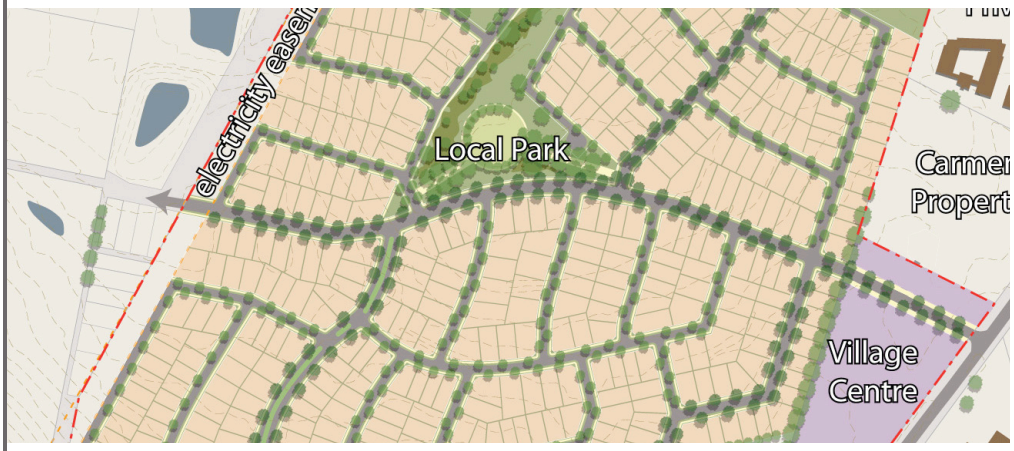

Appendix 8
Preliminary Site Investigation

Environmental Earth Sciences

Peter Andrews + Associates Pty Ltd
paa.design architecture planning urban design

REPORT NO. **408015**

PRELIMINARY SITE INVESTIGATION AGRICULTURAL INSTITUTE, FOREST ROAD, ORANGE, NEW SOUTH WALES

ENVIRONMENTAL EARTH SCIENCES CWNSW

REPORT TO NSW DEPARTMENT PRIMARY INDUSTRIES
MAY 2008

EXECUTIVE SUMMARY

Environmental Earth Sciences CWNSW was requested by the NSW Department of Primary Industries (DPI), to undertake a preliminary site investigation (PSI) at the Agricultural Institute, Forest Road, Orange, New South Wales (the site).

The objectives of the investigation were to evaluate the potential for soil contamination as a result of past and present onsite or offsite activities. To determine this, Environmental Earth Sciences CWNSW compiled information from a desktop study, historical review, site inspection and soil sampling.

The preliminary site investigation was undertaken in accordance with the NSW EPA (1997) — *Contaminated sites: guidelines for consultants reporting on contaminated sites* and SEPP 55 requirements.

Lots 147, 134 and 2 and 63 were found to have a low potential for contamination which was confirmed with soil analysis. Laboratory results for heavy metals, organochlorine and organophosphate pesticides were all below DEC (2006) health based soil investigation guidelines for standard residential use with garden/accessible soil. These Lots were therefore considered suitable for residential and commercial development.

Lot 179 was used as night soil depot and as a result elevated levels of total PAHs and benzo(a)pyrene were found to exceed both the DEC (2006) health based soil investigation guidelines for standard residential use with garden/accessible soil, and the commercial/ industrial criteria. A soil lead level also exceeded the residential criteria but was below the commercia/industrial criteria.

As contaminant levels exceeded the site criteria for residential and commercial landuse, remedial strategies may be required. Environmental Earth Sciences CWNSW recommends further investigation is warranted within Lot 179 to delineate the extent of contamination. Further details have been provided in the report. Once the results of the detailed investigation are known a remedial strategy can be implemented.

Project Manager
Stuart Brisbane
Senior Soil Scientist

Project Director / Internal Reviewer
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Principal

TABLE OF CONTENTS

FIGURES

APPENDICES

1 INTRODUCTION

The NSW Department of Primary Industries (DPI) requested Environmental Earth Sciences CWNSW to undertake a preliminary site investigation (PSI) of the Agricultural Institute, Forest Road, Orange, New South Wales (the site).

This environmental investigation was undertaken with reference to the NSW EPA (1997) — *Contaminated sites: guidelines for consultants reporting on contaminated sites* (Reference 11).

Environmental Earth Sciences CWNSW is not responsible for variations due to alterations of site conditions or chemistry since the time of inspection, for example, through illegal dumping.

This report is based on the scope of works presented in proposal PO408011 dated 19 February 2008.

2 OBJECTIVE AND SCOPE OF WORK

The objective of the investigation was to evaluate the potential for soil contamination as a result of past and present, onsite or offsite activities.

The information used to achieve the objective involved the following scope of work:

- review of available historical site information;
- a desktop geological, hydrogeological, soil and topographical study;
- undertake a site and soil inspection, with focus on areas designated for night soil disposal and land filling;
- laboratory analysis of selected samples for a limited array of analytes commonly associated with night soil, landfills and farming; and
- provision of a report discussing the outcomes of the investigation in relation to proposed landuse including any recommendations for further works.

The findings of this investigation are discussed in the following sections.

3 SITE CONDITIONS

3.1 Location and property description

The investigated site forms part of the Agricultural Institute, Forest Road, Orange, New South Wales (Figure 1). Located in the southern limits of the city of Orange the site is predominantly surrounded by sporting, commercial/industrial and agricultural landuse.

The study area (Figure 1) includes portions:

- Lot 63 DP750401 – 3.91 ha

- Lot 179 DP750401 – 4.02 ha
- Lot 147 DP750401 – 2.83 ha
- Lot 134 DP750401 – 1012 m^2
- Lot 2 DP750401 – 1012 m^2
- Lot 7017 DP750401 – site area unknown.

Lots 2 and 134 are encompassed by Lot 147 (Figure 1). All Lots are Crown Land within the meaning of the Crown Lands Act and zoned rural for general farming landuse.

3.2 Geology, topography and soil

Local geology has been described as Tertiary Volcanics derived from Mount Canobolas (Reference 6).

The site has been identified in the Soil Landscapes of Bathurst 1:250 000 sheet as in the Towac Soil Landscape. A soil landscape is an area of land that has recognisable and specifiable topographies and soils. Dominant soils in the Towac Soil Landscape are krasnozems which occur on the upper to midslopes. Red podsolic/krasnozem intergrades are found on upper slopes with yellow podsolic/solodic soils found in drainage depressions (Reference 6).

3.3 Topography and drainage

Topography consists of undulating hills to rolling low hills from 980-1080 m in elevation. Slopes usually range from 6-10% however can be up to 20%. Local relief is found in the range 40-60 m but can be up to 100 m. Drainage channels are fixed and moderately spaced (Reference 6). The site generally drains to the north and forms part of the Blackman Swamp Creek catchment.

3.4 Hydrogeology

A groundwater bore search conducted using the NSW Department of Natural Resources. (Updated 2007) - NSW Natural Resource Atlas (Reference 1) provided details of twelve registered groundwater bores within a one kilometre radius of the area. Three other bores are located within this area, however no details were available.

The groundwater bores are constructed to depths between 4 to 106 metres and are used for a variety of purposes including irrigation, domestic and monitoring. A small number of monitoring bores located to the north west of the site had shallow water bearing zones (4-7.5 metres).

Water bearing zones were varied and generally located in fractured basalt however water bearing zones at depth were associated with fractured shale lithology (>30 metres). Given the depth of the groundwater is as shallow as 4 metres in some areas, the potential for groundwater contamination as a result of onsite activities should be considered.

3.5 Site history

The site history was compiled by reviewing a series of historical aerial photographs, interviews with site personnel and historical site searches.

3.5.1 Aerial photographs

The review of aerial photographs taken 1956 to 1998 is summarized in Table 1.

TABLE 1 AERIAL PHOTOGRAPHS (1956-1998)

Year	Comments
1956	Lot 147 appears to be well grassed with no signs of disturbance and contained a small dam along the north western boundary. An entrance road from Forest Rd to Lot 179 was evident along the northern boundary of Lot 147. Lot 179 contains a small galvanised shed with over half of the Lot containing bare ground devoid of vegetation. Lot 63 is well grassed and contains numerous stands of established eucalypts. Soil disturbances were also noted to the north of the site where the current TAFE is located. The area to the south appeared to be used for agricultural purposes.
1963	No apparent changes from the 1957 aerial photograph with the bare patches of soil in Lot 179 still evident. Ground disturbances within the TAFE site were also grassed at this time.
1972	No apparent change although dark grassed areas within Lot 179 and 63 could indicate drainage lines or preferential pathways for water movement. Bare patches still evident within Lot 63.
1975	Grass has started to grow in the bare soil towards the middle of Lot 179. The area along the northern boundary of Lot 179 was still bare. Remaining Lots remained unchanged.
1984	The only bare soil visible in Lot 179 was along the northern boundary and near the galvanised shed. Lot 147 and 63 appear to have been established with sown pasture. Established trees are still evident in Lot 63.
1989	No apparent change to 1984
1998	Lot 179 had been ploughed although the bare patch to the north is still visible. Relatively minor changes to Lot 149 and 63 except that a large dam had been constructed to the west of the Lot 63.

3.5.2 Title searches

Title information and past land use has been outlined in report Harcombe (2007), *Assessment of Crown Land at Bloomfield, Orange,* Department of Lands. Records show that Lot 63 was reserved for a Night Soil Depot in 1911 and subsequently reserved for travelling stock and camping in 1925. Lots 147, 134, 2 and 7017 were reserved for a rubbish depot in 1928. The location of Lot 7017 is unknown.

3.5.3 Interviews

Information gained from interviews in Harcombe (2007) conflicted with evidence collected from aerial photographs, where it was reported that local residents and staff at DPI confirmed that a rubbish dump was located within Lot 147, 134, 2 and 179 and the location of a night soil depot was vague. However aerial photographs indicated that Lot 179 was likely to have been used for the night soil depot and rubbish mentioned by on site personnel was associated with the dumping of night soil rather than a landfill.

Additional evidence supplied by an earth moving contractor suggested that the TAFE land contained landfill material however this area was north of the site.

3.6 Potential for contamination

Following the desktop investigation, we consider that the site contained a moderate to high potential for contamination associated with use as a night soil depot and potential landfill.

Aerial photographs from 1957 indicate that activities such as a night soil depot were limited to Lot 179 and the other Lots appeared to have only been used for agricultural purposes. Land filling activities could have occurred prior to 1957 however there was no evidence within the aerial photographs to support this. As such, residual contamination is expected to be associated with night soil depot and agricultural lands.

The main potential chemicals of concern are considered to be:

- heavy metals and organochlorine and organophosphate pesticides associated with pesticide application; and
- heavy metals associated with application night soil, however as the effluent was sourced from residences rather than commercial premises, the potential for contamination is expected to be low.

The purpose of the site inspection and sampling was to further elucidate and/or assess any potential contamination sources on site.

4 SITE INVESTIGATION

Field investigations were undertaken on 2 and 3 April 2008 and consisted of soil sampling targeting information gained in the historical survey. The site description has been divided into three sections in relation to the main Lots 147, 179 and 63. Site features at the time of the investigation are presented in Figure 2, 3 and 4.

4.1 Lots 147, 134 and 2

Lots 147, 134 and 2 (Figure 2) formed a relatively flat paddock (<1% slope) of *phalaris sp.* pasture with a broadleaf component. Groundcover was high and maintained at 90-100% and the round bales at the north western corner indicated that the pasture was of high enough quality to be cut for hay. Pasture appeared healthy with no indication of phytotoxic effects such as bare ground or poor development. A small depression found to the western boundary of Lots 147, 134 and 2 showed signs of periodic saturation due to the presence of sedges and annuals. There was no evidence across the paddock to suggest that major disturbance had occurred.

A compacted gravel road was found at the northern boundary of the Lots which entered from Forest Rd (east) to Lot 179 to the west. The paddock bordered Forest Rd to east, the TAFE to the north and grazing paddock to south.

4.2 Lot 179

Lot 179 contained a predominantly lucerne based pasture although in several sections lucerne persistence was poor and replaced with Yorkshire fog and annuals (Figure 3). Slope was relatively flat (<2%) and the TAFE site to the north drained to the site. Along the northern and western boundaries a fenced tree line had been established. Isolated established eucalypts were also found around the Lot.

A small galvanised shed (<25m^2) was found within the fenced northern tree line. The shed contained an internal wall of cemented asbestos sheeting which had been smashed leaving fragments on the floor. The shed also had a wooden floor with a fire place suggesting that it may have been a lunch room *etc* for the onsite workers associated with the night soil depot. There was no evidence available to suggest that contaminants had been stored in this area.

A concrete apron or concrete floor was found nearby this shed to the south with accompanying rubble. Site personnel suggested this was originally the floor of another shed which had been demolished. The road in Lot 147 lead to the entrance of the shed and former shed. It was thought that this area represented the night soil depot shown in the aerial photographs.

Soil within the northern tree line appeared as a bleached silt and did not support any vegetation. Development of the trees in the northern tree line near the shed was mildly affected in comparison to the trees within the southern tree line. Trees in the northern tree line had been established in disturbed soil or a ripped line in which subsoil was exposed.

Across this area several pieces of glass fragments and ceramics were found including a portion of the TAFE site. A slight sweet smelling hydrocarbon odour was noted and this was confirmed with onsite personnel who suggested that the odour was strongest after heavy rain and soil saturation. No hydrocarbon staining or ash material was found associated with this bleached topsoil.

The phytotoxic effect of this material was evident in a washout which had been washed from the northern tree line into the lucerne pasture (Figure 3). This small area of material 2m^2 contained no vegetation and was surrounded by established pasture.

The tree line along the western boundary contained grass and a well established tree line and showed no phytotoxic effects such as evident along the northern boundary.

The lucerne persistence in some areas of the Lot 179 was poor (Figure 3) and had been replaced by annuals and Yorkshire fog along the northern boundary and towards the middle of the site.

4.3 Lot 63

Lot 63 (Figure 4) was the most western Lot of the site and as with Lot 147 contained a phalaris pasture with broadleaf and annual component. Groundcover was 90-100% and there was no vegetation scalds or poor development of pasture to indicate phytotoxic effects. Lot 63 contained numerous stands of established eucalypts indicating that minimal disturbance had occurred in this area. Lot 63 drained to the west to a large dam in the adjoining paddock. There were no indication of drainage lines or preferential flow lines and the site contained a linear slope to the west of approximately 5-6 %.

There were no structures nor any evidence of structures observed across the site.

4.4 Sampling locations

The intrusive field investigation consisted of soil sampling using an excavator and hand auger. A total of twenty test pits were excavated, which included 5 in Lots 149, 134 and 2, 10 in Lot 179 and 5 in Lot 63 (Figures 2, 3 and 4). Two hand auger holes were drilled to a depth of 0.5 m.

Sample depth was determined by location, however most trenches were excavated to weathered basalt bedrock. Samples were taken from each of the horizons and any features of interest.

During the investigation, soil description, texture and pH were recorded at each of the sampling locations. Sample information is provided in Appendix A of this report. Sampling techniques conform to the Environmental Earth Sciences Pty Ltd (2005) *Soil, gas and groundwater sampling manual*, and the quality assurance and quality control (QA/QC) procedures detailed in Appendix C.

4.5 Soil stratigraphy

Soil was varied across the site, however it was consistent with soils derived from the underlying basalt. Topsoil generally consisted of an organic layer, dark grey brown sandy loam to loam, which was well structured and a field pH of 5.5 to 6.5. This organic layer usually extended to a depth of 0.1 m. A lighter grey brown sandy loam to silty loam was detected in some of the trenches to a depth of 0.5 m. This layer was moderately structured with a plastic consistence and field pH 6. Fe/Mn nodules were abundant in the lower depth of this layer.

Subsoil ranged from a red brown well structured clay loam to light clay to a yellow brown with grey mottle light to medium clay. Soil was well to moderately structured, slightly moist with a slightly plastic consistence. Fe/Mn nodules and large concretions were abundant. Depth of the subsoil varied and ranged from 1.0 – 1.8 m and field pH ranged from 6-7. At most sampling locations a grey sandy clay loam to clay loam was encountered above a weathered basalt layer. Large Fe/Mn concentrations were present in this layer. Basalt floaters 0.3 m in diameter were also found in some of the trenches to the west of the site.

A grey, medium clay was observed in testpit 3 which was located in the depression illustrating seasonal saturation and poor drainage. Slickensides were also evident in the clay profile. This testpit and testpit 2 were different to the rest of the site however this is likely to be the cause of poor drainage and periodic saturation rather than disturbance.

Soil appeared to show limited disturbance although rubbish consisting of ceramics, glass burnt material and charcoal was found to a depth of 0.7 m in testpit 11. This rubbish layer was not extensive across the testpit and appeared to be limited to the northern corner of the testpit indicating an isolated event.

The bare topsoil within Lot 179 was a grey brown silt with minor charcoal and glass and ceramic fragments. Soil pH of this layer was 4-5 which was different to the residual soil of the site. Low soil pH was found in the areas of Lot 179 where lucerne was not persisting even though the paddock had been initially treated with lime. Low soil pH (4-5) was found to a depth of 1.0 m. There appeared to be a strong link between the low persistence of lucerne and low soil pH which also happened to be the areas used for the night soil depot. A slight sweet odour was detected near the galvanised shed and areas of bare soil.

The soil appeared to be consistent with the local basalt geology and indicated that minor disturbance has occurred to depth. Shallow bedrock is also an indication of limited potential for soil disturbance. No groundwater was encountered during sampling.

5 APPLICATION OF RELEVANT GUIDELINES

A range of threshold guidelines has been derived covering concentrations of contaminants in soils.

Environmental Earth Sciences NSW refer to the NSW DEC (2006) — *Contaminated sites: guidelines for the NSW site auditor scheme* and the NSW EPA (1995) — *Contaminated sites: sampling design guidelines* as the recommended guidelines for contaminant level thresholds, sample selection, and site coverage.

The health-based soil investigation levels presented in the NSW DEC (2006) — *Contaminated sites: guidelines for the NSW site auditor scheme* are based on the National Environment Protection Council (NEPC) (1999) —*National Environment Protection (Assessment of Site Contamination) Measure* (NEPM).

As the future landuse of the site is unknown until the findings of the report are finalised the results have been compared against both residential and commercial criteria. The human health based investigation level presented as Column A (Table 2) for *'Standard' residential with garden/accessible soil* are the more stringent guidelines.

In accordance with the NEPM, the data collected in an environmental site assessment are statistically assessed as follows:

- comparison of the arithmetic mean of sampled soil populations to the adopted site criteria;
- comparison of the standard deviation of the sampled populations to 50% of the site criteria; and
- assessing whether any sample results exceed the site criteria by 250%.

TABLE 2 SOIL INVESTIGATION LEVELS

SUBSTANCE	Health-based Soil Investigation Levels (mg/kg)					
Exposure Settings	A	B[a]	C[a]	D	E	F
Aldrin + Dieldrin	10			40	20	50
Arsenic (total)	100			400	200	500
Benzo (a) pyrene	1			4	2	5
Cadmium	20			80	40	100
Chlordane	50			200	100	250
Chromium (III)	120 000			480 000	240 000	600 000
Chromium (VI)	100			400	200	500
Copper	1 000			4 000	2 000	5 000
Cyanides (complexed)	500			2 000	1 000	2 500
DDT+DDD+DDE	200			800	400	1 000
Heptachlor	10			40	20	50
Lead	300			1 200	600	1 500
Manganese	1 500			6 000	3 000	7 500
Methyl mercury	10			40	20	50
Mercury (inorganic)	15			60	30	75
Nickel	600			2 400	600	3 000
Total PAH	20			80	40	100
PCBs (total)	10			40	20	50
Phenol	8 500			34 000	17 000	42 500
TPH >C16-C35 aromatics	90			360	180	450
TPH >C16-C35 aliphatics	5 600			22 400	11 200	28 000
TPH >C35	56 000			224 000	112 000	280 000
Zinc	7 000			28 000	14 000	35 000

Exposure Settings:

A. 'Standard' residential with garden/accessible soil (less than 10% intake of home grown produce; no poultry): this category includes children's day-care, pre-schools etc.
B. Residential with substantial vegetable garden (contributing up to 50% of vegetable and fruit intake) and poultry providing all dietary egg intake and 25% poultry meat intake.
C. Residential with substantial vegetable garden (contributing up to 50% of vegetable and fruit intake); poultry excluded.
D. Residential with minimal opportunities for soil access includes high-rise apartments and flats.
E. Parks, recreational open space and playing fields: includes secondary schools.
F. Commercial/Industrial: includes premises such as shops and offices as well as factories and industrial sites. (If, however, a commercial site is also used for residential purposes or regular soil access by children if possible then the appropriate 'residential' setting should be used.) It is assumed that thirty years is the duration of exposure.

a Site and contaminant specific

6 LABORATORY RESULTS

Selected soil samples were analysed for:

- heavy metals – twenty three samples (including 2 duplicates);

- organochlorine and organophosphate pesticides (OCPs & OPPs) – four samples; and,
- 8270 scan which is capable of detecting a range of semi volatile organic contaminates – 9 samples (including 1 duplicate).

Laboratory results for heavy metals concentrations are provided in Tables 3.

As no organophosphates and organophosphates were detected above 1 mg/kg for selected samples TP 4 (0-0.1 m), TP5 (0-0.1 m), TP8 (0-0.1) and TP 9 (0-0.1 m), they have not been listed. Results are presented in the laboratory transcripts presented in Appendix B.

Only the PAHs results which were found to be above the detection limit were reported for the 8270 analysis in Table 4. The remainder of the results are presented in laboratory transcripts (Appendix B).

Laboratory analyses were undertaken by the National Measurement Institute (NMI) and Sydney Analytical Laboratories (SAL), who are both NATA registered for the methods used.

TABLE 3 INORGANIC LABORATORY SOIL RESULTS – HEAVY METALS

Sample	Depth (m)	Copper	Lead	Zinc	Cadmium	Chromium	Nickel	Arsenic	Mercury
TP2	0-0.1	8.0	8.0	29	<0.5	46	8.0	3.0	0.025
TP3	0-0.1	13	22	48	<0.5	66	10	3.5	0.035
TP3	0.4-0.8	15	12	31	<0.5	72	15	3.0	0.020
TP5	0-0.1	9.0	12	26	<0.5	54	6.0	3.0	0.025
TP7	0-0.1	8.0	10	27	<0.5	48	5.0	3.0	0.020
TP8	0-0.1	8.0	8.0	39	<0.5	89	13	4.0	0.030
TP8	0.4-0.8	18	9.0	49	<0.5	145	26	4.0	0.025
TP9	0-0.1	14	11	39	<0.5	130	12	4.0	0.025
TP12	0-0.1	26	28	79	<0.5	125	16	4.5	0.090
TP13	0-0.15	28	34	53	<0.5	90	10	5.0	0.090
TP13	0.8-1.0	27	39	50	<0.5	95	9.0	4.5	0.10
TP14	0-0.1	31	62	90	<0.5	92	11	5.0	0.16
Residential criteria		100	300	7000	20	120000	600	100	15
Commercial criteria		5000	1500	35000	100	600000	3000	500	75

Notes:
1. Site criteria: taken from DEC (2006): Health based investigation levels for standard residential and commercial/industrial land use
2. All results expressed in mg/kg on a dry weight basis

TABLE 3 INORGANIC LABORATORY SOIL RESULTS – HEAVY METALS (CONTINUED)

Sample	Depth (m)	Copper	Lead	Zinc	Cadmium	Chromium	Nickel	Arsenic	Mercury
TP15	0-0.1	31	52	40	<0.5	73	14	4.0	0.14
TP15	0.3-0.5	19	60	31	<0.5	48	5.0	3.5	0.055
TP16	0-0.1	8.0	69	49	<0.5	370	125	4.5	0.20
TP17	0-0.1	4.0	47	45	<0.5	510	145	4.0	0.27
TP17	0.1-0.2	13	40	33	<0.5	420	160	3.5	0.17
TP18	0-0.1	29	100	300	<0.5	77	22	6.0	0.045
TP19	0-0.1	7.0	25	50	<0.5	68	6.0	3.0	0.02
HA1	0-0.2	65	**380**	590	<0.5	64	16	7.0	0.06
HA2	0-0.2	2.0	16	25	<0.5	220	190	3.0	0.21
Residential criteria		1000	300	7000	20	120000	600	100	15
Commercial criteria		5000	1500	35000	100	600000	3000	500	75

Notes:

1. Site criteria: taken from DEC (2006): Health based investigation levels for standard residential and commercial/industrial land use
2. All results expressed in mg/kg on a dry weight basis
3. Bold results exceed the DEC (2006) guidelines for standard residential land use

TABLE 4 ORGANIC LABORATORY SOIL RESULTS – PAHS

Sample	TP13	TP16	TP16	TP17	Residential criteria	Commercial criteria
Depth	0-0.1 m	0-0.1 m	0.4-0.5 m	0-0.1m		
Poly Aromatic Hydrocarbons						
Acenaphthylene	<1	<2.5	<1	<10		
Naphthalene	<1	<2.5	<1	<10		
Acenaphthene	<1	<2.5	<1	<10		
Fluorene	<1	<2.5	<1	<10		
Phenanthrene	<1	<2.5	<1	<10		
Anthracene	<1	<2.5	<1	<10		
Fluoranthene	<1	4.0	<1	<10		
Pyrene	<1	3.8	<1	<10		
Benz(a)anthracene	<1	3.0	<1	<10		
Chrysene	<1	9.2	<1	14		
Benzo(b,k)fluoranthene	<2	18	<2	33		
Benzo(a)pyrene	<1	**3**	<1	<10	1	5
Indeno(1,2,3-cd)pyrene	<1	<5	<1	<10		
Dibenz(a,h)anthracene	<1	<5	<1	<10		
Benzo(g,h,i)perylene	<1	<5	<1	<10		
Total PAHs	<15	**41**	<15	**47**	20	100

Notes:

1. Site criteria: taken from DEC (2006): Health based investigation levels for standard residential and commercial/industrial land use
2. All results expressed in mg/kg on a dry weight basis
3. Bold results exceed the DEC (2006) guidelines for standard residential land use

TABLE 4 ORGANIC LABORATORY SOIL RESULTS – PAHS (CONTINUED)

Sample	TP17	TP18	TP19	HA1	Residential criteria	Commercial criteria
Depth	0.4-0.6 m	0-0.1 m	0-0.1 m	0-0.2 m		
Poly Aromatic Hydrocarbons						
Acenaphthylene	<1	<10	<1	<10		
Naphthalene	<1	<10	<1	<10		
Acenaphthene	<1	<10	<1	<10		
Fluorene	<1	<10	<1	<10		
Phenanthrene	<1	48	<1	12		
Anthracene	<1	12	<1	<10		
Fluoranthene	<1	47	<1	17		
Pyrene	<1	56	<1	22		
Benz(a)anthracene	<1	18	<1	<10		
Chrysene	<1	27	<1	15		
Benzo(b,k)fluoranthene	<2	46	<2	28		
Benzo(a)pyrene	<1	**36**	<1	**29**	1	5
Indeno(1,2,3-cd)pyrene	<1	12	<1	<10		
Dibenz(a,h)anthracene	<2	<10	<1	<10		
Benzo(g,h,i)perylene	<1	<15	<1	<10		
Total PAHs	<15	**302**	<15	**123**	20	100

Notes:
1. Site criteria: taken from DEC (2006): Health based investigation levels for standard residential and commercial/industrial land use
2. All results expressed in mg/kg on a dry weight basis
3. Bold results exceed the DEC (2006) guidelines for standard residential land use

6.1 Discussion of laboratory results

6.1.1 Organic results

Selected surface samples from Lots 147, 134 and 2, TP4 (0-0.1 m) and TP5 (0-0.1 m) had organochlorine and organophosphates levels below detection limits of 0.01 mg/kg and therefore below DEC (2006) health based soil investigation guidelines, for standard residential, with garden/accessible soil (the most stringent level).

An 8270 scan was used for samples taken from Lot 179 as it is capable of detecting most semi volatile organic contaminants including poly aromatic hydrocarbons, phenols, phthalates, chlorinated hydrocarbons, ethers, amines nitroaromatic and nitrosamines, organochlorines and organophosphates.

Elevated levels of PAHs were detected in the area of Lot 179 used to deposit night soil. Although, TP13 (0-0.1m) and TP19 (0-0.1m) located towards the edge of the area used for night soil application had PAHs levels below detection limits and site criteria.

PAHs concentrations which exceeded guidelines were detected in surface samples TP16 (0-0.1 m), TP17 (0-0.1 m), TP18 (0-0.1 m) and HA1 (0-0.2 m). TP16 (0-0.1 m) had total PAH

(41 mg/kg) levels were above DEC (2006) health based soil investigation guidelines residential criteria but below industrial criteria. Benzo(a)pyrene (3 mg/kg) which is a PAH that has its own health criteria was also above residential guidelines but below the industrial criteria (Table 2).

TP17 (0-0.1 m) located in the bare soil of the tree line contained no detectable levels of benzo(a)pyrene to a concentration of 10 mg/kg. This larger detection limit in comparison to the other analysis was due to the high concentrations of chrysene and benzo(b,k)fluoranthene detected within the sample. It is likely that benzo(a)pyrene was at similar concentrations to TP16. Results therefore indicate that both benzo(a)pyrene and total PAH levels are above DEC (2006) health based soil investigation guidelines for residential but below industrial.

Sampling locations TP18 (0-0.1 m) and HA1 (0-0.1 m had total PAHs 302 mg/kg and benzo(a)pyrene 36 mg/kg. HA1 (0-0.2 m) had total PAH concentrations at 123 mg/kg and benzo(a)pyrene 29 mg/kg. As such both locations had samples which exceed both residential health and industrial health criteria for total PAH and benzo(a)pyrene in soil.

The two samples taken at depth TP16 (0.4-0.5 m) and TP17 (0.4-0.6 m) contained no detectable levels of organic contaminants including PAHs to a detection limit of <1 mg/kg.

Lot 63 had a similar history to Lots 147, 134 and 2 and as such potential for contamination was low. Selected surface samples TP8 (0-0.1 m) and TP9 (0-0.1 m) had organochlorine and organophosphates levels below detection limits of 0.01 mg/kg and therefore below DEC (2006) health based soil investigation guidelines, for standard residential, with garden/accessible soil (the most stringent level).

6.1.2 Inorganic results

The laboratory analysis of samples taken from Lots 147, 134 and 3 and 63 were relatively low and below the DEC (2006) health based soil investigation guidelines for standard residential use, with garden/accessible soil. Only HA1 (0-0.2 m) was found to have lead concentrations (380 mg/kg) above the DEC (2006) health based soil investigation guidelines for standard residential use, with garden/accessible soil. This level however was below the industrial health criteria.

6.2 Procedures for quality control and quality assurance

Quality control (QC) is achieved by using a NATA registered laboratory using ASTM standard methods supported by internal duplicates, and the checking of high, abnormal or otherwise anomalous results against background and other chemical results for the sample concerned.

Quality assurance (QA) is achieved by confirming field, or anticipated results based upon field observations, with laboratory results.

Field observations are compared with laboratory results when they are not as expected and confirmation, re-sampling and re-analysis are undertaken if results cannot be correlated. In brief, all field and internal laboratory duplicate results were within the acceptable range of reproducibility. A full discussion on quality control and quality assurance (QC/QA) for the site investigation program is given in Appendix C.

7 DISCUSSION

The early aerial photographs showed that the site had been subdivided along Lot boundaries, 147, 179 and 63 since 1956. Site activities were therefore restricted to these boundaries.

7.1 Organics

Site history and field investigation was able to show that Lots 147, 134 and 2 and 63 were relatively free of soil disturbance and had been used for predominantly grazing since 1957. There was no indication across the site or in the soil profile to suggest that these Lots have been used for a landfill or for night soil deposits. Limited sample analysis confirmed this as no organic contaminants OCP/OPP were detected and heavy metal levels were equivalent to an undisturbed background range.

Most of the site activity since 1956 was focused around Lot 179 and it appears that this area was used for a night soil deposits. This is in contrast to the title information collected. Aerial photographs in 1956 showed over half Lot 179 had bare ground which was most likely the areas used to dump the night soil. During the inspection bare ground was noted still within the fenced northern tree line near the galvanised shed. Surface soil (0-0.1 m) was found to contain elevated levels of PAHs and benzo(a)pyrene which was above DEC (2006) health based soil investigation guidelines for both standard residential use and commercial industry landuse.

The presence of PAHs in the soil can be contributed to a number of scenarios. Ash may have been mixed with the night soil during soil application to dry out the material and make it easier to spread. However no large deposits of ash material were found across Lot 179 except for the old entrance road and an area where material had been burnt.

The presence of PAHs is therefore likely associated with the cleaning process of the night soil tins. These tins were often coated with creosote or tar (which contains PAHs) to inhibit corrosion from the effluent. These tins were cleaned with phenol (Carbolic acid) which is a disinfectant. As the phenol is a solvent it would have stripped some of the creosote coating from the tins during cleaning and PAHs associated with the creosote would have been deposited with the effluent on to the soil. Over time the phenols would have dissipated or bioremediated leaving only the strongly fixed PAHs in the soil. The phenols being corrosive would have also stripped organic matter (OM) from the topsoil leaving only the inorganic fraction such as the bleached brown silt, observed at the site. Without organic matter in the topsoil the PAHs remain moderately bioavailable which explains the phytotoxic effects observed in these areas. Although the PAHs show phytotoxic effects they appear relatively well adsorbed to the soil inorganic fraction as PAHs have not migrated into the soil profile, or significantly across the site.

Given the result of the 8270 scan in which no phenols were detected it could be summarised that that the odour associated with the soil is likely to be associated with the pyrene compounds rather than phenols.

7.2 Heavy metals

A slight difference in heavy metal concentrations in the soil was observed between the Lots used for mainly agricultural purposes (Lot 147, 134 and 2 and 63) and Lot 179 which was used as a night soil depot. Heavy metal levels generally affected were copper, lead, zinc, chromium and nickel. Elevated levels of nickel were associated with elevated levels of

chromium in the soil and it was difficult to distinguish whether this was a naturally derived feature or anthropogenic related.

Chromium was elevated and generally >50 mg/kg with the highest levels 145 mg/kg at TP8 (0.4-0.8 m). High chromium levels are naturally derived and associated with the volcanic geology underlying the site. Elevated chromium concentrations were found to depth across the site and the chromium detected is likely to be in the chromium (III) form as the soil is well aerated and drained as indicated by the red colouring and well structured subsoil. As a result, the guideline criteria for chromium (VI), the anaerobic form are not applicable to this site.

7.3 Soil pH

Lower pH levels to depth were also noted in Lot 179, in comparison to the reminder of the site. Reduced soil pH levels are related to use of phenols for cleaning. Phenol was used as a disinfectant and is a weak acid which would have reduced soil pH on application. However it is also very corrosive and would have dissolved OM fraction of the topsoil forming organic acid. This in conjunction with the presence of urea within the effluent would have resulted in reduction in pH across the site. While the elevated PAHs were generally restricted to bare ground within the tree line the poor persistence of lucerne throughout some portions of the Lot 179 appear to be related to the soil pH and not the presence of PAHs . It appears that these areas may have been used less frequently for night soil deposits or ploughing and pasture development has increased the micro-organisms in the soil which have degraded PAHs over time.

7.4 Groundwater

Soil contaminants were shown to be restricted to the surface soil (0 – 0.3 m) and well bound to the soil matrix. Groundwater or lateral flow was not encountered during the site inspection except for a poorly drained section of soil in Lot 149, 134 and 2. As such the potential for groundwater contamination appears to be low in relation to the night soil depot and site activities.

8 RECOMMENDATIONS

Results of the preliminary investigation would indicate that Lots 147, 134 and 2 and 63 are suitable for either residential or commercial development.

Lot 179 had total PAHs, benzo(a)pyrene and above both residential and industrial health criteria and lead above residential criteria. The bare soil is also an indication that PAH levels in the soil were phytotoxic to most vegetation.

Contamination appears limited to the surface soil and has not migrated to deeper in the soil profile or been moved through the site via sediment flow. It is therefore likely that the potentially contaminated material has generally remained in the same position since application. However given the hazardous nature of the contaminants detected and before any remedial works can be evaluated a detailed site investigation (DSI) of Lot 179 needs to

be completed to further delineate the contaminated area. The detailed site investigation would be limited to upper profile samples (<1.0 m).

The detailed investigation would also incorporate sampling near the boundaries of Lots 147 and 63 with Lot 179 to verify past land use was restricted to current site boundaries.

Sampling strategy for the DSI will be focused towards PAHs, including benzo(a)pyrene and heavy metals. Additional samples should also be analysed for speciated chromium to confirm the chromium in the soil is the chromium (III) and not the more toxic chromium (VI). Current soil conditions suggest that chromium is in the form of chromium (III) which does not pose a problem.

Once additional sampling has been undertaken to provide the necessary sampling density for site coverage and to delineate hotspot areas, statistical analysis will be undertaken to establish the 95% upper confidence limit and areas that require remediation. DPI will need to determine at this point whether the site is to be redeveloped for residential or commercial use.

Once the contaminated areas are delineated remedial options such as bioremediation or offsite disposal if permitted to landfill can be determined.

Broken asbestos cemented sheets will also have to be disposed appropriately to landfill when the shed is demolished.

9 CONCLUSION

Lots 147, 134 and 2 and 63 were found to have a low potential for contamination which was confirmed with the soil analysis. Laboratory results for heavy metals analytes, organochlorine and organophosphate pesticides were all below DEC (2006) health based soil investigation guidelines for standard residential use. These Lots were therefore considered suitable for residential and commercial development.

Lot 179 was used as night soil depot and as a result elevated levels of total PAHs and benzo(a)pyrene were found to exceed both the DEC (2006) health based soil investigation guidelines for standard residential use with garden/accessible soil, and the commercial/ industrial criteria. Lead also exceeded the residential criteria but was below the commercia/industrial criteria.

Environmental Earth Sciences CWNSW recommends further investigation is warranted within Lot 179 to delineate the area that will require remediation. Further recommendations have been outlined in the report.

10 LIMITATIONS

This report has been prepared by Environmental Earth Sciences CWNSW ABN 109 404 006 in response to and subject to the following limitations:

1. The specific instructions received from DPI;
2. The specific scope of works set out in PO408011 issued by Environmental Earth Sciences CWNSW for and on behalf of DPI, is included in Section 2(Objectives) of this report;
3. May not be relied upon by any third party not named in this report for any purpose except with the prior written consent of Environmental Earth Sciences CWNSW (which consent may or may not be given at the discretion of Environmental Earth Sciences CWNSW);
4. This report comprises the formal report, documentation sections, tables, figures and appendices as referred to in the index to this report and must not be released to any third party or copied in part without all the material included in this report for any reason;
5. The report only relates to the site referred to in the scope of works being located at Agricultural Institute, Forest Road, Orange, New South Wales ("the site");
6. The report relates to the site as at the date of the report as conditions may change thereafter due to natural processes and/or site activities;
7. No warranty or guarantee is made in regard to any other use than as specified in the scope of works and only applies to the depth tested and reported in this report;
8. Fill, soil, groundwater and rock to the depth tested on the site may be fit for the use specified in this report. Unless it is expressly stated in this report, the fill, soil and/or rock may not be suitable for classification as clean fill if deposited off site; and
9. The general limitations which are attached to this report.

11 REFERENCES

1. NSW Department of Natural Resources. (Updated 2007) - NSW Natural Resource Atlas.
2. Environmental & Earth Sciences Pty Ltd (1999) — *Quality control and environmental management manual.*
3. Environmental & Earth Sciences Pty Ltd (2005) — *Soil, gas and groundwater sampling manual.*
4. Harcombe (2007), *Assessment of Crown Land at Bloomfield, Orange,* Department of Lands
5. Imray, P and Langley, A (1999) — *Health-based soil investigation levels*, National Environmental Health Forum monographs, Soil series No. 1, 3rd edition. Changes reflect National Environment Protection Council measure development process.
6. Kovac, M., Murphy, B. W. and Lawrie, J. W. (1990), — *Soil Landscapes of the Bathurst 1:250 000 Sheet Report.* Soil Conservation Service of NSW, Sydney.
7. National Environment Protection Council (NEPC) (1999) — *National environmental protection (assessment of site contamination) measure*.

8. NSW Department of Environment and Conservation (2006) — Contaminated sites: *guidelines for the NSW site auditor scheme* (2nd edition).
9. NSW Department of Urban Affairs and Planning (1998) — *Managing Land Contamination: Planning guidelines SEPP 55 – Remediation of Land*
10. NSW Environment Protection Authority (1995) — *Contaminated sites: sampling design guidelines*.
11. NSW Environment Protection Authority (1997) — *Contaminated sites: guidelines for consultants reporting on contaminated sites*.

GENERAL LIMITATIONS

Scope of services

The work presented in this report is Environmental Earth Sciences response to the specific scope of works requested by, planned with and approved by the client. It cannot be relied on by any other third party for any purpose except with our prior written consent. Client may distribute this report to other parties and in doing so warrants that the report is suitable for the purpose it was intended for. However, any party wishing to rely on this report should contact us to determine the suitability of this report for their specific purpose.

Data should not be separated from the report

A report is provided inclusive of all documentation sections, limitations, tables, figures and appendices and should not be provided or copied in part without all supporting documentation for any reason, because misinterpretation may occur.

Subsurface conditions change

Understanding an environmental study will reduce exposure to the risk of the presence of contaminated soil and or groundwater. However, contaminants may be present in areas that were not investigated, or may migrate to other areas. Analysis cannot cover every type of contaminant that could possibly by present. When combined with field observations, field measurements and professional judgement, this approach increases the probability of identifying contaminated soil and or groundwater. Under no circumstances can it be considered that these findings represent the actual condition of the site at all points.

Environmental studies identify actual sub-surface conditions only at those points where samples are taken, when they are taken. Actual conditions between sampling locations 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 below the ground surface. 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 that predicted. Nothing can be done to prevent the unanticipated. However, steps can be taken to help minimize the impact. For this reason, site owners should retain our services.

Problems with interpretation by others

Advice and interpretation is provided on the basis that subsequent work will be undertaken by Environmental Earth Sciences CWNSW. This will identify variances, maintain consistency in how data is interpreted, conduct additional tests that may be necessary and recommend solutions to problems encountered on site. Other parties may misinterpret our work and we cannot be responsible for how the information in this report is used. If further data is collect4ed or comes to light we reserve the right to alter their conclusions.

Obtain regulatory approval

The investigation and remediation of contaminated sites is a field in which legislation and interpretation of legislation is changing rapidly. Our interpretation of the investigation findings should not be taken to be that of any other party. When approval from a statutory authority is required for a project, that approval should be directly sought by the client.

Limit of liability

This study has been carried out to a particular scope of works at a specified site and should not be used for any other purpose. This report is provided on the condition that Environmental Earth Sciences CWNSW disclaims all liability to any person or entity other than the client in respect of anything done or omitted to be done and of the consequence of anything done or omitted to be done by any such person in reliance, whether in whole or in part, on the contents of this report. Furthermore, Environmental Earth Sciences CWNSW disclaims all liability in respect of anything done or omitted to be done and of the consequence of anything done or omitted to be done by the client, or any such person in reliance, whether in whole or any part of the contents of this report of all matters not stated in the brief outlined in Environmental Earth sciences CWNSW's proposal number and according to Environmental Earth Sciences general terms and conditions and special terms and conditions for contaminated sites.

To the maximum extent permitted by law, we exclude all liability of whatever nature, whether in contract, tort or otherwise, for the acts, omissions or default, whether negligent or otherwise for any loss or damage whatsoever that may arise in any way in connection with the supply of services. Under circumstances where liability cannot be excluded, such liability is limited to the value of the purchased service.

FIGURES

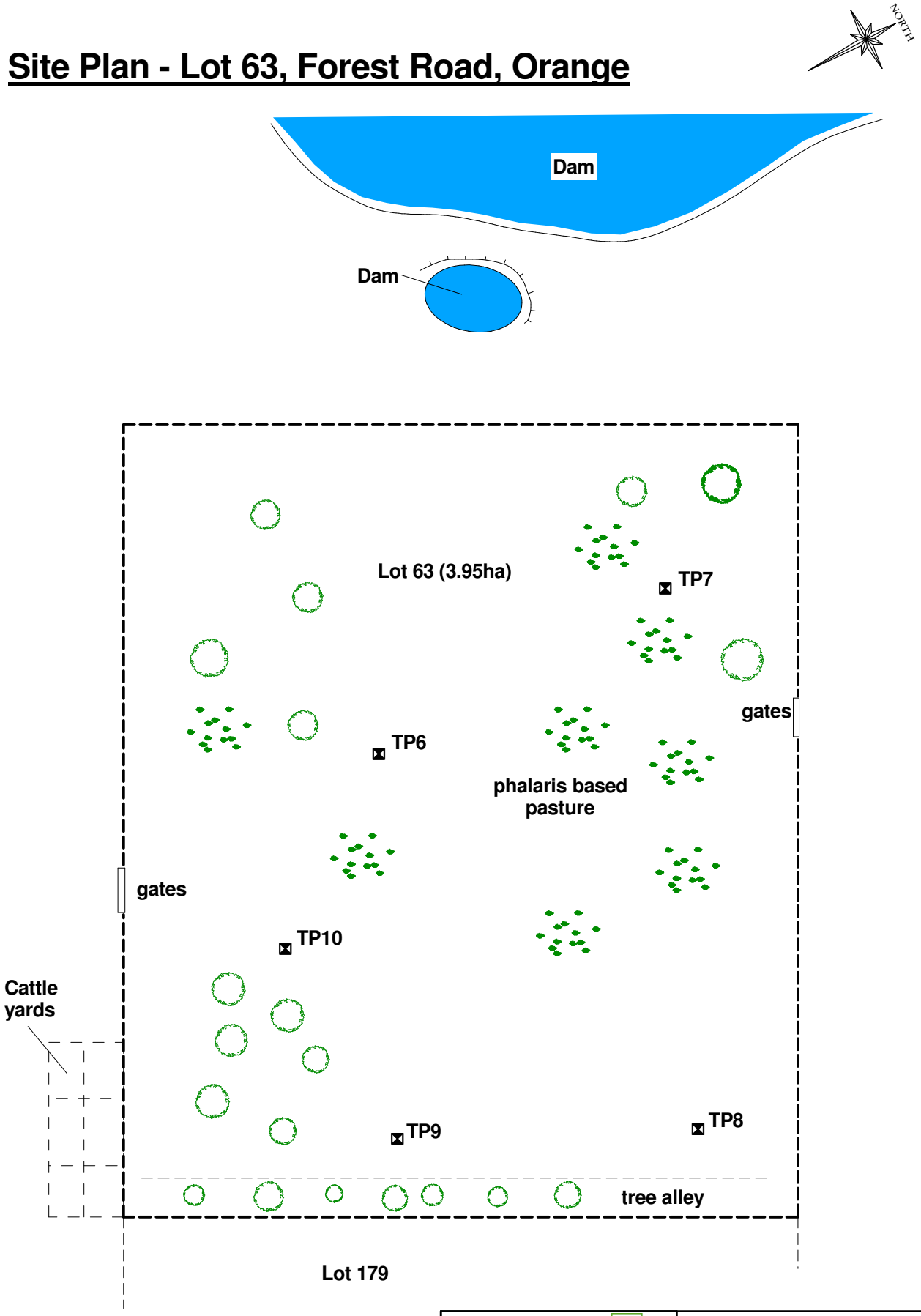
NORTH

Site Plan - Forest Road, Orange

Reference: Dept. Lands SIX website.

ENVIRONMENTAL EARTH SCIENCES THE KNOW AND THE HOW	Title: Site Location	
	Location: Lots 147, 179 & 63 Forest Road, Orange, NSW	
Client: Dept. Primary Industry		Job number: 408015
Drawn by: TRJ	Scale: Unknown	Source: As shown
Proj Man: SB	Date: 14 Mar. 2008	Figure 1

Site Plan - Lot 63, Forest Road, Orange

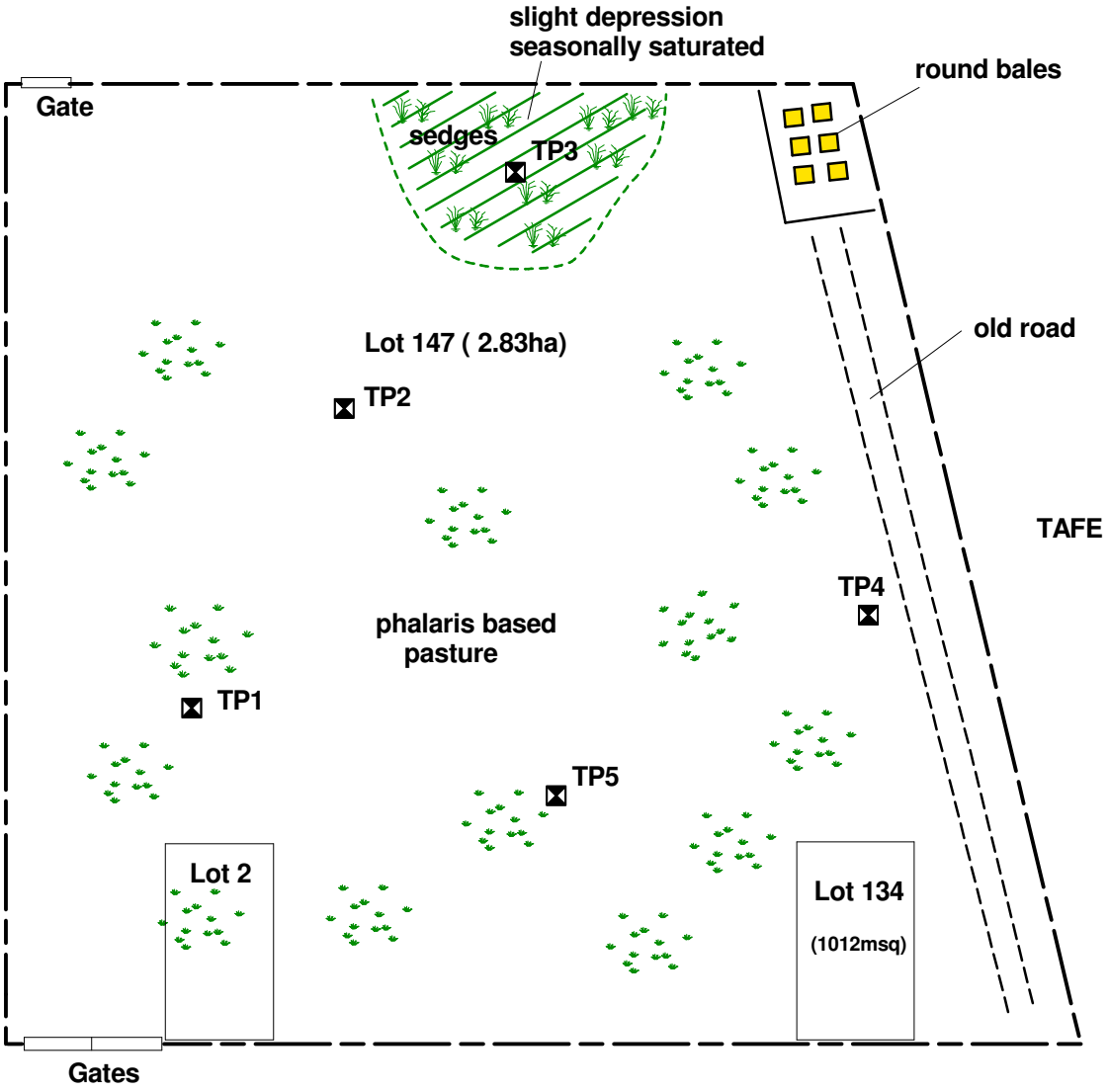


Key:

⊠ Test pit locations

ENVIRONMENTAL EARTH SCIENCES THE KNOW AND THE HOW	Title: Site Characteristics & Sampling Locations	
	Location: Lot 63 Forest Road, Orange, NSW	
Client: Dept. Primary Industry		Job number: 408015
Drawn by: TRJ	Scale: Unknown	Source:
Proj Man: SB	Date: 14 Mar. 2008	Figure 4

Site Plan - Lot 147, Lot 134 & Lot 2 Forest Road, Orange

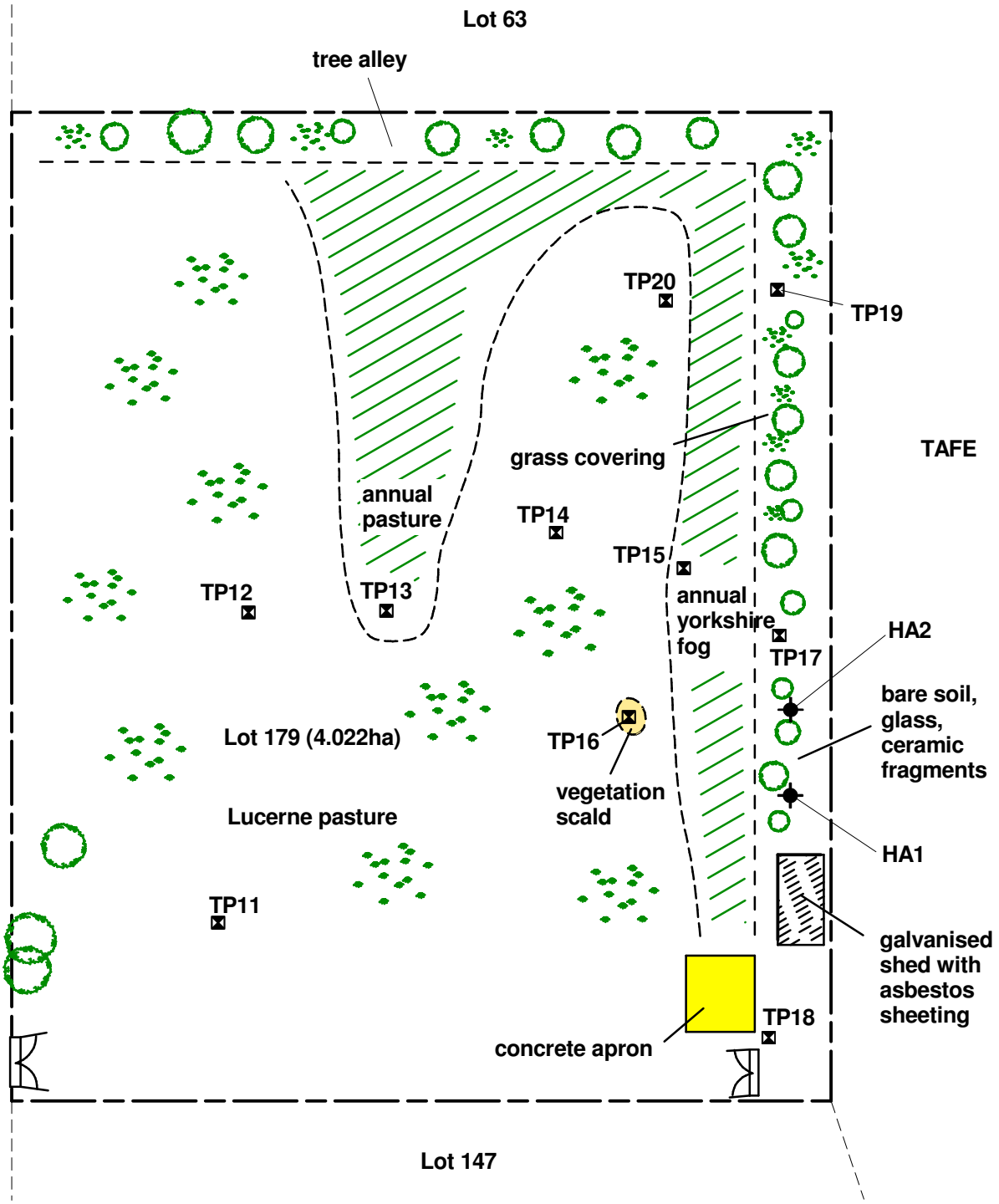


Key:

⊠ Test pit locations

ENVIRONMENTAL EARTH SCIENCES THE KNOW AND THE HOW	Title: Site Characteristics & Sampling Locations	
	Location: Lots 147, 134 & Lot 2 Forest Road, Orange, NSW	
Client: Dept. Primary Industry		Job number: 408015
Drawn by: TRJ	Scale: Schematic only	Source:
Proj Man: SB	Date: 14 Mar. 2008	Figure 2

Site Plan - Lot 179, Forest Road, Orange



Key:

- Hand Auger hole locations
- Test pit locations

ENVIRONMENTAL EARTH SCIENCES THE KNOW AND THE HOW	Title: Site Characteristics & Sampling Locations	
	Location: Lot 179, Forest Road, Orange, NSW	
Client: Dept. Primary Industry		Job number: 408015
Drawn by: TRJ	Scale: Unknown	Source:
Proj Man: SB	Date: 14 Mar. 2008	Figure 3

APPENDIX A BOREHOLE LOGS

REPORT OF ANALYSIS

Client	: Environmental & Earth Sciences (NSW)	Job No.	: ENVI10/080408
	The Coal Loader Balls Head Road	Quote No.	: QT-00043
	Waverton NSW 2060	Order No.	:
		Date Sampled	:
		Date Received	: 8-APR-2008
Attention	: STUART BRISBANE	Sampled By	: CLIENT
Project Name	:		
Your Client Services Manager	: BRIAN WOODWARD	Phone	: (02) 94490151

Lab Reg No.	Sample Ref	Sample Description
N08/011464	TP4	SOIL DPI-ORANGE JOB 408015 (0.0-0.1)
N08/011465	TP5	SOIL DPI-ORANGE JOB 408015 (0.0-0.1)
N08/011466	T8	SOIL DPI-ORANGE JOB 408015 (0.0-0.1)
N08/011467	T9	SOIL DPI-ORANGE JOB 408015 (0.0-0.1)

Lab Reg No.		N08/011464	N08/011465	N08/011466	N08/011467	
Sample Reference	Units	TP4	TP5	T8	T9	Method
Organochlorine (OC) Pesticides						
HCB	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
Heptachlor	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
Heptachlor epoxide	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
Aldrin	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
gamma-BHC (Lindane)	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
alpha-BHC	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
beta-BHC	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
delta-BHC	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
trans-Chlordane	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
cis-Chlordane	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
Oxychlordane	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
Dieldrin	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
pp-DDE	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
pp-DDD	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
pp-DDT	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
Endrin	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
Endrin Aldehyde	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
Endrin Ketone	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
alpha-Endosulfan	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
beta-Endosulfan	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
Endosulfan Sulfate	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
Methoxychlor	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	NR_19
Organophosphate (OP) Pesticides						
Dichlorvos	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	NR_19
Demeton-S-Methyl	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	NR_19
Diazinon	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	NR_19
Dimethoate	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	NR_19
Chlorpyrifos	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	NR_19

REPORT OF ANALYSIS

Report No. RN673989

Lab Reg No.		N08/011464	N08/011465	N08/011466	N08/011467	
Sample Reference	Units	TP4	TP5	T8	T9	Method
Organophosphate (OP) Pesticides						
Chlorpyrifos Methyl	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	NR_19
Malathion	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	NR_19
Fenthion	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	NR_19
Ethion	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	NR_19
Fenitrothion	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	NR_19
Chlorfenvinphos (E)	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	NR_19
Chlorfenvinphos (Z)	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	NR_19
Parathion (Ethyl)	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	NR_19
Parathion Methyl	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	NR_19
Pirimiphos Methyl	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	NR_19
Pirimiphos Ethyl	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	NR_19
Azinphos Methyl	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	NR_19
Azinphos Ethyl	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	NR_19
Surrogate						
Surrogate OC Rec.	%	124	130	128	112	NR_19
Surrogate OP Rec.	%	108	112	113	111	NR_19
Dates						
Date extracted		9-APR-2008	9-APR-2008	9-APR-2008	9-APR-2008	
Date analysed		10-APR-2008	10-APR-2008	10-APR-2008	10-APR-2008	

Luke Baker, Analyst
Organics - NSW
Accreditation No. 198

16-APR-2008

Lab Reg No.		N08/011464	N08/011465	N08/011466	N08/011467	
Sample Reference	Units	TP4	TP5	T8	T9	Method
Trace Elements						
Total Solids	%	83.2	85.3	84.7	85.5	NT2_49

Michael Wu, Analyst
Inorganics - NSW
Accreditation No. 198

16-APR-2008

REPORT OF ANALYSIS

All results are expressed on a dry weight basis.

This Report supersedes reports: RN673350 RN673912

APPENDIX B LABORATORY TRANSCRIPTS AND CHAIN OF CUSTODY FORMS

SYDNEY
ANALYTICAL
LABORATORIES

Office:
PO BOX 48
ERMINGTON NSW 2115

Laboratory:
1/4 ABBOTT ROAD
SEVEN HILLS NSW 2147
Telephone: (02) 9838 8903
Fax: (02) 9838 8919
A.C.N. 003 614 695
A.B.N. 81 829 182 852
NATA No: 1884

ANALYTICAL REPORT for:

ENVIRONMENTAL & EARTH SCIENCES

PO BOX 380
NORTH SYDNEY 2059

ATTN: STUART BRISBANE

JOB NO:	SAL20512
CLIENT ORDER:	408015
DATE RECEIVED:	09/04/08
DATE COMPLETED:	29/04/08
TYPE OF SAMPLES:	SOILS
NO OF SAMPLES:	23

.....
Issued on 07/05/08
Lance Smith
(Chief Chemist)

SYDNEY ANALYTICAL LABORATORIES

ANALYTICAL REPORT

JOB NO: SAL20512
CLIENT ORDER: 408015

	SAMPLES	Cu mg/kg	Pb mg/kg	Zn mg/kg	Cd mg/kg	Cr mg/kg
1	TP2/0-0.1	8.0	8.0	29	<0.5	46
2	TP3/0-0.1	13	22	48	<0.5	66
3	TP3/0.4-0.8	15	12	31	<0.5	72
4	TP5/0-0.1	9.0	12	26	<0.5	54
5	TP7/0-0.1	8.0	10	27	<0.5	48
6	TP8/0-0.1	8.0	8.0	39	<0.5	89
7	TP8/0.4-0.8	18	9.0	49	<0.5	145
8	TP9/0-0.1	14	11	39	<0.5	130
9	TP12/0-0.1	26	28	79	<0.5	125
10	TP13/0-0.15	28	34	53	<0.5	90
11	TP13/0.8-1.0	27	39	50	<0.5	95
12	TP14/0-0.1	31	62	90	<0.5	92
13	TP15/0-0.1	31	52	40	<0.5	73
14	TP15/0.3-0.5	19	60	31	<0.5	48
15	TP16/0-0.1	8.0	69	49	<0.5	370
16	TP17/0-0.1	4.0	47	45	<0.5	510
17	TP17/0.1-0.2	13	40	33	<0.5	420
18	TP18/0-0.1	29	100	300	<0.5	77
19	TP19/0-0.1	7.0	25	50	<0.5	68
20	HA/0-0.2	65	380	590	<0.5	64
21	HA2/0-0.1	2.0	16	25	<0.5	220
22	DUP/1	12	16	36	<0.5	50
23	DUP/2	62	390	575	<0.5	62
	BLANK	<0.5	<0.5	<0.5	<0.5	<0.5
DUPLICATES:						
15	TP16/0-0.1	9.5	65	50	<0.5	385
	BCSS-1	18	21	120	<0.5	90
MDL		0.5	0.5	0.5	0.5	0.5
Method Code		M1	M1	M1	M1	M1
Preparation		P3	P3	P3	P3	P3

SYDNEY ANALYTICAL LABORATORIES

ANALYTICAL REPORT

JOB NO: SAL20512
CLIENT ORDER: 408015

	SAMPLES	Ni mg/kg	As mg/kg	Hg mg/kg
1	TP2/0-0.1	8.0	3.0	0.025
2	TP3/0-0.1	10	3.5	0.035
3	TP3/0.4-0.8	15	3.0	0.020
4	TP5/0-0.1	6.0	3.0	0.025
5	TP7/0-0.1	5.0	3.0	0.020
6	TP8/0-0.1	13	4.0	0.030
7	TP8/0.4-0.8	26	4.0	0.025
8	TP9/0-0.1	12	4.0	0.025
9	TP12/0-0.1	16	4.5	0.090
10	TP13/0-0.15	10	5.0	0.090
11	TP13/0.8-1.0	9.0	4.5	0.10
12	TP14/0-0.1	11	5.0	0.16
13	TP15/0-0.1	14	4.0	0.14
14	TP15/0.3-0.5	5.0	3.5	0.055
15	TP16/0-0.1	125	4.5	0.20
16	TP17/0-0.1	145	4.0	0.27
17	TP17/0.1-0.2	160	3.5	0.17
18	TP18/0-0.1	22	6.0	0.045
19	TP19/0-0.1	6.0	3.0	0.020
20	HA/0-0.2	16	7.0	0.060
21	HA2/0-0.1	190	3.0	0.21
22	DUP/1	8.0	3.0	0.025
23	DUP/2	18	7.5	0.055
	BLANK	<0.5	<0.5	<0.005
DUPLICATES:				
15	TP16/0-0.1	125	4.5	0.20
	BCSS-1	54	13	0.12
MDL		0.5	0.5	0.005
Method Code		M1	M7	M3
Preparation		P3	P3	P1

RESULTS ON DRY BASIS

SYDNEY ANALYTICAL LABORATORIES

LABORATORY DUPLICATE REPORT

JOB NO: SAL20512
CLIENT ORDER: 408015

Sample Number	Analyte	Units	MDL	Sample Result	Duplicate Result	%RPD
TP16/0-0.1	Copper	mg/kg	0.5	8.0	9.5	17
TP16/0-0.1	Lead	mg/kg	0.5	69	65	6
TP16/0-0.1	Zinc	mg/kg	0.5	49	50	2
TP16/0-0.1	Cadmium	mg/kg	0.5	<0.5	<0.5	0
TP16/0-0.1	Chromium	mg/kg	0.5	370	385	4
TP16/0-0.1	Nickel	mg/kg	0.5	125	125	0
TP16/0-0.1	Arsenic	mg/kg	0.5	4.5	4.5	0
TP16/0-0.1	Mercury	mg/kg	0.005	0.20	0.20	0

Acceptance criteria:

RPD <50% for low level (<20xMDL)
RPD <30% for medium level (20-100xMDL)
RPD <15% for high level (>100xMDL)
No limit applies at <2xMDL

MDL = Method Detection Limit

All results are within the acceptance criteria

SYDNEY ANALYTICAL LABORATORIES

CERTIFIED REFERENCE MATERIAL

JOB NO: SAL20512
CLIENT ORDER: 408015

CRM Number	Analyte	Units	CRM Result	Certified Value	%Recovery	Acceptance Criteria %
BCSS-1	Copper	mg/kg	18	18.5	97	90-115
BCSS-1	Lead	mg/kg	21	22.7	93	90-110
BCSS-1	Zinc	mg/kg	120	119	101	90-110
BCSS-1	Cadmium	mg/kg	<0.5	0.25	-	-
BCSS-1	Chromium	mg/kg	90	123	73	60-80
BCSS-1	Nickel	mg/kg	54	55.3	98	90-110
BCSS-1	Arsenic	mg/kg	13	11.1	117	90-120
BCSS-1	Mercury	mg/kg	0.12	0.129	93	85-110

All results are within the acceptance criteria

Note: The hot acid digest does not always determine 'total' metals. Refractory elements such as Iron and Aluminium and some base metals (particularly Chromium) show lower recoveries depending on their form within the sample matrix. Silicates and oxides are normally less soluble than elements in metallic or salt forms. The acceptance criteria for this reference material is based on histories of analyte recoveries using the nitric acid based digestion procedures.

ANALYTICAL REPORT

JOB NO: SAL20512
CLIENT ORDER: 408015

METHODS OF PREPARATION AND ANALYSIS

The tests contained in this report have been carried out on the samples as received by the laboratory.

P3	Sample dried, jaw crushed and sieved at 1mm
P1	Analysis performed on sample as received
M1	Base Metal - Digestion Method 3050 (HNO_3/H_2O_2) Element determined by APHA 3111B (Flame AAS)
M7	Hydride Element - Digestion Method 7061 (HNO_3/H_2SO_4) Element determined by APHA 3114B (Hydride Generation AAS)
M3	Mercury - Digestion Method 7471 (HNO_3/HCl) Determined by APHA 3112B (Cold Vapour AAS)

A preliminary report was faxed on 29/04/08

APPENDIX C QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES