DEFENCE HOUSING AUTHORITY

PROPOSED RESIDENTIAL DEVELOPMENT

LOT 101 DP1037972, BRUNKER ROAD ADAMSTOWN NSW

CONTAMINATION ASSESSMENT

N07998/01-AH

12 June 2002

N07998/01-AH AJC:
12 June 2002

Defence Housing Authority
26 Brisbane Avenue
BARTON ACT 2600

Attention: Irena Sharp

Dear Madam,

RE: LOT 101 DP 1037972, BRUNKER ROAD ADAMSTOWN NSW–
CONTAMINATION ASSESSMENT

Please find enclosed our report on a contamination assessment at the above site. The report should be read in conjunction with the attached sheet, Important Information About Your Coffey Report.

The report concludes that limited PAH contamination is present at the site. This contamination appears to be confined to surface soils, and is not considered to be at concentrations or quantities that would preclude future residential development.

It is recommended that validation testing be undertaken beneath bitumen areas after stripping during redevelopment of the site. The purpose of the validation testing would be to confirm that PAH compounds have not leached into underlying soils.

If you have any questions regarding this matter, please contact Mr Arthur Love or the undersigned.

For and on behalf of

COFFEY GEOSCIENCES PTY LTD

STEVE MORTON

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TABLE OF CONTENTS

1. INTRODUCTION **1**

2. SITE DESCRIPTION & HISTORY **1**

2.1 Site Location and Land Use **1**

2.2 Previous Report **2**

2.3 Site History **2**

2.3.1 Available Information 2

2.3.2 Validity of Information 2

2.4 Site Topography and Description **2**

2.5 Geology and Hydrogeology **3**

3. AREAS AND CHEMICALS OF CONCERN **3**

4. FIELD WORK **4**

5. ENVIRONMENTAL LABORATORY TESTING **4**

5.1 Sample Selection and Analysis Suite **4**

5.2 Quality Control **5**

5.3 Guidelines and Acceptance **5**

5.4 Results **5**

6. DISCUSSION AND RECOMMENDATIONS **6**

6.1 Limitations of Contamination Assessment **6**

6.2 General **6**

6.3 Residential Redevelopment **7**

6.4 Flora & Fauna Survey **7**

Important Information About Your Coffey Report

TABLE OF CONTENTS (CONT.)

APPENDICES

A Site History

B Results of Field Investigation

C Laboratory Test Results

D Flora and Fauna Study

DRAWINGS

N07998/01-1 Site Locality Plan (A4)

N07998/01-2 Borehole Location Plan (A3)

Copy of Survey Plan Produced by Asquith & DeWitt Pty Ltd (A0)

1. INTRODUCTION

This report presents the results of a contamination assessment carried out by Coffey Geosciences Pty Ltd (Coffey) at former Army land located off Brunker Road, Adamstown NSW. The work was commissioned by Irena Sharp on behalf of the Defence Housing Authority (DHA) by letter dated 27 March 2002, in response to Coffey Proposal N07998/01-AD of 12 September 2001.

A contamination assessment was previously carried out for the site by others. A copy of this report was provided by DHA.

It is understood that the site is to be redeveloped as residential land, and that the work is required to assess the suitability of the site for such development in terms of potential contamination.

The purpose of the work was to assess the presence of contamination by sampling and analysis, and to assess whether any such contamination would be significant enough to impact on redevelopment of the land for residential use.

The assessment was based on the following:

- Review of historical land titles information
- Review of a previous report prepared on the site.
- Walkover assessment of the site by a Coffey Environmental Engineer.
- Sampling and analysis of soils across the site.

A dated survey plan was provided by DHA. At the request of DHA, Coffey commissioned Asquith and DeWitt, consulting surveyors, to produce a current survey plan of the site.

Coffey also commissioned Wild Thing Pty Ltd, consulting ecologists, to conduct a flora and fauna survey of the site at the request of DHA.

2. SITE DESCRIPTION & HISTORY

2.1 Site Location and Land Use

The site is identified as Lot 101 DP 1037972, 321 Brunker Road, Adamstown NSW and is located on the eastern side of Brunker Road as shown on Drawing No. N07998/01-1.

Land titles information indicates that the site was transferred from Department of Defence to the Defence Housing Authority on 27 March 2002.

The site is presently zoned by Newcastle City Council as 2(a) Residential. A 6m wide electricity easement (containing above and below ground power lines) runs east – west across the site to the nearby Energy Australia Adamstown Sub-Station.

The site is bound by Brunker Road to the west, operational Army land to the south, Merewether Golf Course and residential land to the east and St Columba's Catholic Primary School to the north. The site is roughly rectangular in plan and occupies an area of approximately 5.25 hectares.

Regionally, the site is in an area of residential, recreational and commercial land. At the time of this assessment, the site was vacant and unused.

2.2 Previous Report

A site contamination assessment was undertaken by Gutteridge Haskins & Davey Pty Ltd (GHD) on behalf of Department of Defence (Document Number 14125, October 1997) as part of a rezoning application to Newcastle City Council.

This contamination assessment involved collection of samples at 49 locations (43 test pits and 6 hand augered boreholes). Samples were tested for a broad range of common organic and inorganic contaminants.

The report indicated that the 95% upper confidence limit of all analytes tested for were below adopted guideline criteria for residential development. It was recommended that a hydraulic hoist present in the former workshop area be removed. The report concluded that the site would be suitable for residential development from an environmental and human health perspective after removal of the hydraulic hoist.

No further investigations were considered necessary.

2.3 Site History

2.3.1 Available Information

A site history study was undertaken as part of the GHD contamination assessment. A summary of that site history information is presented below.

According to the GHD report, the site was acquired by the Commonwealth in 1911 for defence purposes. Titles information obtained by Coffey indicate that this acquisition occurred in 1913.

Shooting targets were located south of the site, however 900, 800 and possibly 700 yard targets were located on the site. Use of the rifle range ceased during the 1960's.

The northern portion of the site was developed during the late 1930's and during World War II. This development is understood to include timber storage huts, vehicle garages and a vehicle workshop. Since WWII, this area has been used to accommodate various Army Reserve units.

This usage remained largely unchanged until 1995 / 1996 when the Army Reserve vacated the site. The buildings in the northwestern corner were demolished in 1996.

Married quarters were developed in the southwestern corner of the site in the 1950's. These quarters were still present at the time of the 1997 GHD investigation, however they had been demolished at the time of the current investigation.

According to the GHD report, there have been no bulk fuel storage facilities (including underground tanks) at the site, with vehicle refuelling occurring off-site. Further, wastes from offices and workshops were understood to be disposed off site.

2.3.2 Validity of Information

The GHD report was the source of most of the site history information presented above. GHD obtained site history information from Department of Defence documentation, interviews with the Department of Defence site manager, land titles information and NSW EPA records. Coffey conducted additional interviews with long term site personnel, who confirmed the history presented by GHD as being correct to the extent known.

The accuracy the information obtained by GHD is considered sufficient for inclusion in this report.

2.4 Site Topography and Description

Topographically, the site is situated on the lower eastern facing slopes of a minor hillside in an area of gently undulating terrain. Topographic relief on the site varies from about RL 30m AHD in the northwestern corner of

the site to about RL 16.5m AHD near the eastern boundary. The site flattens out toward the eastern boundary.

Some minor filling has occurred at the site, primarily in the northwestern corner, to create level areas for building construction. Fill was encountered to a maximum depth of approximately 0.8m. Much of the fill is judged to have been won from on-site cuts, with some limited importation of gravelly road base material.

The site is vacant and contains no standing dwellings, although a large number of concrete slabs associated with former buildings and pavements are present in the northwestern corner of the site.

The hydraulic lift in the former workshop area (identified as requiring remediation in the GHD report) appeared to have been removed at the time of this investigation.

The site is predominantly cleared, with vegetation consisting of short grasses with some scattered mature trees. A dense cluster of trees is present in the northeastern corner of the site.

There was no obvious evidence of contamination at the time of fieldwork, for example visibly stained areas, oil sheens, vegetation dieback or hydrocarbon odours.

These was no evidence of the former rifle range targets observed during fieldwork.

Drainage of the site is expected to occur primarily by runoff towards the east. The lower lying eastern part of the site was quite boggy at the time of fieldwork. Extensive seepage was observed over the full length of the lower half of the hillside.

2.5 Geology and Hydrogeology

Reference to the BHP Newcastle Coalfields Surface Geology Map indicates the site to be underlain by the Bar Beach Formation of the Newcastle Coal Measures, typically consisting of conglomerate, sandstone, siltstone, claystone and tuff. The Bar Beach Formation may be overlain by shallow alluvium at the lower lying parts of the site.

Natural soils were encountered at all 55 sampling locations, and generally consisted of clayey topsoil and residual sandy clays. Weathered sandstone causing drill rig refusal was encountered in 13 boreholes, at depths between 0.4m and 1.8m. Slopewash / alluvial soils were encountered in several boreholes at the (lower lying) eastern end of the site. Some minor filling associated with past site developments was encountered.

Seepages were encountered in several boreholes in the lower lying areas of the site where there was ponded surface water or boggy ground. Groundwater inflows were not encountered in other boreholes.

The groundwater encountered is likely to be a localised water table perched over relatively impermeable residual clays rather than a regional aquifer, although seepage on the lower half of the hillside indicates the presence of a water carrying bed in the rock profile in this area.

Based on activities at the site, contamination (if present) was expected to be generally confined to surface soils. A detailed groundwater assessment was therefore not considered necessary for the site.

3. AREAS AND CHEMICALS OF CONCERN

Based on the site history and observations made during the walkover assessment, it was considered that potential existed for contamination to be present in soils across the site due to possible random spillage or surface spraying. No areas of specific contamination (e.g. underground fuel storage tanks, areas containing unexploded ordinance etc.) were identified. Therefore, it was concluded that the assessment should address the site as a whole, with testing to be undertaken for a broad suite of common contaminants.

The following suite of Chemicals of Concern was therefore adopted to cover a broad range of common contaminants:

- Heavy metals – copper, lead, zinc, cadmium, chromium, nickel, arsenic, and mercury – from general industrial use, slag or imported fill.
- Polycyclic Aromatic Hydrocarbons (PAH) – from oils, greases, tar and ash products.
- Total Petroleum Hydrocarbons (TPH) – from fuel, oil, solvents etc.
- Benzene, Toluene, Ethyl Benzene & Xylene (BTEX) – from fuels & oils.
- Organochlorine Pesticides (OCP) – from spraying for pest control, treatment of timber structures etc.

4. FIELD WORK

Due to the absence of specific areas of concern for targeted sampling, a systematic grid was considered appropriate for the site. In accordance with NSW EPA Guidelines (Reference 1) for a site of approximately 5ha, 55 sampling points are required for a systematic grid-sampling pattern. Such a sampling pattern provides a 95% confidence level of detecting a "hot-spot" of contamination of about 35m diameter.

Fieldwork was carried out on 6th – 10th March 2002, and consisted of the drilling, logging and sampling of 55 boreholes in a grid across the site. Boreholes were drilled to a maximum depth of 2m.

The majority of the boreholes (43 no.) were drilled using a trailer mounted drilling rig equipped with solid flight augers. Twelve boreholes were drilled using a hand auger, at locations where boggy surface soils prevented drill rig access.

Boreholes were located by measurement relative to existing site features and boundaries. The approximate locations of the boreholes are shown on Drawing No. N07998/01-2.

Samples from the drill rig boreholes were obtained using a standard penetration test (SPT) split tube sampler. Samples obtained from the hand augered boreholes were obtained using a stainless steel push tube sampler. All sampling equipment was decontaminated between sample locations using Decon-90 detergent and a final rinse with potable water.

Samples were sealed in glass jars with screw on lids. The samples were placed in eskies on ice immediately after sampling, and retained on ice while on site and during transit to the testing laboratory.

Sampling was undertaken by Mr Stewart McMaster, a Coffey Engineer familiar with environmental sampling protocols, who located the boreholes, nominated sampling intervals and produced engineering logs of the boreholes. The engineering logs of the boreholes are presented in Appendix B, together with explanation sheets defining the terms and symbols used in their preparation.

5. ENVIRONMENTAL LABORATORY TESTING

5.1 Sample Selection and Analysis Suite

Samples were returned to Coffey's Newcastle Laboratory and placed in refrigerated storage. Selected samples were couriered, under Chain of Custody Conditions, to Gribbles Analytical Laboratory (Gribbles), a specialist NATA registered chemical testing laboratory.

Selected samples were tested for the suite of common contaminants detailed in Section 3 as summarised in Table 1.

TABLE 1 – SUMMARY OF LABORATORY TESTING

Analyte	No. Samples Tested
TPH	35
PAH	31
BTEX	26
Heavy Metals	37
OCP	27

5.2 Quality Control

Samples were transported to Gribbles on ice under Chain of Custody conditions.

Five field duplicate samples were taken for quality control purposes. Comparison between the results of analyses on primary and duplicate soil samples is presented in Table 2.

As shown in Table 2, the samples show good general correlation considering the low concentrations involved, although some discrepancy was noted in copper, lead and zinc concentrations in Samples 25 and 250.

In addition to field quality control, the laboratory conducted internal quality control using laboratory duplicates, spikes and method blanks. The results are shown with laboratory report sheets in Appendix C. Analytical methods used for the laboratory testing are also indicated on the laboratory report sheets. The results of laboratory quality control testing are considered to be within acceptable limits.

Evaluation of internal and laboratory QA/QC is presented in Appendix C.

On the basis of the field and laboratory quality control results discussed above, the field and laboratory methods are considered appropriate, and the data obtained is considered to reasonably represent the concentrations at the sampling points at the time of sampling.

5.3 Guidelines and Acceptance

For evaluation of soil contamination, reference was made to the criteria presented in NEPM-1999 (Reference 2). These criteria present ecological and health based investigation levels for a broad range of contaminants in soil. Reference has also been made to health based soil investigation levels presented in NSW EPA "Guidelines for the Site Auditor Scheme" (Reference 3), which offers several sets of guideline values based upon intended site usage. Health based guideline values applying to residential sites were adopted for this assessment, based on the proposed future residential development of the site.

Petroleum hydrocarbon concentrations were assessed using the NSW EPA "Guidelines for Assessing Service Station Sites" (Reference 4) criteria of 1000mg/kg, recommended for sensitive sites, e.g. residential land use.

5.4 Results

The results of the soil testing are summarised and compared to guideline criteria in Table 3.

From Table 3, the following points are noted:

- All detection limits were below guideline values
- Short chain (C_6 – C_9) hydrocarbons were below detection limit for all samples tested.

- Long chain (C_{10} – C_{36}) hydrocarbons exceeded adopted health based guidelines at 1 sample location of 35 tested. The 95% upper confidence limit of the arithmetic mean (95% UCL) for TPH concentrations was below the adopted guideline level.
- Arsenic concentrations exceeded adopted health based guidelines at 1 sample location of 37 tested. The 95% UCL for arsenic was below the adopted guideline level.
- Cadmium, chromium, copper, lead, nickel, zinc and mercury concentrations were below adopted health based guidelines at all sample locations tested.
- The 95% UCL for all heavy metals except cadmium were below adopted environmental guidelines.
- BTEX concentrations were below detection limits at all 26 sample locations tested.
- Total PAH concentrations exceeded health based guideline levels at 3 sample locations of 31 tested. Benzo-a-pyrene concentrations also exceeded guideline values for these 3 samples.
- OCP concentrations were below detection limits for all 27 samples tested.

6. DISCUSSION AND RECOMMENDATIONS

6.1 Limitations of Contamination Assessment

The findings of this assessment are the result of discrete and specific sampling methodologies, sampling from systematically predetermined locations within the soil profile. Whilst it is considered that the results obtained are likely to be representative of conditions on the site, the existence of undetected contamination between sampling locations cannot be precluded. If any obvious evidence of contamination is encountered during construction (oily sheens, odours, unexploded ordinance etc.) is encountered during redevelopment of the site, further advice should be sought without delay.

6.2 General

No evidence of past potentially contaminating activities on the site was discovered, other than limited importation of fill, use of the site as a rifle range and general workshop activities.

TPH concentrations marginally exceeding the guideline concentration were encountered at one surface sample location. The 95% UCL for TPH concentrations across the site was well below the guideline value, and therefore TPH contamination is not considered significant in terms of future redevelopment.

Elevated PAH concentrations (including benzo-a-pyrene) were encountered in surface samples from three borehole locations (BH19, BH33 & BH34). The ratio of total PAH to benzo-a-pyrene is similar for each of these samples (approximately 20:1), suggesting that the PAH's may be from the same source. Each of these samples was collected from areas with an adjacent surface bitumen seal, and it is likely that these PAH concentrations are associated with the bitumen seal. Coal tar based bitumen was commonly used in the Newcastle area in the past, although there is insufficient information to assess whether the bitumen at this site is coal tar or petroleum based. PAH compounds may leach from coal-tar based bitumen.

A deeper sample from BH34 (0.5-0.8m) revealed PAH compounds to be below detection limits. It is therefore considered unlikely that significant leaching of PAH compounds has occurred, however this should be confirmed by validation testing during construction.

The GHD report recommended that the hydraulic hoist in the former workshop area be excavated and removed from the site. The hoist appeared to have been removed at the time of this investigation.

6.3 Environment

The 95% UCL for all analytes tested was below the environmental investigation level (where a guideline value was presented) with the exception of chromium.

Chromium occurs in two oxidation states, chromium(III) and chromium(VI). Chromium(VI) is unstable and will readily oxidize to form the more stable Chromium(III). High concentrations of Chromium(VI) are not common and are usually only associated with recent spills of liquid chromium that may be found at chromium plating plants. It is therefore considered unlikely that any chromium found at the site is chromium(VI).

The EIL for chromium(VI) is 1mg/kg, whilst the EIL for chromium(III) is 400mg/kg. Adopting the EIL for chromium(III) results in all samples having a chromium concentration below the guideline value.

Therefore, contamination at the site is not considered to present a risk of adverse environmental impacts.

6.4 Residential Redevelopment

Based on the results of this investigation, the site is considered to be generally suitable for residential development in terms of contamination.

It is recommended that validation testing be undertaken after stripping of the bitumen roads during redevelopment of the site. The purpose of the validation testing would be to confirm that PAH compounds have not leached into underlying soils.

6.5 Flora & Fauna Survey

Coffey commissioned Wild Thing Pty Ltd, specialist ecological consultants, to conduct a flora and fauna survey of the site.

A copy of the flora and fauna survey is presented in Appendix D.

For and on behalf of

COFFEY GEOSCIENCES PTY LTD

STEVE MORTON

REFERENCES

1. NSW Environment Protection Authority, Contaminated Sites Sampling Design Guidelines, September 1995.
2. National Environment Protection (Assessment of Site Contamination Measure), Guideline on Investigation Levels for Soil and Groundwater, December 1999.
3. NSW Environment Protection Authority, Guidelines for the NSW Site Auditor Scheme, June 1998.
4. NSW Environment Protection Authority, Guidelines for Assessing Service Station Sites, December 1994.

TABLE 2 – COMPARISON BETWEEN PRIMARY AND DUPLICATE SAMPLES (all results in mg/kg)

Analyte	Primary BH22 0-0.2m	Duplicate BH222 0-0.2m	Primary BH25 0-0.2m	Duplicate BH250 0-0.2m	Primary BH42 0.5-0.9m	Duplicate BH420 0.5-0.9m	Primary BH14 0.1-0.3m	Duplicate BH144 0.1-0.3m	Primary BH38 0-0.2m	Duplicate BH380 0-0.2m
Arsenic (As)	3.4	2.6	3.9	3.4	7.2	3.2	-	-	4.4	8.4
Cadmium (Cd)	<1	<1	<1	<1	<1	<1	-	-	<1	<1
Chromium (Cr)	4.3	4.5	12	12	40	22	-	-	30	11
Copper (Cu)	42	40	2.1	28	<2	<2	-	-	<2	18
Lead (Pb)	81	80	11	59	16	9	-	-	16	36
Nickel (Ni)	2.1	2.2	<2	3.9	2.3	<2	-	-	2.2	4.8
Zinc (Zn)	140	150	7.6	110	5.3	3.7	-	-	6.1	39
Mercury (Hg)	0.06	0.05	0.04	0.09	0.03	0.03	-	-	0.02	0.05
TPH – C_6 – C_9	<20	<20	<20	<20	-	-	<20	<20	<20	<20
TPH – C_{10} – C_{35}	<60	187	<60	74	-	-	<60	<20	108	172
Benzene	-	-	<0.1	<0.1	-	-	-		<0.1	<0.1
Toluene	-	-	<0.1	<0.1	-	-	-		<0.1	<0.1
Ethyl Benzene	-	-	<0.1	<0.1	-	-	-		<0.1	<0.1
Xylene	-	-	<0.1	<0.1	-	-	-		<0.1	<0.1
PAH (total)	-	-	<2	<2	-	-	<2	<2	<2	3
Benzo-a-Pyrene	-	-	<0.05	<0.05	-	-	<0.05	<0.05	<0.05	0.14
OCP (total)	<1.9	<1.9	<1.9	<1.9	-	-	<1.9	<1.9	<1.9	<1.9

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N07998/01-AH
12 June 2002

APPENDIX A

SITE HISTORY INFORMATION

N07998/01-AH
12 June 2002

APPENDIX B

RESULTS OF FIELD INVESTIGATION

APPENDIX C

LABORATORY TEST RESULTS

N07998/01-AH
12 June 2002

APPENDIX D

FLORA AND FAUNA STUDY