Douglas Partners
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Report on
Remediation Action Plan

Proposed Residential Development
51 St Andrews Road, Leppington

Prepared for
Cornish Group No.2 Pty Ltd

Project 76571.01
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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
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Table of Contents

Report on Remediation Action Plan
Proposed Residential Development
51 St Andrews Road, Leppington

1. Introduction

This report details of the Remediation Action Plan (RAP) for the former Foti Fireworks factory site located at 51 St Andrews Road, Leppington. The site covers an area of approximately 13 hectares and is referred to herein as "the site". This RAP was prepared by Douglas Partners Pty Ltd (DP) at the request of Mr Paul Parfenow of SMEC Urban Pty Ltd on behalf of Cornish Group No.2 Pty Ltd.

All remedial works within the Camden Council area, including the currently proposed works, are classified as Category 1 which requires Development Consent in accordance with State Environmental Planning Policy No 55 (SEPP55).

A Detailed Site Investigation (DSI) was carried out on the site by DP entitled *Report on Detailed Site Investigation, Proposed Residential Subdivision, Foti Fireworks Factory, 51 St Andrews Road, Leppington NSW*, Project 76571.00 dated 23 December 2013 (DP, 2013). The DSI identified three contamination issues within the site and Camden Council has specified that all remediation work requires a RAP.

The purpose of this RAP is to provide a strategy to render the site suitable for the proposed residential development. This is achieved by detailing a methodology to remediate and validate the contamination issues in an environmentally sound manner.

The three contamination issues that are present within the site comprise:

- Five areas that exceeded the ecological investigation levels (EIL) and/or ecological screening levels (ESL): The contaminants of concern within these areas are either total recoverable hydrocarbons (TRH), polycyclic aromatic hydrocarbons (PAH) or copper;
- PAH contaminated area: One detection of benzo (a) pyrene toxic equivalence quotient (TEQ) was observed at Pit 62 which exceeded the health screening level (HSL); and
- Asbestos pipe: An asbestos pipe was observed within the site.

2. Scope of Works

The scope of the RAP has been established on the basis of the findings of DP (2013) (refer to Section 3). The scope of the RAP is to:

- Establish an appropriate remedial strategy so as to render the Site suitable for the proposed use;
- Establish appropriate requirements for the validation and confirmation of the successful implementation of the remediation strategy, and the remediation acceptance criteria to be adopted for the validation of the remediation areas;

- Outline the requirements for the remediation works to be completed in an environmentally acceptable manner; and
- Outline the requirements for appropriate Work Health and Safety (WHS) procedures to be adopted for the remediation works so as not to pose a threat to the health of site workers or users.

3. Previous Investigation

DP (2013) comprised site history searches, site inspection, non-intrusive and intrusive site investigations, laboratory testing of selected samples, engineering analysis and reporting.

A review of historical aerial photographs, EPA public registers, title deeds, council records, a section 149 certificate and WorkCover searches was undertaken for the Site. The site history and site inspection indicated that the Site had primarily been vacant and used for agricultural purposes prior to being used for the manufacturing and storage of pyrotechnics.

Potential sources of contamination at the site were considered to be from the current landuse of manufacturing and storage of pyrotechnics, the storage of chemicals and flammables and shallow filling within roadways and stockpiles of unknown origin.

A total of 80 test pits were excavated as part of DP (2013). Filling was encountered in 17 locations to depths of between 0.1 m and 0.5 m below ground level (bgl). Soil stockpiles were located within the northern portion of the site. The filling, including the stockpiles, was underlain by natural silty clays. These soils were underlain in turn by siltstone bedrock.

A total of 80 soil samples were analysed for a combination of metals, TRH, benzene, toluene, ethybenzene and xylene (BTEX), PAH, organochlorine pesticides (OCP), organophorphorous pesticides (OPP), polychlorinated biphenyls (PCB), phenols and asbestos. Four intra-laboratory replicates and four inter-laboratory replicates were analysed, QA/QC samples were tested for metals and PAH.

All analyte concentrations in the analysed soil samples collected for the investigation were reported either below their respective laboratory limits of detection or below the site assessment criteria (SAC) with the exception of:

- Sample 49/0.1-0.2 which exceeded the EIL for copper.
- Samples 38/0.1-0.2, 40/0.1-0.2 and 41/0.1-0.2 which exceeded the ESL for BaP;
- Sample 62/0.1-0.2 which exceeded the ESL for BaP and HSL for BaP TEQ; and
- Sample 67/0.1-0.2 which exceeded the ESL for TRH >C_{10}-C_{16} less naphthalene (TRH F2).

All exceedances were within shallow filling, with the exception of 40/0.1-0.2 which was within topsoil.

One asbestos fragment was identified on the ground surface and one asbestos pipe section was observed. No other asbestos fragments were observed during the investigation.

All samples collected and tested from the stockpiles recorded analytical results below their respective laboratory limits of reporting and / or below the SAC. It was therefore considered that no further investigation was required for the stockpiles, however significant anthropogenic materials were to be removed and reused/recycled or disposed of to a licensed landfill.

Two surface water samples were collected from the two dams. All results were below their respective laboratory limits of reporting and / or below the SAC, with the exception of copper. Copper levels were elevated above the SAC, however, this was considered to reflect natural background concentrations for waters from the western Sydney region with a dominant shale geology. No significant elevated copper concentrations were detected in the soil.

As only minor soil contamination was detected, groundwater monitoring was not considered necessary on the site. It was further noted that the soils have a low hydraulic conductivity which would limit the potential transfer of contamination to the groundwater.

Based on the investigation findings, additional investigation was required within the following areas:

- Step out test pits at Pit 62 to determine the extent of BaP TEQ impacted soils; and
- Re-evaluation of the surface material in all areas of the site that exceeded the EIL or ESL prior to any reuse in landscaped areas of the proposed development.

Additionally, the following needed to be undertaken for the site to be considered suitable for the proposed land use:

- Removal and disposal of all chemicals, paints, oils and lubricants at the site; and
- Removal of the asbestos pipe and validation of the removal process to comply with NSW WorkCover Code of Practice for Removal of Asbestos.

As the required additional investigations and contamination issues are relatively minor in nature and all remedial works within the Camden Council area are classified as Category 1 (which requires Development Consent in accordance with State Environmental Planning Policy No 55 [SEPP55]), the additional investigation has been included within this RAP and will be undertaken as part of the remediation process.

4. Site Information

4.1 Site Identification and Description

The site is located at 51 St Andrews Road, Leppington (Lot 72 in Deposited Plan 706546) and was previously used for the production of fireworks. The site has an irregular shape and covers an area of approximately 13 ha. The site location and boundaries are shown on Drawing 1, Appendix B.

At the time of preparing this RAP the site was in the process of being decommissioned with all buildings vacated and no pyrotechnic production occurring. The northern portion of the site consisted of brick and corrugated iron buildings associated with the former production of pyrotechnics. Various shipping containers were located within the site, as well as other storage sheds. Access tracks (both sealed and unsealed) were located within the site.

The southern portion of the site was grass-covered in the west and tree covered in the south-east and a large shed formerly located along the southern boundary had been removed. Two dams were located within the site, one within the former fireworks manufacturing area and the second down-gradient within the southern portion of the site.

Fill mounds consisting of reworked natural material were observed in the northern portion of the site and anecdotal evidence indicates that the material was sourced from the construction of St Andrews Road.

4.2 Regional Geology, Soils and Hydrogeology

Reference to the Penrith 1:100 000 Geological Series Sheet indicates that the site is underlain by Bringelly Shale (mapping unit Rwb) of the Wianamatta Group of Triassic age. This formation typically comprises shale, carbonaceous claystone, laminite and some minor coaly bands which weather to form clays of high plasticity. The results of the investigation were consistent with the geological mapping, with siltstone encountered in the pits that intersected rock.

The Penrith 1:100,000 Soils Landscape Sheet indicates that the majority of the site is within the Blacktown soil landscape group (mapping unit bt), which is associated with residual soils with moderately reactive, highly plastic subsoil, low soil fertility and poor soil drainage.

The McNally, G. 2005, Investigation of Urban Salinity – Case Studies from Western Sydney, Urban Salt 2005 Conference Paper, Parramatta (McNally 2005) describes some general features of the hydrogeology of Western Sydney which are relevant to this site. The shale terrain of much of Western Sydney is known for saline groundwater, resulting either from the release of connate salt in shales of marine origin or from the accumulation of windblown sea salt. Seasonal groundwater level changes of 1 – 2 m can occur in a shallow regolith aquifer or a deeper shale aquifer due to natural influences.

Groundwater investigations undertaken by DP in the Camden area and previous studies of areas underlain by the Wianamatta Group and Quaternary river alluvium indicate that:

- the shales have a very low intrinsic permeability, hence groundwater flow is likely to be dominated by fracture flow with resultant low yields (typically < 1 L/s) in bores; and
- the groundwater in the Wianamatta Group is typically brackish to saline with total dissolved solids (TDS) in the range 4000 – 5000 mg/L (but with cases of TDS up to 31750 mg/L being reported). The dominant ions are typically sodium and chloride and the water is generally unsuitable for livestock or irrigation.

5. Remediation Issues

Three contamination issues have been identified within the Site as follows.

- Five areas that exceeded the EIL and/or ESL: The contaminants of concern in these areas were either TRH, B(a)P or copper.
- PAH contaminated area: One detection of BaP TEQ and BaP was observed at Pit 62 which exceeded the ESL and HSL.
- Asbestos Pipe: An asbestos pipe was observed within the site.

The following sections of this report assess the remediation goals and acceptance criteria, the extent of remediation, remediation options and the recommended remediation strategy for each contamination issue listed above.

6. Areas with Ecological (EIL and ESL) Exceedances

6.1 Introduction

The National Environment Protection Council (NEPC), National Environment Protection (Assessment of Site Contamination) Measure (NEPC, 2013) allows for statistical analysis to be undertaken on data sets with EIL and ESL exceedances. A review of the analytical results from DP (2013) along with a statistical anaylsis of the data set was undertaken as part of the preparation of this RAP. The 95% upper confidence limit (UCL) was calculated for B(a)P and is provided in Appendix C. The calculated 95% UCL for B(a)P (0.265 mg/kg) was found to be below the ESL guideline value (0.7 mg/kg). As the 95% UCL was below the ESL for residential sites, it is considered that the B(a)P concentrations recorded within TP38, TP40 and TP41 are suitable for the proposed residential site with no further investigation or remediation required.

Also the B(a)P ESL exceedances were located within areas with bitumen gravel. The higher levels of B(a)P could be associated with the bitumen gravel. Note 6 of Table 1A(1) in Schedule B1 of NEPM (2013) indicates that where B(a)P occurs in bitumen fragments it is relatively immobile and does not represent a significant health risk.

With regards to the copper exceedance at TP49, the concentration was greater than 2.5 times the EIL therefore statistical analysis cannot be undertaken and the copper contaminated soils will require further assessment or action.

Insufficient data was available for statistical analysis of the TRH F2 exceedance as the majority of the concentrations were below practical quantification limit (PQL). However, inspection of the results indicates that 83 samples recorded concentrations below the PQL, two samples recorded concentrations above the PQL but below the ESL and a single sample recorded a concentration of 130 mg/kg which is marginally above the ESL of 120 mg/kg. It is considered that this single localised minor exceedance will not have a significant on ecological receptors on site and therefore it is considered that no further investigation or remediation is required.

6.2 Remediation Tasks

The main objectives of the remediation programme will be to:

- Excavate the filling from the area surrounding TP 49 with the copper concentration that exceeded the EIL;
- Validate the resultant excavation;
- Appropriately manage the copper contaminated excavated material removed during remediation;
- If required, backfill the excavation using virgin excavated natural material (VENM) under geotechnical control;

6.3 Extent of Remediation

The extent of remediation will be to the full extent of the filling surrounding TP 49 with the EIL exceedances as identified in DP (2013). Drawing 2 shows the location of TP 49. The extent of the contaminated soils identified within the test pit will need to be further delineated. This will be conducted with 'chase out' remediation during excavation.

6.4 Remediation Options

A list of potential remediation options for the area with filling that exceed the EIL has been developed. The options are listed below and will be discussed in greater detail in the following section.

- Option 1 – Excavation and re-use at depth;
- Option 2 – Excavation and off-site disposal;

Option 1 – Excavation and re-use at depth

As part of the bulk earthworks across the site, the contaminated filling may be buried on site at depths below 2 m, however the materials will need to be geotechnically suitable for this reuse. .

Advantages of this option include a solution with zero ongoing maintenance following remediation and validation.

Disadvantage of this option is that not all of the contaminated material will be geotechnically suitable for reuse at depth below structures.

Option 2 – Excavation and off-site disposal

As part of site redevelopment, areas of identified contaminated soils may be removed and disposed of at an appropriately licensed facility following classification in accordance with the NSW DECCW's *Waste Classification Guidelines* (2009).

Advantages of this option include a solution with no ongoing maintenance, unrestricted land use following remediation and validation as well as a relatively straight forward remediation program.

Disadvantages include the cost of transport and waste disposal.

6.5 Recommended Remediation Strategy

The recommended strategy for the contaminated soils that exceed the ecological guideline values are a combination of Option 1 and Option 2, which will involve the excavation of contaminated soils and reuse at depths greater than 2 m (if geotechnically suitable) or off-site disposal (if not geotechnically suitable or not viable to place at depth).

This strategy was selected based on the proposed cut and fill within the site and the requirements of providing a comprehensive remediation strategy at reasonable cost and in a reasonable timeframe (with respect to the project requirements) without placing restrictions on the future land use of the subject site. A review of the proposed cut and fill indicates that there are areas of the site which will require fill to depths of up to 3 m.

The sides and base of the excavation will require validation as per Section 11.2.1 followed by chase out remediation if continuing signs of contamination are observed. If required, the resultant excavations will be backfilled with VENM material sourced from within the site, under engineering supervision.

7. PAH Contaminated Area

7.1 Remediation Tasks

The main objectives of the remediation programme will be to:

- Excavate the filling from the area surrounding TP 62 with the PAH concentration that exceeded the ESL and HSL;
- Validate the resultant excavation;
- Appropriately manage the PAH contaminated excavated material removed during remediation;
- If required, backfill the excavation with VENM under geotechnical control.

7.2 Extent of Remediation

The extent of remediation will be to the full extent of the filling surrounding TP 62 with the ESL and HSL exceedances identified in DP (2013). Drawing 2 shows the location of TP 62. The extent of the PAH contaminated soils identified within TP 62 will need to be further delineated. This will be conducted with 'chase out' remediation during excavation.

7.3 Remediation Options

A list of potential remediation options for the area with PAH contamination has been developed. The options are listed below and will be discussed in greater detail in the following sections.

Option 1 – Excavation and on-site containment;

Option 2 – Excavation and off-site disposal.

Option 1 – Excavation and on-site containment

As part of the bulk earthworks across the site, the contaminated filling may be buried on site at depth in a purpose built containment cell. However, there is the potential of restricted land use in the vicinity of the containment cell and ongoing environmental management of the cell would be required.

Option 2 – Excavation and off-site disposal

As part of site redevelopment, areas of identified contaminated soils may be removed and disposed of at an appropriately licensed facility following classification in accordance with the NSW DECC's *Waste Classification Guidelines* (2009).

Advantages of this option include a solution with no ongoing maintenance, unrestricted land use following remediation and validation as well as a relatively straight forward remediation program.

Disadvantages include the cost of transport and waste disposal.

7.4 Recommended Remediation Strategy

Based on the above review, the preferred option is Option 2: Excavation and off-site disposal of PAH impacted soil at an appropriately licensed facility. This will include (but not limited to) the following general steps:

- Excavate the full extent of PAH impacted soil located within the vicinity of TP 62;
- Waste classify the excavated material in accordance with the NSW DECCW (2009) and dispose of at an appropriately licenced landfill;
- Validation of the remedial excavation; and
- Following validation, backfilling the remediation excavation with VENM.

This strategy was selected based on the requirements of providing a comprehensive remediation strategy at reasonable cost and in a reasonable time frame (with respect to the project requirements) without placing restrictions on the future land use of the subject site.

The sides and base of the excavation will require validation as per Section 11.2.2 followed by chase out remediation if continuing signs of contamination are recorded. If required, the resultant excavations will be backfilled with VENM, under engineering supervision.

8. Asbestos Pipe

8.1 Remediation Tasks

The main objectives of the remediation programme will be to:

- Locate and remove the identified asbestos pipe;
- Manage potential health risks from the handling of asbestos-containing materials; and
- Validate the resultant excavation prior to backfilling with clean fill material (if required);

8.2 Extent of Remediation

The extent of remediation will be the asbestos pipe identified in DP (2013). Drawing 2 shows the location of the asbestos pipe.

8.3 Remediation Options

A list of potential remediation options for the asbestos pipe are listed below and will be discussed in greater detail in the following sections.

Option 1 – Removal of asbestos pipe and any asbestos impacted soils to an appropriately licensed facility, followed where necessary by replacement with "clean fill";

Option 2 – Excavation and On-site Containment.

Option 1 – Removal of asbestos pipe and asbestos impacted soil to an appropriately licensed facility

To minimise the potential for contamination of site soils, the asbestos pipe is to be excavated intact followed by offsite disposal of the asbestos pipe and any asbestos impacted soil as Special Waste (asbestos). This offers a straight forward remedial approach with minimal time delay and no remaining potential legacy.

Option 2 – Excavation and On-site Containment

As part of the bulk earthworks across the site, asbestos pipe may be buried on site at depth in a purpose built containment cell. However, there is the potential of restricted land use in the vicinity of the containment cell. Also on-going environmental management of the cell would be required.

8.4 Recommended Remediation Strategy

Based on the above review, the preferred option is Option 1: Removal of asbestos pipe and asbestos impacted soil to an appropriately licensed facility. This will include (but not limited to) the following general steps:

- Identify and excavate the asbestos pipe located within the site;
- Dispose of intact asbestos pipe and any asbestos impacted soil, identified by the licensed contractor and/or the environmental consultant during the remediation process (outlined in Section 10.1.3), offsite as special waste (asbestos);
- Validation of the remedial excavation; and
- Following validation, backfilling the remediation excavation with clean filling material (if required).

This strategy was selected based on the requirements of providing a comprehensive remediation strategy at reasonable cost and in a reasonable time frame (with respect to the project requirements) without placing restrictions on the future land use of the subject site.

9. Remediation Acceptance Criteria

9.1 Soils

The proposed development of the site is for residential land use. For the purposes of selecting relevant guideline criteria, the most sensitive site use; residential with accessible soil and gardens, has been adopted.

The following table presents the adopted remediation acceptance criteria (RAC) for the site, along with their source documents.

Table 1: Remediation Acceptance Criteria for Soil (RAC)

Contaminant	RAC	Rationale
Asbestos	• 0.01% w/w of asbestos in soil with bonded ACM generally comprising 15% asbestos; • 0.001% w/w FA and AF; and • No visible asbestos on the ground surface.	NEPC (2013) defines the various terminology for asbestos: Bonded ACM: Asbestos containing material which is in sound condition, bound in a matrix of cement or resin, and cannot pass a 7 mm x 7 mm sieve. FA: Fibrous asbestos material including severely weathered cement sheet, insulation products and woven asbestos material. This material is typically un-bonded or was previously bonded and is now significantly degraded and crumbling. AF: Asbestos fines including free fibres, small fibre bundles and also small fragments of bonded ACM that pass through a 7mm x 7mm sieve. Given that the proposed land use is residential, the 'Residential A' Asbestos Health Screening Levels (in accordance with Table 7, Schedule B1 of NEPC 2013) has been adopted.
Copper	Calculated EIL EIL for Urban residential and public open space sites – NEPC (2013)	The EILs have been developed and discussed in NEPC, 2013 for selected metals and organic compounds and are applicable for assessing risk to terrestrial ecosystems. EILs depend on specific soil physiochemical properties and land use scenarios and generally apply to the top 2 m of soil, which essentially corresponds to the root zone and habitation zone of many species.
B(a)P	BAP 0.7 mg/kg ESLs for Urban residential and public open space sites – NEPC (2013)	The current Ecological Screening levels are provided in the NEPC, 2013. ESLs are used to assess the risk of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene to terrestrial ecosystems. ESLs apply to the top 2 m of the soil profile, which essentially corresponds to the root zone and habitation zone of many

Contaminant	RAC	Rationale
		species. Given that the proposed land use is residential, the ESLs for Urban Residential /public open space sites and for fine soil texture have been adopted as the RAC.
B(a)P TEQ	3 mg/kg HIL A – NEPC (2013)	The current Health Screening levels are provided in the NEPC, 2013. The health investigation levels (HILs) are scientifically based, generic assessment criteria designed to be used in the first stage (Tier 1) of an assessment of potential risks to human health from chronic exposure to contaminants. Given the proposed land use is residential, the HIL (A) guideline values have been adopted which are for sites that are residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake (no poultry)), and also includes childcare centres, preschools and primary schools.

10. Remediation Strategy

10.1 Remediation Scope

For all asbestos related remediation, the remediation must be undertaken by a licensed asbestos contractor and completed in accordance with the relevant regulations and in line with NSW environmental and safety requirements, WorkCover NSW requirements and industry best practice. The licensed asbestos contractor will also determine whether air monitoring will be required for airborne asbestos fibres.

The remediation approach proposed by DP comprises:

10.1.1 Areas with Ecological (EIL) Exceedances (TP 49)

1. Excavation of a 4 m x 4 m square to a depth of 0.3 m below ground level at the area with the EIL exceedance as shown on Drawing 2;
2. Validation of excavations with laboratory analysis (at the rate discussed in Section 11.2.1);
3. Reuse excavated materials that are geotechnically suitable at depths greater than 2 m (where ecological receptors are not likely to be present). If materials are not geotechnically suitable or it is not viable to reuse material at depths greater than 2 m, the impacted soils will require waste classification and offsite disposal under a waste classification.
4. Survey of the full extent of the remediation areas and deep fill areas with coordinates and produce a survey drawing showing the extent of the known location of the remediation area and placement area relative to proposed development layout; and
5. If backfilling of excavation is required, backfill with VENM under engineering supervision (refer Section 10.5).

10.1.2 PAH Contaminated Area (TP 62)

1. Excavation of a 4 m x 4 m square to a depth of 0.3 m below ground level at the location impacted by PAH as shown on Drawing 2 ;
2. Validation of excavations with laboratory analysis (at the rate discussed in Section 11.2.2);
3. Waste Classification of excavated material in accordance with NSW DECCW (2009);
4. Survey of the full extent of the remediation areas with coordinates and produce a survey drawing showing the extent of the known location of the remediation area relative to proposed development layout; and
5. If backfilling of excavation is required, backfill with VENM under engineering supervision (refer Section 10.5).

10.1.3 Asbestos Pipe

1. Locate the pipe initially at the known location, and then “chase-out” from this location.
2. Excavation of any trench backfill above the pipe and stockpiling for assessment. Care must be taken during this process not to damage the underlying asbestos pipe.
3. Removal of the asbestos pipe to its full extent. This work is to be conducted by a licensed contractor, and the removed asbestos disposed as Special Waste (Asbestos).
4. Placing any visually asbestos impacted trench back fill materials in a stockpile separate from the general backfill materials. This material is to be waste classified and disposed off-site at an appropriately licensed facility legally able to accept the material.
5. Validation of the trenches in accordance with Section 11.2.3.
6. Validation of the stockpiled excavated materials in accordance with Section 11.2.3.
7. Surveying the full extent of the remediation area with coordinates and produce a survey drawing showing the extent of the known location of the remediation area relative to proposed development layout.
8. If backfilling of excavation is required, backfill with VENM under engineering supervision (refer Section 10.5).

10.1.4 Sequence of Remediation

The detailed procedures for removal of the impacted soil will rest with the contractor and will depend upon the equipment to be used and the overall sequence of removal. It is the contractor's responsibility to devise a safe work method statement and to implement proper controls that enable the personnel undertaking the remediation to work in a safe environment. This RAP does not relieve the contractor(s) of their ultimate responsibility for occupational health and safety of their workers and to prevent contamination of areas outside the immediate workspace. This RAP sets out the minimum standards and guidelines for remediation which will need to be used in preparing individual method statements for each remediation location.

10.1.5 Contingencies for Unexpected Finds

Should unexpected conditions be encountered during the remediation (or construction) phases of the redevelopment (such as buried tanks or unexpected contaminated soil or contaminants), the following general approach should be adopted:

- Notify the Principal's Representative (PR) of the occurrence;
- At the instruction of the PR, place barricades around the affected area and cease work in that area;
- Notify the Environmental Consultant for an assessment of the severity of the find in terms of the potential impact to human health and the environment;
- Provision of advice from the Environmental Consultant to the PR and the regarding the recommended course of action; and
- Implementation of recommendations of the Environmental Consultant.

Further remediation may be required following the assessment by an Environmental Consultant, however, this will be dependent upon the type of unexpected find and the degree of the potential impact.

10.1.6 Minimisation of Cross-Contamination

Measures should be enforced as required to eliminate the potential for cross contamination. In addition to the recommendations provided in the following sections for management of the remedial works, the following are the minimum requirements to be adopted:

- Plant movements within areas of active remediation should also be restricted and monitored to ensure vehicles do not pass over validated surfaces.
- Areas that have been remediated and validated should be delineated with a clear marking system and isolated. Truck and vehicle movements into these areas should be restricted, however, if required, vehicles should pass through a wheel washing bay on entering the remediated area.

10.1.7 Waste Disposal

Since some of the materials will be disposed of at an off-site location, sampling and analysis of the materials at a frequency of 1 sample per 100 – 250 m^3 of soil will be required to provide a classification of the materials for waste disposal according to the provisions of the NSW DECCW (2009).

10.1.8 Storage of Asbestos Fragments

Asbestos-containing materials collected during the remediation process will be stored in a defined area and kept damp to minimise release of asbestos fibres to the air. The asbestos storage area must be secure to prevent access by non-inducted personnel. Disposal of the waste will be the responsibility of the Asbestos Contractor. Transport must be undertaken by appropriately licensed vehicles and operators. Disposal must be to an appropriately licensed EPA landfill.

The storage area will be subject to validation upon completion of the remediation works.

10.1.9 Contingency for Stockpiling of Contaminated Material

Potentially contaminated material shall be stockpiled at a suitable designated location. Dust control is required for all stockpiled materials and should include light conditioning with water for exposed materials or covering with anchored geotextile or similar.

All stockpiles of contaminated material to remain on the site overnight shall be surrounded by star pickets and marking tape or other suitable material to clearly delineate their boundaries and be adequately secured in order to reduce the risk of sediment runoff. Should the stockpile remain for over 48 hours they should be appropriately managed to prevent fugitive dust leaving the site (eg: light wetting or covering with anchored geotextile depending on weather conditions) and geotextile silt fences or hay bales should be erected around each stockpile to prevent losses by surface erosion.

The defined stockpiling area will be subject to validation upon completion of the remediation works.

10.2 Spoil Contingency Plan

Any materials which fail to meet the EPA criteria for direct landfill disposal (ie: Hazardous Waste materials) following initial waste classification, assessment will require segregation and separate stockpiling pending further testing and treatment. The contingency plan to cater for the storage, treatment and disposal of these materials is as follows:

- On the basis of on-site observations and the contaminant exceedances detected, materials will be carefully excavated, segregated and placed in well delineated locations.
- Stockpiles of excavated materials will be appropriately bunded with hay bales / sandbags and if required conditioned with water, covered and/or lined with anchored impermeable plastic sheeting to prevent dust generation.
- If considered appropriate, further sampling and analysis will be conducted to more fully characterise the subject material, and confirm its contamination status. If the further characterisation works show that the material can be classified as General Solid or Restricted Solid Waste, dispose of the material directly to an appropriately licensed landfill.
- Review potential options for the treatment, re-use or recycling of the material, and adopt options identified to be suitable for the subject material.
- Review EPA General Immobilisation Approvals on the EPA website. If an applicable General Immobilisation Approval exists, further assess/dispose of the waste in accordance with the approval and other approvals or licences as required by the EPA.

If no General Immobilisation Approval is applicable to the material, the NSW DECC *Waste Classification Guidelines Part 2: Immobilisation of Waste* (2008) will apply, and the following will be conducted:

- Conduct additional sampling and analysis as required based on the available results to provide information for immobilisation options. In general immobilisation options include natural immobilisation, chemical fixation, micro-encapsulation and macro-encapsulation.
- Investigate, including trials as appropriate, immobilisation treatment options for the material.
- Apply to the EPA for a Specific Immobilisation Approval;
- Implement the requirements imposed on management/disposal of the material by the EPA.

10.3 Loading and Transport of Spoil

All transport of waste and disposal of materials must be conducted in accordance with the requirements of the *Protection of the Environment Operations* (POEO) *Act* (1997). All required licences and approvals required for disposal of the material will be obtained prior to removal of the materials from the site.

Transport of spoil shall be via a clearly delineated, pre-defined haul route.

Removal of waste materials from the site shall only be carried out by a licensed contractor holding the appropriate licence, consent or approvals to dispose of the waste materials according to the classification outlined in the NSW DECCW *Waste Classification Guidelines* (2009) and with the appropriate approvals obtained from the NSW EPA, if required.

The proposed waste transport route will be notified to the local Council and truck dispatch shall be logged and recorded by the contractor for each load leaving the site. A record of the truck dispatch will be provided to the PR.

10.4 Disposal of Material

All materials excavated and removed from the site shall be disposed in accordance with the POEO Act 1997 and to a facility/site legally able to accept the material. Copies of all necessary approvals from the receiving site shall be given to the PR prior to any contaminated material being removed from the site. A record of the disposal of materials will be maintained.

All relevant analysis results shall be made available to the contractor and proposed receiving site/ waste facility to enable selection of a suitable disposal location. Holding arrangements, treatment and disposal requirements for excavated materials which fail to meet the landfill disposal guideline levels are discussed in Section 10.2.

Details of all contaminated and spoil materials removed from the site (including VENM) shall be documented by the contractor with copies of weighbridge slips, trip tickets and consignment disposal confirmation (where appropriate) provided to the Environmental Consultant and the Principal's Representative. A site log will be maintained by the PR to track disposed loads against on-site origin.

10.5 Materials for Use in Backfilling and Imported Fill

Any additional material required for redevelopment works, including backfilling of remedial excavations shall be either:

- uncontaminated material from the Site (ie: materials meeting the RAC and SAC); or
- imported material, which is to be analysed and certified as VENM, as well as meeting the RAC and SAC via a validation certificate by the contractor. The material and material management should also comply with relevant legislation (eg: *POEO* Act 1997).

The report for any imported VENM is to be prepared by a suitably qualified consultant. Sampling and analysis of any imported material should be undertaken to confirm its suitability for use on the site as follows:

- Collect samples at a density of 1 sample per 1,000 m^3 of imported VENM, or a minimum of 3 samples per source site;
- Analysis of samples for heavy metals, PAH, TPH, BTEX, PCB, OCP, OPP, phenol, asbestos and any other identified contaminant of concern;
- Collection and analysis of QA/QC samples in accordance with Section 11.3; and
- Comparison of results with published background levels and the RAC and SAC to determine its status as VENM and its suitability for use on the site.

Materials used on site should also meet other requirements (eg: geotechnical and salinity requirements).

11. Validation Plan

11.1 Validation Data Quality Objectives (DQO)

The objective of the validation plan is to assess the results of post remediation testing against the RAC stated within the RAP and to provide information on any environmental impacts which may have resulted from the works.

The validation assessment will be conducted in accordance with Data Quality Objectives (DQOs) and Quality Assurance/ Quality Control (QA/QC) procedures to assess the repeatability and reliability of the results.

The following DQOs will be adopted, based on the Australian Standard *Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil Part 1: non-volatile and semi-volatile compounds* (AS 4482.1 – 2005):

- State the Problem;
- Identify the Decision;
- Identify Inputs to the Decision;
- Define the Boundary of the Assessment;

- Develop a Decision Rule;
- Specify Acceptable Limits on Decision Errors; and
- Optimise the Design for Obtaining Data.

A checklist of Data Quality Indicators (DQI) in accordance with Appendix V of the NSW EPA Contaminated Sites *Guidelines for the NSW Site Auditor Scheme* (2nd edition) (2006) will be completed as part of the validation assessment.

11.2 Validation Sample Collection and Analysis

11.2.1 Area with EIL Exceedance (TP 49)

Once contaminated material is removed, the resultant excavation area will require validation sampling and testing. The Environmental Consultant will undertake all validation sampling at the following rates:

- Base: 1 sample per 100 m^2 (equivalent to a 10 m by 10 m area) or a minimum of one sample;
- Walls (if present): 1 sample per 10 m horizontal length or a minimum of one sample per wall, collected at the horizon(s) most likely to be contaminated; and
- Collection and analysis of QA/QC samples as per Section 11.3.

Samples will be tested for the contaminant of concern(copper).

If the validation samples exceed the RAC, excavation of the contaminated materials will be required in the direction of the exceeded samples, followed by waste classification for off-site disposal. The resultant surface following excavation of these materials will require further validation sampling.

11.2.2 PAH Contaminated area (TP 62)

Once contaminated material is removed, the resultant excavation area will require validation sampling and testing. The Environmental Consultant will undertake all validation sampling at the following rates

- Base: 1 sample per 100 m^2 (equivalent to a 10 m by 10 m area) or a minimum of one sample;
- Walls: 1 sample per 10 m horizontal length or a minimum of one sample per wall, collected at the horizon(s) most likely to be contaminated; and
- Collection and analysis of QA/QC samples as per Section 11.3.

Samples will be tested for the contaminant of concern (PAH).

If the validation samples exceed the RAC, excavation of the contaminated materials will be required in the direction of the exceeded samples, followed by waste classification for off-site disposal. The resultant surface following excavation of these materials will require further validation sampling.

11.2.3 Asbestos Pipe

Visual validation, as well as validation sampling, will be undertaken in the asbestos pipe remediation area. Evidence of asbestos fragments or fibres in the base or walls of the excavation will be targeted by the validation sampling of fragments and surrounding soil to allow assessment of its significance.

Following the removal of the asbestos pipe and any identified contaminated materials, the base of the excavations/footprint will be validated to confirm complete removal of the contaminated materials as follows:

- Validation sampling of the excavated trench at a rate of 1 composite sample per 10 linear metres and at any points where the asbestos pipe was broken prior to or during removal or a minimum of one composite sample;
- The composite sample will comprise three discrete samples taken from the base and both walls of the resultant remediation trench, at each composite sampling location. The discrete samples are to be collected at the horizon/s most likely to be contaminated (i.e. the level of the asbestos pipe) and the total combined volume of composite samples will be 500 ml;
- Validation sampling of excavated and stockpiled general back fill materials from around the asbestos pipes, not visibly impacted by asbestos, at a rate of 1 sample per 10 linear metres or a minimum of 4 samples, to assess the suitability of the material for reuse as back fill or for off-site disposal; and
- Analysis of all samples for the asbestos fragments identification and asbestos fibres in soil.

If the trench excavation validation samples exceed the RAC, further excavation of the contaminated materials will be required.

The Environmental Consultant will undertake the validation sampling.

11.3 Quality Assurance Plan

11.3.1 Sample Collection and Handling

The general sampling procedures comprise:

- the use of stainless steel or disposable sampling equipment;
- washing of all re-usable sampling equipment, including excavator parts in contact with the sample, in a 3% solution of phosphate free detergent (Decon 90) then rinsing with distilled water prior to each sample being collected; transfer of the sample into an appropriate sampling container, sealing of containers to eliminate cross contamination during transportation to the laboratory;
- use of laboratory prepared sampling containers. Samples to be tested for asbestos will be placed in a sealable plastic bag;
- labelling of the sample containers with individual and unique identification including Project No. and Sample No;
- placement of the sampling containers into an enclosed and secure container for transport to the laboratory; and

- use of chain-of-custody documentation to ensure that sample tracking and custody can be cross-checked at any point in the transfer of samples from the field to hand-over to the laboratory.

11.3.2 Field QA/QC

Quality assurance (QA) and quality control (QC) procedures will be adopted throughout the field sampling programme to ensure sampling precision and accuracy and prevent cross contamination. Furthermore, all site management personnel are to be qualified and experienced in dealing with asbestos (supporting information to be provided and included in the validation report).

The following QA/QC samples will be collected/prepared and analysed:

- 5% intra-laboratory duplicate samples; and
- 5% inter-laboratory duplicate samples.

Appropriate sampling procedures will be undertaken to prevent cross contamination. These include:

- Standard operating procedures are followed;
- Duplicate field samples are collected and analysed;
- Samples are stored under secure conditions;
- Chain-of-custody documentation is employed for the handling, transport and delivery of samples to the selected laboratory; and that
- Proper disposal of contaminated soil, fill or surface water originating from the site is completed.

11.3.3 Laboratory Quality Assurance and Quality Control

NATA accredited laboratories will be used to conduct analysis. The laboratory will need to undertake analysis in accordance with its accreditation, including in-house QA/QC procedures involving the routine testing (where applicable) of:

- Laboratory duplicate analysis; and
- Statistical analysis of laboratory QA/QC data.

11.3.4 Achievement of Data Quality Objectives

Based on the analysis of quality control samples ie: duplicates and in-house laboratory QA/QC procedures, the following data quality objectives will be required to be achieved:

- QA/QC samples collected and analysed in accordance with this RAP; and
- field and laboratory duplicates and replicates samples will have a precision average of +/- 30% relative percent difference (RPD) where applicable (note some exceptions to this apply, including analyte concentrations near the laboratory reporting limits, samples collected from heterogeneous filling, and organic compounds, where higher RPDs may be appropriate). RPDs exceeding +/- 30% will be assessed and a conclusion made as to the significance of the results.

Based on a fulfilment of the data quality objectives, an assessment of the overall data quality will be presented in the validation report.

11.4 Validation Reporting

A validation assessment report will be prepared by the Environmental Consultant in accordance with NSW DECC Contaminated Sites *Guidelines for Consultants Reporting on Contaminated Sites* (reprint 2011) and other appropriate guidance documentation. The objective is for the validation report to confirm that the site has been remediated to a suitable standard for the proposed redevelopment and occupation and that no related adverse human health and environmental effects have occurred as a result of the temporary works. The validation report will also include a summary of the information from previous investigations.

The validation report will include:

- Details of the total volume of contaminated materials removed from the site;
- Drawings showing contamination assessment sample locations and validation sample locations;
- Survey drawing showing the extent of the remediation areas;
- Detailed analytical results where obtained;
- Daily air monitoring reports for asbestos works (if required);
- The final disposal destination of the materials removed from site and disposal dockets, where appropriate; and
- Details of backfill source(s) and the assessment of suitability.

12. Site Management Plan

It is the responsibility of the head contractor to develop a Site Management Plan detailing site management, environmental management and occupational health and safety (OH&S) plans for the site. This section provides a brief summary of some of the items which need to be included in the Contractor's plans.

Works shall comply with all legislative requirements including, but not limited, to those set out under the following Acts (and subsequent amendments and regulations):

- Environmentally Hazardous Chemicals Act (1985);
- Hazardous Chemicals Act (1985) (under review);
- Environmental Offences and Penalties Act (1989);
- Agricultural and Veterinary Chemicals Act (1994);
- Protection of the Environment Operations Act (POEO) (1997);
- Pesticide Act (1999);
- Work Health and Safety Act 2011;

- OHS Amendment (Dangerous Goods) Act 2003 (including OHS Amendment (Dangerous Goods) Regulation 2005); and
- POEO Amendment Act 2005 (including POEO Amendment (Scheduled Activities and Waste) Regulation 2008).

12.1 Site Operations

The schedule of remedial works, including timing and staging is to be prepared by the contractor to meet the requirements of this RAP.

Remediation works will be restricted to the hours set out by Camden Council.

It is the site owner/developers responsibility to ensure that appropriate personnel are appointed to manage and conduct the remediation and validation works. This will include:

- The Principal's Representative (PR), who is responsible for overseeing the implementation of this RAP;
- A head contractor, who will be responsible conducting the remedial works and managing the site; and
- An Environmental Consultant, who will be responsible for providing advice as required for the remedial works and undertaking the validation works in accordance with this RAP.

Other parties who may be employed to assist in the implementation of this RAP include, but are not limited to, occupational hygienist(s) and asbestos licensed contractor(s).

The PR will be responsible for preparing a list of contacts for the works. The head contractor will be responsible for preparing a list of contacts, including emergency contacts for the site operations and provision of signage at the site to allow the public to contact nominated site personnel out of hours.

12.2 Environmental Management

The work shall be undertaken with all due regard to the minimisation of environmental effects and to meet all statutory requirements. The contractor shall have in place an Environmental Management Plan (EMP) which addresses the following items:

- Site stormwater management plan;
- Soil management plan;
- Noise control plan;
- Dust control plan;
- Odour control plan;
- Contingency measures for environmental incidents.

The contractor shall also be responsible to ensure that the site works comply with the following conditions:

- fugitive dust leaving the confines of the site is minimised;
- no water containing suspended matter or contaminants leaves the site in a manner which could pollute the environment;
- vehicles shall be cleaned and secured so that no mud, soil or water are deposited on any public roadways or adjacent areas;
- spoil is managed in accordance with Section 10 of this RAP; and
- noise and vibration levels at the site boundaries comply with the legislative requirements.

12.3 Occupational Health and Safety

The contractor should develop a site emergency response plan (ERP) and occupational health and safety plan (OHSP). This will ensure the safety of the personnel working on site, given any likely emergency situation which may occur. The OHSP and ERP should include emergency phone numbers and details of local emergency facilities.

Appropriate fencing and signage should be installed around and within the site to prevent unauthorised access to the site, restricted access remedial areas (eg: asbestos remediation areas) and deep excavations.

All asbestos works will be conducted by an appropriately licensed asbestos contractor and in accordance with WorkCover requirements.

All personnel on site should be required to wear the following personnel protective equipment (PPE) at all times (as a minimum):

- Steel-capped boots;
- High visibility clothing; and
- Hard hat meeting AS1801-1981 requirements.

The following additional PPE will be worn as required:

- All PPE required by the A1 Licenced asbestos contractor (eg: P2 disposable dust mask or a particulate half-face mask with a P3 filter, disposal coveralls);
- Hearing protection meeting AS1270-1988 requirements when working around machinery or plant equipment if noise levels exceed exposure standards;
- Safety glasses or safety goggles with side shields meeting AS1337-1992 requirements (as necessary, particularly during demolition);
- Disposable coveralls (if necessary) to prevent contact with splashed contaminated soil, materials or water;
- Nitrile work gloves meeting AS2161-1978 requirements or heavy duty gauntlet gloves; and
- Any additional protection identified by the Environmental Consultant.

All contractors are required to show compliance with the Work Health and Safety Regulation 2011, including the preparation of a Site Safety Management Plan and Safe Work Method Statements.

13. Conclusion

It is considered that remediation of the site in accordance with this RAP will render the Site as suitable for the proposed residential development and appropriately manage potential temporary impacts on the environment.

14. References

1. Department of Environment and Conservation (2006) Contaminated Sites Guidelines for the NSW Site Auditor Scheme 2nd Edition;
2. McNally, GH (2005) Investigation of urban salinity – case studies from western Sydney. UrbanSalt 2005 Conference Paper, Parramatta;
3. McNally, GH (2004) Shale, salinity and groundwater in western Sydney, Australian Geomechanics 39(3), pp 109 – 123;
4. McNally, GH (2009) Soil and groundwater salinity in the shales of western Sydney, Groundwater in the Sydney Basin Symposium, International Association of Hydrogeologists, pp 228 – 235;
5. National Environment Protection Council (2013a) National Environment Protection (Assessment of Site Contamination) Measure (NEPM, 1999 – amended 2013) Schedule B1 Investigation Levels for Soil and Groundwater;
6. National Environment Protection Council (2013b) National Environment Protection (Assessment of Site Contamination) Measure (NEPM, 1999 – amended 2013) Schedule B2 Site Characterisation;
7. National Environment Protection Council (2013c) National Environment Protection (Assessment of Site Contamination) Measure (NEPM, 1999 – amended 2013) Schedule B3 Guideline on Laboratory Analysis of Potentially Contaminated Soils;
8. Office of Environment and Heritage (2011) Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites; and
9. Douglas Partners Pty Ltd *Report on Detailed site Investigation, Proposed Residential Subdivision, Foti Fireworks Factory, 51 St Andrews Road, Leppington NSW*, Project 76571.00 dated 23 December 2013 (DP 2013).

15. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at 51 St Andrews Road, Leppington. The report is provided for the exclusive use of Cornish Group No.2 Pty Ltd for this project only and for the purpose(s) described in the report.

It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

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

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

Although the sampling plan adopted for the DSI was considered appropriate to achieve the stated project objectives, there are necessarily parts of the investigation area that have not been sampled and analysed. This is either due to undetected variations in ground conditions, limitations arising from the presence of underground services, budget constraints, or to parts of the site being inaccessible and not available for inspection/sampling or to vegetation preventing visual inspection and reasonable access. It is therefore considered possible that other hazardous building materials, including asbestos, may be present in unobserved or untested parts of the site, between and beyond sampling locations, and hence no warranty can be given that asbestos is not present between sampled locations.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Appendix A

About this Report

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

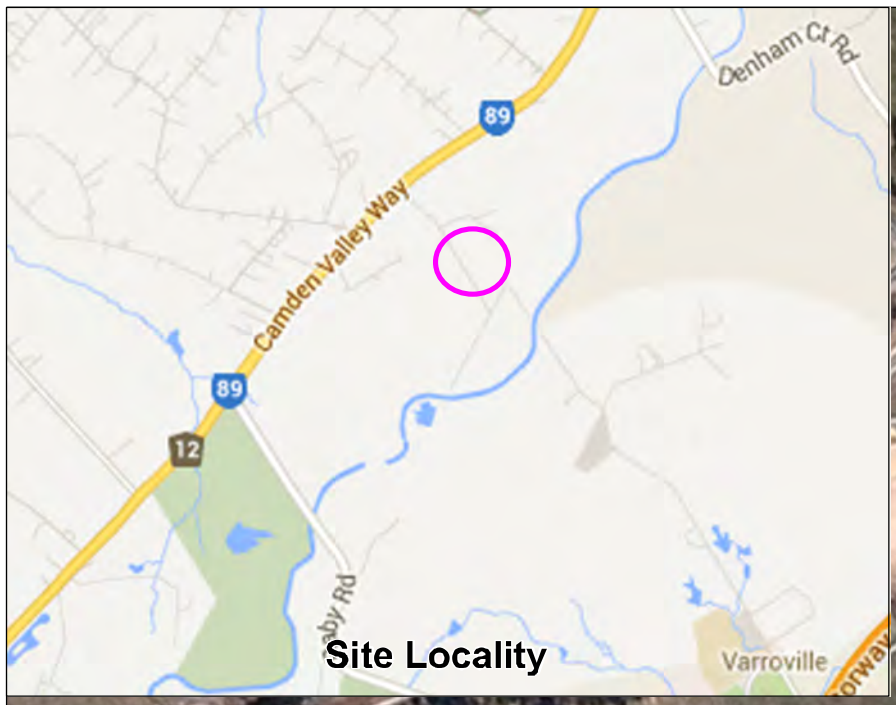
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Appendix B

Drawings 1 and 2



296800
297000
297200
297400
297600
6237600
6237400
6237200
6237000

Legend

Site Boundary

Grid: GDA94/MGA94 Zone 56

0 200.0

Metres

Douglas Partners
Geotechnics / Environment / Groundwater

TITLE: Site Boundary and Locality
Remediation Action Plan
51 St Andrews Road, Leppington

N
MGA

OFFICE: Macarthur
DRAWN BY: BAH
DATE: 18.06.2014

CLIENT: Cornish Group No.2 Pty Ltd

PROJECT No: 76571.01

DRAWING No: 1

REVISION: A

SCALE: As shown

297000

297200

297400

6237600

6237400

6237200

6237000

62

49

Legend

- Site Boundary
- PAH Contaminated Soil
- Copper EIL Exceedance
- Asbestos Pipe
- Grid: GDA94/MGA94 Zone 56

0 100.0

Metres

Douglas Partners
Geotechnics / Environment / Groundwater

TITLE: Remediation Locations
Remediation Action Plan
51 St Andrews Road, Leppington

N
MGA

OFFICE: Macarthur
DRAWN BY: BAH
DATE: 18.06.2014

CLIENT: Cornish Group No.2 Pty Ltd

PROJECT No: 76571.01

DRAWING No: 2

REVISION: A

SCALE: As shown

Appendix C

ProUCL Calculation

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	6/26/2014 10:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

B(a)P

General Statistics

Total Number of Observations	89	Number of Distinct Observations	12
Number of Detects	11	Number of Non-Detects	78
Number of Distinct Detects	11	Number of Distinct Non-Detects	1
Minimum Detect	0.06	Minimum Non-Detect	0.05
Maximum Detect	5.4	Maximum Non-Detect	0.05
Variance Detects	2.467	Percent Non-Detects	87.64%
Mean Detects	0.821	SD Detects	1.571
Median Detects	0.17	CV Detects	1.913
Skewness Detects	2.95	Kurtosis Detects	9.137
Mean of Logged Detects	-1.323	SD of Logged Detects	1.471

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.54	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.314	Lilliefors GOF Test
5% Lilliefors Critical Value	0.267	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.145	Standard Error of Mean	0.065
SD	0.584	95% KM (BCA) UCL	0.265
95% KM (t) UCL	0.253	95% KM (Percentile Bootstrap) UCL	0.262
95% KM (z) UCL	0.252	95% KM Bootstrap t UCL	0.529
90% KM Chebyshev UCL	0.34	95% KM Chebyshev UCL	0.428
97.5% KM Chebyshev UCL	0.551	99% KM Chebyshev UCL	0.792

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.983	Anderson-Darling GOF Test
5% A-D Critical Value	0.777	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.292	Kolmogrov-Smirnoff GOF
5% K-S Critical Value	0.268	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.555	k star (bias corrected MLE)	0.464
Theta hat (MLE)	1.478	Theta star (bias corrected MLE)	1.767
nu hat (MLE)	12.22	nu star (bias corrected)	10.22
MLE Mean (bias corrected)	0.821	MLE Sd (bias corrected)	1.204

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0618	nu hat (KM)	11
Approximate Chi Square Value (11.00, α)	4.576	Adjusted Chi Square Value (11.00, β)	4.508
95% Gamma Approximate KM-UCL (use when n>=50)	0.349	95% Gamma Adjusted KM-UCL (use when n<50)	0.355

Gamma (KM) may not be used when k hat (KM) is < 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.11
Maximum	5.4	Median	0.01
SD	0.594	CV	5.385
k hat (MLE)	0.339	k star (bias corrected MLE)	0.335
Theta hat (MLE)	0.325	Theta star (bias corrected MLE)	0.329
nu hat (MLE)	60.33	nu star (bias corrected)	59.63
MLE Mean (bias corrected)	0.11	MLE Sd (bias corrected)	0.19
		Adjusted Level of Significance (β)	0.0473
Approximate Chi Square Value (59.63, α)	42.88	Adjusted Chi Square Value (59.63, β)	42.64
95% Gamma Approximate UCL (use when n>=50)	0.153	95% Gamma Adjusted UCL (use when n<50)	0.154

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.874	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.227	Lilliefors GOF Test
5% Lilliefors Critical Value	0.267	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.104	Mean in Log Scale	-8.042
SD in Original Scale	0.595	SD in Log Scale	4.038
95% t UCL (assumes normality of ROS data)	0.209	95% Percentile Bootstrap UCL	0.222
95% BCA Bootstrap UCL	0.296	95% Bootstrap t UCL	0.495
95% H-UCL (Log ROS)	15.85		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-2.789	95% H-UCL (KM -Log)	0.0949
KM SD (logged)	0.739	95% Critical H Value (KM-Log)	2.038
KM Standard Error of Mean (logged)	0.0822		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.123	Mean in Log Scale	-3.396
SD in Original Scale	0.591	SD in Log Scale	0.927
95% t UCL (Assumes normality)	0.228	95% H-Stat UCL	0.0638

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	0.265

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.