



19 March 2008

Hill Top Residents Action Group
c/o Pike Pike and Fenwick Solicitors
Level 3, 50 King Street
Sydney NSW 2000

Attention: **Julie Cook**

Dear Julie

Hill Top Shooting Complex – assessment of contamination issues

Environmental Earth Sciences VIC is pleased to present this advice on contamination issues as they relate to the existing, and proposed extension to, Hill Top Shooting Complex, Hill Top, NSW. In formulating this advice, information was referred to from those references cited in Section 7.0 of this document.

1.0 Executive summary

Environmental Earth Sciences VIC has assessed information relating to contamination issues associated with the existing and proposed extension development of the site as a shooting complex. This assessment included review of, and comment on, the appropriateness or otherwise of investigations undertaken on the site over 2006 and 2007.

A number of concerns have been raised relating to the level of assessment undertaken to date, in particular, a lack of compliance to the *Environmental assessment requirements under Part 3A of the Environmental Planning and Assessment Act 1979*, and lack of an in-depth, risk-based, scientifically justifiable, site-specific approach to assessment. As such, further assessment as a minimum is required.

It is Environmental Earth Sciences VIC opinion that the information currently existing, as relates to contamination issues associated with the current and proposed Hill Top shooting complex, is not adequate to allow consent to be granted for the development proposed.

2.0 Introduction

On 7 March 2008, Environmental Earth Sciences VIC was requested by Sonja Lyneham on behalf of Hill Top Residents Action Group Inc. to provide a proposed methodology for assessing information relating to contamination issues associated with the existing and proposed extension development of the site as a shooting complex. This assessment was to include review of, and comment on, the appropriateness or otherwise of investigations undertaken on the site over 2006 and 2007 (GHD 2006, 2007c and 2008). The proposed methodology was submitted on 10 March 2008 (via email), with Sonja Lyneham accepting this methodology and requesting that work proceed on 10 March 2008 (via email).



3.0 Objective and scope of works

The objective of this preliminary review is to utilise available information to provide an assessment of the proposal as it currently stands, in terms of contamination issues (current and future). The proposal is to be compared against the *Environmental assessment requirements under Part 3A of the Environmental Planning and Assessment Act 1979* (issued on 20 August 2007 by the Department of Planning).

This objective is to be achieved through the following scope of works:

- collate available relevant information relating to the site and surrounds, and to the environmental issues being considered (primarily the potential impact of lead on possible receptors and beneficial uses such as the environment and human health);
- consider this information against the *Environmental assessment requirements* and other relevant legislation, standards, guidelines and best management practices; and
- provide preliminary advice on the suitability (or otherwise) of the proposal in terms of contamination issues and their potential to adversely impact the surrounding environment and human health via potential exposure pathways.

4.0 Review of existing reports on contamination

Environmental Earth Sciences VIC has reviewed available documentation associated with contamination assessments (soil, sediment and water) at and about the site (GHD 2006, 2007c and 2008). By way of advice, we offer the following comments on this documentation.

4.1 Adequacy and appropriateness of methodology

The following comments are made on methodology of contamination assessment (soil, sediment and water):

- soil and sediment sampling density (spatially, laterally and to depth) does not comply with AS4482.1 (2005) or similar. It would be expected that sampling events occur at a number of different times across (immediately after) a range of climatic (and associated erosion and run-off) events. These should be undertaken at a number of different locations both on the existing range, between the range and the ephemeral tributaries, and at various distances down these tributaries and Rocky Waterholes Creek;
- 'background' locations were not assessed (e.g. Belway and Findlay 2001, Hamon *et al.* 2004);
- water sampling during run-off events in the ephemeral streams about the site has not been undertaken; and
- a risk-based approach has not been considered, including identification of potential receptors and receptor pathways (e.g. ANZECC/NHMRC 1992, enHealth 2002, Fernandez *et al.* 2006, FSANZ 2002, Mulvey and Elliot 2000, NHMRC 1991, Peddicord 1998, Swane 2007, Taylor and Langley 1998, US EPA 2007, 2004a and 2004b).

4.2 Adequacy and appropriateness of data-set

The following comments are made on the data-set developed for the contamination assessment (soil, sediment and water):

- the soil, sediment and water analytical suite does not include other chemicals of potential concern (CoPC) such as polycyclic aromatic hydrocarbons (PAHs) associated with coal tar pitch in clay pigeon targets;



- the analytical suite does not include additional soil data requirements to allow solubility and bioavailability assessment (such as clay content, soil mineralogy, soil phosphorous, iron and manganese content) (e.g. Fernandez *et al.* 2006, Hamon *et al.* 2004, Lindsay 1979, US EPA 2003b p19);
- leach testing has not considered methodologies to assess potential impacts on human health or plant ecology (particularly solubility and bioavailability) (e.g. Cook and Hendershot 1996, Davies 1990, Drever 1997, Halim *et al.* 2005, Hettiarachchi and Pierzynski 2004, McLaughlin *et al.* 2000, Rooney *et al.* 2007, Ruby *et al.* 1996, US EPA 2007, Yang *et al.* 2006); and
- lead (and other heavy metal) analysis did not consider concentrations in varying soil particle size ranges to assess ingestion potential (e.g. US EPA 2003a and 2003b).

4.3 Adequacy of impact assessment

The following comments are made on the adequacy of data assessment:

- soil and water results were compared against standard criteria for human health and ecology (NEPC 1999, ANZECC/ARMCANZ 2000 and NHMRC 2004). For assessment of potential impacts on ecology and human health from soil contamination in particular, a risk-based strategy should have been adopted with the aim of developing site-specific criteria that are more relevant to the exposure scenarios developed and potential receptors and beneficial uses identified. For example, the NEPC 1999 health-based investigation level (HIL) for lead (after Imray and Langley 1999, Langley *et al.* 1998 and Maynard 1991) are based on 1981 to 1989 data (after Maynard 1991), when much more recent and relevant data exists (e.g. FSANZ 2002, Swane 2007). Use of such data allows adjustment of the standard residential HIL criteria from 300 to 480 mg/kg;
- it is agreed that the potential for site impact on the regional aquifer is not significant, even though groundwater has not been sampled (but has been attempted to a depth of 50 metres); and
- it is also agreed that suspended solids have the potential to be resulting in 'false positives' for dissolved heavy metal analysis of surface waters. In light of this, future water analysis for dissolved metals should involve centrifugation and/or (serial) filtration through 0.1-0.22 µm paper prior to acid preservation and analysis.

4.4 Adequacy of proposed monitoring and mitigation measures

The following comments are made on the Soil and Water Management Plan (SWMP) (GHD 2007 and 2008):

- the most significant inadequacy of the SWMP is the lack of recommendation for further, more detailed, assessment of the potential for lead (in particular but not exclusively) impacts on potential receptors and beneficial uses (primarily the ecosystem including flora and fauna and human health);
- the above point is however likely to be addressed by the recommendation by GHD that a Site Audit Statement be prepared by a site auditor. Such undertaking is likely to result in a significant amount of additional assessment and monitoring works at the site and surrounds being required;
- establishment of sediment control ponds, and stormwater and wastewater management is considered appropriate from a contaminated sediment and water potential migration perspective (but may or may not comply with regional run-off requirements). Note, it is not considered that construction of ponds will increase potential for dissolved lead migration to groundwater, due primarily to the depth of the



underlying uppermost aquifer, and the expected high adsorption potential of near surface soils and the subsequent aquitard (due to soil physical and chemical factors such as pH, carbon, iron and clay content). Such factors should be considered as part of a detailed site assessment;

- range design measures to minimise erosion are considered sound in principle;
- recommendations on the application of soil amendments are sound in principle (also recommended in US EPA 2005 and 2003b); and
- long term environmental monitoring requirements are sound in principle, however will require extensive review (for example through additions to the proposed analytical suite, greater frequency of monitoring and undertaking of a more risk-based approach to assessment).

5.0 Recommendations and conclusions

A number of concerns remain as to the extent of assessment undertaken to date, relating particularly to:

- lack of compliance to the *Environmental assessment requirements under Part 3A of the Environmental Planning and Assessment Act 1979*; and
- lack of an in-depth, risk-based, scientifically justifiable, site-specific approach to assessment.

As such, further assessment as a minimum is required. This assessment should be risk-based and therefore follow the following steps:

- issue identification and engage stakeholders: the local community should be engaged at an early stage so as to ensure their concerns are addressed;
- exposure assessment: identify all potential exposure pathways (e.g. for human health via soil ingestion, dust inhalation, dermal absorption, and drinking water from Warragamba catchment) to all potential receptors and beneficial uses;
- hazard and dose response assessment: assess the potential for the identified CoPC that are exposed to potential receptors to be accessible and available to those receptors, and their potential toxicity to those receptors;
- risk characterisation: quantify the risks to the identified receptors based on exposure, toxicity, hazard and dose-response assessments; and
- manage the risk.

In conclusion, we believe that no reasonable person or consenting authority would approve the application without the additional data and analysis, and subsequent site- and region-specific risk-based assessment, recommended above.

It is Environmental Earth Sciences VIC considered opinion that the information currently existing (that has been reviewed in this advice and is listed in Section 6.0), as relates to contamination issues associated with the current and proposed Hill Top shooting complex, is not adequate to allow consent to be granted for the development proposed.



6.0 Limitations

This letter report has been prepared by Environmental Earth Sciences VIC ABN 109 404 024 in response to and subject to the following limitations:

1. The specific instructions received from Hill Top Residents Action Group Inc.;
2. The specific scope of works set out in PO208055 issued by Environmental Earth Sciences VIC for and on behalf of Hill Top Residents Action Group Inc., as included in Section 2.0 (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 (which consent may or may not be given at the discretion of Environmental Earth Sciences);
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 Hill Top Rifle Range, Hill Top, NSW (“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.

Should you have any further queries, please do not hesitate to contact us on (03) 9687 1666.

On behalf of

Environmental Earth Sciences VIC

Project Manager

Mark Stuckey

Principal Soil Scientist & Hydrogeologist

Project Director / Internal Reviewer

Tracey Bauer

Principal Geological Engineer

Technical Reviewer

Todd Mitchell

Senior Environmental Consultant

MELB JOBS 2008/208029/Report/208029 Final.doc



7.0 References

- 1 Australian & New Zealand Environment & Conservation Council (ANZECC)/ Agriculture & Resource Management Council of Australia & New Zealand (ARMCANZ) (2000) — *Australian and New Zealand guidelines for fresh and marine water quality*. National Water Quality Management Strategy.
- 2 ANZECC/ National Health and Medical Research Council (NHMRC) (1992) — *Australian and New Zealand guidelines for the assessment and management of contaminated sites*.
- 3 Belway, S and Findlay, E (2001) — *Site assessment, Union Mine Gun Range, El Dorado County, California*. Kleinfelder Inc report to El Dorado County.
- 4 Cook, N and Hendershot, W H (1996) — *The problem of establishing ecologically-based soil quality criteria: the case of lead*. *Can. J. Soil Sci* 76:335-342.
- 5 Davies, B E (1990) — *Lead*. In Alloway, B J (Ed.). *Heavy metals in soils*. John Wiley and Sons, Inc.
- 6 Department of Health & Ageing and enHealth Council (2002) — *Environmental Health Risk Assessment: Guidelines for assessing human health risks from environmental hazards*.
- 7 Drever, J I (1997) — *The geochemistry of natural waters*. Third Edition. Prentice Hall.
- 8 Fernandez, M D, Vega, M M and Tarazona, J V (2006) — *Risk-based ecological soil criteria for the characterization of contaminated soils. Combination of chemical and biological tools*. *Science of the Total Environment* (366): 466-484.
- 9 Food Standards Australia New Zealand (FSANZ) (2002) — *The 20th Australian total diet survey*.
- 10 GHD Pty Ltd (2006) — *Southern Highlands Regional Shooting Complex – Preliminary assessment*. Report to NSW Department of Arts, Sport and Recreation, August 2006.
- 11 GHD Pty Ltd (2007a) — *Southern Highlands Regional Shooting Complex – Addendum to preliminary assessment*. Report to NSW Department Planning, April 2007.
- 12 GHD Pty Ltd (2007b) — *Southern Highlands Regional Shooting Complex – Addendum No.2 to preliminary assessment*. Report to NSW Department Planning, August 2007.
- 13 GHD Pty Ltd (2007c) — *Southern Highlands Regional Shooting Complex – Water and contamination assessment*. Report to NSW Sport and Recreation, November 2007.
- 14 GHD Pty Ltd (2008) — *Southern Highlands Regional Shooting Complex – Environmental assessment*. Report to NSW Sport and Recreation, February 2008.
- 15 Halim, C E, Scott, J A, Amal, R, Short, S A, Beydoun, D and Cattle, J (2005) — *Evaluating the applicability of regulatory leaching tests for assessing the hazards of Pb-contaminated soils*. *Journal of Hazardous Materials B120*: 101-111.
- 16 Hettiarachchi, G M and Pierzynski, G M (2004) — *Soil lead bioavailability and in-situ remediation of lead-contaminated soils: a review*. *Environmental Progress Vol.23, No.1*.
- 17 Hamon, R E, McLaughlin, M J, Gilkes, R J, Rate, A W, Zarcinas, B, Robertson, A, Cozens, G, Radford, N and Bettenay, L (2004) — *Geochemical indices allow estimation of heavy metal background concentrations in soils*. *Global Biogeochemical Cycles, Vol 18, GB1014*.
- 18 Imray, P and Langley, A (1999) — *Health-based soil investigation levels*, National Environmental Health Forum Monographs, Soil Series No. 1, 3rd edition.



- 19 John, P C L (2003) — *Pollution hazards to humans, cattle and oysters from the proposed shooting complex at Mt. Dromedary*. Submission to the Commission of Inquiry into the Proposed Shooting Complex at Mount Dromedary.
- 20 John, P C L (2008) — *Hill Top environmental statement notes*. For Planning Workshop Australia.
- 21 Langley, A, Taylor, A and Dal Grande, E (1998) — *1996 Australian Exposure Factors*. In Langley, A, Imray, P, Lock, W and Hill, H (Eds). The health risk assessment and management of contaminated sites. SAHC, CSMS No. 7.
- 22 Lindsay, W L (1979) — *Chemical equilibria in soils*. John Wiley & Sons Inc.
- 23 Maynard, E J (1991) — *Setting response levels for lead (Pb)*. In El Saadi, O and Langley, A (Eds). The health risk assessment and management of contaminated sites. SAHC, CSMS No. 1.
- 24 McLaughlin, M J, Hamon, R E, McLaren, R E, Speir, T W and Rogers S L (2000) — *Review: A bioavailability-based rationale for controlling metal and metalloid contamination of agricultural land in Australia and New Zealand*. Australian Journal of Soil Research, 38, 1037-86.
- 25 Mulvey, P J and Elliott, G L (2000) — *Toxicities in soils*. In Charman, P E V and Murphy, B W (Eds), Soils: their properties and management. Second Edition. Oxford University Press.
- 26 National Environment Protection Council (NEPC) (1999) — *National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999*.
- 27 NHMRC (2004) — *Australian drinking water guidelines*. National Water Quality Management Strategy.
- 28 NHMRC (1991) — *Protocol for the Health Risk Assessment and Management of Contaminated sites*.
- 29 Peddicord, R K (1998) — *Testimony on oversight hearing on Tuscon Rod and Gun Club, Sabino Canyon Shooting Range*. US House of Representatives Subcommittee on Forests and Forest Health.
- 30 Rooney, C P, McLaren, R G and Condron, L M (2007) — *Control of solubility in soil contaminated with lead shot: effect of soil pH*. Environmental Pollution (2007) 1-9 (in press).
- 31 Ruby, M V, Davis, A, Schoof, R, Eberle, S and Sellstone, C M (1996) — *Estimation of lead and arsenic bioavailability using a physiologically based extraction test*. Environmental Science & Technology 30(2): 422-430.
- 32 Standards Australia AS 4482.1 (2005) — *Guide to the investigation and sampling of sites with potentially contaminated soil*. Part 1: Non-volatile and semi-volatile compounds.
- 33 Swane, I (2007) — *Investigation levels for residential land having substantial home-grown produce in Australia*. Presented at the Contamination Clean-up 07 Conference, Adelaide, June 2007.
- 34 Taylor, R and Langley, A (1998) — *Exposure scenarios and exposure settings*, National Environmental Health Forum Monographs, Soil Series No. 2, 2nd edition.
- 35 US Environmental Protection Agency (EPA) (2007) — *Framework for metals risk assessment*. March 2007.
- 36 US EPA (2005) — *Best management practices for lead at outdoor shooting ranges*. Region 2, revised June 2005.



- 37 US EPA (2004a) — *Integrated Risk Information System (IRIS)*. Available on the website: <http://www.epa.gov/iris/>. Information provided on specific chemical substances, Office of Research and Development, National Center for Environmental Assessment.
- 38 US EPA (2004b) — *User's guide and background technical document for USEPA Region 9's Preliminary Remediation Goals (PRG) Table*. October 2004.
- 39 US EPA (2003a) — *Technical Review Workshop recommendations for performing human health risk analysis on small arms shooting ranges*. Office of Solid Waste and Emergency Response, March 2003.
- 40 US EPA (2003b) — *Analysis of considerations for developing a methods applicability study, small arms firing range, Bluffton, South Carolina*. Prepared by Brownfields Technology Support Centre, US EPA Office of Solid Waste and Emergency Response.
- 41 Yang, J Y, Yang, X E, He, Z L, Li, T Q, Shentu, J L and Stoffella, P J (2006) — *Effects of pH, organic acids, and inorganic ions on lead desorption from soils*. Environmental Pollution 143:9-15.



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 be 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 VIC. 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 collected 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 VIC 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 VIC 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 VIC'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.