacant and possibly forming part of a driveway leading to the greenkeeper's area for a golf club. The surrounding area appears to contain some large sheds and trees.
1978	Disturbance of ground surface is evident within the site and adjacent southern area.
1986	The site appears to resemble the current surface condition, which is covered with concrete. The disturbed adjacent southern area noted in 1978 photograph appears to be a built-up platform.
1994, 2005	The site and surrounding areas remain essentially unchanged since 1986.

In summary, the aerial photographs reveal that the site was vacant and possibly forming part of a driveway leading to the greenkeeper's area for the golf club as early as 1951. The ground surface of the site might have been disturbed in the late 1970s and covered with concrete in the early 1980s. Since then, the site remained essentially unchanged. Major features of the surround areas include some large sheds, trees and a built-up platform.

4.2 WorkCover NSW Records

A request was made to WorkCover NSW to search for any information on licences to store dangerous goods including underground tank(s) and/or other underground facilities at the site.

A search of the Stored Chemical Information Database (SCID) and the microfiche records by WorkCover NSW locate some records pertaining to the land owned by Mona Vale Golf Club Ltd. The club was licensed to keep a number of items of dangerous goods. The results are presented in Appendix A of this report and summarised below.

Occupier	Date of Application for renewal	Holding Facility	Storage location	Content	Maximum Storage Capacity / Quantity
Mona Vale Golf Club Ltd	04/11/1952	Roofed Store	70 feet away from exhausting equipment shed	Mineral Spirit	44 Gallons
		Roofed Store		Mineral Oil	44 Gallons
Mona Vale Golf Club Ltd	10/11/1982	Underground Storage Tank	Greens Shed Fuel Storage Facility (GSFSF) – subject site	Class3.1 Petrol	2000 Litres (L)
		Underground Storage Tank		Class3.1 Petrol	1000L
		Underground Storage Tank		Distillate Fuel	5000L
Mona Vale Golf Club Ltd	18/05/1993	Underground Storage Tank	GSFSF – subject site	Petrol	2000L
		Underground Storage Tank		Petrol	1000L
		Underground Storage Tank		Diesel	5000L
		Tank	East of Club House (ECH)	Diesel	1000L
		Roofed Store	Green Keepers Shed (GKS)	Oxygen	Unknown
		Roofed Store		Acetylene	Unknown
		Cage		Poison	Unknown
Mona Vale Golf Club Ltd	27/04/1999	Underground Storage Tank	Depot 1 (GSFSF) – subject site	Petrol	2000L
		Underground Storage Tank	Depot 2 (GSFSF) – subject site	Waste Oil	1000L
		Cylinder Store	Depot 3 (GKS)	Oxygen	3800L
		Cylinder Store	Depot 4 (GKS)	Acetylene	3200L
		Underground Storage Tank	Depot 5 (GSFSF) – subject site	Diesel	5000L
		Roofed Store	Depot 6 (GKS)	Toxic Liquid	700L
		Aboveground Storage Tank (Decommissioned)	Depot 7 (ECH)	Diesel	500L
Mona Vale Golf Club Ltd	04/09/2004	Underground Storage Tank	Depot 1 (GSFSF) – subject site	Petrol	2000L
		Underground Storage Tank	Depot 2 (GSFSF) – subject site	Waste Lubricating Oil	1000L
		Underground Storage Tank	Depot 5 (GSFSF) – subject site	Diesel	5000L
		Roofed Store	Depot 6 (GKS)	Organophosphorus Pesticide Toxic Liquid	700L
		Cylinder Store	Depot 7 (GKS)	Compressed Gas NOS, Carbon Dioxide	100 cubic metres (m^3)
		150L Approve Flammable Liquids Cabinet	Depot 8 (GKS)	Petrol, Kerosene, Flammable Liquid NOS	150L
		Roofed Store	Depot 9 (GKS)	Class C2	250L

Within the site three of those items were located, as detail below:

Storage location	Holding Facility	Content	Maximum Storage Capacity (L)
Depot 1 (GSFSF) – subject site	Underground tank	Unleaded petrol	2000
Depot 2 (GSFSF) – subject site	Underground tank	Waste Lubricating Oil (formerly petrol)	1000
Depot 5 (GSFSF) – subject site	Underground tank	Diesel Fuel	5000

It is understood from Application for Renewal of Licence to Keep Dangerous Goods dated 27/04/1999 that Depot 2 was used to store petrol prior to 1999 and has been used to store waste lubricating oil since 1999.

In summary, WorkCover NSW records reveal 2 UFST (with capacity of 2000L and 5000L for unleaded petrol and diesel fuel respectively) and 1 UWMOT (with capacity of 1000L for waste lubricant oil / formerly petrol) located within the site. The UFST and UWMOT might have been in use since early 1980s.

4.3 NSW EPA Records

The NSW EPA publishes records of contaminated lands under Section 58 of the Contaminated Land Management (CLM) Act 1997. 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.

A search of the NSW EPA records on 05 December 2011 revealed that the site is not listed.

There is however, one listed contaminated land located approximately 800m to the north-east of the subject site. *Voluntary Remediation Proposal: EPA Agreement* (Notice No. 26046) issued by NSW EPA on 3 September 2003, which remains current, indicates that EPA declares the site known as Caltex Service Station located at 79 Brrenjoey Road, Mona Vale and the neighbouring sites, to be a remediation land under the Contaminated Land Management Act 1997. The groundwater and the soil at the land is contaminated with petroleum hydrocarbons (TPH) and monoaromatic hydrocarbons including Benzene, Toluene, Ethyl Benzene and Xylenes (BTEX) in such a way as to present a significant risk of harm.

It should be noted that the EPA records of notices for contaminated land do not provide records of all contaminated lands in NSW. At the time of searching the records, 327 sites in NSW were registered in the database.

Reference may be made to Appendix B for a copy of EPA records.

4.4 Anecdotal Information

Based on the information provided by Mr A Thompson, it is understood that there is only very general history relating to the club and the course in the early days. There is no information regarding the area in the vicinity of where the present underground fuel tanks are located.

A plan of the course in 1927 shows it was only 9 holes and is likely to have included the area now occupied by the fuel tanks.

The 18 hole course, generally as it presently exists, was opened in February 1960. The old igloo building immediately to the north of the diesel tank became an equipment shed for the greens staff in the mid 1960's.

The golf cart storage shed located to the south of the fuel tank area would have been constructed in 1998/99.

As to the condition of the land in the early days the 1927 plan shows what is referred to as "Black Swamp" extending from the sand hills at the beach as far west as Pittwater / Barrenjoey Roads. The swamp was drained and filled in the 1930's.

As noted above there is no information available as to earlier uses of the area presently occupied by the tanks.

The club does not have records of when the existing tanks were installed and from enquiries made from the long time members it seems they would have been installed over 30 years ago.

5.0 SITE CONDITION AND SURROUNDING ENVIRONMENT

5.1 Site Condition

An inspection of the site was carried out by the writer during field work on 16 November 2011. During the inspection, the following observations were made:

- The site was part of Mona Vale Golf Club and located in a designated area of the golf club that is used by green keepers and mechanics.
- The site was concrete covered.
- There were 1 unleaded petrol UFST, 1 diesel UFST, 1 UWMOT and 1 bowser located within the site. The estimated extents of the tanks were marked on the ground by GBG Australia (GBGA) during the recent geophysical survey of the underground tanks.

The above noted features are indicated on Drawing No 12593/1-AA1.

5.2 Surrounding Environment

At the time of inspections, observations of the neighbouring areas, also part of Mona Vale Golf Club, were as follows:

To the north	Mechanical workshop
To the north east	Green keeper's shed
To the east	A concrete area/former gravel storage area
To the south	A bitumen driveway
To the west	A roofed area, a wash bay and a cart shed.

6.0 TOPOGRAPHY, GEOLOGY & HYDROGEOLOGY

The regional topography around the site is undulating, generally slopes to the south and south-east. Ground surface within the site is generally flat. The general slope of the immediate region is towards the south.

The Soil Landscape Map of Sydney (Soil Landscape Series Sheet 9130, Scale 1:100,000, 2002), prepared by the Soil Conservation Service of NSW, indicates that the site is located within the Warriewood landscape area and typically consists of localised flooding and run-on high water tables, highly permeable soil. The Landscape Map also indicates that disturbed terrain possibly exist beneath the site, commonly consisting of a turfed fill area, capped with up to 40 centimetres (cm) of sandy loam or up to 60cm of compacted clay over fill or waste materials.

The Geological Map of Sydney (Geological Series Sheet 9130, Scale 1:100,000, 1983), published by the Department of Mineral Resources, indicates the residual soils within the site to be underlain by Quarternary Age soils consisting of silty to peaty quartz sand, silt and clay ferruginous and humic cementation in places, common shell layers or Triassic Age Newport Formation and Garie Formation of the Narrabeen Group, comprising interbedded laminite, shale and quartz to lithic quartz sandstone.

Reference should be made to Table 1 in Appendix C for descriptions of the soils encountered during sampling for this assessment on 16 November 2011. Based on information from all the boreholes BH1 to BH4 and MW1, the sub-surface profile across the site is generalised as follows:

Fill	Sand or clayey sand (Type 1 fill), fine grained brown to dark brown and sandy clay (Type 2 fill), medium plasticity, dark brown, trave of gravel, to depths ranging from about 0.6m to 1.2m below the existing ground level (EGL).
Residual Soil	Clay, high plasticity, yellow brown or grey, with ironstones, encountered beneath the fill to depths ranging from about 3.2m to 4.0m below EGL.
Bedrock	Clayey shale/siltstone, extremely weathered, grey with ironstones to depths ranging from about 3.9m to 6.0 below EGL. Auger refusal on sandstone bedrock was encountered in MW1 at depth of about 6.0m from EGL.

Reference may be made to Drawing No 12593/1-AA2 for the borehole locations.

Diesel staining was noted and weak to distinct petroleum product odour detected in some fill layers in BH1 and MW1.

Photo-Ionised Detector (PID) was used to screen the recovered soil samples for the presence or otherwise of volatile organic compounds (VOC). The PID readings ranging from 0ppm to 240ppm are summarised in Table 1 and Engineering Log included in Appendix C.

No visual evidence of asbestos-cement pieces or other indicators of potential contamination, such as ash materials or other foreign matter were noted in recovered soil samples.

One single-level monitoring well (MW1) was installed during the field work for this assessment, using a Geoprobe to a depth of about 3.7m and a drilling rig with solid flight auger, terminated on sandstone bedrock at a depth of about 6.0m below the EGL. Water (possibly seepage) was encountered at a depth of about 4.5m in MW1 below EGL. Rockwell Drilling Services installed the well, under the supervision of Geotechnique. Reference should be made to Drawing No 12593/1-AA1 for the monitoring well location.

The monitoring wells consisted of a standpipe of 50 millimetres (mm) internal diameter, Class 18 PVC casing and a 0.45mm machine slotted screen. The slotted section was wrapped in a non-woven geotextile filter sock to prevent fines from entering the standpipe. The annulus was backfilled with clean sand, bentonite (seal material) and concrete to prevent ingress of surface run-off. A push-on cap was fitted on top of the standpipe and a gatic cover placed on top. Construction details of the monitoring well are shown in the Engineering Log in Appendix A.

Based on a report provided by Mr A Thompson of The Mona Vale Golf Club Ltd, previous groundwater investigation in the golf course area suggested that the shallowest aquifer is about 17m to 18m below the EGL at location relatively lower than the site. Reference should be made to a copy of the report included in Appendix D.

As such, it is our opinion that the water encountered in the monitoring well installed for this PCA is most likely due to seepage from storm water run-off in the areas nearby.

The closest coastline is approximately 500m to the north east of the site. A number of ponds within the golf course are within close proximity to the site. The ponds capture stormwater run-off from the site.

In order to obtain some understanding of regional groundwater conditions, a search was carried out through the website of the Department of Natural Resources for any registered groundwater bore data within a radius of 0.5 kilometre (km) of the site. The search revealed nineteen (19) bores within this radius. The bores were drilled between 1960 and 2010 and ranged in depths from 3.5m to 124.9m. Fifteen (15) bores had recorded water bearing zones at depths ranging from 2.00m to 93.8m below the EGL and standing water levels ranging from 1.5m to 21.3m.

The bores were authorised and intended for waste disposal, domestic, irrigation, recreation and test / monitoring bore purposes. The information obtained is summarised in the following table and included in Appendix D of this report.

Bore	Date	Authorised/ Intended Purpose	AMG coordinates	Water Bearing Zone (m)	Standing Water Level (m)	Salinity (mg/L)
GW018770	1.08.1960	Waste Disposal	$_{3}43.269_{E}$ & $_{62}72.378_{N}$	22.2-40.1	3.60	Unknown
GW018771	1.11.1960	Waste Disposal	$_{3}43.434_{E}$ & $_{62}72.277_{N}$	64.0-68.5 92.0-93.8	No Details	Unknown Unknown
GW018778	1.10.1960	Waste Disposal	$_{3}42.629_{E}$ & $_{62}72.395_{N}$	42.6-44.1 54.2-74.6	21.3 21.3	Unknown Unknown
GW018808	1.12.1960	Waste Disposal	$_{3}43.691_{E}$ & $_{62}72.615_{N}$	No Details	No Details	No Details
GW019104	1.02.1961	Waste Disposal	$_{3}43.984_{E}$ & $_{62}72.690_{N}$	No Details	No Details	No Details
GW026026	1.11.1966	Domestic	$_{3}43.004_{E}$ & $_{62}72.400_{N}$	15.5-15.5 34.1-35.0	3.0 2.4	Unknown Fresh
GW026027	1.12.1966	Domestic	$_{3}42.964_{E}$ & $_{62}72.385_{N}$	12.1-12.1 48.7-48.7 56.3-56.3	4.5 4.5 4.5	Fresh Fresh Fresh
GW026581	0.01.1967	Waste Disposal	$_{3}42.984_{E}$ & $_{62}72.520_{N}$	13.7-13.7 28.0-28.0 56.3-56.3 71.3-71.3 86.8-86.8	2.4 2.4 2.4 2.4 1.5	Unknown Unknown Unknown Unknown Unknown
GW105936	19.05.2005	Domestic	$_{3}43.556_{E}$ & $_{62}72.453_{N}$	No Details	No Details	No Details
GW108158	7.05.2006	Domestic	$_{3}43.576_{E}$ & $_{62}72.442_{N}$	2.6-6.3	2.6	Good
GW108500	10.11.2006	Domestic	$_{3}43.526_{E}$ & $_{62}72.338_{N}$	2.0-4.0	2.0	No Details
GW108558	5.02.2007	Domestic	$_{3}43.632_{E}$ & $_{62}72.612_{N}$	2.3-4.3	2.8	No Details
GW108579	9.03.2007	Domestic	$_{3}43.749_{E}$ & $_{62}72.426_{N}$	4.0-6.6	4.0	Fair
GW108682	23.03.2007	Domestic	$_{3}43.618_{E}$ & $_{62}72.714_{N}$	2.6-3.5	2.6	600.00
GW111427	25.02.2008	Recreation	$_{3}42.793_{E}$ & $_{62}71.999_{N}$	18.0-19.0 24.0-25.0 72.0-73.0	 3.0	3.2 3.1 3.2
GW111444	25.02.2008	Test Bore	$_{3}42.900_{E}$ & $_{62}72.193_{N}$	18.0-19.0 24.0-25.0 72.0-73.0	 3.0	3.2 3.1 3.2
GW108888	2.06.2008	Irrigation Recreation	$_{3}43.062_{E}$ & $_{62}72.010_{N}$	17.0-18.0 29.0-30.0 57.0-58.0	7.0	No Details
GW111104	15.06.2010	Monitoring Bore	$_{3}43.146_{E}$ & $_{62}72.387_{N}$	2.0-4.0	2.0	No Details
GW111105	15.06.2010	Monitoring Bore	$_{3}43.164_{E}$ & $_{62}72.381_{N}$	2.0-5.0	2.0	No Details

Based on the foregoing, the groundwater level in the shallowest aquifer beneath the site is anticipated to be in excess of at least 15.0m below the EGL, within the underlying sandstone bedrock.

7.0 POTENTIAL FOR CONTAMINATION

Based on the available site historical information, existing site conditions and field work, the following Table 1 summarises the areas of potential environmental concern.

Table 1 Areas of Potential Environmental Concern

Rationale / Details	Potential Contamination [1]
➢ The presence of 2 UFST, 1 UWMOT, 1 bowser and associated pipelines	➢ Lead (Pb) ➢ Total Petroleum Hydrocarbons (TPH) ➢ Benzene, Toluene, Ethyl Benzene and Xylenes (BTEX) ➢ Polycyclic Aromatic Hydrocarbons (PAH) ➢ Phenols
➢ Fill, which could have been imported from unknown sources, was encountered during field sampling for this PCA; therefore, there is potential for the fill to be contaminated.	➢ Metals [2] ➢ TPH ➢ BTEX ➢ PAH ➢ Organochlorine Pesticides (OCP) ➢ Polychlorinated Biphenyls (PCB) ➢ Phenols ➢ Cyanides ➢ Asbestos
➢ Groundwater beneath the site may be contaminated as a result of soil contamination due to site activities and the presence of tanks, bowser and fill	➢ The above mentioned contaminants except Asbestos
➢ Soil and groundwater beneath the site may be contaminated as a result of the potential migration of any chemical stored within the nearby green keeper shed and the mechanical workshop	➢ Metals [2] ➢ TPH ➢ BTEX ➢ PAH ➢ OCP ➢ Organophosphate Pesticides (OPP) ➢ Phenols ➢ Volatile Organic Compounds (VOC)

1 The suite of potential contaminants identified in Table 1 will be reviewed subject to the findings of inspection of the excavated materials during and/or after decommission and removal of the tanks, bowser and/or hardstands and added to if considered appropriate.
2 Metals suite includes arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), Pb, mercury (Hg), nickel (Ni) and zinc (Zn).

It was understood from discussion between Mr A Thompson of The Mona Vale Golf Club Ltd and James Ngu of our office that Caltex Service Station is located topographically lower than the subject site. As such, impact of the contaminated groundwater from the concerned Caltex Service Station on the subject site is unlikely.

8.0 SAMPLING & ANALYSIS PLAN AND SAMPLING METHODOLOGY

Sampling and analyses for the contamination assessment were carried out to obtain a reasonable assessment of the following:

1. Nature, location and likely distribution of soil contaminants beneath the site.
2. The risks that the contaminants (if present) pose to human health or the environment, both presently and under the conditions of the proposed development.

The risk of harm to human health and the environment was determined through comparison of test results with EPA produced or endorsed criteria available at the time, as discussed in Section 11.0 of this report.

Site sampling was carried out on 16 November 2011 by the writer, who was responsible for visually assessing the site, locating the boreholes as close as possible to nominated locations, supervision of the drilling and installation of a monitoring well, recovery of soil samples, carrying out insitu PID screening, preparation of samples for delivery to NATA accredited laboratories and logging the sub-surface profile encountered at each borehole location.

Ground penetrating radar survey to locate the underground tanks, bowser and associated pipelines had been carried out by GBGA prior to the sampling. Two UFSTs, one UWMOT and bowser with their associated pipelines had been located and marked on ground surface of the site.

Five (5) boreholes (BH1 to BH4 and MW1) were located (refer to Drawing No 12593/1-AA1) as close as possible to the tanks and bowser.

Prior to sampling, the borehole locations were scanned by a service locator in order to avoid any underground services.

Water (possible seepage) was encountered at a depth of about 4.5m in MW1 below EGL. It is our opinion that the water encountered is most likely due to seepage from storm water run-off in the areas nearby. It is anticipated that the groundwater would be within the underlying sandstone bedrock.

One single-level monitoring well was installed at MW1 and terminated on sandstone bedrock at depth of about 6.0m below the EGL. Groundwater assessment was not included as part of the scope of work.

The sampling procedures adopted were as follows:

- Soil samples were collected using a Geoprobe ® sampling system by operators from Rockwell Drilling Services.
- The sampling equipment / tools were decontaminated thoroughly washed with biodegradable, phosphate-free detergent (Decon 90) and then rinsed thoroughly in clean distilled water. This procedure was undertaken prior to sampling and after collection of samples.
- At each sampling depth, 2 fill samples were recovered, one for laboratory analysis, the other one for head space screening, using a calibrated PID, to screen for the presence or otherwise of VOC. The PID readings are summarised in Table 1 and monitoring well log of Appendix E. The PID readings on the recovered samples, recorded on the field logs, were ranging from 0ppm to 240ppm.
- To minimise the potential loss of VOC, the laboratory soil sample was immediately transferred, using a stainless steel trowel, to a labelled, laboratory supplied, 250ml glass jar and sealed with an airtight, Teflon screw top lid. The fully filled jar was then placed in a chilled container.

In order to ensure the analytical performance of the primary laboratory, duplicate and split samples were prepared for analyses. Samples were kept in a labelled laboratory supplied glass jar (acid-washed and solvent-rinsed) and sealed with an airtight screw Teflon top lid.

A rinsate water sample was collected and placed in a bottle supplied by the laboratory. The fully filled bottle was labelled and placed in a chilled container.

At completion of field sampling, the primary samples in chilled container with a trip spike sample were forwarded under Chain of Custody (COC) conditions to the primary testing laboratory SGS Environmental Services (SGS). Inter-laboratory duplicate (split) samples were forwarded to the secondary testing laboratory of Envirolab Services Pty Ltd (Envirolab). Both SGS and Envirolab are NATA accredited.

On receipt of the samples, the laboratories returned the Sample Receipt Advice, verifying the integrity of all the samples received.

The soil profile encountered, as described in Section 6.0 of this report, with the exception of staining and odour, did not reveal visual evidence of asbestos-cement pieces or other indicators of potential contamination, such as ash materials or other foreign matter. Diesel staining was noted and weak to distinct petroleum product odour detected in some fill layers in BH1 and MW1. In addition, PID readings ranging from 0ppm to 240ppm were recorded in the recovered soil samples. Based on this data and the potential for contamination discussed previously in this report (Section 7.0), the following laboratory analysis plan was implemented:

- At least one to two soil samples with the highest PID reading and the corresponding duplicate and split samples were selected from each borehole and analysed for TPH and BTEX.

  The selected soil samples and the corresponding duplicate and split samples were screened for metals including As, Cd, Cr, Cu, Pb, Hg, Ni and Zn and PAH.

  Two soil samples and the corresponding duplicate and split samples were also screened for Total Phenols.
- For screening purposes, one sample from each type of fill (sand and sandy clay) was selected for analysis of OCP, PCB and Total Cyanides.
- One trip spike sample for BTEX.
- One rinsate sample for metals, TPH, BTEX and PAH.

No asbestos pieces were noted within the boreholes and the recovered soil samples. As such, asbestos analysis was not carried out.

The laboratory testing schedule adopted is presented in Table A.

9.0 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

In order to ensure the integrity and reliability of the chemical analysis carried out, the following QA/QC procedures were implemented for the sampling and analytical program.

9.1 Rinsate Sample

A rinsate water sample (Rinsate R1) was recovered on completion of field work in order to identify possible cross contamination between the sampling locations. A sample of the same water source used for cleaning the equipment (clean distilled water) was previously analysed by the primary laboratory, thus with known concentrations of the selected analytes. The concentrations of the analytes in the rinsate sample were then compared with the results of the original distilled water.

The rinsate water sample was analysed for metals, TPH, BTEX and PAH. The test results for the rinsate water and distilled water samples are summarised in Table B. The laboratory analytical report is included in Appendix E.

As indicated in Table B, concentrations of the analytes were not significantly different to those of the distilled water sample, indicating that the cleaning and decontamination processes adopted in the field were adequate.

9.2 Trip Spike Sample

Trip spike samples are obtained from the laboratory on a regular basis, prior to conducting field sampling where volatile substances are suspected. The samples are held in the Penrith office of Geotechnique, at less than 4 degrees Celsius, for a period of not more than seven days. During the field work, the trip spike samples are kept in the chilled container with soil samples recovered from the site. The trip spike sample is then forwarded to the primary laboratory together with the soil samples recovered from the site.

The laboratory prepares the trip spike by adding a known amount of pure petrol standard to a clean sand sample. The sample is mixed thoroughly to ensure a relatively homogenous distribution of the spike throughout the sample. When the sample is submitted for analysis, the same procedure is adopted for testing as for the soil samples being analysed from the site.

The purpose of the trip spike is to detect any loss, or potential loss, of volatiles from the soil samples, during field work, transportation, sample extraction or testing.

A trip spike sample (TS1) was forwarded to the primary analytical laboratory with the samples collected from the site and was tested for BTEX. The test results for the trip spike sample, reported as a percentage recovery of the applied and known spike concentrations, are shown in Table C. The laboratory analytical report is included in Appendix E.

As indicated in Table C, the results show a good recovery of the spike concentrations, ranging between 95% and 99%. Applying the losses experienced in the spike sample (worst case scenario), the actual concentrations of BTEX in the soil samples analysed might be at worst, 0.53mg/kg (Benzene), 0.71mg/kg (Toluene), 1.24mg/kg (Ethyl benzene) and 7.07mg/kg (Xylenes). The concentrations in this case would still be considerably less than the relevant EPA Level adopted (1mg/kg, 1.4mg/kg, 3.1mg/kg and 14mg/kg respectively).

Based on the above, it is considered that any loss of volatiles from the recovered samples that might have occurred would not affect the outcome / conclusions of this report.

9.3 Duplicate Sample

A field duplicate sample was prepared in the field through the following process:

- A larger than normal quantity of soil was recovered from the sample location selected for duplication.
- The sample was placed in a decontaminated stainless bowl and divided into two portions, using the decontaminated trowel.
- One portion of the sub-samples was immediately transferred, using the decontaminated trowel, into a labelled, laboratory supplied, 250ml glass jar and sealed with an airtight, Teflon screw top lid. The fully filled jar was labelled as the duplicate sample and immediately placed in a chilled container.
- The remaining portion was stored in the same way and labelled as the original sample.

Duplicate sample D2 was prepared from original sample MW1 (0.8-1.1m) and analysed for metals including As, Cd, Cr, Cu, Pb, Hg, Ni and Zn, TPH, BTEX, PAH, OCP, PCB, Total Phenols and Total Cyanides.

Duplicate samples were prepared on the basis of sample numbers recovered during the field work. The duplicate sample frequency was computed using the total number of samples analysed as part of this assessment.

The duplicate frequency adopted (14% for metals, TPH, BYEX and PAH and 25% for OCP, PCB, Total Phenols and Total Cyanides) complies with the NEPM, which recommends a duplicate frequency of at least 5%.

The duplicate samples test results are presented with the laboratory analytical report in Appendix E and summarised in Table D.

A comparison was made of the laboratory test results for the duplicate samples with the original samples and the Relative Percentage Differences (RPD) were computed, in order to assess the accuracy of the laboratory test procedures. An RPD within 30-50% is generally considered acceptable. However, this variation can be higher for organic analysis than for inorganics and for low concentrations of analytes.

As shown in Table D, the comparisons between the duplicate and corresponding original samples generally indicated acceptable RPD, with the exception of the RPD of Hg (97%), Benzene (67%) and Total Phenols (67%), mainly due to the low concentrations of analytes detected and/or expected for organic analysis.

It should be noted that the duplicate was prepared from a fill sample and therefore heterogeneity of the sample could also result in relatively higher RPD.

Based on the above, the variations are not considered to be critical and overall the duplicate sample comparisons indicate that the laboratory test data provided by SGS are of adequate accuracy and reliability for this assessment.

9.4 Inter-laboratory Duplicate (Split) Samples

The inter-laboratory duplicate (split) samples provide a check on the analytical performance of the primary laboratory. Split samples were prepared on the basis of sample numbers recovered during field work and the analyses undertaken by the primary laboratory.

The split samples were prepared in the same manner as the duplicate samples. Reference should be made to Section 9.4.

Split sample S3 was prepared from original sample BH4 (0.2-0.5m) and forwarded to a secondary laboratory Envirolab for analysis of metals including As, Cd, Cr, Cu, Pb, Hg, Ni and Zn, TPH, BTEX, PAH, OCP, PCB, Total Phenols and Total Cyanides.

The split sample frequency was computed using the total number of samples analysed as part of this assessment, including select individual and composite samples.

The split sample frequency adopted (14% for metals, TPH, BYEX and PAH and 25% for OCP, PCB, Total Phenols and Total Cyanides) complies with the NEPM, which recommends a frequency of 5%.

The laboratory analytical report from Envirolab is included in Appendix E of this report. The results are also summarised in Table E.

Based on Schedule B (3) of the NEPM, the difference in the results between the split samples should generally be within 30% of the mean concentration determined by both laboratories, i.e., RPD should be within 30%. However, this variation can be higher for organic analysis than for inorganics and for low concentrations of analytes.

As shown in Table E, the comparisons between the split and corresponding original samples generally indicated acceptable RPD, with the exception of the RPD of Cu (45%), which was marginally in excess of 30%.

The RPD of Cu in Table E was found to be comparatively high, mainly due to the low concentrations of Cu detected. The split was also prepared from a fill sample and therefore heterogeneity of the sample could also result in relatively higher RPD.

Based on the above, the variations are not considered critical. Based on the overall split sample numbers and comparisons, it is concluded that the test results provided by the primary laboratory can be relied upon for this assessment.

10.0 LABORATORY QUALITY ASSESSMENT AND QUALITY CONTROL

Only laboratories accredited by the NATA for chemical analyses were used for analysis of samples recovered as part of this assessment. The laboratory must also incorporate quality laboratory management systems to ensure that trained analysts, using validated methods and suitably calibrated equipment, produce reliable results.

In addition to the quality control samples, the laboratory must also ensure that all analysts receive certification as to their competence in carrying out the analysis and participate in national and international proficiency studies. SGS and Envirolab, the two laboratories used for this assessment, are both accredited by NATA. The two laboratories also operate Quality Systems that are designed to comply with ISO/IEC 17025.

The following table lists the allowable holding times, detailed in Schedule B(3) of The National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM) prepared by the National Environment Protection Council (NEPC).

ANALYTE	HOLDING TIME
Metals *	6 months
Mercury	28 days
Benzene, Toluene, Ethyl Benzene and Xylenes (BTEX)	14 days
Total Petroleum Hydrocarbons (TPH)	14 days
Polycyclic Aromatic Hydrocarbons (PAH)	14 days
Organochlorine Pesticides (OCP)	14 days
Polychlorinated Biphenyls (PCB)	14 days
Phenols	14 days
Cyanides	7 days

* Metals include arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni) and zinc (Zn)

The actual holding times of the two laboratories used for this assessment are indicated with the laboratory analytical report and certificate of analysis included in Appendix D of this report. All analyses were conducted within the relevant holding times.

The test methods and Limits of Reporting (LOR) / Practical Quantitation Limits (PQL) adopted by SGS / Envirolab are indicated with the laboratory analytical report and certificate of analysis in Appendix D.

The samples analysed for TPH (C_6–C_9) and BTEX were extracted by the purge and trap method recommended by the NSW EPA.

All reported laboratory LOR / PQL were less than the assessment criteria adopted for each analyte or analyte group.

SGS and Envirolab incorporate the QA / QC procedures in order to demonstrate:

- method proficiency within the laboratory
- conformance to the performance characteristics expected of the method
- confidence in the results produced

As part of the analytical run for the project, the laboratories included laboratory blanks, duplicate samples, laboratory control samples, matrix spikes and surrogate spikes.

We have checked the QA/QC procedures and results adopted by the laboratories against the appropriate guidelines. The quality control sample numbers adopted by SGS and Envirolab are considered to be adequate for the analyses undertaken and generally conform to the recommendations provided in the NEPM 1999 "*Guideline on Laboratory Analysis of Potentially Contaminated Soils*" and Australian and ANZECC -1996 "*Guidelines for the Laboratory Analysis of Contaminated Soils*".

Overall, the quality control elements adopted by SGS and Envirolab indicate the analytical data to fall within acceptable levels of accuracy and precision for the analysis of soils. The analytical data provided is therefore considered to be reliable and useable for this assessment.

11.0 ASSESSMENT CRITERIA

The guidelines used in this assessment were as follows:

- The *National Environment Protection (Assessment of Site Contamination) Measure* (NEPM, 1999) in the National Environment Protection Council (NEPC) publications provide risk-based Health Investigation Levels (HILs) for selected organic and inorganic chemicals in Table 5-A of Schedule B(1) – Guideline on the Investigation Levels for Soil and Groundwater. These levels are provided for a variety of exposure settings.

  The *Guidelines for the NSW Site Auditor Scheme* (NSW DEC, 2006) also provide Health-Based Investigation Levels (HBILs) for a variety of exposure settings.

  With respect to human health, analytical results are assessed against HBILs / HILs guidelines appropriate for *parks, recreational open space and playing fields* development (NEHF 'E' / HILs 'E').
- With respect to the protection of the environment, the available Provisional Phytotoxicity Based Investigation Levels (PPBILs) published in the *Guidelines for the NSW Site Auditor Scheme* (NSW EPA/DEC, 2006) and Ecological Investigation Levels (EILs) published in the NEPM for inorganics are used.
- The *Guidelines for Assessing Service Station Sites* (NSW EPA, 1994) provide guidance regarding petroleum hydrocarbons and BTEX compounds.

The adopted assessment criteria are presented in the following table:

Contaminant	Assessment Criteria (mg/kg)			Source
	NEHF 'E' / HILs 'E'	PPBILs / EILs	NSW EPA	
Inorganics				
Metals				
Arsenic	200	20	-	NEPM, 1999; NSW DEC, 2006
Cadmium	40	3	-	NEPM, 1999; NSW DEC, 2006
Chromium (+3)	240,000	400	-	NEPM, 1999; NSW DEC, 2006
Chromium (+6)	200	1	-	NEPM, 1999; NSW DEC, 2006
Copper	2,000	100	-	NEPM, 1999; NSW DEC, 2006
Lead	600	600	-	NEPM, 1999; NSW DEC, 2006
Mercury (Methyl / Inorganic)	20 / 30	1	-	NEPM, 1999; NSW DEC, 2006
Nickel	600	60	-	NEPM, 1999; NSW DEC, 2006
Zinc	14,000	200	-	NEPM, 1999; NSW DEC, 2006
Organics				
TPH/BTEX				
C_6 to C_9 Fraction	-	-	65	NSW EPA, 1994
C_{10} to C_{40} Fraction	-	-	1,000	NSW EPA, 1994
Benzene	-	-	1	NSW EPA, 1994
Toluene	-	-	1.4	NSW EPA, 1994
Ethyl Benzene	-	-	3.1	NSW EPA, 1994
Total Xylenes	-	-	14	NSW EPA, 1994
PAH				
Benzo(a)pyrene	2	-	-	NEPM, 1999; NSW DEC, 2006

Contaminant	Assessment Criteria (mg/kg)			Source
Total PAH	40	-	-	NEPM, 1999; NSW DEC, 2006
OCP				
Aldrin + Dieldrin	20	-	-	NEPM, 1999; NSW DEC, 2006
Chlordane	100	-	-	NEPM, 1999; NSW DEC, 2006
DDT+DDD+DDE	400	-	-	NEPM, 1999; NSW DEC, 2006
Heptachlor	20	-	-	NEPM, 1999; NSW DEC, 2006
PCB (Total)	20	-	-	NEPM, 1999; NSW DEC, 2006
Phenols (Total)	17000	-	-	NEPM, 1999; NSW DEC, 2006
Other				
Cyanides (Free)	500	-	-	NEPM, 1999; NSW DEC, 2006
Cyanides (Complex)	1000	-	-	NEPM, 1999; NSW DEC, 2006

The subject site will be deemed contaminated or containing contamination "hot spots", if any of the above criteria are unfulfilled. Further investigation, remediation and/or management will be recommended if the site is found to be contaminated or contain contamination "hot spots".

12.0 FIELD & LABORATORY TEST RESULTS, ASSESSMENT & DISCUSSION

12.1 Field Results

Details of the sub-surface conditions encountered during field work for this assessment are presented in Table 1 and Engineering Log in Appendix C of this report. As discussed in Section 6.0, the general soil profiles revealed fill comprising sand/clayey sand and/or sandy clay, underlain by residual clay, then clayey shale/siltstone.

Diesel staining was noted and weak to distinct petroleum product odour detected in some fill layers in BH1 and MW1. The PID readings in the recovered soil samples were ranging from 0ppm to 240ppm.

No visual evidence of asbestos-cement pieces or other indicators of potential contamination, such as ash materials or other foreign matter were noted in recovered soil samples.

Water (possibly seepage) was encountered at a depth of about 4.5m in MW1 below EGL.

12.2 Analytical Results

Reference may be made to Appendix E for the actual laboratory analytical report from SGS. The test results are also presented in Tables F to H, together with the assessment criteria adopted. A discussion of the test results is presented in the following sub-sections.

12.2.1 Metals (As, Cd, Cr, Cu, Pb, Hg, Ni & Zn)

The metals test results are presented in Table F. With the exception of highlighted concentrations of As, Hg and Zn, the remaining concentrations of metals (As, Cd, Cr, Cu, Pb, Hg, Ni and/or Zn) for the analysed samples were well below the relevant PPBILs / EILs and NEHF 'E' / HILs 'E' adopted.

The highlighted concentrations of Hg (2.9mg/kg and 2.4mg/kg), As (58mg/kg and 72mg/kg) and Zn (230mg/kg) in soil samples Duplicate D2 (= MW1, 0.8-1.1m), BH1 (0.7-0.9m) and BH2 (0.5-0.8m) exceeded the PPBILs / EILs of 20mg/kg and 200mg/kg for As and Zn respectively, but were below the relevant NEHF 'E' / HIL 'E' of 200mg/kg and 14000mg/kg. However, if the soil with elevated concentrations of As and Zn remains underneath the existing concrete slab / hardstand, the PPBILs will no longer be the appropriate threshold level.

The highlighted concentration of Hg (220mg/kg) in soil sample BH1 (0.7-0.9m) exceeded the PPBIL / EIL of 1mg/kg and the relevant NEHF 'E' / HILs 'E' of 20mg/kg and 30mg/kg for Methyl Hg and Inorganic Hg respectively.

12.2.2 TPH and BTEX

The TPH and BTEX test results for are presented in Table G.

As indicated in Table G, with the exception of the highlighted concentrations of TPH, the remaining concentrations of TPH were less than the relevant EPA Level adopted.

The concentrations of TPH (C6-C9) (250mg/kg and 220mg/kg) in soil samples MW1 (0.8-1.1m = Duplicate D2) and BH1 (0.7-0.9m), as well as TPH (C10-C40) (20050mg/kg and 21350mg/kg) in soil samples MW1 (0.8-1.1m = Duplicate D2), BH1 (0.1-0.2m), BH1 (0.7-0.9m) and BH2 (0.5-0.8m) exceeded the relevant EPA Level.

As shown in Table G, the concentrations of BTEX were below the relevant EPA Level adopted.

12.2.3 Polycyclic Aromatic Hydrocarbons (PAH)

The PAH test results are presented in Table H as benzo(a)pyrene and Total PAH.

As shown in Table H, the concentrations of benzo(a)pyrene for the analysed soil samples were well below the NEHF 'E' / HIL 'E' adopted.

With the exception of the highlighted concentrations of Total PAH, the remaining concentrations of Total PAH were well below the NEHF 'E' / HIL 'E' adopted.

The concentrations of Total PAH (ranging from 74mg/kg to 175mg/kg) in soil samples MW1 (0.8-1.1m = Duplicate D2) and BH1 (0.7-0.9m) exceeded the NEHF 'E' / HIL 'E'.

12.2.4 Organochlorine Pesticides (OCP)

The OCP test results are presented in Table H and as shown, the concentrations of OCP for the analysed soil samples were well below the relevant NEHF 'E' / HILs 'E' adopted.

12.2.5 Polychlorinated Biphenyls (PCB)

The PCB test results are presented in Table H. As indicated on Table H, the concentrations of PCB were well below the NEHF 'E' / HIL 'E' adopted.

12.2.6 Total Phenols

The Total Phenols test results are presented in Table H and as shown, the concentrations of Total Phenols for the analysed soil samples were well below the NEHF 'E' / HIL 'E' adopted.

12.2.7 Total Cyanides

The Total Cyanides test results are presented in Table H. As indicated on Table H, the concentrations of Total Cyanides were well below the relevant NEHF 'E' / HILs 'E' adopted.

13.0 SITE CHARACTERISATION

As presented in the summary tables (Tables F to H) and discussed in Section 12.0, the majority of the laboratory results satisfied the criteria for stating that the analytes selected are either not present (i.e. concentrations less than LOR), or present in the sampled soils at concentrations that do not pose a risk of hazard to human health or the environment, under the conditions for parks, recreational open space or playing fields use.

However, this assessment identified soil contaminants of concern (As, Zn, Hg, TPH and Total PAH) in a number of locations as indicated and tabulated on Drawing No 12593/1-AA2:

- Soil with elevated concentrations of Hg (220mg/kg), TPH (C6-C9) (220mg/kg and 360mg/kg), TPH (C10-C40) (ranging from 1070mg/kg to 49150mg/kg) and Total PAH (ranging from 74mg/kg to 175mg/kg) will pose a risk of harm to human health if the soil is to be exposed in the future.

  Soil with elevated Hg concentration (220mg/kg) could also impact on the growth of certain plant species if the soil is to be exposed in the future.
- Soil containing elevated concentrations of As (58mg/kg and 72mg/kg), Hg (2.4mg/kg and 2.9mg/kg) and Zn (5.4mg/kg) would potentially impact on the growth of certain plant species if the soil is to be exposed in the future, however, would not present a risk of harm to human health under the proposed development.

Off-site impacts of contaminated soil are generally governed by the transport media available and likely receptor(s). The most common transport medium is water, whilst receptors include groundwater, surface waterbodies, humans, flora & fauna.

Migration of soil contaminants to the deeper soils or groundwater regime would generally be via leaching of contaminants from the surface soil or fill, facilitated by infiltration of surface water. Possible seepage water was encountered at about 4.5m below EGL. As the site is currently completely covered with concrete, the potential for water infiltration is considered low. Furthermore, the natural clayey soils beneath the site are relatively impermeable and the groundwater levels are anticipated to be at least 6.0m below the EGL, within the underlying bedrock. It is considered unlikely that the groundwater regime beneath the site has been impacted by contaminants within the soils.

A number of ponds within the golf course are within close proximity to the site. The ponds capture stormwater run-off from the site.

Any potential off-site impacts of contaminants on groundwater and waterbodies will be addressed upon completion of the proposed additional works as detailed in Section 14.0.

14.0 CONCLUSION AND RECOMMENDATIONS

Based on this PCA, a number of locations situated in the vicinity of unleaded underground fuel storage tank (UFST), underground waste motor oil tank (UWMOT) and bowser, as shown and tabulated on the attached Drawing No 12593/1-AA2 were identified to have Arsenic (As), Mercury (Hg), Zinc (Zn), Total Petroleum Hydrocarbons (TPH) and Total Polycyclic Aromatic Hydrocarbons (PAH) concentrations of concern. Soil contaminated with Hg, TPH and Total PAH at those locations will pose a risk of harm to human health if the soil is to be exposed in the future. The concentrations of As, Hg and Zn might present a potential hindrance to the growth of some plant species if the soil is to be exposed in the future.

It is our opinion that the site will be suitable for the proposed development, subject to implementation of the following works:

1. Assessment of the soil in the area for the proposed above ground fuel storage tank (AFST) will be required in order to ascertain the contamination status of the soil.
2. The unleaded UFST, the UWMOT and the bowser should be decommissioned, removed and disposed of at a licensed facility by a licensed contractor.

   Validation assessment will be required following the removal of the tanks and the bowser in order to ensure the complete removal of the contaminated soil.
3. No contamination was identified in the analysed soil samples recovered from two (2) borehole locations close to the diesel UFST. Additional soil sampling and testing will be required in order to ascertain the contamination status of soil in the vicinity of the diesel UFST.

   Alternatively, the diesel UFST could be decommissioned, removed and disposed of at a licensed facility, together with the unleaded UFST, the UWMOT and the bowser by a licensed contractor. Validation assessment will be required following the removal of the tank.
4. Detailed assessment to delineate the extent of contamination in the vicinity of the locations of concern, as shown on Drawing No 12593/1-AA2 will be required.
5. Assessment of the possible seepage water within the installed monitoring well MW1 will be required in order to determine the contamination status of the water.
6. Waste classification will be required for the contaminated soil that requires landfill disposal.
7. Preparation of a remedial action plan (RAP) will be required to provide guidance on a suitable remediation and validation methodology.
8. Groundwater assessment might be required depending on the outcomes of the above mentioned works.

It is our opinion that:

- The proposed additional work (Point 1) must be undertaken prior to installation of the proposed AFST.
- The proposed additional works (Points 2 to 7) as mentioned above can be undertaken during / after removal of the tanks and the concrete slab at and in the vicinity of locations/areas of concern.

15.0 LIMITATIONS

Within the scope of works outlined in the fee proposal dated 14 November 2011, the services performed by Geotechnique were conducted in a manner consistent with the level of quality and skill generally exercised by members of the profession and consulting practice.

This report has been prepared for the purpose stated within. Pittwater Council can rely upon this report for development application assessment processes. Any reliance on this report by other parties shall be at such parties' sole risk, as the report might not contain sufficient information for other purposes.

This report shall only be presented in full and may not be used to support any other objective than those set out in the report, except where written approval is provided by Geotechnique.

The information in this report is considered accurate at the date of field sampling (16 November 2011), in accordance with the current conditions of the site. Any variations to the site form or use beyond this date might nullify the conclusions stated.

No contamination assessment can eliminate all risk; even a rigorous professional assessment might not detect all contamination within a site.

Presented in Appendix F is a document entitled "Environmental Notes", which should be read in conjunction with this report.

GEOTECHNIQUE PTY LTD

LIST OF REFERENCES

Contaminated Land Management Act 1997

Contaminated Land Management Regulation 1998

Contaminated Sites: Guidelines for Assessing Service Station Sites – NSW Environment Protection Authority 1994

Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (2nd Edition) – Department of Environment and Conservation NSW 2006

Geology of Sydney 1:100,000 Sheet (9130) – Geological Survey of New South Wales, Department of Mineral Resources 1983

Guidelines for the Laboratory Analysis of Contaminated Soils - Australian and New Zealand Environment and Conservation Council (ANZECC) 1996

Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land – Department of Urban Affairs and Planning / NSW Environment Protection Authority 1998

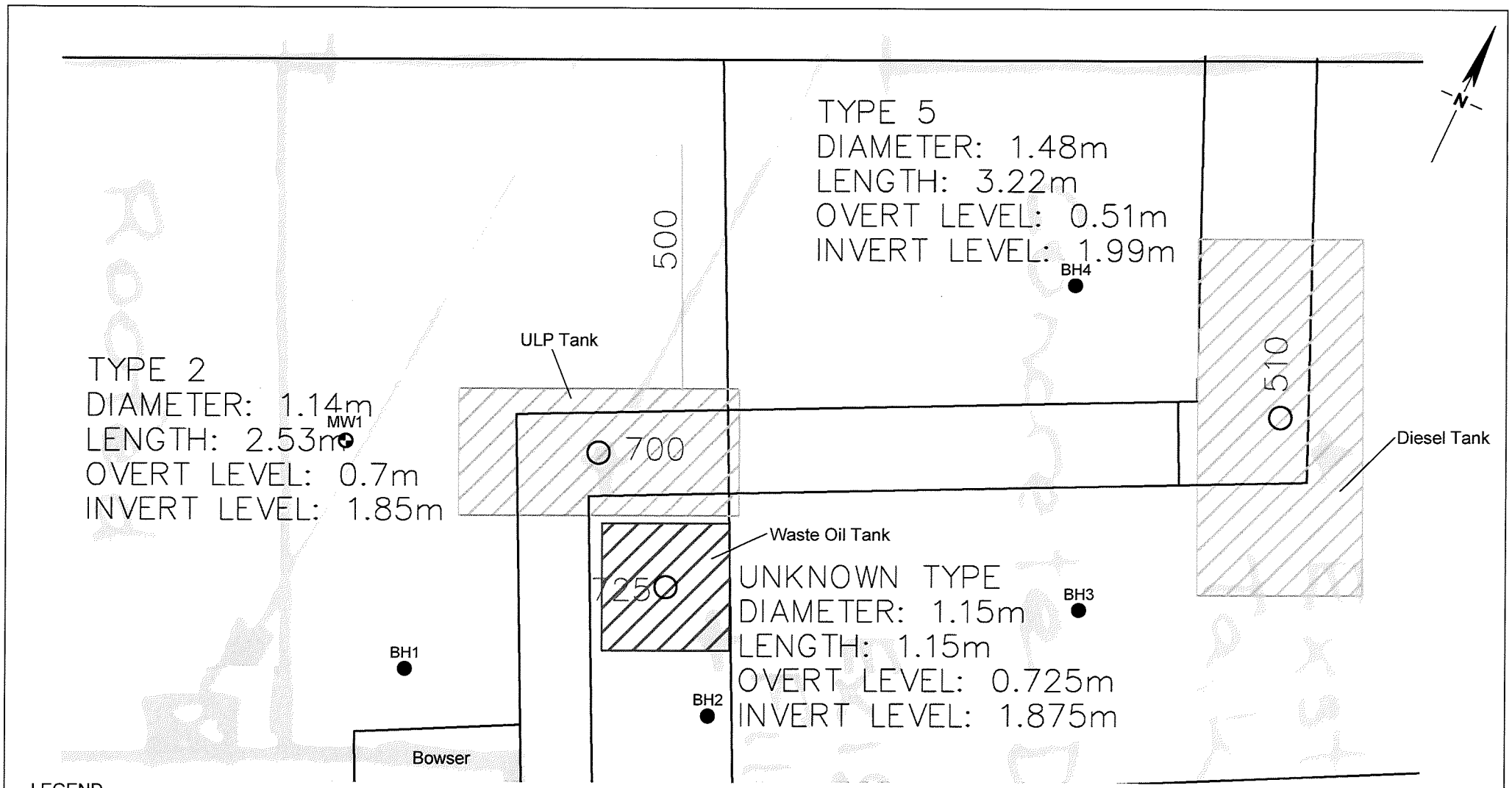
National Environment Protection (Assessment of Site Contamination) Measure – National Environmental Protection Council 1999

Soil Landscape of Sydney 1:100,000 Sheet (9130) – Department of Land & Water Conservation 2002

Protection of the Environment Operations Act – 1997

DRAWINGS

Drawing No 12593/1-AA1	*Borehole and Monitoring Well Locations*
Drawing No 12593/1-AA2	*Locations of Contamination*



LEGEND

- Borehole
- Monitoring Well

0 0.5 1.0 1.5 2.0 2.5m

Scale 1:50

GEOTECHNIQUE PTY LTD
CONSULTING ENGINEERS

PO Box 880
Penrith NSW 2750
Tel: 02 4722 2700
Fax: 02 4722 2777
e-mail:info@geotech.com.au
www.geotech.com.au

NOTES

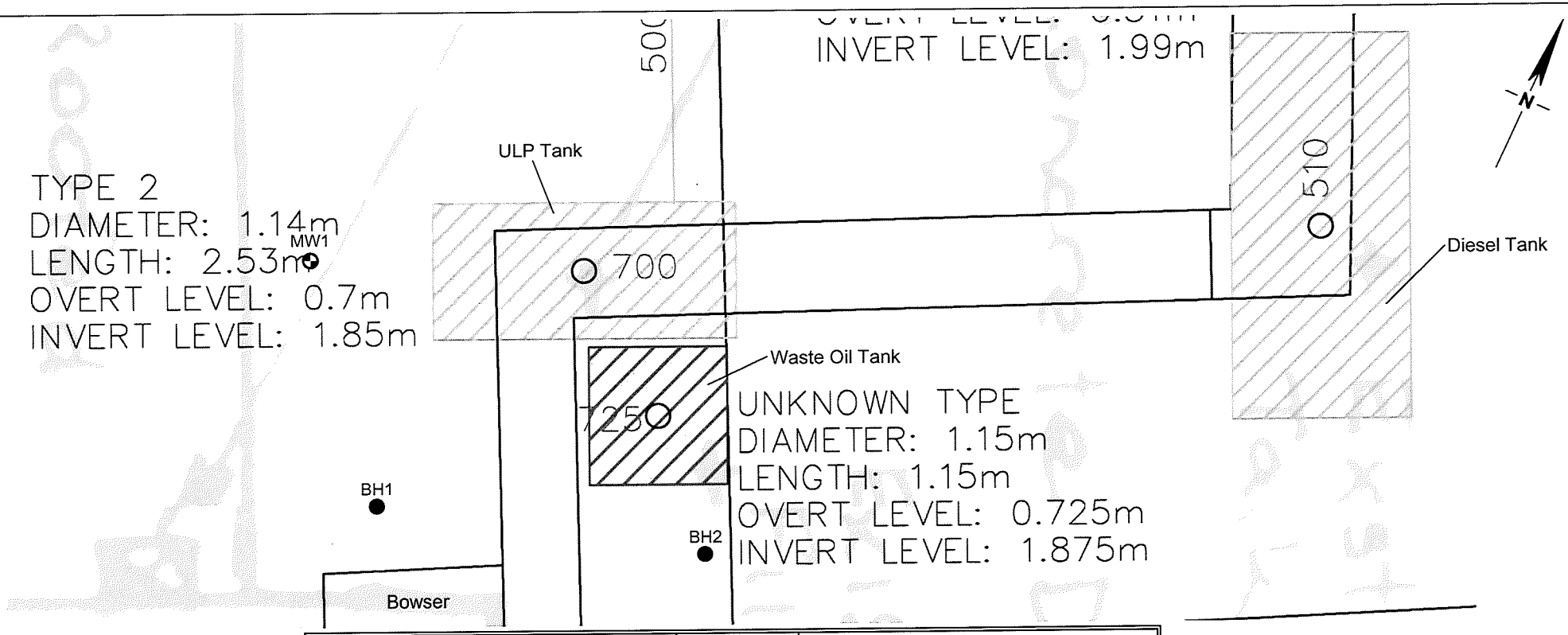
1. Site features are indicative and are not to scale.
2. This drawing has been produced using a base plan provided by others to which additional information e.g test pits, borehole locations or notes have been added. Some or all of the plan may not be relevant at the time of producing this drawing

The Mona Vale Golf Club Limited
Mona Vale Golf Club
1 Golf Avenue
Mona Vale

Boreholes and Monitoring Well Locations

Drawing No: 12593/1-AA1
Job No: 12593/1
Drawn By: MH
Date: 1 December 2011
Checked By: AN

File No: 12593-1
Layers: 0, AA1



Sample Location	Depth (m)	Contaminant	Concentration (mg/kg)	Assessment Criteria (mg/kg)		
				NEHF 'E' / HIL 'E'	PPBIL / EIL [a]	EPA Suggested Levels [b]
MW1 (=D2)	0.8-1.1	Hg, TPH (C6-C9, C10-C40), Total PAH	**2.9, 250, 21350, 78**	Hg=20 / 30 [c] PAH=40	As=20 Hg=1 Zn=200	TPH (C6-C9)=65 TPH (C10-C40)=1000
BH1	0.1-0.2	TPH (C10-C40)	**1070**			
BH1	0.7-0.9	As, Hg	**58, 220**			
		TPH (C6-C9, C10-C40), Total PAH	**360, 49150, 175**			
BH2	0.5-0.8	As, Hg, Zn, TPH (C10-C40)	**72, 2.4, 230, 4750**			

Notes:
HIL 'E' = Health Investigation Level for parks, recreational space and playing fields.
PPBIL / EIL = Provisional Phytotoxity-Based Investigation Level / Ecological Investigation Levels
As = Arsenic, Hg = Mercury, Zn = Zinc
TPH : Total Petroleum Hydrocarbons
PAH = Polycyclic Aromatic Hydrocarbons
a : If the soil remains in-situ and underneath the concrete slab, the threshold level is no longer applicable
b : EPA service station guidelines
c : 20mg/kg for Methyl Mercury and 30mg/kg for Inorganic Mercury.

LEGEND
- Borehole
- Monitoring Well

0 0.5 1.0 1.5 2.0 2.5m
Scale 1:50

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The Mona Vale Golf Club Limited
Mona Vale Golf Club
1 Golf Avenue
Mona Vale

Locations of Contamination

Drawing No: 12593/1-AA2
Job No: 12593/1
Drawn By: MH
Date: 15 December 2011
Checked By: AN
File No: 12593-1
Layers: 0, AA2

TABLES

TABLE A
SCHEDULE OF LABORATORY TESTING
(Ref No: 12593/1-AA)

Analyte / Analyte Group		TYPE	SAMPLING DATE	DUPLICATE	SPLIT	METALS	TPH & BTEX	PAH	OCP	PCB	TOTAL PHENOLS	TOTAL CYANIDES	BTEX
Sample	Depth (m)												
MW1	0.8-1.1	F	16/11/2011	D2		✔	✔	✔	✔	✔	✔	✔	
BH1	0.1-0.2	F	16/11/2011			✔	✔	✔					
BH1	0.7-0.9	F	16/11/2011			✔	✔	✔					
BH2	0.5-0.8	F	16/11/2011			✔	✔	✔					
BH3	2.0-2.3	N	16/11/2011			✔	✔	✔					
BH4	0.2-0.5	F	16/11/2011		S3	✔	✔	✔	✔	✔	✔	✔	
BH4	0.5-0.8	F	16/11/2011				✔	✔					
Rinsate R1	-		16/11/2011			✔	✔	✔					
Trip Spike TS1	-												✔

Notes
METALS: arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc
TPH: Total Petroleum Hydrcarbons
OCP : Organochlorine Pesticides
F, N: Fill, Natural Soil
BTEX: Benzene, Toluene, Ethyl Benzene, Xylenes
PAH: Polycyclic Aromatic Hydrocarbons
PCB : Polychlorinated Biphenyls

TABLE B
RINSATE SAMPLE
(Ref No: 12593/1-AA)

ANALYTE	RINSATE (mg/L)	CLEAN DISTILLED WATER (mg/L)
HEAVY METALS		
Arsenic	<0.05	<0.05
Cadmium	<0.005	<0.005
Chromium	<0.005	<0.005
Copper	<0.01	<0.01
Lead	<0.02	<0.02
Mercury	<0.0001	<0.0005
Nickel	<0.010	0.011
Zinc	<0.010	<0.010
TOTAL PETROLEUM HYDROCARBONS (TPH)		
C6 - C9	<0.040	<0.040
C10 - C14	<0.10	<0.1
C15 - C28	<0.20	<0.2
C29 - C40	<0.40	<0.6
BTEX		
Benzene	<0.0005	0.0006
Toluene	<0.0005	0.0009
Ethyl Benzene	<0.0005	<0.0005
Total Xylenes	<0.0015	<0.0015
POLYCYCLIC AROMATIC HYDROCARBONS (PAH)		
Benzo(a)Pyrene	<0.0005	<0.0005
Total PAH	<0.009	<0.009

TABLE C
TRIP SPIKE SAMPLE
(Ref No: 12593/1-AA)

ANALYTE	TRIP SPIKE
BTEX	
Benzene	95%
Toluene	99%
Ethyl Benzene	97%
Total Xylenes	99%

Note : results are reported as percentage recovery of known spike concentration

TABLE D
DUPLICATE SAMPLE
(Ref No: 12593/1-AA)

ANALYTE	MW1 0.8-1.1m mg/kg	DUPLICATE D2 mg/kg	RELATIVE PERCENTAGE DIFFERENCE %
HEAVY METALS			
Arsenic	15	14	7
Cadmium	0.4	0.5	22
Chromium	10	11	10
Copper	9.1	9.7	6
Lead	22	21	5
Mercury	1	2.9	97
Nickel	2.3	2.6	12
Zinc	41	46	11
TOTAL PETROLEUM HYDROCARBONS (TPH)			
C6 - C9	250	220	13
C10 - C14	5900	6200	5
C15 - C28	14000	15000	7
C29 - C40	<150	<150	-
BTEX			
Benzene	0.2	0.1	67
Toluene	0.7	0.6	15
Ethyl Benzene	1	0.9	11
Total Xylenes	6.2	5.7	8
POLYCYCLIC AROMATIC HYDROCARBONS (PAH)			
Benzo(a)Pyrene	0.1	<0.10	-
Total PAH	74	78	5
ORGANOCHLORINE PESTICIDES (OCP)			
Heptachlor	<0.1	<0.1	-
Aldrin	<0.1	<0.1	-
Dieldrin	<0.05	<0.05	-
DDD	<0.2	<0.2	-
DDE	<0.2	<0.2	-
DDT	<0.2	<0.2	-
Chlordane	<0.2	<0.2	-
POLYCHLORINATED BIPHENYLS (PCB)			
Total PCB	<0.9	<0.9	-
PHENOLS & CYANIDES			
Total Phenols	0.4	0.8	67
Total Cyanides	0.18	<0.10	-

TABLE E
SPLIT SAMPLE
(Ref No: 12593/1-AA)

ANALYTE	BH4 0.2-0.5m mg/kg (SGS)	SPLIT SAMPLE S3 mg/kg (ENVIROLAB)	RELATIVE PERCENTAGE DIFFERENCE %
HEAVY METALS			
Arsenic	10	12	18
Cadmium	0.93	<0.5	-
Chromium	33	31	6
Copper	19	30	45
Lead	18	14	25
Mercury	0.76	0.6	24
Nickel	25	29	15
Zinc	53	68	25
TOTAL PETROLEUM HYDROCARBONS (TPH)			
C6 - C9	<20	<25	-
C10 - C14	<20	<50	-
C15 - C28	<50	<100	-
C29 - C40 or *** C29-C36 for Envirolab***	<150	<100	-
BTEX			
Benzene	<0.1	<0.2	-
Toluene	<0.1	<0.5	-
Ethyl Benzene	<0.1	<1.0	-
Total Xylenes	<0.3	<3.0	-
POLYCYCLIC AROMATIC HYDROCARBONS (PAH)			
Benzo(a)Pyrene	<0.10	<0.05	-
Total PAH	<1.8	<1.6	-
ORGANOCHLORINE PESTICIDES (OCP)			
Heptachlor	<0.1	<0.1	-
Aldrin	<0.1	<0.1	-
Dieldrin	<0.05	<0.2	-
DDD	<0.2	<0.2	-
DDE	<0.2	<0.2	-
DDT	<0.2	<0.2	-
Chlordane	<0.2	<0.2	-
POLYCHLORINATED BIPHENYLS (PCB)			
Total PCB	<0.9	<0.6	-
PHENOLS & CYANIDES			
Total Phenols	0.2	<5.0	-
Total Cyanides	0.11	<0.5	-

TABLE F
METALS TEST RESULTS
DISCRETE SAMPLES
(Ref No: 12593/1-AA)

Sample Location	Depth (m)	METALS (mg/kg) ARSENIC	CADMIUM	CHROMIUM	COPPER	LEAD	MERCURY	NICKEL	ZINC
MW1	0.8-1.1	15	0.4	10	9.1	22	1	2.3	41
Duplicate D2 = MW1 (0.8-1.1m)		14	0.5	11	9.7	21	**2.9**	2.6	46
BH1	0.1-0.2	5	0.3	4.5	3.3	3	<0.05	1.4	7
BH1	0.7-0.9	**58**	1.2	14	14	50	**220**	5.2	200
BH2	0.5-0.8	**72**	0.4	12	6.8	14	**2.4**	2.6	**230**
BH3	2.0-2.3	<3	0.97	29	16	15	<0.05	3.1	50
BH4	0.2-0.5	10	0.93	33	19	18	0.76	25	53
Split sample S3 = BH4 (0.2-0.5m)		12	<0.5	31	30	14	0.6	29	68
Limits of Reporting (LOR)		3	0.3	0.3	0.5	1	0.05	0.5	0.5
GUIDELINES FOR THE NSW SITE AUDITOR SCHEME (2006)/ NEPM (1999) [a]									
Health-Based Investigation Levels (NEHF 'E' [b]) / Health Investigation Levels (HILs 'E' [b])		200	40	24%/200 [c]	2000	600	20/30 [d]	600	14000
Provisional Phytotoxity-Based Investigation Levels / EILs [e]		20	3	400/1 [f]	100	600	1	60	200

Notes
a: National Environmental Protection Measure
b: Parks, recreational space and playing fields.
c: 24% (240000mg/kg) for Chromium (+3) and 200mg/kg for Chromium (+6). Chromium (Cr) may exist in a number of states. Cr (+6) is easily reduced to form the most stable Cr (+3) whenever exposed to the atmosphere. Therefore the Health-Based Investigation Level of 240000mg/kg for Cr (+3) is adopted for this assessment.
d: 20mg/kg for Methyl Mercury and 30mg/kg for Inorganic Mercury.
e: Ecological Investigation Levels
f: 400mg/kg for Chromium (+3) and 1mg/kg for Chromium (+6).

TABLE G
TOTAL PETROLEUM HYDROCARBONS (TPH) AND BTEX TEST RESULTS
DISCRETE SAMPLES
(Ref No: 12593/1-AA)

Sample Location	Depth (m)	TPH (mg/kg) C6-C9	C10-C14	C15-C28	C29-C40	C10-C40 [a]	BTEX (mg/kg) BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES
MW1	0.8-1.1	**250**	5900	14000	<150	**20050**	0.2	0.7	1	6.2
Duplicate D2 = MW1 (0.8-1.1m)		**220**	6200	15000	<150	**21350**	0.1	0.6	0.9	5.7
BH1	0.1-0.2	<20	180	740	<150	**1070**	<0.1	<0.1	<0.1	0.4
BH1	0.7-0.9	**360**	14000	35000	<150	**49150**	0.5	0.1	1.2	7
BH2	0.5-0.8	30	1300	3300	<150	**4750**	<0.1	<0.1	<0.1	<0.3
BH3	2.0-2.3	<20	42	190	<150	382	<0.1	<0.1	<0.1	<0.3
BH4	0.2-0.5	<20	<20	<50	<150	220	<0.1	<0.1	<0.1	<0.3
Split sample S3 = BH4 (0.2-0.5m)		<25	<50	<100	<100	250	<0.2	<0.5	<1.0	<3.0
BH4	0.5-0.8	<20	38	150	<150	338	<0.1	<0.1	<0.1	<0.3
Limits of Reporting (LOR)		20	20	50	150	NA	0.1	0.1	0.1	0.3
EPA Levels [b]		65	C10-C40 =1000				1	1.4	3.1	14

Notes
a: C10-C40 = (C10-C14) + (C15-C28) + (C29-C40); concentrations less than LOR are assumed equal to LOR.
b: Contaminated Sites: "Guidelines for Assessing Service Station Sites", 1994, EPA
NA: Not Applicable

TABLE H
BENZO(a)PYRENE, POLYCYCLIC AROMATIC HYDROCARBONS (PAH), ORGANOCHLORINE PESTICIDES (OCP), POLYCHLORINATED BIPHENYLS (PCB), PHENOLS AND CYANIDES TEST RESULTS
DISCRETE SAMPLES
(Ref No: 12593/1-AA)

Analyte / Sample Location	Depth (m)	PAH (mg/kg)		Organochlorine Pesticides (mg/kg)							TOTAL PCB (mg/kg)	TOTAL PHENOLS (mg/kg)	TOTAL CYANIDES (mg/kg)
		BENZO(a)PYRENE	TOTAL PAH	HEPTACHLOR	ALDRIN	DIELDRIN	DDD	DDE	DDT	CHLORDANE			
MW1	0.8-1.1	0.1	**74**	<0.1	<0.1	<0.05	<0.2	<0.2	<0.2	<0.2	<0.9	0.4	0.18
Duplicate sample D2 = MW1 (0.8-1.1)		<0.10	**78**	<0.1	<0.1	<0.05	<0.2	<0.2	<0.2	<0.2	<0.9	0.8	<0.10
BH1	0.1-0.2	<0.10	2.5	-	-	-	-	-	-	-	-	-	-
BH1	0.7-0.9	<0.10	**175**	-	-	-	-	-	-	-	-	-	-
BH2	0.5-0.8	<0.10	21	-	-	-	-	-	-	-	-	-	-
BH3	2.0-2.3	<0.10	<1.8	-	-	-	-	-	-	-	-	-	-
BH4	0.2-0.5	<0.10	<1.8	<0.1	<0.1	<0.05	<0.2	<0.2	<0.2	<0.2	<0.9	0.2	0.11
Split sample S3 = BH4 (0.2-0.5)		<0.05	<1.6	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.6	<5.0	<0.5
BH4	0.5-0.8	<0.10	5.2	-	-	-	-	-	-	-	-	-	-
Limits of Reporting (LOR)		0.1	NA	0.1	0.1	0.05	0.2	0.2	0.2	0.2	0.9	0.1	0.1
GUIDELINES FOR THE NSW SITE AUDITOR SCHEME (2006)/ NEPM (1999) [a]													
Health-Based Investigation Levels (NEHF 'E' [b]) / Health Investigation Levels (HILs 'E' [b])		2	40	20	20 [c]	20 [c]	400 [d]			100	20	17000	500 [e] / 1000 [f]

Notes
a: National Environmental Protection Measure
b: Parks, recreational space and playing fields.
c: Aldrin + Dieldrin
d: Total of DDD + DDE + DDT
e: Cyanide (free)
f: Cyanide (complex)
NA: Not Applicable

APPENDIX A

NSW WORKCOVER RECORDS

WorkCover NSW
92-100 Donnison Street, Gosford, NSW 2250
Locked Bag 2906, Lisarow, NSW 2252
T 02 4321 5000 F 02 4325 4145
WorkCover Assistance Service 13 10 50
DX 731 Sydney workcover.nsw.gov.au

Our Ref: D11/146673
Your Ref: Frances Kuipers

23 November 2011

Attention: Frances Kuipers
Geotechnique Pty Ltd
PO BOX 880
Penrith NSW 2751

Dear Ms Kuipers,

RE SITE: 1 Golf Ave Mona Vale NSW 2103

I refer to your site search request received by WorkCover NSW on 17 November 2011 requesting information on licences to keep dangerous goods for the above site.

Enclosed are copies of the documents that WorkCover NSW holds on Dangerous Goods Licence 35/001115 relating to the storage of dangerous goods at the above-mentioned premises, as listed on the Stored Chemical Information Database (SCID).

If you have any further queries please contact the Dangerous Goods Licensing Team on (02) 4321 5500.

Yours Sincerely

Brent Jones
Senior Licensing Officer
Dangerous Goods Notification Team

Licence No. 35/001115

** REMINDER NOTICE **

APPLICATION FOR RENEWAL

OF LICENCE TO KEEP DANGEROUS GOODS

ISSUED UNDER AND SUBJECT TO THE PROVISIONS OF THE DANGEROUS GOODS ACT, 1975 AND REGULATION THEREUNDER

DECLARATION: Please renew licence number 35/001115 to 2004/2005 . I confirm that all the licence details shown below are correct (amend if necessary). * SEE REPORT.

(Signature)	GRAEME HEWITT (Please print name)	4/9/04 (Date signed)

for: MONA VALE GOLF CLUB LTD

*THIS **SIGNED** DECLARATION SHOULD BE **RETURNED TO:***

WorkCover New South Wales
Dangerous Goods Licensing Section
Locked Bag 2906
LISAROW NSW 2252

Enquiries: ph (02) 4321 5500
fax (02) 9287 5500

Details of licence on 4 June 2004

Licence Number 35/001115 **Expiry Date** 30/04/2004 **No. of Depots** 6

Licensee MONA VALE GOLF CLUB LTD ACN 000 024 224

Postal Address: GOLF AVE MONA VALE NSW 2103

Licensee Contact ~~SHIRLEY ROBINSON~~ Ph 9994 266 Fax 9997 5791 GRAEME HEWITT.

Premises Licensed to Keep Dangerous Goods
MONA VALE GOLF CLUB LTD
GOLF AVE MONA VALE 2103

Nature of Site CREATIVE ARTS

Major Supplier of Dangerous Goods UNKNOWN OR OTHER

Emergency Contact for this Site ~~SHIRLEY ROBINSON~~ Ph ~~994 266~~ 9999 4266.

Site staffing 8 HRS 7 DAYS GRAEME HEWITT

Details of Depots

Depot No.	Depot Type	Goods Stored in Depot		Qty
1 #as.s	UNDERGROUND TANK	Class 3		2000 L
	UN 1203 PETROL			2000 L
2	UNDERGROUND TANK	Class 3		1000 L
	UN 00C2 COMBUSTIBLE LIQUID 2			1000 L
3	~~CYLINDER STORE~~	Class 2.1	SEE REPORT.	3800 L
	UN 1073 OXYGEN, REFRIGERATED LIQUID			3800 L
4	~~CYLINDER STORE~~	Class 2.1		3200 L
	UN 1001 ACETYLENE, DISSOLVED			3200 L
5 #as.s	UNDERGROUND TANK	Class C1		5000 L
	UN ~~0001~~ DIESEL 1202-C1			5000 L
6	ROOFED STORE	Class 6.1		700 L
	~~UN 2810~~ TOXIC LIQUID, ORGANIC, N.O.S.,			~~500L~~
	#3018 6.1 50L			

FORM DG10

PARTC DANGEROUS GOODS STORAGE

Mona Vale Golf Club

DEPOT NO	Type of Depot	Depot Class	Maximum Storage Capacity
1	Underground Tank	3	2000Litres

UN Number	Proper Shipping Name	Class	PG (I,II,III)	Product or Common Name	Typical Quantity	Unit. Eg. L,kg,m³
1203	Unleaded Petrol	3	II	Unleaded petrol	2000	L

Exempt Storage SCID reference only

Depot No	Type of Depot	Depot Class	Maximum Storage Capacity
2	Underground Tank	C2	2000 Litres

UN Number	Proper Shipping Name	Class	PG (I,II,III)	Product or Common Name	Typical Quantity	Unit. Eg. L,kg,m³
	Lubricating Oil	C2		Waste Lubricating Oil	1000	L

Depot No 3 Removed from Site delete 3

Depot No 4 Removed from Site delete 4

Exempt Storage SCID reference only

Depot No	Type of Depot	Depot Class	Maximum Storage Capacity
5	Underground tank	C1	5000 Litres

UN Number	Proper Shipping Name	Class	PG (I,II,III)	Product or Common Name	Typical Quantity	Unit. Eg. L,kg,m³
1202	Diesel Fuel	C1		Diesel Fuel	5000	L

Exempt Storage SCID reference only - Quantity Reduced from last DG Licence application.

Depot No	Type of Depot	Depot Class	Maximum Storage Capacity
6	Roofed Store	6.1	~~60 Litres~~ 100L

UN Number	Proper Shipping Name	Class	PG (I,II,III)	Product or Common Name	Typical Quantity	Unit. Eg. L,kg,m³
3018	Organophosphorus Pesticide Liquid Toxic	6.1	II	Chlorpynifoces 500EC	40	L
3018	Organophosphorus Pesticide Liquid Toxic	6.1	II	Supracide	1	L

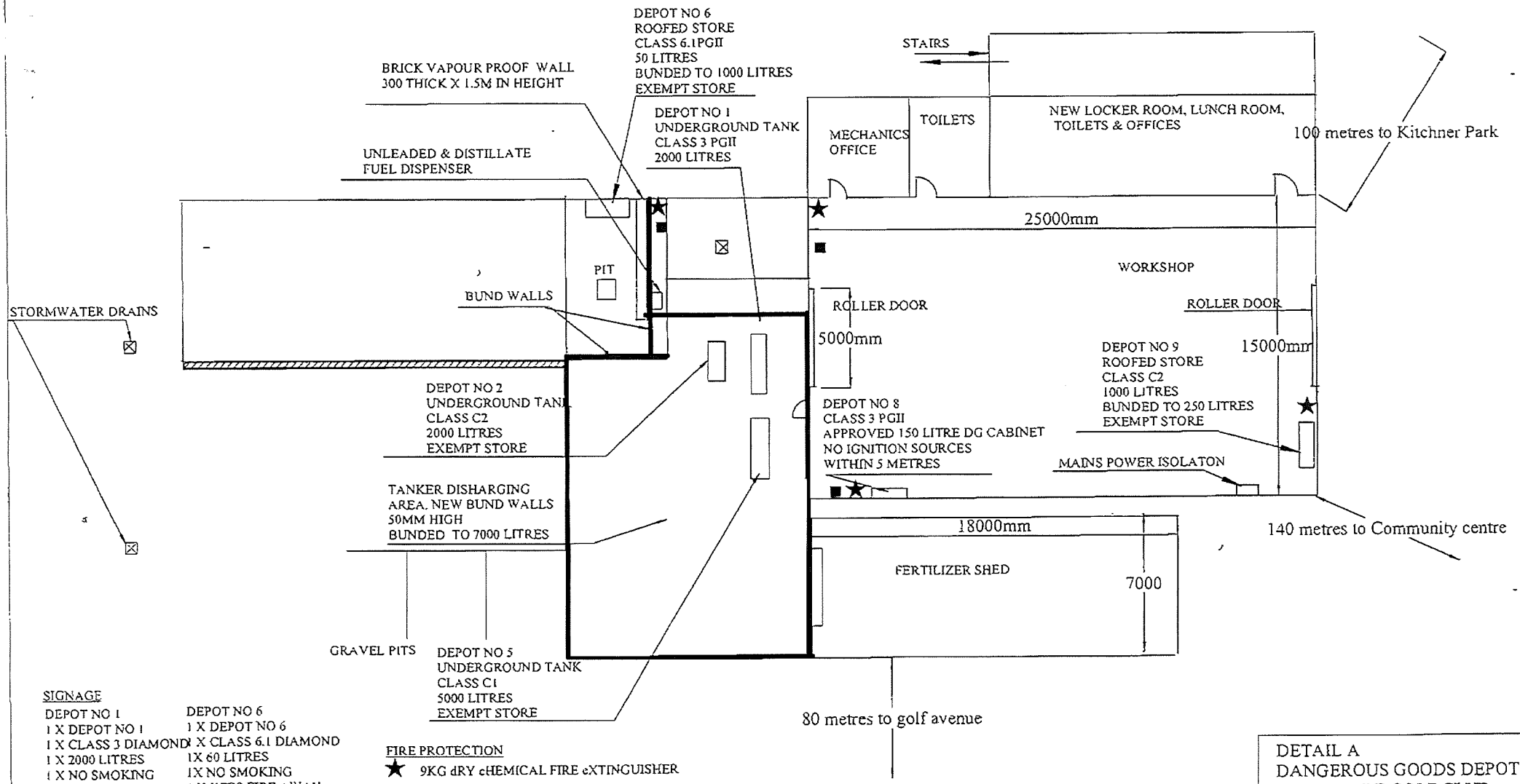
Exempt Storage SCID reference only exempt storage area (plans not req'd)pt.

Depot No	Type of Depot	Depot Class	Maximum Storage Capacity
7	Cylinder Store	2.2	100m³

UN Number	Proper Shipping Name	Class	PG (I,II,III)	Product or Common Name	Typical Quantity	Unit. Eg. L,kg,m³
1956	Compressed Gas NOS	2.2		Cellarmix	40m³	m³
1013	Carbon Dioxide	2.2		Carbon Dioxide	40m³	m³

Depot No	Type of Depot	Depot Class	Maximum Storage Capacity
8	150 Litre Approve Flammable Liquids Cabinet	3	150 Litres

UN Number	Proper Shipping Name	Class	PG (I,II,III)	Product or Common Name	Typical Quantity	Unit. Eg. L,kg,m³
1203	Petrol	3	II	Unleaded Petrol 2 Stroke	50	L
1223	Kerosene	3	III	Kerosene	5	L
1993	Flammable Liquid NOS	3	III	Miti-fol-ec	10	L



SIGNAGE

DEPOT NO 1	DEPOT NO 6
1 X DEPOT NO 1	1 X DEPOT NO 6
1 X CLASS 3 DIAMOND	1 X CLASS 6.1 DIAMOND
1 X 2000 LITRES	1X 60 LITRES
1 X NO SMOKING	1X NO SMOKING
1X KEEP FIRE AWAY	1 X KEEP FIRE AWAY
DEPOT NO 2	DEPOT NO 7
1 X CLASS C2	1X DEPOT NO 7
1 X 2000 LITRES	1 X DEPOT NO 8
1 X NO SMOKING	1 X CLASS 3 DIAMOND
1 X KEEP FIRE AWAY	1X 150 LITRES
DEPOT NO 5	1 X NO SMOKING
1 X DEPOT NO 5	1 X KEEP FIRE AWAY
1 X CLASS C1	1 X CLASS C2
1 X 5000 LITRES	1 X 1000 LITRES
1 X NO SMOKING	1 X NO SMOKING
1 X KEEP FIRE AWAY	1 X KEEP FIRE AWAY

FIRE PROTECTION

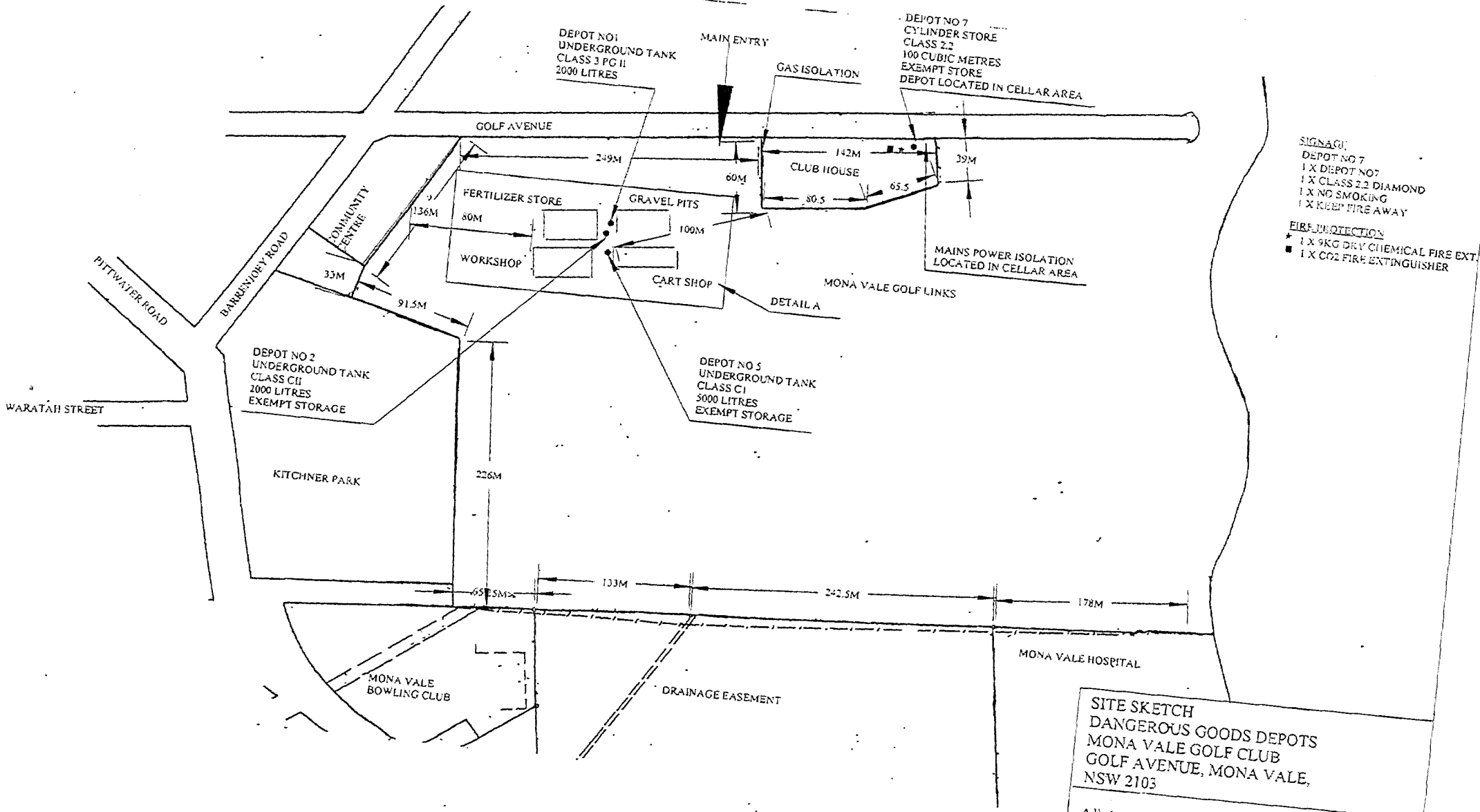
★ 9KG dRY cHEMICAL FIRE eXTINGUISHER

■ CO2 fIRE EXTINGUISHER

DETAIL A
DANGEROUS GOODS DEPOTS
MONA VALE GOLF CLUB

All Areas Dangerous Goods Consultants
50 Pleasant Avenue
Lindfield NSW 2070
PO Box 313 Lindfield NSW 2070
Tel. (02) 9415 8061 Fax. (02) 94158561
Mob. 0417 449 519
email:russel@bigpon.net.au

Scale NTS- 4/8/2004
Drg: Mona Vale 2



SITE SKETCH
DANGEROUS GOODS DEPOTS
MONA VALE GOLF CLUB
GOLF AVENUE, MONA VALE,
NSW 2103

All Areas Dangerous Goods Consultants
50 Pleasant Avenue
Lindfield NSW 2070
PO Box 313 Lindfield NSW 2070
Tel. (02) 9415 8061 Fax: (02) 9415 8561
Mob 0417 449 519
email: russel@ bigpond.net.au

NTS - 20/8/04

WorkCover New South Wales, 400 Kent Street, Sydney 2000 Telephone 9370 5000 ALL MAIL TO G.P.O. BOX 5364 SYDNEY 2001

Licence No. 35/001115

WORKCOVER NEW SOUTH WALES

APPLICATION FOR RENEWAL

OF LICENCE TO KEEP DANGEROUS GOODS

ISSUED UNDER AND SUBJECT TO THE PROVISIONS OF THE DANGEROUS GOODS ACT, 1975 AND REGULATION THEREUNDER

DECLARATION: Please renew licence number 35/001115 to 30/04/2000 . I confirm that all the licence details shown below are correct (amend if necessary).

Shirley Robinson (Signature) SHIRLEY ROBINSON (Please print name) 27/4/1999 (Date signed)

for: MONA VALE GOLF CLUB LTD

*THIS **SIGNED** DECLARATION SHOULD BE **RETURNED TO:***

WorkCover New South Wales
Dangerous Goods Licensing Section
GPO BOX 5364
SYDNEY 2001

Enquiries: ph (02) 9370 5187
fax (02) 9370 6105

RECEIVED 29 APR 1999 SCIENTIFIC SERVICES

Details of licence on 13 March 1999

Licence Number 35/001115 **Expiry Date** 1/05/1999

Licensee MONA VALE GOLF CLUB LTD ACN 000 024 224

Postal Address: GOLF AVE MONA VALE NSW 2103

Licensee Contact SHIRLEY ROBINSON Ph. 994 266 Fax. 997 5791

Premises Licensed to Keep Dangerous Goods
MONA VALE GOLF CLUB LTD
GOLF AVE MONA VALE 2103

RECEIVED 29 APR 1999 SCIENTIFIC SERVICES

Nature of Site CREATIVE ARTS

Major Supplier of Dangerous Goods UNKNOWN OR OTHER

Emergency Contact for this Site SHIRLEY ROBINSON Ph. 994 266

Site staffing 8 HRS 7 DAYS

Details of Depots

Depot No.	Depot Type	Goods Stored in Depot	Qty
1	UNDERGROUND TANK	Class 3	2000 L
	UN 1203 PETROL		2000 L
2 edit	UNDERGROUND TANK	Class 3	1000 L
	~~00C2 UN 1203 PETROL~~ WASTE OIL		1000 L
3	CYLINDER STORE	Class 2.1	3800 L
	UN 1073 OXYGEN, REFRIGERATED LIQUID		3800 L
4	CYLINDER STORE	Class 2.1	3200 L
	UN 1001 ACETYLENE, DISSOLVED		3200 L
5	UNDERGROUND TANK	Class C1	5000 L
	UN 00C1 DIESEL		5000 L
6	ROOFED STORE	Class 6.1	700 L
	UN 2810 TOXIC LIQUID, ORGANIC, N.O.S.,		500 L
Title	~~ABOVE GROUND TANK~~	~~Class C1~~	~~500 L~~
	~~UN 00C1 DIESEL~~ To be commissioned		~~500 L~~

RECEIVED 29 JUN 1999

Form DG10

THE NEW SOUTH WALES GOVERNMENT
Putting people first by managing better

PART A

SCIENTIFIC SERVICES BRANCH
1 JUN 1993
DANGEROUS GOODS

WorkCover Authority

EXISTING LICENCE

LICENCE TO KEEP DANGEROUS GOODS

ISSUE SCIDS licence c.Darrell 6-6-93

(Dangerous Goods Act 1975)

Application for new licence, amendment or transfer

Exp: 1/5/96

1. Name of applicant — ACN
   MONA VALE GOLF CLUB LIMITED | 000 024 224

2. Site to be licensed
   No | Street
   | GOLF AVENUE
   Suburb/Town | Postcode
   MONA VALE | 2103

3. Previous licence number (if known) 35/001115

4. Nature of site REGISTERED GOLF CLUB

5. Emergency contact on site:
   Phone | Name
   (02) ~~994 2166~~ | ~~DON SHARP~~ Shirley Robinson

6. Site staffing: Hours per day 8 Days per week 7

7. Major supplier of dangerous goods J & B PETROLEUM

8. If new site or significant modification
   Plan stamped by: | Accredited consultant's name: | Date stamped

9. Number of dangerous goods depots at site 6

10. Trading name or occupier's name
    MONA VALE GOLF CLUB LIMITED

11. Postal address of applicant | Suburb/Town | Postcode
    GOLF AVENUE | MONA VALE | 2103

12. Contact for licence enquiries:
    Phone | Fax | Name
    (02) 994 266 | (02) 997578 | ~~DON SHARP~~ Shirley Robinson

I certify that the details contained in this application (or the accompanying computer disk) are true and correct

13. Signature of applicant | Date 15.5.93

Please complete attached site sketch, depot listing and check sheet

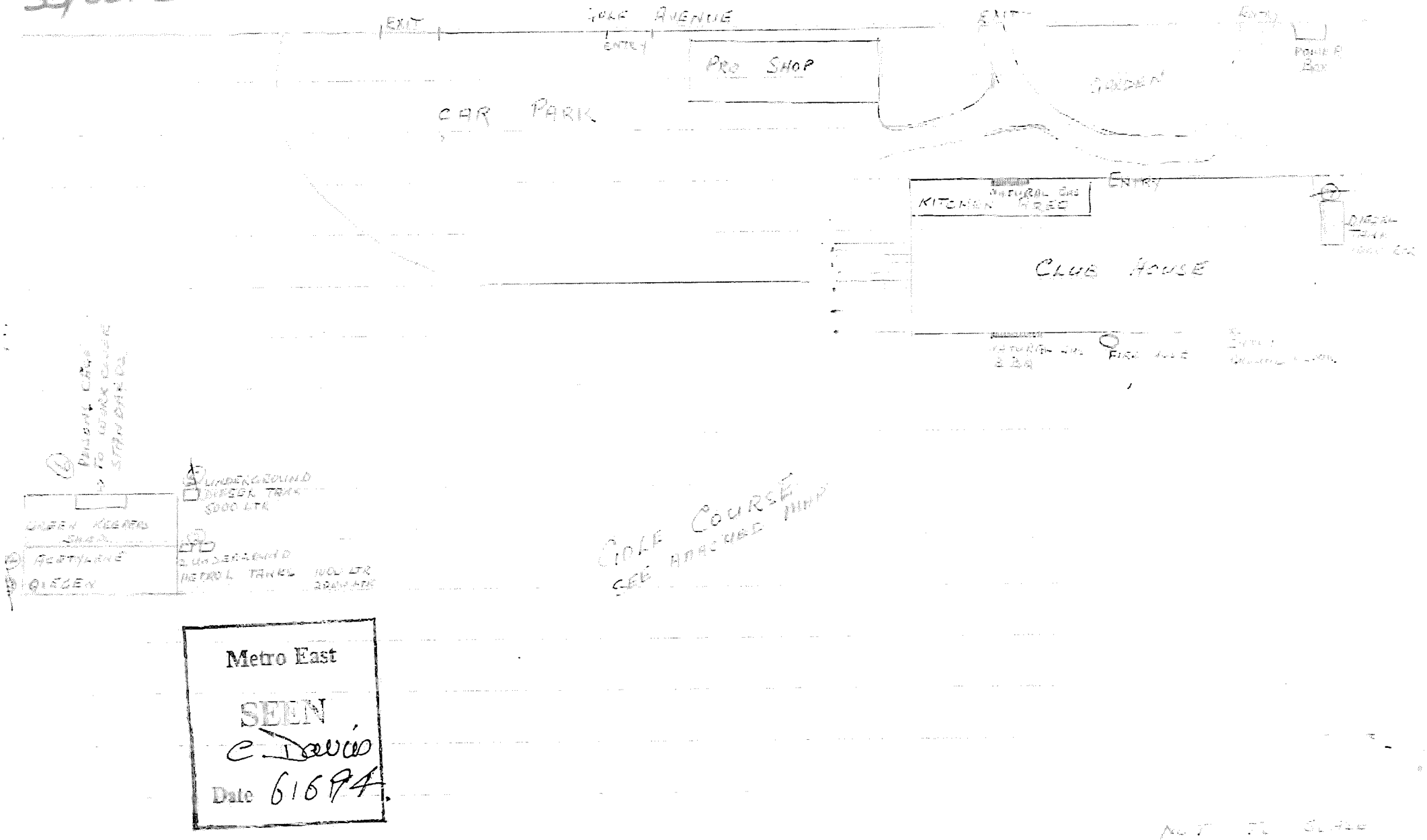
Sent 23/6

Form DG1

Site Sketch

Please carefully read the instructions in Part B of the guide before sketching the site.

35/00115



Metro East
SEEN
C. Davies
Date 6/6/94

PART B

FOR THE KEEPING OF DANGEROUS GOODS

$10.00 ✓

Application is hereby made for— *a licence (or amendment of the licence) *the transfer of the licence for the keeping of dangerous goods in or on the premis described below.

(*delete whichever is not required)

FEE: $10.00 per Depot for new licence. $10.00 for amendment or transfer.

Name of Applicant in full (see over)	Mona Vale Golf Club Limited.
Trading name or occupier's name (if any)	
Postal address	Postcode
Address of the premises including street number (if any)	Golf Av. Mona Vale Postcode 2103
Nature of premises (see over)	Golf Club 3443 24/11/82 034
Telephone number of applicant	STD Code 020 Number 994266-7

Particulars of type of depots and maximum quantities of dangerous goods to be kept at any one time.

Depot number	Type of depot (see over)	Storage capacity	Dangerous goods: Product being stored	C & C Office use only
1	Underground Tank ✓	2000	Class 3.1. Petrol ✓	PD002 020 2020 2
2	✓	1000	✓	2020 1
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Has site plan been approved? Yes ~~No~~ If yes, no plans required. If no, please attach site plan.

Have premises previously been licensed? Yes ~~No~~ If yes, state name of previous occupier. 1115

Name of company supplying flammable liquid (if any) —

Signature of applicant [signature] Date 10.11.82

For external explosives magazine(s), please fill in side 2.

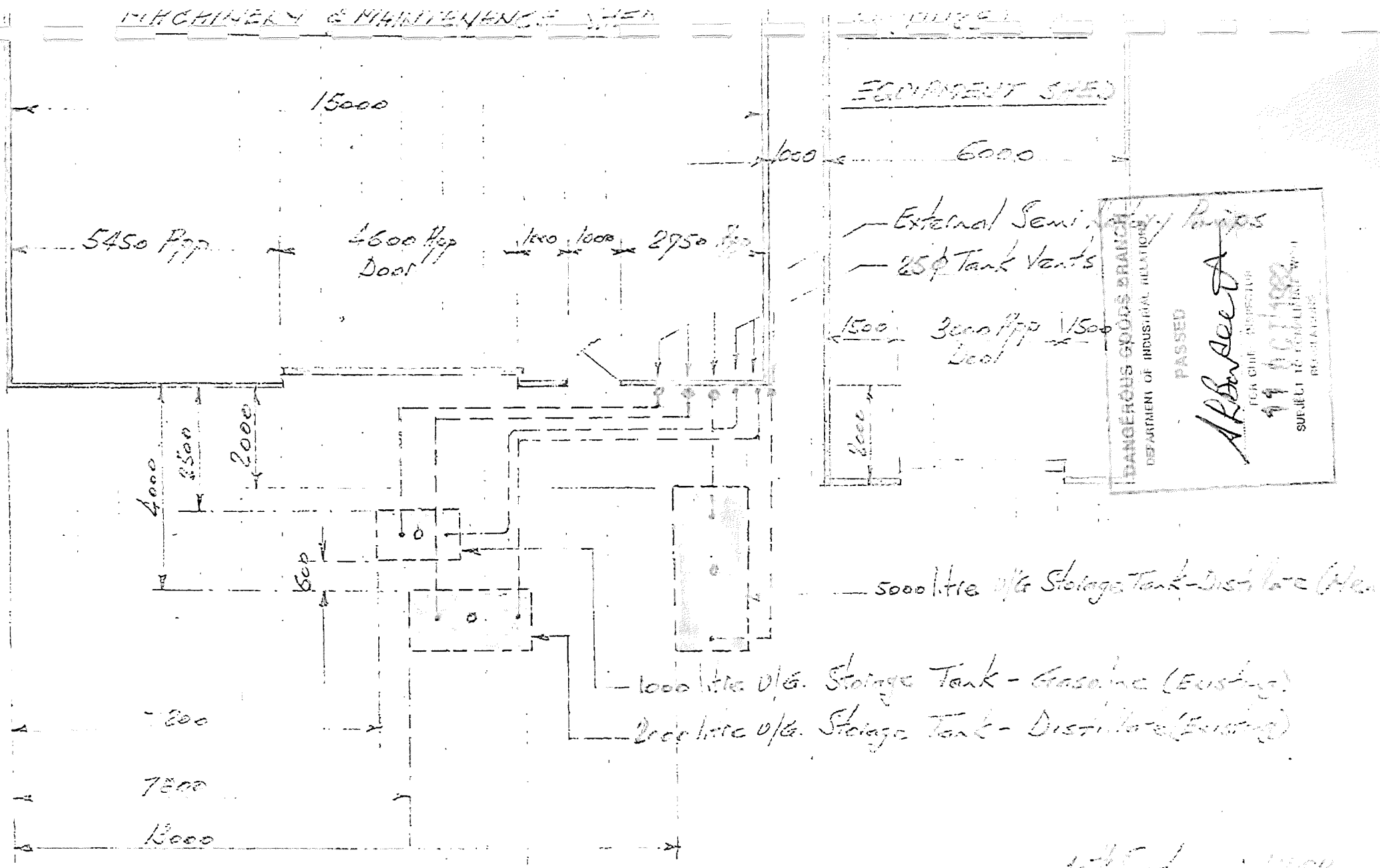
FOR OFFICE USE ONLY

CERTIFICATE OF INSPECTION

I, Cecil Edward A. Mallam being an Inspector under the Dangerous Goods Act, 1975, do hereby certify that the premises described above do comply with the requirements of the Dangerous Goods Act, 1975, and the Dangerous Goods Regulation with regard to their situation and construction for the keeping of dangerous goods of the nature and in the quantity specified.

Signature of Inspector C.A. Mallam Date 24-1-83

Licence No. P001115-7



MOUNT VALE GOLF CLUB LIMITED

GREENS SHED FUEL STORAGE FACILITIES

Scale 1:100

Inflammable Liquid—

Mineral Oil—includes kerosene, mineral turpentine and white spirit (for cleaning), and compositions containing same.

Mineral Spirit—includes petrol, benzine, benzolene, benzol and naphtha, and compositions containing same.

Dangerous Goods—

Class 1.—Acetone, amyl acetate, butyl acetate, carbon bisulphide; any combination of substances of an inflammable character suitable for use as an industrial solvent and having a true flashing point of less than 73 degrees Fahrenheit.

Class 2.—Nitro-cellulose (also known as "pyroxylin" and "collodion cotton") moistened with an alcohol, butyl alcohol (also known as "butanol"), methylated spirits, vegetable turpentine; and any liquid or solid containing methylated spirits, having a true flashing point of less than 150 degrees Fahrenheit.

Class 3.—Nitro-cellulose product.

Class 4.—Compressed or dissolved acetylene contained in a porous substance.

DIRECTIONS.

1. Applications must be forwarded to the Chief Inspector of Inflammable Liquid, Explosives Department, No. 4 Albert Street, off Pitt Street, Circular Quay, Sydney (Box 48 G.P.O.), and must be accompanied by the prescribed fee, as set out hereunder:—

Registration of Premises (Fee, 10s. p.a.).—For quantities not exceeding 300 gallons of mineral oil and 100 gallons of mineral spirit, if kept together; or 800 gallons of mineral oil and 100 gallons of mineral spirit, if kept in separate depots; or 500 gallons of mineral spirit, if kept in an underground tank depot; or 800 gallons of mineral oil and 500 gallons of mineral spirit, if mineral spirit is kept in an underground tank depot.

In addition to, or in lieu of the above, similar quantities of Dangerous Goods of Classes 1 and 2 may be kept under the like conditions; reading Dangerous Goods of Class 1 for the words Mineral Spirit and Dangerous Goods of Class 2 for the words Mineral Oil.

Store License, Div. A (Fee, £1. p.a.).—For quantities in excess of those stated above, but not exceeding 4,000 gallons mineral oil and/or mineral spirit, and/or Dangerous Goods of Classes 1 and 2.

Store License, Div. B (Fee, £2. p.a.).—For quantities exceeding 4,000 gallons of mineral oil and/or mineral spirit, and/or dangerous goods of Classes 1 and 2, and/or dangerous goods of Class 3.

For the keeping of Dangerous Goods of Classes 3 and/or 4.

2. The certificate of inspection at foot hereof must be signed by an Inspector under the Inflammable Liquid Act, 1915–1946, or Police Officer, or other officer duly authorised in that behalf, and where the premises are situated outside the Metropolitan Area of Sydney, it is requested that such certificate be obtained prior to forwarding application.

1. Name in full of occupier ... Mona Vale Golf Club Ltd

2. Occupation... Golf Course

3. Locality of the premises in which the depot or depots are situated... No. or Name Golf avenue
Street Mona Vale
Town

4. Nature of premises (Dwelling, Garage, Store, etc.) ... Equipment shed

5. Will mineral spirit be kept in a prescribed underground tank depot ? No.

6. Particulars of construction of depots and maximum quantities of inflammable liquid and/or Dangerous Goods to be kept at any one time.

Depot No.	Construction of Depots.			Inflammable Liquid.		Dangerous Goods.			
	Walls.	Roof.	Floor.	Mineral Spirit. Gallons.	Mineral Oil. Gallons.	Class 1. Gallons.	Class 2. Gallons.	Class 3. lb.	Class 4. cub. ft.
1	Gal. iron	Gal. iron	Concrete	44	44				
2								105	
3							Cle		
4								6888	
5									
6					1350				
7									
8			10/-						
9									
10									

TRANSFERRED TO PUBLIC REVENUE ACCOUNT 5 JUL 1957

Signature of Applicant D.G. Young Manager

Date of Application 4-11-1957 Postal Address Mona Vale Golf Club Ltd Golf Course Mona Vale

CERTIFICATE OF INSPECTION.

I, [signature], being an Inspector under the Inflammable Liquid Act, 1915–46, do hereby certify that the premises or store herein referred to and decribed is suitable with regard to its situation and construction for the safe keeping of inflammable liquid and/or dangerous goods in quantity and nature specified.

Signature of Inspector [signature]

Date 4-4-58

[PLEASE TURN OVER

S6 8130

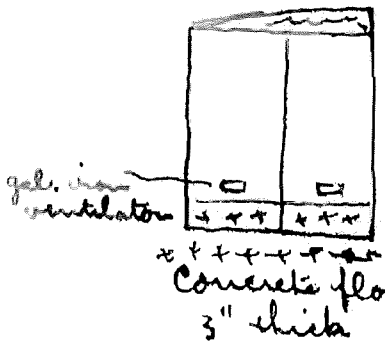
A. H. PETTIFER, GOVERNMENT PRINTER.

Ma. ...ches showing—

Ground plans of premises showing position of depot or ... and adjacent buildings, also distances separating depots and buildings.

Sketch of depot or depots showing provision made for ventilation, also inside dimensions (length, width, and depth) of the ... or lower portion, designed to prevent outflow.

This sketch is not required for underground tanks.



Compound 4' 6" x 4 x 6" x 6"

existing equipment shed about 70' away

Side elevation

depot. 6' x 6' x 7' high 3x2 hardwood bottom and top plates 3x2 studs and rafters covered gal. iron

pit. approx. 5' x 5' x 7" high concrete wall approx 12 cub. feet.

TABLES SHOWING DISTANCES WHICH UNDER LICENSE MUST SEPARATE PROTECTED WORKS FROM DEPOTS.

Table I.—Where Mineral Spirit and/or Dangerous Goods of Class 1 (with or without Mineral Oil and/or Dangerous Goods of Class 2) are kept or to be kept :—

In an underground Tank Depot, in quantity exceeding 500 gallons, but not exceeding—	In an aboveground Tank Depot or other Depot, separated from protected works by a screen wall, in quantity exceeding 100 gallons, but not exceeding—	In an aboveground Tank Depot or other Depot not separated from protected works by a screen wall, in quantity exceeding 100 gallons, but not exceeding—	Distance not less than—
Gallons.	Gallons.	Gallons.	Feet.
2,000	1,000	250	10
2,400	1,200	300	11
2,800	1,400	350	12
3,200	1,600	400	13
3,600	1,800	450	14
4,000	2,000	500	15
7,200	3,600	900	16
10,400	5,200	1,300	17
13,600	6,800	1,700	18
16,800	8,400	2,100	19
20,000	10,000	2,500	20
22,000	11,000	2,750	21
24,000	12,000	3,000	22
26,000	13,000	3,250	23
28,000	14,000	3,500	24
30,000	15,000	3,750	25
32,000	16,000	4,000	26
40,000	20,000	5,000	30
80,000	40,000	10,000	40
100,000 and over.	80,000	20,000	50
	160,000	40,000	75
	320,000 and over.	80,000	100
		120,000	115
		240,000	130
		400,000 and over.	150

Table II.—Where Mineral Oil and/or Dangerous Goods of Class 2 only are kept or to be kept :—

St 8130

In an underground Tank Depot, in quantity exceeding 800 gallons, but not exceeding—	In an aboveground Tank Depot or other Depot separated from protected works by a screen wall, in quantity exceeding 800 gallons, but not exceeding—	In an aboveground Tank Depot or other Depot not separated from protected works by a screen wall, in quantity exceeding 800 gallons, but not exceeding—	Distance not less than—
Gallons.	Gallons.	Gallons.	Feet.
4,000	2,000	1,000	10
8,000	4,000	2,000	16
14,400	7,200	3,600	16
20,800	10,400	5,200	17
40,000	20,000	10,000	20
80,000	40,000	20,000	30
100,000	80,000	40,000	40
320,000 and over.	160,000	80,000	60
	320,000 and over.	160,000	75
		320,000 and over.	100

APPENDIX B

NSW EPA RCORDS OF NOTICES

Office of Environment & Heritage

You are here: Home > Contaminated land > Record of notices

Contaminated land - record of notices

Record under section 58 of the Contaminated Land Management Act 1997

This record is maintained by OEH in accordance with Part 5 of the Contaminated Land Management Act 1997 (CLM Act).

The record **does** provide

- ✓ a record of written notices issued by OEH under the CLM Act, including preliminary investigation orders.
- ✓ the names of the sites, owners or occupiers **at the time of OEH action** in relation to the site
- ✓ copies of site audit statements (SAS) provided to OEH under section 52 of the CLM Act and relating to significantly contaminated land.

The record **does not** provide

- ✘ a record of all contaminated land in NSW. See frequently asked questions
- ✘ a list of notifications of contamination that OEH receives.
- ✘ the names of the sites, owners or occupiers if it changes **after OEH action** in relation to the site.
- ✘ full copies of agreed management
- ✘ some personal information.

... more about the CLM record of notices

From 1 July 2009 there were changes to the terminology of certain OEH actions under the CLM Act. See the list of these changes.

The record includes notices issued under sections 35 and 36 of the Environmentally Hazardous Chemicals Act 1985. These sections have been repealed. These notices are treated by the CLM Act as management orders.

Before using the record of notices see the Disclaimer and terms of use.

As at Monday, 5 December 2011 there are 919 notices in the record relating to 327 sites.

Show me the entire record or Search the record

5 December 2011

Rate this site

Office of Environment & Heritage

Search results

Your search for: LGA: Pittwater Council

Matched 2 notices relating to 8 sites.

Search Again
Refine Search

Suburb	Address	Site Name	Notices related to this site
Mona Vale	79 Barrenjoey Road	Caltex Service Station, Mona Vale	1 current and 1 former
Mona Vale	4, 10-14 Polo Avenue	Investigation Area Adj to Caltex Service Station	1 former
Mona Vale	3-9 Perak Street	Investigation Area Adj to Caltex Service Station	1 former
Mona Vale	51 Bassett Street	Investigation Area Adj to Caltex Service Station	1 former
Mona Vale	58 Darley Street	Investigation Area Adj to Caltex Service Station	1 former

Mona Vale	6 Polo Avenue	Remediation Area Adj to Caltex Service Station	1 current and 1 former
Mona Vale	75 Barrenjoey Road	Remediation Area Adj to Caltex Service Station	1 current and 1 former
Mona Vale	45 Bassett Street	Remediation Area Adj to Caltex Service Station	1 current and 1 former

14 December 2011

Notice No:	26046
Area No:	3169
Date:	3 September 2003
Party:	Caltex Australia Petroleum Pty Limited
Site:	79 Barrenjoey Road, Mona Vale, NSW, comprising Lot A of Deposited Plan 405025; 2 Polo Avenue (75 Barrenjoey Road), Mona Vale, NSW, comprising Lot 2 of Deposited Plan 236552; 6 Polo Avenue, Mona Vale, NSW, comprising Lot 23 of Deposited Plan 5497; and 45 Bassett Street, Mona Vale, NSW, comprising Strata Plan 31269.

Download Voluntary Agreement (Format = PDF, Size = 587 kB)

COPY

Our Reference : Agreement No. 26046#3169
File No. HO1823

ENVIRONMENT PROTECTION AUTHORITY (EPA)

VOLUNTARY REMEDIATION PROPOSAL: EPA AGREEMENT

SECTION 26 CONTAMINATED LAND MANAGEMENT ACT 1997

To: **Caltex Australia Petroleum Pty Ltd (ACN 000 032 128)**
Level 12
19-29 Martin Place
SYDNEY NSW 2000

(referred to in this agreement as "the proponent").

Date: **3 September 2003**

Land: The land to which this voluntary proposal relates to is described as:

- 79 Barrenjoey Road, Mona Vale, NSW, comprising Lot A of Deposited Plan 405025,

referred to in this proposal as "the site", and

- 2 Polo Avenue (75 Barrenjoey Road), Mona Vale, NSW, comprising Lot 2 of Deposited Plan 236552,
- 6 Polo Avenue, Mona Vale, NSW, comprising Lot 23 of Deposited Plan 5497,
- 45 Bassett Street, Mona Vale, NSW, comprising Strata Plan 31269

referred to this in this agreement as the "neighbouring sites".

The site and the neighbouring sites are collectively referred to in this agreement as "the land" and are indicated by outline on the attached site location drawing that is marked as Attachment 1.

Contamination:

The groundwater and the soil at the land is contaminated with the following substances in such a way as to present a significant risk of harm:

> Petroleum hydrocarbons ("TPH") and monoaromatic hydrocarbons including benzene, toluene, ethyl benzene and xylenes ("BTEX"), these substances being referred to in this agreement as "the contaminants".

Background:

In 1996 approximately 34,000 litres of unleaded petrol were released from an underground storage tank at the site. Since 1996 the proponent has taken steps to reduce the contaminants at the site.

In July 1999 the Environment Protection Authority ("the EPA") was made aware of the contaminants at the site and in October 1999 it determined that the contaminants at the site posed a significant risk of harm. On 27 September 2000 the EPA agreed to a voluntary investigation proposal submitted to it by the proponent. That proposal aimed at investigating the off-site impacts of the contaminants.

The voluntary investigation found that a plume of dissolved contaminants in the groundwater below the site extended to the south-west and included the neighbouring sites. The plume is predominantly characterised by the presence of benzene.

A further proposal to remediate the land has been furnished to the EPA by the proponent, in accordance with the provisions of the Contaminated Land Management Act 1997 ("the Act").

This proposal comprises the following reports.

- *Remedial Action Plan – Off-site Activities, Caltex Service Station – 79 Barrenjoey Road, Mona Vale NSW,* prepared by PPK dated September 2002 (Attachment 2);
- *Biosparging Trial – On-site Remediation Program, Activities, Caltex Service Station – 79 Barrenjoey Road, Mona Vale NSW,* prepared by PPK dated September 2002 (Attachment 2);
- Letter to Caltex Australia Petroleum Pty Ltd from Chris Jewell, EPA accredited site auditor dated 15 October 2002 providing a review of the above two documents (Attachment 3);
- Letter from Caltex Australia Petroleum Pty Ltd to EPA dated 17 October 2002 providing a copy of the above three documents and a timetable for the remediation (Attachment 4). The timetable for the remediation will be modified as per this agreement;
- Letter from Caltex Australia Petroleum Pty Ltd to EPA dated 21 July 2003 advising that Caltex is prepared to enter into a Voluntary Remediation Agreement with the EPA in accordance with proposed Agreement No. 26046#3163;

Objectives:

The objectives of the proposal are to achieve the following:

O1 Removal of all free-phase hydrocarbon contamination at the land together with a reduction of the concentration of dissolved-phase contaminants in the groundwater at the land through enhanced natural attenuation.

O2 The completion of a program of monitoring at the land and an assessment of the monitoring results to determine the effectiveness of the remediation in reducing the contaminant concentrations at the land.

O3 If the remediation is effective, use of the monitoring data obtained during the remediation to calculate acceptable and achievable long-term remediation goals for the dissolved-phase contamination together with a timeframe to achieve other long-term remediation goals for residual contamination at the land.

O4 Remediation of the land through enhanced natural attenuation until the long term remediation goals are met.

Principal Features of the Proposal:

The principal features of the proposal include the following (within the timeframes as specified):

P1 Installation of a horizontal biosparging system at the site.

P2 Operation and, if necessary, adjustment of the biosparging system so that sufficient oxygenation of the groundwater will occur without excess volatilisation of the contaminants occurring.

P3 Quarterly monitoring of groundwater at 14 locations at the site and a further 18 locations at the neighbouring sites (including the surface water drain location S1 as marked on the map marked as Attachment 1) and various other properties that are in the vicinity of the contamination plume that were included in the voluntary investigation agreement dated 27 September 2000, to determine the effectiveness of the remediation.

P4 Quarterly monitoring of soil vapour at 6 locations at the neighbouring sites and various other neighbouring properties.

P5 The monitoring referred to above is to take place at quarterly intervals for one year from the date of this agreement, after which the monitoring results will be assessed and submitted to the EPA. Depending on the results obtained from the monitoring, the proponent may recommend that the frequency of the monitoring be adjusted to six-monthly for a further year, however no reduction in the frequency of monitoring is permitted other than with the written approval of the EPA.

P6 After the completion of two years of monitoring, all the available data will be assessed and a quantitative trend analysis will be undertaken by the proponent to determine the effectiveness of the remediation and recommend whether the remediation using the biosparging system should continue. If the recommendation is that remediation continue, the proponent will calculate long term remediation goals for the ongoing remediation for the written approval of the EPA.

P7 If, in the opinion of the auditor and with the written concurrence of the EPA, the remediation is considered to be effective the operation of the biosparging system will continue until contamination levels have been reduced to the remediation goals agreed to by the EPA in writing or until the EPA agrees that the system is no longer required to be used. The EPA may issue a notice under section 28 of the Act for maintenance of the remediation system following the completion of this agreement.

P8 If, in the opinion of the EPA, the biosparging system is found to be ineffective in reducing contaminant levels, this agreement will be completed and other remedial methods set out in the proposal will need to be employed and a separate voluntary proposal should be submitted within 12 weeks of the last monitoring event.

P9 All works and sampling undertaken and reports prepared, must be consistent with Guidelines made or approved by the EPA under section 105 of the CLM Act (Attachment 6).

Reporting

R1 The proponent must prepare and provide to the Contaminated Sites Section of the EPA the following separate reports:

R1.1 A written report on the installation and commissioning of the biosparging system within 12 weeks of the commissioning.

R1.2 A copy of the results of monitoring undertaken and a concise written report on the results of the monitoring for each monitoring period as specified above, within 6 weeks of the end of each monitoring period.

R1.3 A written report which reviews the two years of monitoring results, discusses whether the remediation has been effective, and if it is considered to be effective, provides long

term remediation goals within 6 weeks after the completion of the last monitoring event in that 2 year period.

R2 The proponent must engage a site auditor, accredited under the CLM Act, to review all the above reports, together with any relevant material from previous environmental reports which have been commissioned in relation to the land, and provide the following reports to the EPA within 12 weeks of the completion of the last monitoring event in that 2 year period:

R2.1 A summary site audit report ("SSAR") which reviews the reports provided by the proponent in relation to the agreement and comments on the adequacy of the remediation undertaken, whether the bio-sparging system should remain operating, the appropriateness of any long term remediation goals proposed (if applicable) and provides any other relevant recommendations about the ongoing remediation; and

R2.2 A site audit statement that states whether or not the land is suitable for commercial / industrial land use.

EPA Agreement

The EPA is satisfied that the terms of the proposal are appropriate and notes, for the purposes of section 26(3) of the Act, that the proponent has undertaken in writing to the EPA not to recover contributions under Part 3, Division 6 of the Act in respect of the remediation carried out under the proposal.

The EPA agrees with the terms of the proposal, and will not issue a remediation order against the proponent in accordance with the provisions of Part 3 of the Act if the remediation is carried out in accordance with the proposal.

Duration of this Agreement

This agreement commences on the date upon which it is signed on behalf of the EPA, (which is the date set out on the first page of the agreement). All of the principal features of the proposal as listed above are to be completed within the specified time periods as set out in this Agreement. This agreement will end if the EPA advises in writing that, in its opinion, the monitoring results show that the remediation has been ineffective. In any event, this agreement will end when the EPA receives the SSAR or on **30 September 2005**, whichever is sooner.

CAROLYN STRANGE
A/Director Contaminated Sites
ENVIRONMENT PROTECTION AUTHORITY
(by Delegation)

Attachment 1	location map
Attachment 2	copy of front page and index from on-site and off-site RAPs
Attachment 3	letter from Site Auditor
Attachment 4	letter from Caltex, including timetable for works
Attachment 5	letter from Caltex indicating agreement with the draft VRA
Attachment 6	list of Guidelines made or approved under s.105 of the CLM Act

NOTE:

1. The EPA is not prevented by this agreement from making a remediation order against persons (including public authorities) with whom it has made no such agreement (whether or not they were originally parties to the proposal).

2. The EPA is not prevented by this agreement from making a remediation order against the proponent as an appropriate person (as defined in the Act) if, in the opinion of the EPA, the terms of the proposal are not carried out.

3. Section 58 of the Act requires the EPA to maintain a public record of certain matters. Notification of the making of this agreement will be included in the public record.

4. Section 59 of the Act requires the EPA to notify the relevant local council of the making of this agreement and when the terms of the agreement have been fulfilled. The council is required to note on any certificate issued pursuant to section 149(2) Environmental Planning and Assessment Act 1979 with respect to the land that the land is subject to a voluntary agreement until the council receives EPA notification that the terms of the agreement have been fulfilled.

Guidelines made or approved by the EPA under section 105 of the Contaminated Land Management Act 1997

Guidelines made by the EPA

- *Contaminated Sites: Guidelines for Assessing Service Station Sites*, December 1994.
- *Contaminated Sites: Guidelines for the Vertical Mixing of Soil on Former Broad-Acre Agricultural Land*, January 1995.
- *Contaminated Sites: Sampling Design Guidelines*, September 1995.
- *Contaminated Sites: Guidelines for Assessing Banana Plantation Sites*, October 1997.
- *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*, November 1997.
- *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme*, June 1998.
- *Contaminated Sites: Guidelines on Significant Risk of Harm from Contaminated Land and the Duty to Report*, April 1999.

Guidelines approved by the EPA

- *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*, published by Australian and New Zealand Environment and Conservation Council and the National Health and Medical Research Council (NHMRC), January 1992.
- *Australian Water Quality Guidelines for Fresh and Marine Waters*, Australian and New Zealand Environment and Conservation Council, November 1992, which are only approved for the purposes of contaminated site assessment, investigation, remediation and site auditing under the Contaminated Land Management Act (or other relevant legislation) commenced before September 2001.
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Paper No 4, October 2000.

National Environmental Health Forum monographs

- *Composite Sampling*, by Lock, W. H., National Environmental Health Forum Monographs, Soil Series No.3, 1996, SA Health Commission, Adelaide.

National Environment Protection Council publications

National Environment Protection (Assessment of Site Contamination) Measure 1999

- The Measure Includes a policy framework for the assessment of site contamination, Schedule A and Schedule B.

(I) Schedule A

- *Recommended General Process for the Assessment of Site Contamination.*

(II) Schedule B -Guidelines

(1) *Guideline on Investigation Levels for Soil and Groundwater*

(2) *Guideline on Data Collection, Sample Design and Reporting*

(3) *Guideline on Laboratory Analysis of Potentially Contaminated Soils*

(4) *Guideline on Health Risk Assessment Methodology*

(5) *Guideline on Ecological Risk Assessment*

(6) *Guideline on Risk Based Assessment of Groundwater Contamination*

(7a) *Guideline on Health-Based Investigation Levels*

(7b) *Guideline on Exposure Scenarios and Exposure Settings*

(8) *Guideline on Community Consultation and Risk Communication*

(9) *Guideline on Protection of Health and the Environment During the Assessment of Site Contamination*

(10) *Guideline on Competencies & Acceptance of Environmental Auditors and Related Professionals*

Other documents

- *Guidelines for the Assessment and Clean Up of Cattle Tick Dip Sites for Residential Purposes*, NSW Agriculture and CMPS&F Environmental, February 1996.
- *Australian Drinking Water Guidelines*, NHMRC & Agriculture and Resource Management Council of Australia and New Zealand, 1996.

Voluntary Remediation Proposal:
Amendment of Environment Protection Authority Agreement No. 26046

Voluntary remediation agreement no. 26046 dated 3 September 2003 is amended as follows to include a revised completion date for the remediation works to which the agreement applies.

The clause of the agreement which is headed "Lifetime of the Agreement" is omitted and replaced by the following clause:

LIFETIME OF THE AGREEMENT:

The agreement commenced on the date upon which it was signed on behalf of the EPA* (which is the date set out on the first page of the agreement). Implementation of the proposal must be completed by 30 September 2006 in relation to:

- 79 Barrenjoey Road, Mona Vale, NSW;
- 2 Polo Avenue (75 Barrenjoey Road), Mona Vale, NSW;
- 6 Polo Avenue, Mona Vale, NSW; and
- 45 Bassett Street, Mona Vale, NSW.

CAROLYN STRANGE
Director Contaminated Sites
Department of Environment and Conservation
Date:

1 FEB 2006

*** The Environment Protection Authority is part of the Department of Environment and Conservation**

Voluntary Remediation Proposal:
Amendment of Environment Protection Authority Agreement No. 26046

Voluntary remediation agreement no. 26046, dated 3 September 2003, is amended as follows to include a revised completion date for the remediation works to which the agreement applies.

The clause of the agreement which is headed "Lifetime of the Agreement" is omitted and replaced by the following clause:

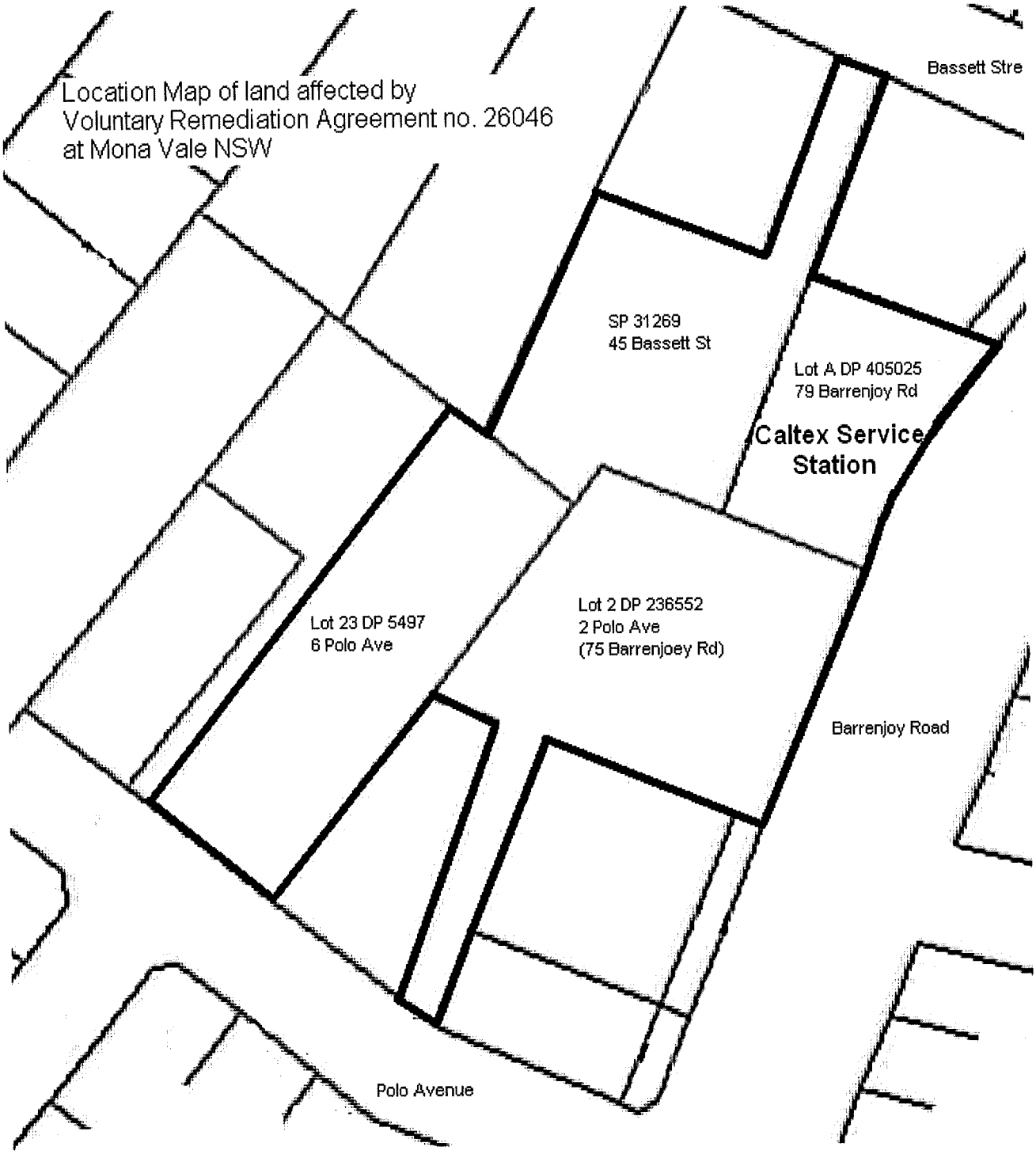
LIFETIME OF THE AGREEMENT:

The agreement commenced on the date upon which it was signed on behalf of the EPA* (which is the date set out on the first page of the agreement). Implementation of the proposal must be completed by 30 September 2007 in relation to:

- 79 Barrenjoey Road, Mona Vale, NSW;
- 2 Polo Avenue (75 Barrenjoey Road), Mona Vale, NSW;
- 6 Polo Avenue, Mona Vale, NSW; and
- 45 Bassett Street, Mona Vale, NSW.

JOHN COFFEY
A/Manager Contaminated Sites
Department of Environment and Conservation
Date: 10/11/06

*** The Environment Protection Authority is part of the Department of Environment and Conservation**


Location Map of land affected by
Voluntary Remediation Agreement no. 26046
at Mona Vale NSW
Bassett Stre
SP 31269
45 Bassett St
Lot A DP 405025
79 Barrenjoy Rd
Caltex Service
Station
Lot 23 DP 5497
6 Polo Ave
Lot 2 DP 236552
2 Polo Ave
(75 Barrenjoey Rd)
Barrenjoy Road
Polo Avenue

APPENDIX C

TABLE 1 - SAMPLE DESCRIPTIONS
AND
ENGINEERING LOG – MONITORING WELL

GEOTECHNIQUE PTY LTD

Project	**Proposed Above Ground Fuel Storage Tank**	**Job No**	**12593/1**
Location	**Mona Vale Golf Course**	**Refer to Drawing No**	**12593/1-AA1**
	1 Golf Avenue, Mona Vale	**Logged & Sampled by**	**AN**

TABLE 1

Borehole	Depth (m)	Sample Depth (m)	Date	Time	Material Description	Remarks*
BH1	0.0-0.1	No Sample (NS)	16/11/2011	-	CONCRETE SLAB	
	0.1-0.2	0.1-0.2	"	-	FILL; Sand, fine grained, brown	PID=140ppm
	0.2-0.7	0.2-0.5	"	-	FILL; Sandy Clay, medium plasticity, dark brown, trace of gravel	PID=140ppm Diesel staining and weak to distinct petroleum products odour from 0.2-0.4m
	0.7-0.9	0.7-0.9	"	-	FILL; Clayey Sand, fine grained, dark brown	PID=240ppm Diesel staining and weak to distinct petroleum products odour
	0.9-1.3	1.0-1.3	"	-	(CH) CLAY, high plasticity, yellow-brown, trace of ironstone	PID=140ppm
	1.3-3.9	1.5-1.8	"	-	(CH) CLAY, high plasticity, grey, with ironstones	PID=50ppm
		2.5-2.8	"	-	(CH) CLAY, high plasticity, grey, with ironstones	PID=30ppm
		3.5-3.8	"	-	(CH) CLAY, high plasticity, grey, with ironstones	PID=0.0ppm
	3.9-5.0	4.5-4.8	"	-	Clayey SHALE, extremely weathered, grey, with ironstones.	PID=0.0ppm
BH2	0.0-0.1	NS	"	-	CONCRETE SLAB	
	0.1-0.2	0.1-0.2	"	-	FILL; Sand, fine grained, brown	PID=30ppm
	0.2-0.5	0.2-0.5	"	-	FILL; Sandy Clay, medium plasticity, dark brown, trace of gravel	PID=50ppm
	0.5-0.8	0.5-0.8	"	-	FILL; Clayey Sand, fine grained, dark brown	PID=130ppm
	0.8-1.3	0.85-1.15	"	-	(CH) CLAY, high plasticity, yellow-brown, trace of ironstone	PID=30ppm
	1.3-4.0	1.3-1.6	"	-	(CH) CLAY, high plasticity, grey, with ironstones	PID=30ppm
		2.0-2.3	"	-	(CH) CLAY, high plasticity, grey, with ironstones	PID=30ppm
		3.0-3.3	"	-	(CH) CLAY, high plasticity, grey, with ironstones	PID=50ppm
	4.0-5.0	4.0-4.3	"	-	Clayey SHALE, extremely weathered, grey, with ironstones.	PID=5ppm

*Odour (O), Discolouration (D), Petroleum Hydrocarbon Staining (PHS), Asbestos Pieces (ASBP), Ash Material (ASHM), Demolition Waste (DW), Groundwater (GW), Perched Water (PW) PID reading etc.

GEOTECHNIQUE
PTY LTD

Project	Proposed Above Ground Fuel Storage Tank	Job No	12593/1
Location	Mona Vale Golf Course	Refer to Drawing No	12593/1-AA1
	1 Golf Avenue, Mona Vale	Logged & Sampled by	AN

TABLE 1

Borehole	Depth (m)	Sample Depth (m)	Date	Time	Material Description	Remarks*
BH3	0.0-0.15	NS	16/11/2011	-	CONCRETE SLAB	
	0.15-0.6	0.15-0.45	"	-	FILL; Sandy Clay, medium plasticity, dark brown, trace of gravel	PID=5ppm
	0.6-0.9	0.65-0.9	"	-	(CH) CLAY, high plasticity, yellow-brown, trace of ironstone	PID=10ppm
	0.9-4.0	1.0-1.3	"	-	(CH) CLAY, high plasticity, grey, with ironstones	PID=20ppm
		2.0-2.3	"	-	(CH) CLAY, high plasticity, grey, with ironstones	PID=40ppm
		3.0-3.3	"	-	(CH) CLAY, high plasticity, grey, with ironstones	PID=10ppm
	4.0-5.0	4.0-4.3	"	-	Clayey SHALE, extremely weathered, grey, with ironstones.	PID=0ppm
BH4	0.0-0.1	NS	"	-	CONCRETE SLAB	
	0.1-0.2	0.1-0.2	"	-	FILL; Sand, fine grained, brown, with gravels	PID=5ppm
	0.2-0.8	0.2-0.5	"	-	FILL; Sandy Clay, medium plasticity, dark brown, trace of gravel	PID=5ppm
		0.5-0.8	"	-	FILL; Sandy Clay, medium plasticity, dark brown, trace of gravel	PID=100ppm
	0.8-1.2	0.85-1.15	"	-	(CH) CLAY, high plasticity, yellow-brown, trace of ironstone	PID=40ppm
	1.2-3.2	2.0-2.3	"	-	(CH) CLAY, high plasticity, grey, with ironstones	PID=0.0ppm

*Odour (O), Discolouration (D), Petroleum Hydrocarbon Staining (PHS), Asbestos Pieces (ASBP), Ash Material (ASHM), Demolition Waste (DW), Groundwater (GW), Perched Water (PW) PID reading etc.

GEOTECHNIQUE
PTY LTD

engineering log - monitoring well

Client : The Mona Vale Golf Club Limited
Project : Proposed Above Ground Fuel Storage Tank
Location : Mona Vale Golf Course, 1 Golf Avenue, Mona Vale

Job No. : 12593/1
Borehole No. : MW1
Date : 16/11/2011
Logged/Checked by: AN/JX

drill rig : Geoprobe 6610DT
R.L. surface : **AHD**

groundwater 16/11/2011 : 4.5m (m)

groundwater	samples	PID Reading (ppm)	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION (soil type, plasticity or particle characteristic, colour, secondary and minor components.)
	G	0	0			CONCRETE
	G	10				FILL; Sand, fine grained, yellow-brown
						FILL; Sandy Clay, low to medium plasticity, dark brown, trace of gravel, diesel staining and weak to distinct petroleum products odour from 0.15 to 0.45m
	G	190	1			FILL; Clayey Sand, fine grained, dark brown, with diesel staining and strong petroleum odour
	G	30			CH	CLAY, high plasticity, yellow-brown, grey, with ironstones
	G	80	2			
	G	30				
	G	40	3			
	G	10				
▼			4			Clayey SHALE/SILTSTONE, grey, extremely weathered, with ironstones
	G	10	5			
			6			Monitoring Well No 1 terminated at 6.0m on sandstone bedrock
			7			
			8			
			9			

MONITORING WELL

Graphic Log	Description
	Gatic cover and cap
	Concrete
	Sand
	Bentonite
	Screen with filter sock
	Sand
	End cap

form no. MW01 version 05 - 11/11

APPENDIX D

GROUNDWATER INFORMATION, MAP AND BORE DATA

Alan Thompson
Mona Vale Golf Club

James Ngu
Fax 4722 2777

HI James,

Re: Preliminary Contamination Investigation.

Attached FYI are pages 3 to 7 inclusive of the report (2006)on the Bore Construction and Testing Operation for the bore drilling exploration for groundwater potential at the club. You will recall I showed you in the clubhouse the glass case containing soil samples taken when the bore was drilled.

The bore is in operation and is located in the order of 50m to the west of where the existing underground fuel tanks are located and the ground level in the location of the bore would be around 6 to 7 m below the level of the concrete paved area under which the tanks are located.

Is there any other info that we could provide to assist?

Regards,
Alan

RECEIVED
22 NOV 2011
BY:_____

P1 of 6

1.0 INTRODUCTION

This report summarises the results of the drilling and evaluation of a bore (Bore 1), located to explore the groundwater potential at Mona Vale Golf Club (*MVGC*). The bore was located to evaluate the groundwater potential of the Newport Formation and Bald Hill Claystone. The successful completion of the bore has followed the success within a similar geological sequence at Long Reef Golf Club. The bore is located approximately 200m south-west of the club house, as shown in Figure 1. The hydrogeological potential of the site was defined in a report to *MVGC* dated January 2006 (*Hydroilex* Report HG06.1.1SY). Groundwater at the site is required for the irrigation of fairways. The proposal is to pump the groundwater into existing dams.

Bore 1 was drilled to a depth of 73m on 4 – 5th April 2006. Aquifers were encountered in the upper part of the borehole at 18m and 30m, associated with brackish waters, together with a significant aquifer at a depth of 57m associated with significantly fresher water.

Following the drilling of the test hole, a suite of geophysical records were acquired to determine the stratigraphic sequence penetrated, the aquifer distribution and water quality trends. A '48' hour drawdown and recovery test was conducted to determine the sustainable yield and recommendations for pumping and equipping.

The following documentation and analysis is included in this report in support of an application to the Department of Natural Resources (*DNR*) for an irrigation license:

- Drilling Report on bore construction
- Borehole Geophysical Records
- Drawdown and Recovery Testing
- Water analyses and interpretation

The drilling and testing results have been successful in defining a significant groundwater resource, in support of a 200 ML groundwater application.

2.0 DRILLING RESULTS AND BORE CONSTRUCTION

The following summarises the bore construction and drilling results;

Location:	AMG 56342948E 6271858N		
Depth Drilled:	73m		
Casing depth:	48m (Pressure-cemented)		
Hole size:	0 – 12m	300mm	Cased with 273mm steel
	12 – 48m	254mm	Cased with 219mm steel (0 – 48m)
Aquifers:	17 – 18m	1.25L/sec	3.18 dS/m (sealed behind casing)
	29 – 30m	0.41L/sec	3.06 dS/m (sealed behind casing)
	57 – 58m	12.4L/sec	1.69 dS/m

The above aquifer yields and water salinity data were collected during the drilling operation and prior to the setting and cementing of casing to a depth of 48m. After casing installation, the electrical conductivity (EC) reduced to 1.57dS/m.

Stratigraphy:

The tentative stratigraphy of the bore is provided in Plate 1:

Quaternary	0 - 11
Bald Hill Claystone	11 - 32
Bulgo Sandstone	32 - 57
Stanwell Park Claystone	57 - 73

A Form 'A' report for the bore is provided in Appendix 1.

3.0 BOREHOLE GEOPHYSICS

A borehole geophysical survey of the bore was conducted on 4th April 2006, during the drilling operation, to determine aquifer distribution and water quality trends, to assist in the final bore construction and design. The geophysical records are provided in Plate 1. A summary of the relevant borehole geophysical responses are provided in Appendix 2.

The following provides a summary of the geophysical records:

1. The gamma ray response records the distribution of relatively 'clean' silicious sediments in 'yellow', and more clayey sediments dominated by shales and siltstones in 'green'. The sediments are dominated by red siltstones to a depth of 50m, and grey siltstones and shales to the base of the bore. The main aquifer at 57 – 58m is clearly within a fractured shale.
2. The caliper curve shows several wash-outs in the upper part of the hole, subsequently cased to a depth of 48m to eliminate saline water and unstable rock. Stable hole conditions are evident below that depth.
3. The electrical resistance resistivity and self potential records identify the main aquifer zones.
4. The temperature records and particularly the differential temperature log clearly identifies the aquifer distribution (refer to major anomaly at 57m).
5. The gamma log signature has enabled the likely correlation with the recent bore at Long Reef Golf Club, used as the control bore for this project.

4.0 DRAWDOWN AND RECOVERY TESTING

A 51hr drawdown and recovery test was conducted over the period 21 – 25th April 2006. Testing was conducted using a submersible pump, electronic manual and down-hole data loggers and a flow meter. Samples were collected during and at the end of the test, and submitted for water quality testing. Pump test data analysis and associated plots are provided in Appendix 3.

Drawdown data and the associated drawdown curve are provided in Table 1 and Figure 1. The drawdown curve exhibits a gradual decline, having a drawdown gradient of 4.7m per log cycle. The projected 7 day drawdown is approximately 35m at the test rate, which averaged 11.97L/sec. The test data demonstrates that there are no significant boundaries, and that the test rate is well within the 'safe limit of pumping'. For shorter pumping cycles, the bore could be pumped at up to 15L/sec.

Recovery data and the associated curve is provided in Table 2 and Figure 1. The similarity of the drawdown and recovery gradients provides a high level of data confidence. It is noted in the recovery data that the bore recovers to approximately 10m in 16hrs.

During the test a total 2.2164ML of water was pumped. Water samples were collected during the test, as recorded in section 5 of this report.

The proposal is to equip the bore to a capacity of up to 12L/sec, and pump on a cyclic basis (12hrs pumping, followed by 12hrs recovery), to produce 0.5ML per day. The test data however, demonstrates that the bore can be pumped continuously for up to 7 days. A conservative pumping scenario is recommended to preserve water quality.

TABLE 1 – SUMMARY OF DRAWDOWN AND RECOVERY TEST RESULTS

AQUIFER PARAMETERS	DATA
SWL (briginal records)	4.21m ✓
Aquifers (driller)	17-18m 1.25L/sec-sealed off 29-30m 0.41 L/sec-sealed off 57-58m 12.4 L/sec Aggregate: 12.4Lsec
'Available drawdown'	53m (main aquifer)
Test date	21-25.4.06
Test rate (average)	12.63 L/sec
Pumping period	51.5 hrs
Recovery period	>51.5 hrs
Recorded Final Drawdown level in pumping bore	34.28
Drawdown Character	Steady, linear drawdown
Recovery Character	Rapid recovery, consistent with drawdown.
Transmissivity, cu.m/day/m	42.5

5.0 WATER QUALITY

The bore was constructed in such a fashion which precluded saline waters entering the bore, by the pressure cementing of the upper 48m of the borehole.

Field samples collected, have recorded an initial EC reading of 1.55dS/m at the start of pumping, and 1.69dS/m at the conclusion of pumping. Water samples submitted for analysis by *MVGC* recorded a 24hr EC of 1.5 dS/m and a final (48hr) EC of 1.57dS/m.

The water is characterised by the following chemistry:

- pH of the water is 7.8 (weakly alkaline).
- The calculated total salinity (TDS) of the water is in the range of 860-1000mg/L, based on a qualitative determination from the electrical conductivity (EC). It should be noted that the TDS levels have been calculated (not determined analytically).
- Moderate concentrations of sodium and chloride.
- Relatively low concentrations of potassium, calcium and sulphate.
- Very low concentration of bicarbonate.
- Moderate concentration of iron (0.7mg/L), but not evident as a precipitate in storage samples.
- The calculated sodium absorption ratio (SAR) is moderate, and continued watering without rainwater flushing may determine the need for gypsum.
- The calculated hardness is approximately 186mg/L (moderately hard).
- The calculated saturation index (SI) is -1.54, which suggests that the water will be weakly corrosive.
- The water is classified as a *chloride–sodium* water.

6.0 SUMMARY AND RECOMMENDATIONS

A highly successful groundwater production bore has been constructed. The following summarises the main results:

- The bore was drilled to a depth of 73m, and constructed as a 200mm completion, which will enable the installation of a 6" submersible pump, having adequate pump clearance and space for the installation of monitoring data.
- The groundwater chemistry in the bore has been enhanced by the isolation of brackish waters in the upper part of the borehole. The approximate total salinity of the groundwater is in the range of 860 – 1000mg/L, characterised by dominant concentrations of sodium and chloride. The proposal is to pump the groundwater to the existing dams, for subsequent irrigation after dilution. It is noted that the water quality of the dam water is approximately 250mg/L TDS.
- A 50hr drawdown and recovery test was conducted at an average discharge rate of 11.97L/sec. The available drawdown in the bore is approximately 53m, based on the depth to the main aquifer at 57m. The drawdown character is linear, without evidence of any boundary conditions. The recovery data confirms this interpretation. The test

confirms that the bore could be pumped continuously, well in excess of 7 days at the test rate. In order however, to preserve the water quality and reduce drawdown, the following is recommended:

- Set discharge rate to a maximum of 12L/sec.
- Install pump with the suction at 55m.
- Install a cut-out probe at 45m depth, and a cut-in probe at 12m.
- Install a 1.25" tube to the top of the pump to allow manual water depth readings to be determined.

- The groundwater requirements for the project have been estimated in the range of 150 – 200ML per year. An allocation request of 200ML has been prepared for lodgement with *DNR*. The bore is located in satisfaction of distance conditions, and based on the proposed pumping scenario, no impacts on other users, or the environment is foreseen.

7.0 REFERENCES

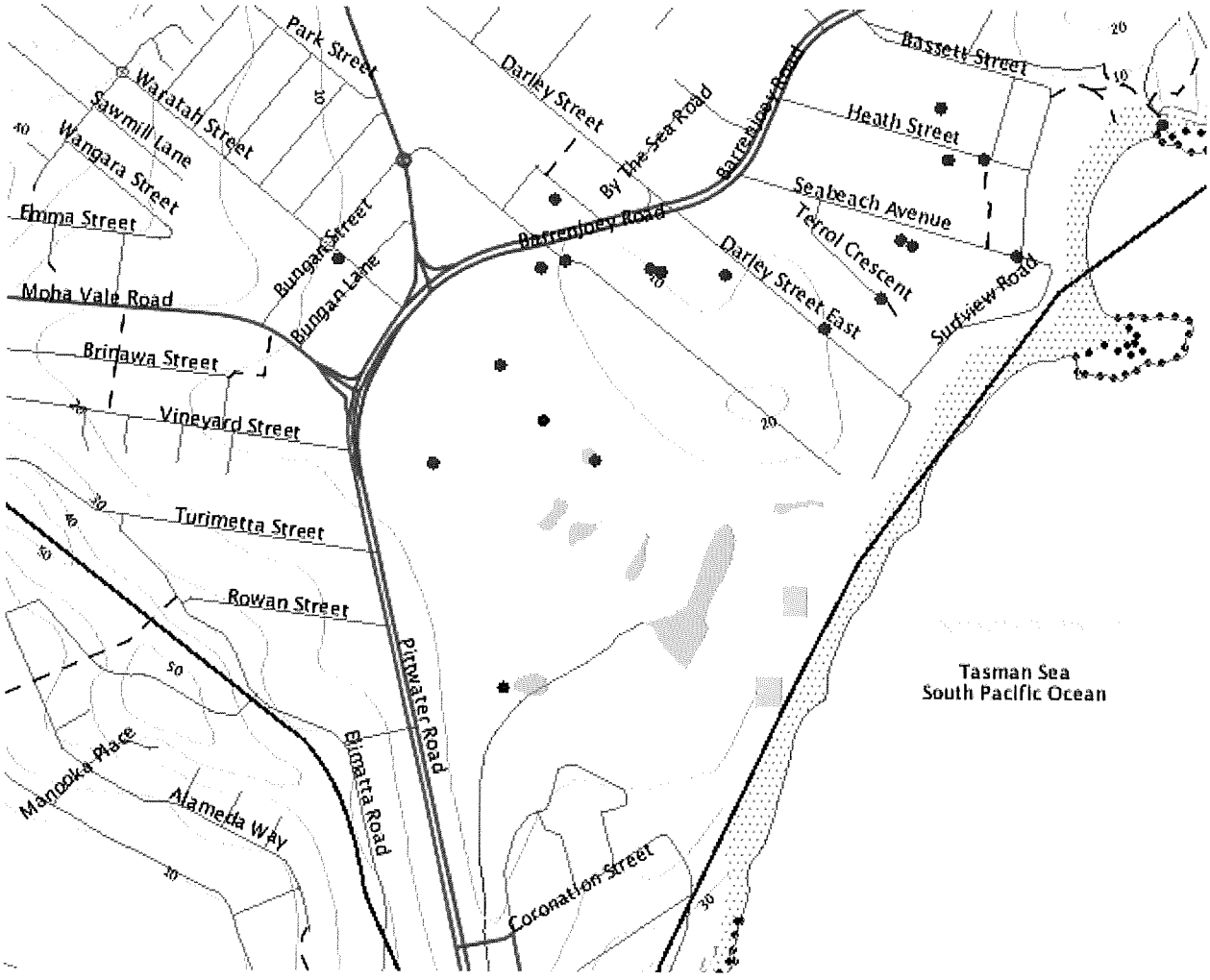
Report HG06.1.1 – Hydrogeological Investigation for Potential Irrigation Supplies – Mona Vale Golf Club

----------oOo----------

12593/1 Groundwater Map

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

Wednesday, November 16, 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	
Primary/arterial road Motorway/freeway Railway Runway Contour Background	Topographic base map	

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Wednesday, November 16, 2011

Print Report

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

Work Requested -- GW018770

Works Details (top)

GROUNDWATER NUMBER	GW018770
LIC-NUM	10WA107451
AUTHORISED-PURPOSES	WASTE DISPOSAL
INTENDED-PURPOSES	WASTE DISPOSAL
WORK-TYPE	Bore open thru rock
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	Cable Tool
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1960-08-01
FINAL-DEPTH (metres)	40.20
DRILLED-DEPTH (metres)	40.20
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	212 - HAWKESBURY RIVER
AREA-DISTRICT	
CMA-MAP	9130-1S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6272378.00
EASTING	343269.00
LATITUDE	33 40' 37"
LONGITUDE	151 18' 33"
GS-MAP	0055B3
AMG-ZONE	56
COORD-SOURCE	GD.,PR. MAP
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	17

Licensed (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	1 29305

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	Threaded Steel	0.00	12.10	152			(Unknow

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	SALINIT
22.20	40.10	17.90	(Unknown)	3.60		0.34			(Unknow

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	2.74	2.74	Clay Red		
2.74	9.75	7.01	Clay White		
9.75	21.94	12.19	Shale Black		
21.94	40.23	18.29	Shale Red Sandy Water Supply		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Wednesday, November 16, 2011

Print Report

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

Work Requested -- GW018771

Works Details (top)

GROUNDWATER NUMBER	GW018771
LIC-NUM	10WA107452
AUTHORISED-PURPOSES	WASTE DISPOSAL
INTENDED-PURPOSES	WASTE DISPOSAL
WORK-TYPE	Bore open thru rock
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	Cable Tool
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1960-11-01
FINAL-DEPTH (metres)	100.50
DRILLED-DEPTH (metres)	100.60
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	212 - HAWKESBURY RIVER
AREA-DISTRICT	
CMA-MAP	9130-1S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6272277.00
EASTING	343434.00
LATITUDE	33 40' 40"
LONGITUDE	151 18' 40"
GS-MAP	0055B3
AMG-ZONE	56
COORD-SOURCE	GD.,PR. MAP
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	17

Licensed (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	7 752046

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	15.80	152			(Unknow

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	SALINIT
64.00	68.50	4.50	Fractured						(Unknow
92.00	93.80	1.80	Fractured						(Unknow

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.52	1.52	Subsoil		
1.52	17.06	15.54	Clay		
17.06	36.57	19.51	Shale		
36.57	39.62	3.05	Shale Clay Seams		
39.62	64.00	24.38	Shale		
64.00	68.58	4.58	Shale Sandy Water Supply		
68.58	76.50	7.92	Shale Hard		
76.50	78.33	1.83	Slate		
78.33	92.04	13.71	Shale		
92.04	93.87	1.83	Shale Sandy Water Supply		
93.87	98.75	4.88	Shale		
98.75	99.97	1.22	Shale Gravel		
99.97	100.58	0.61	Shale		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Wednesday, November 16, 2011

Print Report

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

Work Requested -- GW018778

Works Details (top)

GROUNDWATER NUMBER	GW018778
LIC-NUM	10WA108105
AUTHORISED-PURPOSES	WASTE DISPOSAL
INTENDED-PURPOSES	WASTE DISPOSAL
WORK-TYPE	Bore open thru rock
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	Cable Tool
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1960-10-01
FINAL-DEPTH (metres)	124.90
DRILLED-DEPTH (metres)	125.00
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	212 - HAWKESBURY RIVER
AREA-DISTRICT	
CMA-MAP	9130-1S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6272395.00
EASTING	342629.00
LATITUDE	33 40' 36"
LONGITUDE	151 18' 9"
GS-MAP	0055B3
AMG-ZONE	56
COORD-SOURCE	GD.,PR. MAP
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	SEC 3

Licensed (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	2 752046

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	Threaded Steel	-0.30	48.40	152			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	SALINIT
42.60	44.10	1.50	Unconsolidated	21.30		0.15			(Unknow
54.20	74.60	20.40	Fractured	21.30		0.19			(Unknow

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	19.81	19.81	Clay Red		
19.81	44.19	24.38	Clay Yellow Sandy Water Supply		
44.19	47.24	3.05	Sandstone Yellow		
47.24	48.76	1.52	Clay Grey		
48.76	54.25	5.49	Shale Grey		
54.25	74.67	20.42	Shale Red Water Supply		
74.67	124.96	50.29	Shale Black		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Wednesday, November 16, 2011

Print Report

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

Work Requested -- GW018808

Works Details (top)

GROUNDWATER NUMBER	GW018808
LIC-NUM	10WA108102
AUTHORISED-PURPOSES	WASTE DISPOSAL
INTENDED-PURPOSES	WASTE DISPOSAL
WORK-TYPE	Bore open thru rock
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	Cable Tool
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1960-12-01
FINAL-DEPTH (metres)	91.40
DRILLED-DEPTH (metres)	91.40
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	212 - HAWKESBURY RIVER
AREA-DISTRICT	
CMA-MAP	9130-1S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6272615.00
EASTING	343691.00
LATITUDE	33 40' 30"
LONGITUDE	151 18' 50"
GS-MAP	0055B3
AMG-ZONE	56
COORD-SOURCE	GD.,PR. MAP
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	17

Licensed (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	PT 17

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	Threaded Steel	-0.30	24.90	152			Driven into Hole

Water Bearing Zones (top)

no details

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	11.88	11.88	Sand		
11.88	24.07	12.19	Clay		
24.07	91.44	67.37	Shale Grey		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Wednesday, November 16, 2011

Print Report

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

Work Requested -- GW019104

Works Details (top)

GROUNDWATER NUMBER	GW019104
LIC-NUM	10WA108108
AUTHORISED-PURPOSES	WASTE DISPOSAL
INTENDED-PURPOSES	WASTE DISPOSAL
WORK-TYPE	Bore open thru rock
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	Cable Tool
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1961-02-01
FINAL-DEPTH (metres)	47.20
DRILLED-DEPTH (metres)	47.20
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	212 - HAWKESBURY RIVER
AREA-DISTRICT	
CMA-MAP	9130-1S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6272690.00
EASTING	343984.00
LATITUDE	33 40' 27"
LONGITUDE	151 19' 1"
GS-MAP	0055B3
AMG-ZONE	56
COORD-SOURCE	GD.,PR. MAP
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	17

Licensed (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	28 752046

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	Threaded Steel	-0.30	5.70	203			Suspended Clamps

Water Bearing Zones (top)

no details

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	6.70	6.70	Clay Red		
6.70	17.67	10.97	Clay		
17.67	23.77	6.10	Shale		
23.77	24.68	0.91	Rock Hard		
24.68	25.29	0.61	Shale Grey		
25.29	30.48	5.19	Quartzite		
30.48	35.05	4.57	Shale Soft		
35.05	38.70	3.65	Conglomerate		
38.70	41.75	3.05	Shale		
41.75	47.24	5.49	Quartzite		

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 -- GW026026

Works Details (top)

GROUNDWATER NUMBER	GW026026
LIC-NUM	10WA107458
AUTHORISED-PURPOSES	DOMESTIC
INTENDED-PURPOSES	GENERAL USE
WORK-TYPE	Bore open thru rock
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	Cable Tool
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1966-11-01
FINAL-DEPTH (metres)	51.80
DRILLED-DEPTH (metres)	51.80
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	212 - HAWKESBURY RIVER
AREA-DISTRICT	
CMA-MAP	9130-1S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6272400.00
EASTING	343004.00
LATITUDE	33 40' 36"
LONGITUDE	151 18' 23"
GS-MAP	0055B3
AMG-ZONE	56
COORD-SOURCE	GD.,PR. MAP
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	17

Licensed (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	N/A

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	18.80	152			(Unknown)
1	1	Opening	Slots	0.00	0.00	152		1	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	SALINIT
15.50	15.50	0.00	Fractured	3.00					(Unknow
34.10	35.00	0.90	Consolidated	2.40		0.57			Fresh

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	6.09	6.09	Clay		
6.09	7.62	1.53	Sandstone Hard		
7.62	9.14	1.52	Sandstone Weathered		
9.14	17.67	8.53	Shale Water Supply		
17.67	33.52	15.85	Shale Black		
33.52	35.05	1.53	Sandstone Hard Water Supply		
35.05	37.18	2.13	Shale		
37.18	37.49	0.31	Sandstone		
37.49	51.81	14.32	Shale Black Red		

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 -- GW026027

Works Details (top)

GROUNDWATER NUMBER	GW026027
LIC-NUM	10WA107459
AUTHORISED-PURPOSES	DOMESTIC
INTENDED-PURPOSES	GENERAL USE
WORK-TYPE	Bore open thru rock
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	Cable Tool
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1966-12-01
FINAL-DEPTH (metres)	61.50
DRILLED-DEPTH (metres)	61.70
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	212 - HAWKESBURY RIVER
AREA-DISTRICT	
CMA-MAP	9130-1S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6272385.00
EASTING	342964.00
LATITUDE	33 40' 37"
LONGITUDE	151 18' 22"
GS-MAP	0055B3
AMG-ZONE	56
COORD-SOURCE	GD.,PR. MAP
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	17

Licensed (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	N/A

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	44.80	152			(Unknow

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	SALINIT
12.10	12.10	0.00	Consolidated	4.50					Fresh
48.70	48.70	0.00	(Unknown)	4.50					Fresh
56.30	56.30	0.00	Fractured	4.50		0.44			Fresh

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	9.14	9.14	Clay		
9.14	10.36	1.22	Sandstone		
10.36	48.76	38.40	Sandstone Grey Water Supply		
48.76	56.38	7.62	Shale Water Supply		
56.38	59.58	3.20	Rock Hard		
59.58	61.72	2.14	Shale Grey		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Wednesday, November 16, 2011

Print Report

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

Work Requested -- GW026581

Works Details (top)

GROUNDWATER NUMBER	GW026581
LIC-NUM	10WA107460
AUTHORISED-PURPOSES	WASTE DISPOSAL
INTENDED-PURPOSES	WASTE DISPOSAL
WORK-TYPE	Bore open thru rock
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	Cable Tool
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1967-01-01
FINAL-DEPTH (metres)	92.90
DRILLED-DEPTH (metres)	93.00
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	212 - HAWKESBURY RIVER
AREA-DISTRICT	
CMA-MAP	9130-1S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6272520.00
EASTING	342984.00
LATITUDE	33 40' 32"
LONGITUDE	151 18' 22"
GS-MAP	0055B3
AMG-ZONE	56
COORD-SOURCE	GD.,PR. MAP
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	17

Licensed (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	N/A

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	31.60	203			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	SALINIT
13.70	13.70	0.00	Fractured	2.40					(Unknow
28.00	28.00	0.00	Fractured	2.40		0.38			(Unknow
56.30	56.30	0.00	Consolidated	2.40		0.38			(Unknow
71.30	71.30	0.00	Fractured	2.40		0.51			(Unknow
86.80	86.80	0.00	Fractured	1.50		1.52			(Unknow

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	12.19	12.19	Clay Sandy		
12.19	27.12	14.93	Shale Red Water Supply		
27.12	28.04	0.92	Rock Grey Hard		
28.04	51.81	23.77	Shale Black Water Supply		
51.81	56.38	4.57	Rock Grey Hard		
56.38	60.96	4.58	Sandstone Water Supply		
60.96	71.32	10.36	Rock		
71.32	76.80	5.48	Shale Hard Water Supply		
76.80	92.96	16.16	Rock Black Hard Water Supply		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Wednesday, November 16, 2011

Print Report

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

Work Requested -- GW105936

Works Details (top)

GROUNDWATER NUMBER	GW105936
LIC-NUM	10WA107516
AUTHORISED-PURPOSES	DOMESTIC
INTENDED-PURPOSES	
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	
COMMENCE-DATE	
COMPLETION-DATE	2005-05-19
FINAL-DEPTH (metres)	
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	COPELAND
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	212 - HAWKESBURY RIVER
AREA-DISTRICT	
CMA-MAP	9130-1S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6272453.00
EASTING	343556.00
LATITUDE	33 40' 35"
LONGITUDE	151 18' 45"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	A 339661

Licensed (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	A 339661

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 Wednesday, November 16, 2011

Print Report

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

Work Requested -- GW108158

Works Details (top)

GROUNDWATER NUMBER	GW108158
LIC-NUM	10WA107561
AUTHORISED-PURPOSES	DOMESTIC
INTENDED-PURPOSES	DOMESTIC
WORK-TYPE	Spear
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2006-05-07
FINAL-DEPTH (metres)	6.30
DRILLED-DEPTH (metres)	6.30
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	FRANCIS
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	2.60
SALINITY	
YIELD	1.00

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6272442.00
EASTING	343576.00
LATITUDE	33 40' 35"
LONGITUDE	151 18' 45"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	GIS - Geographic Information System
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	B 339661

Licensed (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	B 339661

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	DETA
1		Hole	Hole	0.00	6.30	100			
1	1	Casing	PVC Class 9	0.00	6.00	100			Glued

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	SALINIT
2.60	6.30	3.70		2.60		1.00			Good

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	6.30	6.30	sand		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Wednesday, November 16, 2011

Print Report

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

Work Requested -- GW108500

Works Details (top)

GROUNDWATER NUMBER	GW108500
LIC-NUM	10WA107522
AUTHORISED-PURPOSES	DOMESTIC
INTENDED-PURPOSES	DOMESTIC
WORK-TYPE	Spear
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	Jetted
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2006-11-10
FINAL-DEPTH (metres)	4.00
DRILLED-DEPTH (metres)	4.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	STRATA PLAN 16473
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	2.00
SALINITY	
YIELD	1.00

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	213 - SYDNEY COAST - GEORGES RIVER
AREA-DISTRICT	
CMA-MAP	9130-1S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6272338.00
EASTING	343526.00
LATITUDE	33 40' 39"
LONGITUDE	151 18' 43"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	GIS - Geographic Information System
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	SP 16473

Licensed (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	16473

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	4.00	110			Jetted
1	1	Casing	P.V.C.	0.00	4.00	100			Glued
1	1	Opening	Screen	3.40	4.00	50			Stainless Steel; A: .01mm; Screwed

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	SALINIT
2.00	4.00	2.00		2.00		2.10			

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.10	0.10	Topsoil		
0.10	4.00	3.90	Sand, yellow		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Wednesday, November 16, 2011

Print Report

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

Work Requested -- GW108558

Works Details (top)

GROUNDWATER NUMBER	GW108558
LIC-NUM	10WA109167
AUTHORISED-PURPOSES	DOMESTIC
INTENDED-PURPOSES	DOMESTIC
WORK-TYPE	Spear
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2007-02-05
FINAL-DEPTH (metres)	4.30
DRILLED-DEPTH (metres)	4.30
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	HARRIS
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	2.80
SALINITY	
YIELD	1.00

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	212 - HAWKESBURY RIVER
AREA-DISTRICT	
CMA-MAP	9130-1S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6272612.00
EASTING	343632.00
LATITUDE	33 40' 30"
LONGITUDE	151 18' 48"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	GIS - Geographic Information System
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	33/F/7236

Licensed (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	33 7236

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	4.30	110			
1	1	Casing	PVC Class 9	0.00	4.30	110	110		Glued; Driven into Hole; (Unknown)
1	1	Opening	Screen - Gauze/Mesh	3.70	4.30	50			Stainless Stee SL: 60mm; Screwed

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	SALINIT
2.30	4.30	2.00		2.80		1.00		4.00	

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	2.30	2.30	Sandstone, compacted		
2.30	4.30	2.00	Sand, fine		
4.30	4.30	0.00	Mud, grey		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Wednesday, November 16, 2011

Print Report

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

Work Requested -- GW108579

Works Details (top)

GROUNDWATER NUMBER	GW108579
LIC-NUM	10WA109184
AUTHORISED-PURPOSES	DOMESTIC
INTENDED-PURPOSES	DOMESTIC
WORK-TYPE	Spear
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	Auger
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2007-03-09
FINAL-DEPTH (metres)	6.60
DRILLED-DEPTH (metres)	6.60
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	MC HUGH
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	4.00
SALINITY	
YIELD	0.50

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	213 - SYDNEY COAST - GEORGES RIVER
AREA-DISTRICT	
CMA-MAP	9130-1S
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6272426.00
EASTING	343749.00
LATITUDE	33 40' 36"
LONGITUDE	151 18' 52"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	GIS - Geographic Information System
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	13/A/6195

Licensed (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	13 6195

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	6.60	110			Auger
1	1	Casing	PVC Class 9	0.00	6.60	110			Glued; Driven into Hole
1	1	Opening	Screen	6.00	6.60	50			Stainless Ste SL: 60mm; Screwed

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	SALINIT
4.00	6.60	2.60		4.00		0.50			Fair

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.10	0.10	Tospoil		
0.10	3.50	3.40	Sand, yellow		
3.50	4.00	0.50	Soil & Sand		
4.00	6.60	2.60	Soil, dark & grey Sand		

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 -- GW108682

Works Details (top)

GROUNDWATER NUMBER	GW108682
LIC-NUM	10WA109190
AUTHORISED-PURPOSES	DOMESTIC
INTENDED-PURPOSES	DOMESTIC
WORK-TYPE	Spear
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	Auger
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2007-03-23
FINAL-DEPTH (metres)	3.50
DRILLED-DEPTH (metres)	3.50
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	CAVE
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	2.60
SALINITY	600.00
YIELD	1.00

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6272714.00
EASTING	343618.00
LATITUDE	33 40' 26"
LONGITUDE	151 18' 47"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	GIS - Geographic Information System
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	26/E/6195

Licensed (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	26 6195

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	3.50	110			Auger
1	1	Casing	PVC Class 9	0.00	3.50	110			Glued; Driven into Hole
1	1	Opening	Screen	3.00	3.50	50			Stainless Ste SL: 60mm; Screwed

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	SALINIT
2.60	3.50	0.90		2.60		1.00			600.00

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.20	0.20	dust, fine		
0.20	1.00	0.80	topsoil, black		
1.00	2.00	1.00	sand, grey		
2.60	3.50	0.90	sand, clay		

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 -- GW111427

Works Details (top)

GROUNDWATER NUMBER	GW111427
LIC-NUM	10BL604448
AUTHORISED-PURPOSES	RECREATION (GROUNDWATER)
INTENDED-PURPOSES	RECREATION (GROUNDWATER)
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	Down Hole Hammer
OWNER-TYPE	Local Govt
COMMENCE-DATE	
COMPLETION-DATE	2008-02-25
FINAL-DEPTH (metres)	103.00
DRILLED-DEPTH (metres)	102.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	NORTH NARRABEEN RESERVE
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	3.00
SALINITY	3.20
YIELD	0.87

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6271999.00
EASTING	342793.00
LATITUDE	33 40' 49"
LONGITUDE	151 18' 15"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	7092//1051073

Licensed (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	1 1064208

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	254			Down Hole Hammer
1		Hole	Hole	7.00	103.00	200			Down Hole Hammer
1	1	Casing	Steel	0.00	7.00	219			Welded; Drive into Hole; Cap
1	1	Casing	PVC Class 9	0.00	103.00	160			Screwed and Glued; Seated on Bottom
1	1	Opening	Slots - Diagonal	30.00	36.00	160			PVC Class 9; Oxy-Acetylene Slotted; SL: 6mm; A: 2mm
1	1	Opening	Slots - Diagonal	48.00	54.00				Oxy-Acetylene Slotted; SL: 6mm; A: 2mm
1	1	Opening	Slots - Diagonal	66.00	78.00				Oxy-Acetylene Slotted; SL: 12mm; A: 2mn
1	1	Opening	Slots - Diagonal	90.00	96.00				Oxy-Acetylene Slotted; SL: 6mm; A: 2mm
1		Annulus	Waterworn/Rounded	0.00	0.00				Graded; GS: 5 7mm
1		Annulus	Concrete	7.00	8.00	200			

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	SALINIT
18.00	19.00	1.00				0.30		0.50	3.20
24.00	25.00	1.00				0.36		0.50	3.10
72.00	73.00	1.00		3.00		0.87		0.50	3.20

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.00	1.00	SANDY SOIL		
1.00	5.00	4.00	CLAY GREY		

5.00	8.00	3.00	CLAY RED
8.00	24.00	16.00	SHALE GREY
24.00	48.00	24.00	CLAYSTONE
48.00	54.00	6.00	SHALE GREY
54.00	60.00	6.00	CLAYSTONE
60.00	102.00	42.00	SLATE

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 -- GW111444

Works Details (top)

GROUNDWATER NUMBER	GW111444
LIC-NUM	10BL602048
AUTHORISED-PURPOSES	TEST BORE
INTENDED-PURPOSES	TEST BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	Down Hole Hammer
OWNER-TYPE	Local Govt
COMMENCE-DATE	
COMPLETION-DATE	2008-02-25
FINAL-DEPTH (metres)	103.00
DRILLED-DEPTH (metres)	103.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	KITCHENER PARK
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	3.00
SALINITY	3.20
YIELD	0.87

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6272193.00
EASTING	342900.00
LATITUDE	33 40' 43"
LONGITUDE	151 18' 19"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY CUMBERLAND
PARISH NARRABEEN
PORTION-LOT-DP 7090//1073460

Licensed (top)

COUNTY CUMBERLAND
PARISH NARRABEEN
PORTION-LOT-DP 7090 1073460

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	254			Down Hole Hammer
1		Hole	Hole	7.00	103.00	200			Down Hole Hammer
1	1	Casing	Steel	0.00	7.00	219			Welded; Driven into Hole; Cap
1	1	Casing	PVC Class 9	0.00	103.00	160			Screwed and Glued; Seated on Bottom
1	1	Opening	Slots - Diagonal	30.00	36.00	160			PVC Class 9; Casing - Oxy-cut Slot; SL: 6mm; A: 2mm
1	1	Opening	Slots - Diagonal	48.00	54.00				Casing - Oxy-cut Slot; SL: 6mm; A: 2mm
1	1	Opening	Slots - Diagonal	66.00	78.00				SL: 12mm; A: 2mm
1	1	Opening	Slots	90.00	96.00				SL: 6mm
1		Annulus	Waterworn/Rounded	0.00	0.00				Graded; GS: 5-7mm
1		Annulus	Concrete	7.00	8.00	200			

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	19.00	1.00				0.30		0.50	3.20
24.00	25.00	1.00				0.36		0.50	3.10
72.00	73.00	1.00		3.00		0.87		0.50	3.20

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.00	1.00	SOIL SANDY		
1.00	5.00	4.00	CLAY GREY		
5.00	8.00	3.00	CLAY RED		
8.00	24.00	16.00	SHALE GREY		

24.00	48.00	24.00	BAULDHILL CLAYSTONE
48.00	54.00	6.00	SHALE GREY
54.00	60.00	6.00	BAULDHILL CLAYSTONE
60.00	103.00	43.00	SLATE

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 -- GW108888

Works Details (top)

GROUNDWATER NUMBER	GW108888
LIC-NUM	10CA107769
AUTHORISED-PURPOSES	IRRIGATION RECREATION (GROUNDWATER)
INTENDED-PURPOSES	IRRIGATION RECREATION (GROUNDWATER)
WORK-TYPE	Bore
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	Down Hole Hammer
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2008-06-02
FINAL-DEPTH (metres)	73.00
DRILLED-DEPTH (metres)	73.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	MONA VALE GOLF COURSE
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	7.00
SALINITY	1.58
YIELD	14.06

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6272010.00
EASTING	343062.00
LATITUDE	33 40' 49"
LONGITUDE	151 18' 25"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	7092 1051073

Licensed (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	7092 1051073

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	300			Down Hole Hammer
1		Hole	Hole	12.00	48.00	254			Down Hole Hammer
1		Hole	Hole	48.00	73.00	203			Down Hole Hammer
1	1	Casing	Steel	0.00	12.00	273			Welded; Driven into Hole
1	1	Casing	Steel	0.00	48.00	219			Welded; 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	SALINIT
17.00	18.00	1.00		7.00		1.25			
29.00	30.00	1.00				0.41			
57.00	58.00	1.00				12.40			

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.00	1.00	TOPSOIL		
1.00	10.50	9.50	CLAY		
10.50	60.00	49.50	SANDSTONE		
60.00	73.00	13.00	SANDSTONE		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Wednesday, November 16, 2011

Print Report

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

Work Requested -- GW111104

Works Details (top)

GROUNDWATER NUMBER	GW111104
LIC-NUM	10BL603983
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	Auger - Solid Flight
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2010-06-15
FINAL-DEPTH (metres)	4.00
DRILLED-DEPTH (metres)	4.20
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	MOBIL MONA VALE
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	2.00
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6272387.00
EASTING	343146.00
LATITUDE	33 40' 37"
LONGITUDE	151 18' 29"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	11//619503

Licensed (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	11 619503

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	4.20	150			Auger - Solid Flight
1	1	Casing	PVC Class 18	0.00	1.00	60	50		Other; Seated on Bottom; En cap
1	1	Opening	Slots - Horizontal	1.00	4.00	60			PVC Class 18; Casing - Machine Slotted; SL: 40mm; A: 3.8mm; Other
1		Annulus	Waterworn/Rounded	0.70	4.00				Graded; GS: 2 4mm

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	SALINI
2.00	4.00	2.00		2.00					

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.20	1.20	FILL		
1.20	2.00	0.80	CLAY YELLOW FIRM		
2.00	4.00	2.00	SAND L/BROWN CLAYEY		

Groundwater Works Summary

For information on the meaning of fields please see Glossary
Document Generated on Wednesday, November 16, 2011

Print Report

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

Work Requested -- GW111105

Works Details (top)

GROUNDWATER NUMBER	GW111105
LIC-NUM	10BL603983
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	Auger - Solid Flight
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2010-06-15
FINAL-DEPTH (metres)	5.00
DRILLED-DEPTH (metres)	5.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	MOBIL MONA VALE
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	2.00
SALINITY	
YIELD	

Site Details (top)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6272381.00
EASTING	343164.00
LATITUDE	33 40' 37"
LONGITUDE	151 18' 29"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	11//619503

Licensed (top)

COUNTY	CUMBERLAND
PARISH	NARRABEEN
PORTION-LOT-DP	11 619503

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			Auger - Solid Flight
1	1	Casing	PVC Class 18	1.00	2.00	60	50		Other; Seated; End cap
1	1	Opening	Slots - Horizontal	2.00	5.00	60			PVC Class 18; Casing - Machine Slotted; SL: 40mm; A: 3.8mm; Other
1		Annulus	Waterworn/Rounded	0.70	5.00				Graded; GS: 2-4mm

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	SALINIT
2.00	5.00	3.00		2.00					

Drillers Log (top)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.20	1.20	FILL		
1.20	2.00	0.80	CLAY FIRM/YELLOW		
2.00	5.00	3.00	SAND LIGHT BROWN CLAYEY		

APPENDIX E

SGS ENVIRONMENTAL SERVICES ANALYTICAL REPORT
AND
ENVIROLAB SERVICES CERTIFICATE OF ANALYSIS

ANALYTICAL REPORT

25 November 2011

GEOTECHNIQUE PTY LTD
P O Box 880
PENRITH
NSW 2751

Attention: **Alan Thompson**

Your Reference: 12593-1 - Mona Vale - Geotechnique

Our Reference: SE90013

Samples: 42 Soils, 1 Water
Received: 16/11/11

Preliminary Report Sent: Not Issued

These samples were analysed in accordance with your written instructions.

For and on Behalf of:
SGS ENVIRONMENTAL SERVICES

Sample Receipt:	Angela Mamalicos	AU.SampleReceipt.Sydney@sgs.com
Production Manager:	Huong Crawford	Huong.Crawford@sgs.com

Results Approved and/or Authorised by:

Edward Ibrahim
Laboratory Manager

Dong Liang
Inorganic/Metal Supervisor

Ly Kim Ha
Organics Signatory

Snezana Kostoska
Chemist

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MBTEX in Soil Our Reference: Your Reference Sample Matrix Date Sampled Depth	UNITS ---------- ----------	SE90013-3 MW1 Soil 16/11/2011 0.8-1.1	SE90013-10 BH1 Soil 16/11/2011 0.1-0.2	SE90013-12 BH1 Soil 16/11/2011 0.7-0.9	SE90013-20 BH2 Soil 16/11/2011 0.5-0.8	SE90013-29 BH3 Soil 16/11/2011 2.0-2.3
Date Extracted (MBTEX)		18/11/2011	18/11/2011	18/11/2011	18/11/2011	18/11/2011
Date Analysed (MBTEX)		18/11/2011	18/11/2011	18/11/2011	18/11/2011	18/11/2011
Methyl-tert-butyl ether (MtBE)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzene	mg/kg	0.2	<0.1	0.5	<0.1	<0.1
Toluene	mg/kg	0.7	<0.1	0.1	<0.1	<0.1
Ethylbenzene	mg/kg	1.0	<0.1	1.2	<0.1	<0.1
Total Xylenes	mg/kg	6.2	0.4	7.0	<0.3	<0.3
BTEX Surrogate (%)	%	95	92	93	94	98

MBTEX in Soil Our Reference: Your Reference Sample Matrix Date Sampled Depth	UNITS ---------- ----------	SE90013-33 BH4 Soil 16/11/2011 0.2-0.5	SE90013-34 BH4 Soil 16/11/2011 0.5-0.8	SE90013-38 Duplicate D2 Soil 16/11/2011 -	SE90013-43 Tripspike TS1 Soil 16/11/2011 -
Date Extracted (MBTEX)		18/11/2011	18/11/2011	18/11/2011	18/11/2011
Date Analysed (MBTEX)		18/11/2011	18/11/2011	18/11/2011	18/11/2011
Methyl-tert-butyl ether (MtBE)	mg/kg	<0.1	<0.1	<0.1	95%
Benzene	mg/kg	<0.1	<0.1	0.1	95%
Toluene	mg/kg	<0.1	<0.1	0.6	99%
Ethylbenzene	mg/kg	<0.1	<0.1	0.9	97%
Total Xylenes	mg/kg	<0.3	<0.3	5.7	99%
BTEX Surrogate (%)	%	102	79	105	100

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Total Recoverable Hydrocarbons in Soil Our Reference: Your Reference Sample Matrix Date Sampled Depth	UNITS ---------- ----------	SE90013-3 MW1 Soil 16/11/2011 0.8-1.1	SE90013-10 BH1 Soil 16/11/2011 0.1-0.2	SE90013-12 BH1 Soil 16/11/2011 0.7-0.9	SE90013-20 BH2 Soil 16/11/2011 0.5-0.8	SE90013-29 BH3 Soil 16/11/2011 2.0-2.3
Date Extracted (TRH C6-C9 PT)		18/11/2011	18/11/2011	18/11/2011	18/11/2011	18/11/2011
Date Analysed (TRH C6-C9 PT)		18/11/2011	18/11/2011	18/11/2011	18/11/2011	18/11/2011
TRH C_6 - C_9 P&T	mg/kg	250	<20	360	30	<20
Date Extracted (TRH C10-C40)		18/11/2011	18/11/2011	18/11/2011	18/11/2011	18/11/2011
Date Analysed (TRH C10-C40)		18/11/2011	18/11/2011	18/11/2011	18/11/2011	18/11/2011
TRH C_{10} - C_{14}	mg/kg	5,900	180	14,000	1,300	42
TRH C_{15} - C_{28}	mg/kg	14,000	740	35,000	3,300	190
TRH C_{29} - C_{40}	mg/kg	<150	<150	<150	<150	<150

Total Recoverable Hydrocarbons in Soil Our Reference: Your Reference Sample Matrix Date Sampled Depth	UNITS ---------- ----------	SE90013-33 BH4 Soil 16/11/2011 0.2-0.5	SE90013-34 BH4 Soil 16/11/2011 0.5-0.8	SE90013-38 Duplicate D2 Soil 16/11/2011 -
Date Extracted (TRH C6-C9 PT)		18/11/2011	18/11/2011	18/11/2011
Date Analysed (TRH C6-C9 PT)		18/11/2011	18/11/2011	18/11/2011
TRH C_6 - C_9 P&T	mg/kg	<20	<20	220
Date Extracted (TRH C10-C40)		18/11/2011	18/11/2011	18/11/2011
Date Analysed (TRH C10-C40)		18/11/2011	18/11/2011	18/11/2011
TRH C_{10} - C_{14}	mg/kg	<20	38	6,200
TRH C_{15} - C_{28}	mg/kg	<50	150	15,000
TRH C_{29} - C_{40}	mg/kg	<150	<150	<150

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PAHs in Soil Our Reference: Your Reference Sample Matrix Date Sampled Depth	UNITS --- ---	SE90013-3 MW1 Soil 16/11/2011 0.8-1.1	SE90013-10 BH1 Soil 16/11/2011 0.1-0.2	SE90013-12 BH1 Soil 16/11/2011 0.7-0.9	SE90013-20 BH2 Soil 16/11/2011 0.5-0.8	SE90013-29 BH3 Soil 16/11/2011 2.0-2.3
Date Extracted		18/11/2011	18/11/2011	18/11/2011	18/11/2011	18/11/2011
Date Analysed		18/11/2011	18/11/2011	18/11/2011	18/11/2011	18/11/2011
Naphthalene	mg/kg	5.9	<0.10	14	1.5	<0.10
2-Methylnaphthalene	mg/kg	30	0.41	78	7.3	<0.10
1-Methylnaphthalene	mg/kg	17	0.31	41	4.7	<0.10
Acenaphthylene	mg/kg	0.41	<0.10	1.0	0.17	<0.10
Acenaphthene	mg/kg	1.8	<0.10	3.9	0.71	<0.10
Fluorene	mg/kg	5.3	0.20	14	2.3	<0.10
Phenanthrene	mg/kg	8.5	0.21	13	2.6	<0.10
Anthracene	mg/kg	1.5	<0.10	2.8	0.42	<0.10
Fluoranthene	mg/kg	0.42	<0.10	1.1	0.20	<0.10
Pyrene	mg/kg	2.3	0.10	5.8	0.70	<0.10
Benzo[*a*]anthracene	mg/kg	0.12	<0.10	<0.10	<0.10	<0.10
Chrysene	mg/kg	0.11	<0.10	<0.10	<0.10	<0.10
Benzo[*b,k*]fluoranthene	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20
Benzo[*a*]pyrene	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10
Indeno[*123-cd*]pyrene	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenzo[*ah*]anthracene	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo[*ghi*]perylene	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
Total PAHs (sum)	mg/kg	<73.71	<2.53	<175.72	<21.42	<1.8
Nitrobenzene-d5	%	84	87	88	99	77
2-Fluorobiphenyl	%	96	87	101	91	82
p -Terphenyl-*d14*	%	103	94	99	97	96

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PAHs in Soil Our Reference: Your Reference Sample Matrix Date Sampled Depth	UNITS ----------	SE90013-33 BH4 Soil 16/11/2011 0.2-0.5	SE90013-34 BH4 Soil 16/11/2011 0.5-0.8	SE90013-38 Duplicate D2 Soil 16/11/2011 -
Date Extracted		18/11/2011	18/11/2011	18/11/2011
Date Analysed		18/11/2011	18/11/2011	18/11/2011
Naphthalene	mg/kg	<0.10	0.40	6.8
2-Methylnaphthalene	mg/kg	<0.10	1.7	31
1-Methylnaphthalene	mg/kg	<0.10	1.1	17
Acenaphthylene	mg/kg	<0.10	<0.10	0.43
Acenaphthene	mg/kg	<0.10	<0.10	1.5
Fluorene	mg/kg	<0.10	0.27	6.7
Phenanthrene	mg/kg	<0.10	0.45	9.9
Anthracene	mg/kg	<0.10	<0.10	1.3
Fluoranthene	mg/kg	<0.10	<0.10	0.43
Pyrene	mg/kg	<0.10	<0.10	2.5
Benzo[*a*]anthracene	mg/kg	<0.10	<0.10	0.11
Chrysene	mg/kg	<0.10	<0.10	<0.10
Benzo[*b,k*]fluoranthene	mg/kg	<0.20	<0.20	<0.20
Benzo[*a*]pyrene	mg/kg	<0.10	<0.10	<0.10
Indeno[*123-cd*]pyrene	mg/kg	<0.10	<0.10	<0.10
Dibenzo[*ah*]anthracene	mg/kg	<0.10	<0.10	<0.10
Benzo[*ghi*]perylene	mg/kg	<0.10	<0.10	<0.10
Total PAHs (sum)	mg/kg	<1.8	<5.23	<79.30
Nitrobenzene-d5	%	84	79	111
2-Fluorobiphenyl	%	83	87	94
p -Terphenyl-*d14*	%	92	98	100

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OC Pesticides in Soil Our Reference: Your Reference Sample Matrix Date Sampled Depth	UNITS ---------- ----------	SE90013-3 MW1 Soil 16/11/2011 0.8-1.1	SE90013-33 BH4 Soil 16/11/2011 0.2-0.5	SE90013-38 Duplicate D2 Soil 16/11/2011 -
Date Extracted		18/11/11	18/11/11	18/11/11
Date Analysed		18/11/11	18/11/11	18/11/11
HCB	mg/kg	<0.1	<0.1	<0.1
Total , , - BHC	mg/kg	<0.3	<0.3	<0.3
gamma-BHC(Lindane)	mg/kg	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.05	<0.05	<0.05
Endrin	mg/kg	<0.1	<0.1	<0.1
Total & - Endosulfan	mg/kg	<0.2	<0.2	<0.2
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1
Total DDD	mg/kg	<0.2	<0.2	<0.2
Total DDE	mg/kg	<0.2	<0.2	<0.2
Total DDT	mg/kg	<0.2	<0.2	<0.2
Total cis, trans- Chlordane	mg/kg	<0.2	<0.2	<0.2
2,4,5,6-Tetrachloro-m-xylene *(Surrogate*	%	79	102	77

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PCBs in Soil Our Reference: Your Reference Sample Matrix Date Sampled Depth	UNITS ---------- ----------	SE90013-3 MW1 Soil 16/11/2011 0.8-1.1	SE90013-33 BH4 Soil 16/11/2011 0.2-0.5	SE90013-38 Duplicate D2 Soil 16/11/2011 -
Date Extracted		18/11/2011	18/11/2011	18/11/2011
Date Analysed		18/11/2011	18/11/2011	18/11/2011
Polychlorobiphenyls Total	mg/kg	<0.9	<0.9	<0.9
PCB_Surrogate 1	%	79	102	77

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Total Phenolics in Soil Our Reference:	UNITS	SE90013-3	SE90013-33	SE90013-38
Your Reference	----------	MW1	BH4	Duplicate D2
Sample Matrix	----------	Soil	Soil	Soil
Date Sampled		16/11/2011	16/11/2011	16/11/2011
Depth		0.8-1.1	0.2-0.5	-
Date Extracted (Phenols)		23/11/2011	23/11/2011	23/11/2011
Date Analysed (Phenols)		23/11/2011	23/11/2011	23/11/2011
Total Phenolics (as Phenol)	mg/kg	0.4	0.2	0.8

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Cyanide Our Reference:	UNITS	SE90013-3	SE90013-33	SE90013-38
Your Reference	----------	MW1	BH4	Duplicate D2
Sample Matrix	----------	Soil	Soil	Soil
Date Sampled		16/11/2011	16/11/2011	16/11/2011
Depth		0.8-1.1	0.2-0.5	-
Date Extracted (Total Cyanide)		23/11/2011	23/11/2011	23/11/2011
Date Analysed (Total Cyanide)		23/11/2011	23/11/2011	23/11/2011
Total Cyanide	mg/kg	0.18	0.11	<0.10

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Metals in Soil by ICP-OES Our Reference: Your Reference Sample Matrix Date Sampled Depth	UNITS ---------- ----------	SE90013-3 MW1 Soil 16/11/2011 0.8-1.1	SE90013-10 BH1 Soil 16/11/2011 0.1-0.2	SE90013-12 BH1 Soil 16/11/2011 0.7-0.9	SE90013-20 BH2 Soil 16/11/2011 0.5-0.8	SE90013-29 BH3 Soil 16/11/2011 2.0-2.3
Date Extracted (Metals)		22/11/2011	22/11/2011	22/11/2011	22/11/2011	22/11/2011
Date Analysed (Metals)		22/11/2011	22/11/2011	22/11/2011	22/11/2011	22/11/2011
Arsenic	mg/kg	15	5	58	72	<3
Cadmium	mg/kg	0.4	0.3	1.2	0.4	0.97
Chromium	mg/kg	10	4.5	14	12	29
Copper	mg/kg	9.1	3.3	14	6.8	16
Lead	mg/kg	22	3	50	14	15
Nickel	mg/kg	2.3	1.4	5.2	2.6	3.1
Zinc	mg/kg	41	7.0	200	230	50

Metals in Soil by ICP-OES Our Reference: Your Reference Sample Matrix Date Sampled Depth	UNITS ---------- ----------	SE90013-33 BH4 Soil 16/11/2011 0.2-0.5	SE90013-38 Duplicate D2 Soil 16/11/2011 -
Date Extracted (Metals)		22/11/2011	22/11/2011
Date Analysed (Metals)		22/11/2011	22/11/2011
Arsenic	mg/kg	10	14
Cadmium	mg/kg	0.93	0.5
Chromium	mg/kg	33	11
Copper	mg/kg	19	9.7
Lead	mg/kg	18	21
Nickel	mg/kg	25	2.6
Zinc	mg/kg	53	46

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Mercury Cold Vapor/Hg Analyser Our Reference:	UNITS	SE90013-3	SE90013-10	SE90013-12	SE90013-20	SE90013-29
Your Reference	----------	MW1	BH1	BH1	BH2	BH3
Sample Matrix	----------	Soil	Soil	Soil	Soil	Soil
Date Sampled		16/11/2011	16/11/2011	16/11/2011	16/11/2011	16/11/2011
Depth		0.8-1.1	0.1-0.2	0.7-0.9	0.5-0.8	2.0-2.3
Date Extracted (Mercury)		23/11/2011	23/11/2011	23/11/2011	23/11/2011	23/11/2011
Date Analysed (Mercury)		23/11/2011	23/11/2011	23/11/2011	23/11/2011	23/11/2011
Mercury	mg/kg	1.0	<0.05	220	2.4	<0.05

Mercury Cold Vapor/Hg Analyser Our Reference:	UNITS	SE90013-33	SE90013-38
Your Reference	----------	BH4	Duplicate D2
Sample Matrix	----------	Soil	Soil
Date Sampled		16/11/2011	16/11/2011
Depth		0.2-0.5	-
Date Extracted (Mercury)		23/11/2011	23/11/2011
Date Analysed (Mercury)		23/11/2011	23/11/2011
Mercury	mg/kg	0.76	2.9

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MBTEX in Water (µg/L) Our Reference: Your Reference Sample Matrix Date Sampled Depth	UNITS ---------- ----------	SE90013-4 2 Rinsate R1 Water 16/11/2011 -
Date Extracted (MBTEX)		22/11/2011
Date Analysed (MBTEX)		22/11/2011
Methyl-tert-butyl ether (MtBE)	µg/L	<1
Benzene	µg/L	<0.5
Toluene	µg/L	<0.5
Ethylbenzene	µg/L	<0.5
Total Xylenes	µg/L	<1.5
Surrogate	%	95

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TRH in water with C6-C9 by P/T Our Reference: Your Reference Sample Matrix Date Sampled Depth	UNITS ---------- ----------	SE90013-4 2 Rinsate R1 Water 16/11/2011 -
Date Extracted (TRH C6-C9 PT)		22/11/2011
Date Analysed (TRH C6-C9 PT)		22/11/2011
TRH C_6 - C_9 P&T in µg/L	µg/L	<40
Date Extracted (TRH C10-C36)		22/11/2011
Date Analysed (TRH C10-C36)		22/11/2011
TRH C_{10} - C_{14}	µg/L	<100
TRH C_{15} - C_{28}	µg/L	<200
TRH C_{29} - C_{40}	µg/L	<400

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PAHs in Water Our Reference: Your Reference Sample Matrix Date Sampled Depth	UNITS ---------- ----------	SE90013-4 2 Rinsate R1 Water 16/11/2011 -
Date Extracted		23/11/2011
Date Analysed		23/11/2011
Naphthalene	µg/L	<0.50
2-Methylnaphthalene	µg/L	<0.5
1-Methylnaphthalene	µg/L	<0.5
Acenaphthylene	µg/L	<0.50
Acenaphthene	µg/L	<0.50
Fluorene	µg/L	<0.50
Phenanthrene	µg/L	<0.50
Anthracene	µg/L	<0.50
Fluoranthene	µg/L	<0.50
Pyrene	µg/L	<0.50
Benzo[*a*]anthracene	µg/L	<0.50
Chrysene	µg/L	<0.50
Benzo[*b,k*]fluoranthene	µg/L	<1.0
Benzo[*a*]pyrene	µg/L	<0.50
Indeno[*123-cd*]pyrene	µg/L	<0.50
Dibenzo[*ah*]anthracene	µg/L	<0.50
Benzo[*ghi*]perylene	µg/L	<0.50
Total PAHs	µg/L	<9
Nitrobenzene-d5	%	99
2-Fluorobiphenyl	%	96
p -Terphenyl-*d14*	%	114

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Metals in water by ICP-OES Our Reference: Your Reference Sample Matrix Date Sampled Depth	UNITS ---------- ----------	SE90013-4 2 Rinsate R1 Water 16/11/2011 -
Date Extracted (Metals)		21/11/2011
Date Analysed (Metals)		21/11/2011
Arsenic (Dissolved)	mg/L	<0.05
Cadmium (Dissolved)	mg/L	<0.005
Chromium (Dissolved)	mg/L	<0.005
Copper (Dissolved)	mg/L	<0.01
Lead (Dissolved)	mg/L	<0.02
Nickel (Dissolved)	mg/L	<0.010
Zinc (Dissolved)	mg/L	<0.010

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Mercury Cold Vapor/Hg Analyser Our Reference: Your Reference Sample Matrix Date Sampled Depth	UNITS ---------- ----------	SE90013-4 2 Rinsate R1 Water 16/11/2011 -
Date Extracted (Mercury)		23/11/2011
Date Analysed (Mercury)		23/11/2011
Mercury (Dissolved)	mg/L	<0.0001

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Moisture Our Reference:	UNITS	SE90013-3	SE90013-10	SE90013-12	SE90013-20	SE90013-29
Your Reference	----------	MW1	BH1	BH1	BH2	BH3
Sample Matrix	----------	Soil	Soil	Soil	Soil	Soil
Date Sampled		16/11/2011	16/11/2011	16/11/2011	16/11/2011	16/11/2011
Depth		0.8-1.1	0.1-0.2	0.7-0.9	0.5-0.8	2.0-2.3
Date Analysed (moisture)		18/11/2011	18/11/2011	18/11/2011	18/11/2011	18/11/2011
Moisture	%	16	12	23	16	15

Moisture Our Reference:	UNITS	SE90013-33	SE90013-34	SE90013-38
Your Reference	----------	BH4	BH4	Duplicate D2
Sample Matrix	----------	Soil	Soil	Soil
Date Sampled		16/11/2011	16/11/2011	16/11/2011
Depth		0.2-0.5	0.5-0.8	-
Date Analysed (moisture)		18/11/2011	18/11/2011	18/11/2011
Moisture	%	21	30	17

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Method ID	Methodology Summary
AN410	BTEX / C6-C9 Hydrocarbons - Soil samples are extracted with methanol, purged and concentrated by a purge and trap apparatus, and then analysed using GC/MS technique. Water samples undergo the same analysis without the extraction step. Based on USEPA 5030B and 8260B.
AN403	Determination of Hydrocarbons by gas chromatography after a solvent extraction. Detection is by flame ionisation detector (FID) that produces an electronic signal in proportion to the combustible matter passing through it. Total Recoverable Hydrocarbons (TRH) are routinely reported as four alkane groupings based on the carbon chain length of the compounds: C_6-C_9, C_{10}-C_{14}, C_{15}-C_{28} and C_{29}-C_{36}, in accordance with the Australian Institute of Petroleum (AIP). Additionally, the volatile C6-C9 fraction may be determined by a purge and trap technique and GC/MS because of the potential for volatiles loss. Total Petroleum Hydrocarbons (TPH) follows the same method of analysis after silica gel cleanup of the solvent extract. Aliphatic/Aromatic Speciation follows the same method of analysis after fractionation of the solvent extract over silica with differential polarity of the elluent solvents. The GC/FID method is not well suited to the analysis of refined high boiling point materials (i.e. lubricating oils or greases) but is particularly suited for measuring diesel, kerosene and petrol (if care to control volatility is taken). This method will detect naturally occurring hydrocarbons, lipids, organic acids, phenols and PAHs if they are present at sufficient levels, dependant on the use of specific cleanup/fractionation techniques. Reference USEPA 3510B, 8015B.
AN422	Polynuclear Aromatic Hydrocarbons - determined by solvent extraction with dichloromethane / acetone for soils and dichloromethane for waters, followed by instrumentation analysis using GC/MS SIM mode. Based on USEPA 8270 and 8310.
AN400	The determination of organochlorine (OC) and organophosphorus (OP) pesticides and polychlorinated biphenyls (PCBs) in soils, sludges and groundwater. (Based on USEPA methods 3510, 3550, 8140 and 8080.)
AN289	Total Phenols - Determined by colourimetric method using Discrete Analyser, following distillation of the sample. Based on APHA 21st Edition 5530B and 5530D.
AN287	Cyanide (Total or Free) - Total Cyanide is determined by colourimetric method using Discrete Analyser, following distillation of the acidified sample. Free Cyanide is determined by colourimetric method using Discrete Analyser on filtered sample. Complex Cyanide is the difference of Total and Free Cyanide. Based on APHA 21st Edition, 4500-CN C and E.
AN320	Determination of elements by ICP-OES following appropriate sample preparation / digestion process. Based on USEPA 6010C / APHA 21st Edition, 3120B.
AN312	After digestion with nitric acid, hydrogen peroxide and hydrochloric acid, mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112B/3500
AN002	Preparation of soils, sediments and sludges undergo analysis by either air drying, compositing, subsampling and 1:5 soil water extraction where required. Moisture content is determined by drying the sample at 105 ± 5°C.

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Method ID	Methodology Summary

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QUALITY CONTROL MBTEX in Soil	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted (MBTEX)				18/11/11	[NT]	[NT]	LCS	18/11/11
Date Analysed (MBTEX)				18/11/11	[NT]	[NT]	LCS	18/11/11
Methyl-tert-butyl ether (MtBE)	mg/kg	0.1	AN410	<0.1	[NT]	[NT]	LCS	113%
Benzene	mg/kg	0.1	AN410	<0.1	[NT]	[NT]	LCS	116%
Toluene	mg/kg	0.1	AN410	<0.1	[NT]	[NT]	LCS	117%
Ethylbenzene	mg/kg	0.1	AN410	<0.1	[NT]	[NT]	LCS	114%
Total Xylenes	mg/kg	0.3	AN410	<0.3	[NT]	[NT]	LCS	118%
BTEX Surrogate (%)	%	0	AN410	109	[NT]	[NT]	LCS	116%

QUALITY CONTROL Total Recoverable Hydrocarbons in Soil	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted (TRH C6-C9 PT)				18/11/11	SE90013-3	18/11/2011 || 18/11/2011	LCS	18/11/11
Date Analysed (TRH C6-C9 PT)				18/11/11	SE90013-3	18/11/2011 || 18/11/2011	LCS	18/11/11
TRH C_6 - C_9 P&T	mg/kg	20	AN410	<20	SE90013-3	250 || [N/T]	LCS	118%
Date Extracted (TRH C10-C40)				18/11/2011	SE90013-3	18/11/2011 || 18/11/2011	LCS	18/11/11
Date Analysed (TRH C10-C40)				18/11/2011	SE90013-3	18/11/2011 || 18/11/2011	LCS	18/11/11
TRH C_{10} - C_{14}	mg/kg	20	AN403	<20	SE90013-3	5900 || 6100 || RPD: 3	LCS	103%
TRH C_{15} - C_{28}	mg/kg	50	AN403	<50	SE90013-3	14000 || 14000 || RPD: 0	LCS	108%
TRH C_{29} - C_{40}	mg/kg	150	AN403	<150	SE90013-3	<150 || <150	LCS	93%

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QUALITY CONTROL PAHs in Soil	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted				18/11/2011	SE90013-3	18/11/2011 || 18/11/2011	LCS	18/11/2011
Date Analysed				18/11/2011	SE90013-3	18/11/2011 || 18/11/2011	LCS	18/11/2011
Naphthalene	mg/kg	0.1	AN422	<0.10	SE90013-3	5.9 || 6.7 || RPD: 13	LCS	101%
2-Methylnaphthalene	mg/kg	0.1	AN422	<0.10	SE90013-3	30 || 32 || RPD: 6	[NR]	[NR]
1-Methylnaphthalene	mg/kg	0.1	AN422	<0.10	SE90013-3	17 || 18 || RPD: 6	[NR]	[NR]
Acenaphthylene	mg/kg	0.1	AN422	<0.10	SE90013-3	0.41 || 0.50 || RPD: 20	LCS	100%
Acenaphthene	mg/kg	0.1	AN422	<0.10	SE90013-3	1.8 || 1.8 || RPD: 0	LCS	100%
Fluorene	mg/kg	0.1	AN422	<0.10	SE90013-3	5.3 || 6.1 || RPD: 14	[NR]	[NR]
Phenanthrene	mg/kg	0.1	AN422	<0.10	SE90013-3	8.5 || 8.7 || RPD: 2	LCS	99%
Anthracene	mg/kg	0.1	AN422	<0.10	SE90013-3	1.5 || 2.2 || RPD: 38	LCS	104%
Fluoranthene	mg/kg	0.1	AN422	<0.10	SE90013-3	0.42 || 0.44 || RPD: 5	LCS	98%
Pyrene	mg/kg	0.1	AN422	<0.10	SE90013-3	2.3 || 2.3 || RPD: 0	LCS	103%
Benzo[*a*]anthracene	mg/kg	0.1	AN422	<0.10	SE90013-3	0.12 || 0.12 || RPD: 0	[NR]	[NR]
Chrysene	mg/kg	0.1	AN422	<0.10	SE90013-3	0.11 || 0.13 || RPD: 17	[NR]	[NR]
Benzo[*b,k*]fluoranthene	mg/kg	0.2	AN422	<0.20	SE90013-3	<0.20 || <0.20	[NR]	[NR]
Benzo[*a*]pyrene	mg/kg	0.1	AN422	<0.10	SE90013-3	0.10 || <0.10	LCS	103%
Indeno[*123-cd*]pyrene	mg/kg	0.1	AN422	<0.10	SE90013-3	<0.10 || <0.10	[NR]	[NR]
Dibenzo[*ah*]anthracene	mg/kg	0.1	AN422	<0.10	SE90013-3	<0.10 || <0.10	[NR]	[NR]
Benzo[*ghi*]perylene	mg/kg	0.1	AN422	<0.10	SE90013-3	<0.10 || <0.10	[NR]	[NR]
Total PAHs (sum)	mg/kg	1.8	AN422	<1.8	SE90013-3	<73.71 || <78.67	[NR]	[NR]
Nitrobenzene-d5	%	0	AN422	86	SE90013-3	84 || 122 || RPD: 37	LCS	82%
2-Fluorobiphenyl	%	0	AN422	83	SE90013-3	96 || 95 || RPD: 1	LCS	81%
p -Terphenyl-*d*14	%	0	AN422	90	SE90013-3	103 || 102 || RPD: 1	LCS	84%

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QUALITY CONTROL OC Pesticides in Soil	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted				18/11/2011	[NT]	[NT]	LCS	18/11/2011
Date Analysed				18/11/2011	[NT]	[NT]	LCS	18/11/2011
HCB	mg/kg	0.1	AN400	<0.1	[NT]	[NT]	[NR]	[NR]
Total , , - BHC	mg/kg	0.3	AN400	<0.3	[NT]	[NT]	LCS	88%
gamma-BHC(Lindane)	mg/kg	0.1	AN400	<0.1	[NT]	[NT]	[NR]	[NR]
Heptachlor Epoxide	mg/kg	0.1	AN400	<0.1	[NT]	[NT]	[NR]	[NR]
Heptachlor	mg/kg	0.1	AN400	<0.1	[NT]	[NT]	LCS	107%
Methoxychlor	mg/kg	0.1	AN400	<0.1	[NT]	[NT]	[NR]	[NR]
Aldrin	mg/kg	0.1	AN400	<0.1	[NT]	[NT]	LCS	96%
Dieldrin	mg/kg	0.05	AN400	<0.05	[NT]	[NT]	LCS	92%
Endrin	mg/kg	0.1	AN400	<0.1	[NT]	[NT]	LCS	100%
Total & - Endosulfan	mg/kg	0.2	AN400	<0.2	[NT]	[NT]	[NR]	[NR]
Endosulfan Sulphate	mg/kg	0.1	AN400	<0.1	[NT]	[NT]	[NR]	[NR]
Total DDD	mg/kg	0.2	AN400	<0.2	[NT]	[NT]	[NR]	[NR]
Total DDE	mg/kg	0.2	AN400	<0.2	[NT]	[NT]	[NR]	[NR]
Total DDT	mg/kg	0.2	AN400	<0.2	[NT]	[NT]	LCS	96%
Total cis, trans-Chlordane	mg/kg	0.2	AN400	<0.2	[NT]	[NT]	[NR]	[NR]
2,4,5,6-Tetrachloro-m-xylene *(Surrogate*	%	0	AN400	79	[NT]	[NT]	LCS	83%

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QUALITY CONTROL PCBs in Soil	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted				18/11/2011	[NT]	[NT]	LCS	18/11/2011
Date Analysed				18/11/2011	[NT]	[NT]	LCS	18/11/2011
Polychlorobiphenyls Total	mg/kg	0.9	AN400	<0.9	[NT]	[NT]	LCS	113%
PCB_Surrogate 1	%	0	AN400	79	[NT]	[NT]	LCS	99%

QUALITY CONTROL Total Phenolics in Soil	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted (Phenols)				23/11/2011	SE90013-3	23/11/2011 || 23/11/2011	LCS	23/11/2011
Date Analysed (Phenols)				23/11/2011	SE90013-3	23/11/2011 || 23/11/2011	LCS	23/11/2011
Total Phenolics (as Phenol)	mg/kg	0.1	AN289	<0.1	SE90013-3	0.4 || 0.4 || RPD: 0	LCS	107%

QUALITY CONTROL Cyanide	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted (Total Cyanide)				23/11/2011	SE90013-3	23/11/2011 || 23/11/2011	LCS	23/11/2011
Date Analysed (Total Cyanide)				23/11/2011	SE90013-3	23/11/2011 || 23/11/2011	LCS	23/11/2011
Total Cyanide	mg/kg	0.1	AN287	<0.10	SE90013-3	0.18 || 0.17 || RPD: 6	LCS	93%

QUALITY CONTROL Metals in Soil by ICP-OES	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted (Metals)				22/11/2011	[NT]	[NT]	LCS	22/11/2011
Date Analysed (Metals)				22/11/2011	[NT]	[NT]	LCS	22/11/2011
Arsenic	mg/kg	3	AN320	<3	[NT]	[NT]	LCS	99%
Cadmium	mg/kg	0.3	AN320	<0.3	[NT]	[NT]	LCS	100%
Chromium	mg/kg	0.3	AN320	<0.3	[NT]	[NT]	LCS	101%
Copper	mg/kg	0.5	AN320	<0.5	[NT]	[NT]	LCS	101%
Lead	mg/kg	1	AN320	<1	[NT]	[NT]	LCS	100%

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QUALITY CONTROL Metals in Soil by ICP-OES	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Nickel	mg/kg	0.5	AN320	<0.5	[NT]	[NT]	LCS	102%
Zinc	mg/kg	0.5	AN320	<0.5	[NT]	[NT]	LCS	101%

QUALITY CONTROL Mercury Cold Vapor/Hg Analyser	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted (Mercury)				23/11/2011	[NT]	[NT]	LCS	23/11/2011
Date Analysed (Mercury)				23/11/2011	[NT]	[NT]	LCS	23/11/2011
Mercury	mg/kg	0.05	AN312	<0.05	[NT]	[NT]	LCS	118%

QUALITY CONTROL MBTEX in Water (µg/L)	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted (MBTEX)				22/11/11	[NT]	[NT]	LCS	22/11/11
Date Analysed (MBTEX)				22/11/11	[NT]	[NT]	LCS	22/11/11
Methyl-tert-butyl ether (MtBE)	µg/L	1	AN410	<1	[NT]	[NT]	LCS	99%
Benzene	µg/L	0.5	AN410	<0.5	[NT]	[NT]	LCS	89%
Toluene	µg/L	0.5	AN410	<0.5	[NT]	[NT]	LCS	85%
Ethylbenzene	µg/L	0.5	AN410	<0.5	[NT]	[NT]	LCS	83%
Total Xylenes	µg/L	1.5	AN410	<1.5	[NT]	[NT]	LCS	82%
Surrogate	%	0	AN410	95	[NT]	[NT]	LCS	99%

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QUALITY CONTROL TRH in water with C6-C9 by P/T	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted (TRH C6-C9 PT)				22/11/11	[NT]	[NT]	[NR]	[NR]
Date Analysed (TRH C6-C9 PT)				22/11/11	[NT]	[NT]	[NR]	[NR]
TRH C_6 - C_9 P&T in µg/L	µg/L	40	AN410	<40	[NT]	[NT]	[NR]	[NR]
Date Extracted (TRH C10-C36)				22/11/2011	[NT]	[NT]	SE90013-10	18/11/2011
Date Analysed (TRH C10-C36)				22/11/2011	[NT]	[NT]	SE90013-10	18/11/2011
TRH C_{10} - C_{14}	µg/L	100	AN403	<100	[NT]	[NT]	SE90013-10	#
TRH C_{15} - C_{28}	µg/L	200	AN403	<200	[NT]	[NT]	SE90013-10	#
TRH C_{29} - C_{40}	µg/L	400	AN403	<400	[NT]	[NT]	SE90013-10	95%

QUALITY CONTROL PAHs in Water	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted				23/11/2011	[NT]	[NT]	LCS	23/11/2011
Date Analysed				23/11/2011	[NT]	[NT]	LCS	23/11/2011
Naphthalene	µg/L	0.5	AN422	<0.50	[NT]	[NT]	LCS	103%
2-Methylnaphthalene	µg/L	0.5	AN422	<0.5	[NT]	[NT]	[NR]	[NR]
1-Methylnaphthalene	µg/L	0.5	AN422	<0.5	[NT]	[NT]	[NR]	[NR]
Acenaphthylene	µg/L	0.5	AN422	<0.50	[NT]	[NT]	LCS	106%
Acenaphthene	µg/L	0.5	AN422	<0.50	[NT]	[NT]	LCS	105%
Fluorene	µg/L	0.5	AN422	<0.50	[NT]	[NT]	[NR]	[NR]
Phenanthrene	µg/L	0.5	AN422	<0.50	[NT]	[NT]	LCS	110%
Anthracene	µg/L	0.5	AN422	<0.50	[NT]	[NT]	LCS	103%
Fluoranthene	µg/L	0.5	AN422	<0.50	[NT]	[NT]	LCS	110%
Pyrene	µg/L	0.5	AN422	<0.50	[NT]	[NT]	LCS	110%
Benzo[*a*]anthracene	µg/L	0.5	AN422	<0.50	[NT]	[NT]	[NR]	[NR]
Chrysene	µg/L	0.5	AN422	<0.50	[NT]	[NT]	[NR]	[NR]
Benzo[*b,k*]fluoranthene	µg/L	1	AN422	<1.0	[NT]	[NT]	[NR]	[NR]
Benzo[*a*]pyrene	µg/L	0.5	AN422	<0.50	[NT]	[NT]	LCS	101%
Indeno[*123-cd*]pyrene	µg/L	0.5	AN422	<0.50	[NT]	[NT]	[NR]	[NR]
Dibenzo[*ah*]anthracene	µg/L	0.5	AN422	<0.50	[NT]	[NT]	[NR]	[NR]

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QUALITY CONTROL PAHs in Water	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Benzo[*ghi*]perylene	µg/L	0.5	AN422	<0.50	[NT]	[NT]	[NR]	[NR]
Total PAHs	µg/L	9	AN422	<9	[NT]	[NT]	[NR]	[NR]
Nitrobenzene-d5	%	0	AN422	111	[NT]	[NT]	LCS	107%
2-Fluorobiphenyl	%	0	AN422	108	[NT]	[NT]	LCS	108%
p -Terphenyl-*d* 14	%	0	AN422	118	[NT]	[NT]	LCS	119%

QUALITY CONTROL Metals in water by ICP-OES	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted (Metals)				21/11/2011	[NT]	[NT]	LCS	21/11/2011
Date Analysed (Metals)				21/11/2011	[NT]	[NT]	LCS	21/11/2011
Arsenic (Dissolved)	mg/L	0.05	AN320	<0.05	[NT]	[NT]	LCS	96%
Cadmium (Dissolved)	mg/L	0.005	AN320	<0.005	[NT]	[NT]	LCS	98%
Chromium (Dissolved)	mg/L	0.005	AN320	<0.005	[NT]	[NT]	LCS	98%
Copper (Dissolved)	mg/L	0.01	AN320	<0.01	[NT]	[NT]	LCS	97%
Lead (Dissolved)	mg/L	0.02	AN320	<0.02	[NT]	[NT]	LCS	98%
Nickel (Dissolved)	mg/L	0.01	AN320	<0.010	[NT]	[NT]	LCS	99%
Zinc (Dissolved)	mg/L	0.01	AN320	<0.010	[NT]	[NT]	LCS	98%

QUALITY CONTROL Mercury Cold Vapor/Hg Analyser	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted (Mercury)				23/11/2011	[NT]	[NT]	LCS	23/11/2011
Date Analysed (Mercury)				23/11/2011	[NT]	[NT]	LCS	23/11/2011
Mercury (Dissolved)	mg/L	0.0001	AN312	<0.0001	[NT]	[NT]	LCS	100%

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QUALITY CONTROL Hold sample-**NO test** required	UNITS	LOR	METHOD	Blank
Sample on HOLD		[NT]		[NT]

QUALITY CONTROL Moisture	UNITS	LOR	METHOD	Blank
Date Analysed (moisture)				[NT]
Moisture	%	1	AN002	<1

QUALITY CONTROL MBTEX in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date Extracted (MBTEX)		SE90013-20	18/11/2011 || 18/11/2011
Date Analysed (MBTEX)		SE90013-20	18/11/2011 || 18/11/2011
Methyl-tert-butyl ether (MtBE)	mg/kg	SE90013-20	<0.1 || <0.1
Benzene	mg/kg	SE90013-20	<0.1 || <0.1
Toluene	mg/kg	SE90013-20	<0.1 || <0.1
Ethylbenzene	mg/kg	SE90013-20	<0.1 || <0.1
Total Xylenes	mg/kg	SE90013-20	<0.3 || <0.3
BTEX Surrogate (%)	%	SE90013-20	94 || 93 || RPD: 1

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QUALITY CONTROL Total Recoverable Hydrocarbons in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date Extracted (TRH C6-C9 PT)		SE90013-20	18/11/2011 || 18/11/2011
Date Analysed (TRH C6-C9 PT)		SE90013-20	18/11/2011 || 18/11/2011
TRH C_6 - C_9 P&T	mg/kg	SE90013-20	30 || 40 || RPD: 29
Date Extracted (TRH C10-C40)		SE90013-20	18/11/2011 || 18/11/2011
Date Analysed (TRH C10-C40)		SE90013-20	18/11/2011 || 18/11/2011

QUALITY CONTROL TRH in water with C6-C9 by P/T	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted (TRH C6-C9 PT)		[NT]	[NT]	LCS	22/11/11
Date Analysed (TRH C6-C9 PT)		[NT]	[NT]	LCS	22/11/11
TRH C_6 - C_9 P&T in µg/L	µg/L	[NT]	[NT]	LCS	114%
Date Extracted (TRH C10-C36)		[NT]	[NT]	LCS	22/11/2011
Date Analysed (TRH C10-C36)		[NT]	[NT]	LCS	22/11/2011
TRH C_{10} - C_{14}	µg/L	[NT]	[NT]	LCS	92%
TRH C_{15} - C_{28}	µg/L	[NT]	[NT]	LCS	111%
TRH C_{29} - C_{40}	µg/L	[NT]	[NT]	LCS	115%

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Result Codes

[INS] : Insufficient Sample for this test
[NR] : Not Requested
[NT] : Not tested
[LOR] : Limit of reporting
[RPD] : Relative Percentage Difference
* : Not part of NATA Accreditation
[N/A] : Not Applicable

Report Comments

Samples analysed as received. Solid samples expressed on a dry weight basis.
Date Organics extraction commenced:
NATA Corporate Accreditation No. 2562, Site No 4354
Note: Test results are not corrected for recovery (excluding Air-toxics and Dioxins/Furans*)

Quality Control Protocol

Method Blank: An analyte free matrix to which all reagents are added in the same volume or proportions as used in sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. A method blank is prepared every 20 samples.
Duplicate: A separate portion of a sample being analysed that is treated the same as the other samples in the batch. One duplicate is processed at least every 10 samples.
Surrogate Spike: An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are added to samples before extraction to monitor extraction efficiency and percent recovery in each sample.
Internal Standard: Added to all samples requiring analysis for organics (where relevant) or metals by ICP after the extraction/digestion process; the compounds/elements serve to give a standard of retention time and/or response, which is invariant from run-to-run with the instruments.
Laboratory Control Sample: A known matrix spiked with compound(s) representative of the target analytes. It is used to document laboratory performance. When the results of the matrix spike analysis indicates a potential problem due to the sample matrix itself, the LCS results are used to verify that the laboratory can perform the analysis in a clean matrix.
Matrix Spike: An aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.

Quality Acceptance Criteria

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: http://www.au.sgs.com/sgs-mp-au-env-qu-022-qa-qc-plan-en-11.pdf

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SGS

16/11/11
S.S
6:30 pm
2.8°
S851-3
SE 90013

GEOTECHNIQUE PTY LTD

Laboratory Test Request / Chain of Custody Record

Lemko Place
PENRITH NSW 2750

P O Box 880
PENRITH NSW 2751

Tel: (02) 4722 2700
Fax: (02) 4722 6161
email: info@geotech.com.au

TO:	**SGS ENVIRONMENTAL SERVICES** **UNIT 16** **33 MADDOX STREET** **ALEXANDRIA NSW 2015**	**Sampling By:**	AN
PH:	**02 8594 0400** **FAX:** **02 8594 0499**	**Project Manager:**	JX
ATTN:	**MS ANGELA MAMALICOS**		

Job No:	12593/1	
Project:		
Location:	**Mona Vale**	

Results required by: Wednesday 23 November 2011 (Normal TAT)

	Sampling details: Location	Depth (m)	Date	Time	Sample type: Soil	Water	Heavy Metals As, Cd, Cr, Cu, Pb, Hg, Ni and Zn	TPH* & BTEX	PAH	OCP	PCB	TOTAL PHENOLS	TOTAL CYANIDES	BTEX		KEEP SAMPLE
1	MW1	0.07-0.15	16/11/2011	-	SG											YES
2	MW1	0.2-0.5	16/11/2011	-	SG											YES
3	MW1	0.8-1.1	16/11/2011	-	SG		✓	✓	✓	✓	✓	✓	✓			YES
4	MW1	1.3-1.6	16/11/2011	-	SG											YES
5	MW1	1.8-2.1	16/11/2011	-	SG											YES
6	MW1	2.3-2.6	16/11/2011	-	SG											YES
7	MW1	2.8-3.1	16/11/2011	-	SG											YES
8	MW1	3.3-3.6	16/11/2011	-	SG											YES
9	MW1	5.0-5.3	16/11/2011	-	SG											YES
10	BH1	0.1-0.2	16/11/2011	-	SG		✓	✓	✓							YES
11	BH1	0.2-0.5	16/11/2011	-	SG											YES
12	BH1	0.7-0.9	16/11/2011	-	SG		✓	✓	✓							YES

Relinquished by			Received by		
Name	Signature	Date	Name	Signature	Date
JOHN XU	jx	17/11/2011	Suba		17/11/11

Legend:

WG	Water sample, glass bottle	SG	Soil sample (glass jar)	SP	Soil sample (plastic bag)
WP	Water sample, plastic bottle			✓	Test required

* Purge & Trap

GEOTECHNIQUE PTY LTD

Laboratory Test Request / Chain of Custody Record

Lemko Place
PENRITH NSW 2750

P O Box 880
PENRITH NSW 2751

Tel: (02) 4722 2700
Fax: (02) 4722 6161
email: info@geotech.com.au

TO: **SGS ENVIRONMENTAL SERVICES**
UNIT 16
33 MADDOX STREET
ALEXANDRIA NSW 2015

PH: **02 8594 0400** FAX: **02 8594 0499**

ATTN: **MS ANGELA MAMALICOS**

Sampling By: AN **Job No:** 12593/1

Project:

Project Manager: JX **Location:** Mona Vale

Results required by: Wednesday 23 November 2011 (Normal TAT)

Sampling details				Sample type											
	Location	Depth (m)	Date	Time	Soil	Water	Heavy Metals As, Cd, Cr, Cu, Pb, Hg, Ni and Zn	TPH* & BTEX	PAH	OCP	PCB	TOTAL PHENOLS	TOTAL CYANIDES	BTEX		KEEP SAMPLE
13	BH1	1.0-1.3	16/11/2011	-	SG											YES
14	BH1	1.5-1.8	16/11/2011	-	SG											YES
15	BH1	2.5-2.8	16/11/2011	-	SG											YES
16	BH1	3.5-3.8	16/11/2011	-	SG											YES
17	BH1	4.5-4.8	16/11/2011	-	SG											YES
18	BH2	0.1-0.2	16/11/2011	-	SG											YES
19	BH2	0.2-0.5	16/11/2011	-	SG											YES
20	BH2	0.5-0.8	16/11/2011	-	SG		✓	✓	✓							YES
21	BH2	0.85-1.15	16/11/2011	-	SG											YES
22	BH2	1.3-1.6	16/11/2011	-	SG											YES
23	BH2	2.0-2.3	16/11/2011	-	SG											YES
24	BH2	3.0-3.0	16/11/2011	-	SG											YES

Relinquished by			Received by		
Name	Signature	Date	Name	Signature	Date
JOHN XU	jx	17/11/2011	Saba		16/11/11

Legend:

WG	Water sample, glass bottle	SG	Soil sample (glass jar)	SP	Soil sample (plastic bag)
WP	Water sample, plastic bottle			✓	Test required

* Purge & Trap

GEOTECHNIQUE PTY LTD

Laboratory Test Request / Chain of Custody Record

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PENRITH NSW 2750

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PENRITH NSW 2751

Tel: (02) 4722 2700
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email: info@geotech.com.au

TO: SGS ENVIRONMENTAL SERVICES
UNIT 16
33 MADDOX STREET
ALEXANDRIA NSW 2015

PH: 02 8594 0400 **FAX:** 02 8594 0499

ATTN: MS ANGELA MAMALICOS

Sampling By: AN **Job No:** 12593/1

Project:

Project Manager: JX **Location:** Mona Vale

Results required by: Wednesday 23 November 2011 (Normal TAT)

Sampling details				Sample type											
	Location	Depth (m)	Date	Time	Soil	Water	Heavy Metals As, Cd, Cr, Cu, Pb, Hg, Ni and Zn	TPH* & BTEX	PAH	OCP	PCB	TOTAL PHENOLS	TOTAL CYANIDES	BTEX		KEEP SAMPLE
25	BH2	4.0-4.3	16/11/2011	-	SG											YES
26	BH3	0.15-0.45	16/11/2011	-	SG											YES
27	BH3	0.65-0.9	16/11/2011	-	SG											YES
28	BH3	1.0-1.3	16/11/2011	-	SG											YES
29	BH3	2.0-2.3	16/11/2011	-	SG		✓	✓	✓							YES
30	BH3	3.0-3.3	16/11/2011	-	SG											YES
31	BH3	4.0-4.3	16/11/2011	-	SG											YES
32	BH4	0.1-0.2	16/11/2011	-	SG											YES
33	BH4	0.2-0.5	16/11/2011	-	SG		✓	✓	✓	✓	✓	✓	✓			YES
34	BH4	0.5-0.8	16/11/2011	-	SG			✓	✓							YES
35	BH4	0.85-1.15	16/11/2011	-	SG											YES
36	BH4	2.0-2.3	16/11/2011	-	SG											YES

Relinquished by			Received by		
Name	Signature	Date	Name	Signature	Date
JOHN XU	jx	17/11/2011	Suba		16/11/11

Legend:

WG	Water sample, glass bottle	SG	Soil sample (glass jar)	SP	Soil sample (plastic bag)
WP	Water sample, plastic bottle			✓	Test required

* Purge & Trap

GEOTECHNIQUE PTY LTD

Laboratory Test Request / Chain of Custody Record

Lemko Place
PENRITH NSW 2750

P O Box 880
PENRITH NSW 2751

Tel: (02) 4722 2700
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email: info@geotech.com.au

TO: SGS ENVIRONMENTAL SERVICES
UNIT 16
33 MADDOX STREET
ALEXANDRIA NSW 2015

PH: 02 8594 0400 **FAX:** 02 8594 0499

ATTN: MS ANGELA MAMALICOS

Sampling By: AN **Job No:** 12593/1

Project:

Project Manager: JX **Location:** Mona Vale

Results required by: Wednesday 23 November 2011 (Normal TAT)

Sampling details				Sample type										
Location	Depth (m)	Date	Time	Soil	Water	Heavy Metals As, Cd, Cr, Cu, Pb, Hg, Ni and Zn	TPH* & BTEX	PAH	OCP	PCB	TOTAL PHENOLS	TOTAL CYANIDES	BTEX		KEEP SAMPLE
37 Duplicate D1	-	16/11/2011	-	SG											YES
38 Duplicate D2	-	16/11/2011	-	SG		✓	✓	✓	✓	✓	✓	✓			YES
39 Duplicate D3	-	16/11/2011	-	SG											YES
40 Duplicate D4	-	16/11/2011	-	SG											YES
41 Duplicate D5	-	16/11/2011	-	SG											YES
42 Rinsate R1	-	16/11/2011	-		WG	✓	✓	✓							YES
43 Tripspike TS1	-		-	-									✓		YES
44															

Relinquished by			Received by		
Name	Signature	Date	Name	Signature	Date
JOHN XU	jx	17/11/2011	Suba		16/11/11

Legend:

WG	Water sample, glass bottle	SG	Soil sample (glass jar)	SP	Soil sample (plastic bag)
WP	Water sample, plastic bottle			✓	Test required

* Purge & Trap

SAMPLE RECEIPT ADVICE (SRA)

18 November 2011

Client Details			Laboratory Details		
Requested By	:	**Alan Thompson**			
Client	:	GEOTECHNIQUE PTY LTD	Laboratory	:	SGS Environmental Services
Contact	:	Alan Thompson (C/O Mona Vale Golf)	Manager	:	Edward Ibrahim
Address	:	P O Box 880 PENRITH NSW 2751	Address	:	Unit 16, 33 Maddox Street Alexandria NSW 2015
Email	:	valan4@optusnet.com.au	Email	:	au.samplereceipt.sydney@sgs.com
Telephone	:	02 4722 2700	Telephone	:	61 2 8594 0400
Facsimile	:	02 4722 6161	Facsimile	:	61 2 8594 0499
Project	:	12593-1 - Mona Vale - Geotechnique	Report No	:	**SE90013**
Order Number	:		No. of Samples	:	43
Samples	:	42 Soils, 1 Water	Due Date	:	23/11/2011

Date Instructions Received	:	17/11/2011
Sample Receipt Date	:	16/11/11

Samples received in good order	:	YES	Samples received in correct containers	:	YES
Samples received without headspace	:	YES	Sufficient quantity supplied	:	YES
Upon receipt sample temperature	:	Cool	Cooling Method	:	Ice Pack
Sample containers provided by	:	SGS	Samples clearly Labelled	:	YES
Turnaround time requested	:	Standard	Completed documentation received	:	YES

Samples will be held for 1 month for water samples and 3 months for soil samples from date of receipt of samples, unless otherwise instructed.

Comments

The signed chain of custody will be returned to you with the original report.

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Member of the SGS Group (SGS SA)

SAMPLE RECEIPT ADVICE (SRA) - continued

Client : GEOTECHNIQUE PTY LTD Report No : SE90013
Project : 12593-1 - Mona Vale - Geotechnique

Summary of Samples and Requested Analysis

The table below represents SGS Environmental Service's understanding and interpretation of the customer supplied sample request.
Please indicate ASAP if your request differs from these details.
Testing shall commence immediately as per this table, unless the customer intervenes with a correction prior to testing.
Note that a small X in the table below indicates some testing has not been requested in the package.

Sample No.	Description	Metals Prep, soil, water, TCLP	MBTEX in Soil	TRH in soil C6-C9 by P/T	PAHs in Soil	OC Pesticides in Soil (GEOT)	total PCBs in Soil (GEOT)	Phenols in Soil	Cyanide	Metals in Soil by ICP-OES	Mercury Cold Vapor/Hg Analyser	MBTEX in Water (µg/L)	TRH in water with C6-C9 by P/T	PAHs in Water	Metals in water by ICP-OES	Mercury Cold Vapor/Hg Analyser
1	MW1															
2	MW1															
3	MW1	x	X	X	X	X	X	X	X	X	X					
4	MW1															
5	MW1															
6	MW1															
7	MW1															
8	MW1															
9	MW1															
10	BH1	x	X	X	X					X	X					
11	BH1															
12	BH1	x	X	X	X					X	X					
13	BH1															
14	BH1															
15	BH1															
16	BH1															
17	BH1															
18	BH2															

SAMPLE RECEIPT ADVICE (SRA) - continued

Client : GEOTECHNIQUE PTY LTD Report No : SE90013
Project : 12593-1 - Mona Vale - Geotechnique

Sample No.	Description	Metals Prep, soil, water, TCLP	MBTEX in Soil	TRH in soil C6-C9 by P/T	PAHs in Soil	OC Pesticides in Soil (GEOT)	total PCBs in Soil (GEOT)	Phenols in Soil	Cyanide	Metals in Soil by ICP-OES	Mercury Cold Vapor/Hg Analyser	MBTEX in Water (µg/L)	TRH in water with C6-C9 by P/T	PAHs in Water	Metals in water by ICP-OES	Mercury Cold Vapor/Hg Analyser
19	BH2															
20	BH2	x	X	X	X					X	X					
21	BH2															
22	BH2															
23	BH2															
24	BH2															
25	BH2															
26	BH3															
27	BH3															
28	BH3															
29	BH3	x	X	X	X					X	X					
30	BH3															
31	BH3															
32	BH4															
33	BH4	x	X	X	X	X	X	X	X	X	X					
34	BH4		X	X	X											
35	BH4															
36	BH4															
37	Duplicate D1															
38	Duplicate D2	x	X	X	X	X	X	X	X	X	X					
39	Duplicate D3															
40	Duplicate D4															
41	Duplicate D5															
42	Rinsate R1	x										X	X	X	X	X

SAMPLE RECEIPT ADVICE (SRA) - continued

Client : GEOTECHNIQUE PTY LTD Report No : SE90013
Project : 12593-1 - Mona Vale - Geotechnique

Sample No.	Description	Metals Prep, soil, water, TCLP	MBTEX in Soil	TRH in soil C6-C9 by P/T	PAHs in Soil	OC Pesticides in Soil (GEOT)	total PCBs in Soil (GEOT)	Phenols in Soil	Cyanide	Metals in Soil by ICP-OES	Mercury Cold Vapor/Hg Analyser	MBTEX in Water (µg/L)	TRH in water with C6-C9 by P/T	PAHs in Water	Metals in water by ICP-OES	Mercury Cold Vapor/Hg Analyser
43	Tripspike TS1		X													

Sample No.	Description	Hold sample-NO test required	Moisture
1	MW1	X	
2	MW1	X	
3	MW1		X
4	MW1	X	
5	MW1	X	
6	MW1	X	
7	MW1	X	
8	MW1	X	
9	MW1	X	
10	BH1		X
11	BH1	X	
12	BH1		X
13	BH1	X	
14	BH1	X	

SGS

SAMPLE RECEIPT ADVICE (SRA) - continued

Client : GEOTECHNIQUE PTY LTD Report No : SE90013
Project : 12593-1 - Mona Vale - Geotechnique

Sample No.	Description	Hold sample-NO test required	Moisture
15	BH1	X	
16	BH1	X	
17	BH1	X	
18	BH2	X	
19	BH2	X	
20	BH2		X
21	BH2	X	
22	BH2	X	
23	BH2	X	
24	BH2	X	
25	BH2	X	
26	BH3	X	
27	BH3	X	
28	BH3	X	
29	BH3		X
30	BH3	X	
31	BH3	X	
32	BH4	X	
33	BH4		X
34	BH4		X
35	BH4	X	
36	BH4	X	
37	Duplicate D1	X	
38	Duplicate D2		X
39	Duplicate D3	X	

SAMPLE RECEIPT ADVICE (SRA) - continued

Client : GEOTECHNIQUE PTY LTD
Project : 12593-1 - Mona Vale - Geotechnique

Report No : SE90013

Sample No.	Description	Hold sample-NO test required	Moisture
40	Duplicate D4	X	
41	Duplicate D5	X	
42	Rinsate R1		
43	Tripspike TS1		

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS 65234

Client:
Geotechnique Pty Ltd
PO Box 880
Penrith
NSW 2751

Attention: John Xu

Sample log in details:

Your Reference:	**12593/1, Mona Vale**
No. of samples:	4 Soils
Date samples received / completed instructions received	16/11/11 / 17/11/11

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	23/11/11 / 15/12/11
Date of Preliminary Report:	Not Issued

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

Nancy Zhang
Chemist

Rhian Morgan
Reporting Supervisor

Nick Sarlamis
Inorganics Supervisor

vTRH & BTEX in Soil		
Our Reference:	UNITS	65234-3
Your Reference	----------	S3
Date Sampled	----------	16/11/11
Type of sample		Soil
Date extracted	-	22/11/2011
Date analysed	-	23/11/2011
vTRH C_6 - C_9	mg/kg	<25
Benzene	mg/kg	<0.2
Toluene	mg/kg	<0.5
Ethylbenzene	mg/kg	<1
m+p-xylene	mg/kg	<2
o-Xylene	mg/kg	<1
Surrogate aaa-Trifluorotoluene	%	88

sTRH in Soil (C10-C36)		
Our Reference:	UNITS	65234-3
Your Reference	----------	S3
Date Sampled	----------	16/11/11
Type of sample		Soil
Date extracted	-	22/11/2011
Date analysed	-	22/11/2011
$TRHC_{10}$ - C_{14}	mg/kg	<50
$TRHC_{15}$ - C_{28}	mg/kg	<100
$TRHC_{29}$ - C_{36}	mg/kg	<100
Surrogate o-Terphenyl	%	105

PAHs in Soil Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ---------- 	65234-3 S3 16/11/11 Soil
Date extracted	-	22/11/2011
Date analysed	-	23/11/2011
Naphthalene	mg/kg	<0.1
Acenaphthylene	mg/kg	<0.1
Acenaphthene	mg/kg	<0.1
Fluorene	mg/kg	<0.1
Phenanthrene	mg/kg	<0.1
Anthracene	mg/kg	<0.1
Fluoranthene	mg/kg	<0.1
Pyrene	mg/kg	<0.1
Benzo(a)anthracene	mg/kg	<0.1
Chrysene	mg/kg	<0.1
Benzo(b+k)fluoranthene	mg/kg	<0.2
Benzo(a)pyrene	mg/kg	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1
Surrogate p-Terphenyl-d_{14}	%	88

Organochlorine Pesticides		
Our Reference:	UNITS	65234-3
Your Reference	----------	S3
Date Sampled	----------	16/11/11
Type of sample		Soil
Date extracted	-	22/11/2011
Date analysed	-	23/11/2011
HCB	mg/kg	<0.1
alpha-BHC	mg/kg	<0.1
gamma-BHC	mg/kg	<0.1
beta-BHC	mg/kg	<0.1
Heptachlor	mg/kg	<0.1
delta-BHC	mg/kg	<0.1
Aldrin	mg/kg	<0.1
Heptachlor Epoxide	mg/kg	<0.1
gamma-Chlordane	mg/kg	<0.1
alpha-chlordane	mg/kg	<0.1
Endosulfan I	mg/kg	<0.1
DDE	mg/kg	<0.2
Dieldrin	mg/kg	0.2
Endrin	mg/kg	<0.1
DDD	mg/kg	<0.2
Endosulfan II	mg/kg	<0.1
DDT	mg/kg	<0.2
Endrin Aldehyde	mg/kg	<0.1
Endosulfan Sulphate	mg/kg	<0.1
Methoxychlor	mg/kg	<0.1
Surrogate TCLMX	%	133

PCBs in Soil		
Our Reference:	UNITS	65234-3
Your Reference	----------	S3
Date Sampled	----------	16/11/11
Type of sample		Soil
Date extracted	-	22/11/2011
Date analysed	-	23/11/2011
Arochlor 1016	mg/kg	<0.1
Arochlor 1221	mg/kg	<0.1
Arochlor 1232	mg/kg	<0.1
Arochlor 1242	mg/kg	<0.1
Arochlor 1248	mg/kg	<0.1
Arochlor 1254	mg/kg	<0.1
Arochlor 1260	mg/kg	<0.1
Surrogate TCLMX	%	133

Total Phenolics in Soil		
Our Reference:	UNITS	65234-3
Your Reference	----------	S3
Date Sampled	----------	16/11/11
Type of sample		Soil
Date extracted	-	22/11/2011
Date analysed	-	22/11/2011
Total Phenolics (as Phenol)	mg/kg	<5

Acid Extractable metals in soil		
Our Reference:	UNITS	65234-3
Your Reference	----------	S3
Date Sampled	----------	16/11/11
Type of sample		Soil
Arsenic	mg/kg	12
Cadmium	mg/kg	<0.5
Chromium	mg/kg	31
Copper	mg/kg	30
Lead	mg/kg	14
Mercury	mg/kg	0.6
Nickel	mg/kg	29
Zinc	mg/kg	68

Miscellaneous Inorg - soil		
Our Reference:	UNITS	65234-3
Your Reference	----------	S3
Date Sampled	----------	16/11/11
Type of sample		Soil
Date prepared	-	23/11/2011
Date analysed	-	23/11/2011
Total Cyanide	mg/kg	<0.5

Moisture		
Our Reference:	UNITS	65234-3
Your Reference	----------	S3
Date Sampled	----------	16/11/11
Type of sample		Soil
Date prepared	-	22/11/2011
Date analysed	-	23/11/2011
Moisture	%	19

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Inorg-030	Total Phenolics - determined colorimetrically following disitillation, based upon APHA 21st ED 5530 D.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-013	Cyanide - total determined colourimetrically after distillation, based on APHA 21st ED, 4500-CN_C,E. Free cyanide determined colourimetrically after filtration.
Inorg-008	Moisture content determined by heating at 105 deg C for a minimum of 4 hours.

QUALITY CONTROL vTRH & BTEX in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike Reco
Date extracted	-			22/11/2011	[NT]	[NT]	LCS-3	22/
Date analysed	-			23/11/2011	[NT]	[NT]	LCS-3	23/
vTRH C_6 - C_9	mg/kg	25	Org-016	<25	[NT]	[NT]	LCS-3	
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	LCS-3	
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	LCS-3	
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	LCS-3	
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	LCS-3	
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	LCS-3	
Surrogate aaa-Trifluorotoluene	%		Org-016	81	[NT]	[NT]	LCS-3	
QUALITY CONTROL sTRH in Soil (C10-C36)	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike Reco
Date extracted	-			22/11/2011	[NT]	[NT]	LCS-1	22/1
Date analysed	-			22/11/2011	[NT]	[NT]	LCS-1	22/1
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	[NT]	[NT]	LCS-1	1
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-1	1
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-1	
Surrogate o-Terphenyl	%		Org-003	104	[NT]	[NT]	LCS-1	1
QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike Reco
Date extracted	-			22/11/2011	[NT]	[NT]	LCS-1	22/1
Date analysed	-			23/11/2011	[NT]	[NT]	LCS-1	23/1
Naphthalene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-1	
Acenaphthylene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	
Acenaphthene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	
Fluorene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-1	
Phenanthrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-1	1
Anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	
Fluoranthene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-1	1
Pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-1	1
Benzo(a)anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	
Chrysene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-1	1

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Benzo(b+k)fluoranthene	mg/kg	0.2	Org-012 subset	<0.2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	mg/kg	0.05	Org-012 subset	<0.05	[NT]	[NT]	LCS-1	108%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d_{14}	%		Org-012 subset	93	[NT]	[NT]	LCS-1	90%
QUALITY CONTROL Organochlorine Pesticides	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			22/11/2011	[NT]	[NT]	LCS-1	22/11/2011
Date analysed	-			23/11/2011	[NT]	[NT]	LCS-1	23/11/2011
HCB	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-1	109%
gamma-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
beta-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-1	110%
Heptachlor	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-1	95%
delta-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Aldrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-1	107%
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-1	107%
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
DDE	mg/kg	0.2	Org-005	<0.2	[NT]	[NT]	LCS-1	105%
Dieldrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-1	117%
Endrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-1	99%
DDD	mg/kg	0.2	Org-005	<0.2	[NT]	[NT]	LCS-1	112%
Endosulfan II	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
DDT	mg/kg	0.2	Org-005	<0.2	[NT]	[NT]	[NR]	[NR]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-1	106%
Methoxychlor	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate TCLMX	%		Org-005	103	[NT]	[NT]	LCS-1	101%

QUALITY CONTROL PCBs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike Reco
Date extracted	-			22/11/2011	[NT]	[NT]	LCS-1	22/1
Date analysed	-			23/11/2011	[NT]	[NT]	LCS-1	23/1
Arochlor 1016	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[
Arochlor 1221	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[
Arochlor 1232	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[
Arochlor 1242	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[
Arochlor 1248	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[
Arochlor 1254	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	LCS-1	9
Arochlor 1260	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[
Surrogate TCLMX	%		Org-006	103	[NT]	[NT]	LCS-1	1

QUALITY CONTROL Total Phenolics in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike Reco
Date extracted	-			22/11/2011	[NT]	[NT]	LCS-1	22/1
Date analysed	-			22/11/2011	[NT]	[NT]	LCS-1	22/1
Total Phenolics (as Phenol)	mg/kg	5	Inorg-030	<5	[NT]	[NT]	LCS-1	9

QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike Reco
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	[NT]	[NT]	LCS-1	1
Cadmium	mg/kg	0.5	Metals-020 ICP-AES	<0.5	[NT]	[NT]	LCS-1	1
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	1
Copper	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	1
Lead	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	1
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	[NT]	[NT]	LCS-1	1
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	1
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-1	1

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			23/11/2011	[NT]	[NT]	LCS-1	23/11/2011
Date analysed	-			23/11/2011	[NT]	[NT]	LCS-1	23/11/2011
Total Cyanide	mg/kg	0.5	Inorg-013	<0.5	[NT]	[NT]	LCS-1	88%

QUALITY CONTROL Moisture	UNITS	PQL	METHOD	Blank
Date prepared	-			[NT]
Date analysed	-			[NT]
Moisture	%	0.1	Inorg-008	[NT]

Report Comments:

This report supersedes the previous report due to a correction of date samples received.

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a bl sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compound which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batched of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes and LCS: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

ENVIROLAB SERVICES
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 65234
Date Received: ~~23/11~~ 16/11/11
Time Received: 16:47
Received by: SB
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

GEOTECHNIQUE PTY LTD

Laboratory Test Request / Chain of Custody Record

Lemko Place
PENRITH NSW 2750

P O Box 880
PENRITH NSW 2751

Tel: (02) 4722 2700
Fax: (02) 4722 6161
email: info@geotech.com.au

TO: **ENVIROLAB SERVICES PTY LD**
12 ASHLEY STREET
CHATSWOOD NSW 2067

PH: **02 9910 6200** FAX: **02 9910 6201**

ATTN: AILEEN HIE

Sampling By: AN
Job No: 12593/1
Project:
Project Manager: JX
Location: Mona Vale

Results required by: Wednesday 23 November 2011 (Normal TAT)

	Sampling details				Sample type										
	Location	Depth (m)	Date	Time	Soil	Water	Heavy Metals As, Cd, Cr, Cu, Pb, Hg, Ni and Zn	TPH* & BTEX	PAH	OCP	PCB	TOTAL PHENOLS	TOTAL CYANIDES			KEEP SAMPLE
1	S1	-	16/11/2011	-	SG											YES
2	S2	-	16/11/2011	-	SG											YES
3	S3	-	16/11/2011	-	SG		✓	✓	✓	✓	✓	✓	✓	Combination 9		YES
4	S4	-	16/11/2011	-	SG											YES

Relinquished by			Received by		
Name	Signature	Date	Name	Signature	Date
JOHN XU	jx	17/11/2011			16/11/11

Legend:
WG Water sample, glass bottle
WP Water sample, plastic bottle
SG Soil sample (glass jar)
SP Soil sample (plastic bag)
✓ Test required
* Purge & Trap

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

SAMPLE RECEIPT ADVICE

Client:

Geotechnique Pty Ltd
PO Box 880
Penrith NSW 2751

ph: 02 4722 2700
Fax: 02 4722 6161

Attention: John Xu

Sample log in details:

Your reference:	**12593/1, Mona Vale**
Envirolab Reference:	**65234**
Date received:	16/11/11
Date results expected to be reported:	**23/11/11**

Samples received in appropriate condition for analysis:	YES
No. of samples provided	4 Soils
Turnaround time requested:	Standard
Temperature on receipt	Cool
Cooling Method:	Ice

Comments:

Samples will be held for 1 month for water samples and 2 months for soil samples from date of receipt of samples.

Contact details:

Please direct any queries to Aileen Hie or Jacinta Hurst
ph: 02 9910 6200 fax: 02 9910 6201
email: ahie@envirolabservices.com.au or jhurst@envirolabservices.com.au

APPENDIX F

ENVIRONMENTAL NOTES

IMPORTANT INFORMATION REGARDING YOUR ENVIRONMENTAL SITE ASSESSMENT

These notes have been prepared by Geotechnique Pty Ltd, using guidelines prepared by the ASFE (Associated Soil and Foundation Engineers). The notes are offered to assist in the interpretation of your environmental site assessment report.

REASONS FOR AN ENVIRONMENTAL ASSESSMENT

Environmental site assessments are typically, though not exclusively, performed in the following circumstances:

- As a pre-acquisition assessment on behalf of either a purchaser or a vendor, when a property is to be sold
- As a pre-development assessment, when a property or area of land is to be redeveloped, or the land use has changed e.g. from a factory to a residential subdivision
- As a pre-development assessment of greenfield sites, to establish baseline conditions and assess environmental, geological and hydrological constraints to the development of e.g. a landfill
- As an audit of the environmental effects of previous and present site usage

Each circumstance requires a specific approach to the assessment of soil and groundwater contamination. In all cases the objective is to identify and if possible quantify the risks that unrecognised contamination poses to the ongoing proposed activity. Such risks may be both financial (clean-up costs or limitations in site use) and physical (health risks to site users or the public).

ENVIRONMENTAL SITE ASSESSMENT LIMITATIONS

Although information provided by an environmental site assessment can reduce exposure to the risk of the presence of contamination, no environmental site assessment can eliminate the risk. Even a rigorous professional assessment may not detect all contamination within a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which did not show signs of contamination when sampled. Contaminant analysis cannot possibly cover every type of contaminant that may occur; only the most likely contaminants are screened.

AN ENVIRONMENTAL SITE ASSESSMENT REPORT IS BASED ON A UNIQUE SET OF PROJECT SPECIFIC FACTORS

In the following events and in order to avoid cost problems, you should ask your consultant to assess any changes in the conclusion and recommendations made in the assessment:

- When the nature of the proposed development is changed e.g. if a residential development is proposed, rather than a commercial development
- When the size or configuration of the proposed development is altered e.g. if a basement is added
- When the location or orientation of the proposed structure is modified
- When there is a change of land ownership, or
- For application to an adjacent site

ENVIRONMENTAL SITE ASSESSMENT FINDINGS ARE PROFESSIONAL ESTIMATES

Site assessment identifies actual sub-surface conditions only at those points where samples are taken, when they are taken. Data obtained from the sampling and subsequent laboratory analyses are interpreted by geologists, engineers or scientists and opinions are drawn about the overall sub-surface conditions, the nature and extent of contamination, the likely impact on any proposed development and appropriate remediation measures. Actual conditions may differ from those inferred, because no professional, no matter how qualified and no sub-surface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, however, steps can be taken to help minimise the impact. For this reason site owners should retain the services of their consultants throughout the development stages of the project in order to identify variances, conduct additional tests that may be necessary and to recommend solutions to problems encountered on site.

Soil and groundwater contamination is a field in which legislation and interpretation of legislation by government departments is changing rapidly. Whilst every attempt is made by Geotechnique Pty Ltd to be familiar with current policy, our interpretation of the investigation findings should not be taken to be that of the relevant authority. When approval from a statutory authority is required for a project, approval should be directly sought.

STABILITY OF SUB-SURFACE CONDITIONS
Sub-surface conditions can change by natural processes and site activities. As an environmental site assessment is based on conditions existing at the time of the investigation, project decisions should not be based on environmental site assessment data that may have been affected by time. The consultant should be requested to advise if additional tests are required.

ENVIRONMENTAL SITE ASSESSMENTS ARE PERFORMED FOR SPECIFIC PURPOSES AND CLIENTS
Environmental site assessments are prepared in response to a specific scope of work required to meet the specific needs of specific individuals e.g. an assessment prepared for a consulting civil engineer may not be adequate to a construction contractor or another consulting civil engineer.

An assessment should not be used by other persons for any purpose or by the client for a different purpose. No individual, other than the client, should apply an assessment, even for its intended purpose, without first conferring with the consultant. No person should apply an assessment for any purpose other than that originally contemplated, without first conferring with the consultant.

MISINTERPRETATION OF ENVIRONMENTAL SITE ASSESSMENTS
Costly problems can occur when design professionals develop plans based on misinterpretation of an environmental site assessment. In order to minimise problems, the environmental consultant should be retained to work with appropriate design professionals, to explain relevant findings and to review the adequacy of plans and specifications relative to contamination issues.

LOGS SHOULD NOT BE SEPARATED FROM THE REPORT
Borehole and test pit logs are prepared by environmental scientists, engineers or geologists, based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these would not be redrawn for inclusion in site remediation or other design drawings, as subtle but significant drafting errors or omissions may occur in the transfer process. Photographic reproduction can eliminate this problem, however, contractors can still misinterpret the logs during bid preparation if separated from the text of the assessment. Should this occur, delays and disputes, or unanticipated costs may result.

To reduce the likelihood of borehole and test pit log misinterpretation, the complete assessment should be available to persons or organisations involved in the project, such as contractors, for their use. Denial of such access and disclaiming responsibility for the accuracy of sub-surface information does not insulate an owner from the attendant liability. It is critical that the site owner provides all available site information to persons and organisations, such as contractors.

READ RESPONSIBILITY CLAUSES CLOSELY
An environmental site assessment is based extensively on judgement and opinion; therefore, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. In order to aid in prevention of this problem, model clauses have been developed for use in written transmittals. These are definitive clauses, designed to indicate consultant responsibility. Their use helps all parties involved recognise individual responsibilities and formulate appropriate action. Some of these definitive clauses are likely to appear in the environmental site assessment and you are encouraged to read them closely. Your consultant will be happy to give full and frank answers to any questions you may have.