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REPORT ON

REMEDIATION ACTION PLAN
BONA VISTA AND FERNADELL SITES
PROPOSED RESIDENTIAL DEVELOPMENT
PITT TOWN, NEW SOUTH WALES

Submitted to :

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EXECUTIVE SUMMARY

The Site consists of two large parcels of land located on the northern and southern sides of Bootles lane, Pitt Town. The northern property known as Bona Vista occupies an area of about 40 hectares (ha). The southern Site known as Fernadell occupies an area of about 32 hectares. Based on historical information available, both Sites have previously been used for agricultural purposes in the past. Golder Associates was commissioned in 1998 to conduct a Preliminary Geotechnical and Contamination Assessment.

The agricultural activities included predominantly citrus orchard landuse. At some time in the past watermelons were cultivated on the Bona Vista property. Agricultural activities ceased in the early 1990s on the Bona Vista Site and about 2001 on the Fernadell Site. Since then, the Site has remained vacant.

A NSW DEC Accredited Site Auditor Mr Andrew Kohlrusch of Environmental Resource Management (ERM) was appointed as the independent Site Auditor for the Site.

Prior to the implementation of the DSI, Golder prepared a Sampling Analysis and Quality Plan in accordance with the NSW DEC Site Auditor Guidelines, which was subsequently reviewed and approved by the appointed Site Auditor. Golder conducted a Detailed Site Investigation (DSI), which report was has also been reviewed and approved by the Site Auditor. The Site Auditor has requested the preparation of a Remediation Action Plan.

The DSI identified five areas of concern (refer to Figure 3) and were as follows:

- Three areas impacted by hydrocarbons (REM1, REM3 and REM4) were identified near existing Diesel ASTs within the south western corner of the Fernadell Site; and
- Two areas identified with Asbestos Containing Materials (REM2 and REM5) were identified. REM 2 located within the south western corner of the Fernadell Site and REM 5 within irrigation pipes identified within an easement along the western part of the Bona Vista Site.

The objective of this RAP is to propose remediation strategies to be implemented in order to prepare the Site for low density residential use and rural housing in accordance with NSW guidelines for such assessments.

The areas of concern will be remediated for the following:

- Area of Concern 1 / Remediation Area 1 (REM1): this corresponds to the area with material identified as containing elevated concentrations of copper and TPH (SS60) in 1998. It is noted that the 2005 investigation did not identify any contamination at that location. REM1 will be remediated to address surface staining.
- Area of Concern 2 / Remediation Area 2 (REM2): Asbestos Containing Material (ACMs) was identified at BH176 and at surface within the general area of the former fruit packing and storage shed. These areas will be remediated for ACMs.

- Area of Concern 3 & 4 / Remediation Area 3 (REM3) and Remediation Area 4 (REM4): visually stained areas within the vicinity of the ASTs. The ASTs contained diesel. REM3 and REM4 will be remediated to address surface staining and near surface contamination related to the diesel ASTs.
- Area of Concern 5 / Remediation Area 5 (REM5): Asbestos Containing Material (ACMs) within the water piping identified within western part of the Bona Vista and Fernadell Sites. The piping extends from the north to the south of Bona Vista, and is likely to continue beneath Bootles Lane and into the Fernadell Site. The piping location within Fernadell is unknown at this time. REM5 will be remediated for ACMs.

The proposed remediations for the different contaminations are:

- REM1, REM3 and REM4: excavate the contaminated soil, validate the excavation, classify the excavated soil and dispose off-site. Reuse of the material onsite will only be possible if the material has been correspondingly validated as suitable for the proposed landuse.
- REM2 and REM5: excavate the asbestos and soil associated with the asbestos, validate the excavation and dispose off-site of the excavated material.

ABBREVIATIONS / GLOSSARY

ACM	Asbestos Containing Material
AST	Above Ground Storage Tank
ANZECC	Australian & new Zealand Environment & Conservation Council
B(a)P	Benzo (a) Pyrene (a PAH Compound)
Brown	Brown Consulting Pty Ltd
BTEX	Benzene, Toluene, Ethyl Benzene, Xylene
C_6-C_9	Light hydrocarbon chain groups (for example petrol)
C_{10}-C_{14}	Medium hydrocarbon chain groups (for example kerosene)
C_{15}-C_{28}	Heavy hydrocarbon chain groups (for example diesel)
C_{29}-C_{36}	Heavy Hydrocarbon chain groups (for example, lube oil)
DEC	Department of Environment and Conservation (formerly NSW EPA)
Eh	Redox potential measured in mV
EPA	Environment Protection Authority
Golder	Golder Associates Pty Ltd
JPG	Johnson Property Group Pty Ltd
kL	Kilolitre (1,000 Litres)
<1, <100	Less than the PQL, that is, less than 1 or 100 units
LEL	Lower Explosive Limit. The lower limit (of vapour and oxygen) that explosive vapours may occur for a particular compound (also see UEL)
LOQ	Limit of quantitation (also see LOR or PQL) – of chemical concentrations attainable
Low Density Residential	Refers to residential properties with gardens and accessible soil, including single family dwellings, townhouses, villas, children's daycare centres, pre-schools and primary schools.
mg/kg	Milligram per Kilogram (or part per million)- equal to
mg/L	Milligram per litre (or part per million)
ND	Not detected above the LOQ or PQL
NHMRC	National Health & Medical Research Council
PAH	Polycyclic Aromatic Hydrocarbon
% RPD	Relative percent difference
PID	Photoionisation Detector
ppb	Part per billion
ppm	Part per million
PQL	Practical Quantitation limit (of chemical concentration)
PSH	Phase Separated Hydrocarbons, liquid petroleum products usually

	detected on the groundwater table. Also none as Free Product or Separate Phase (also see apparent thickness)
RAP	Remediation Action Plan
TDS	Total Dissolved Solids, a measure of salinity
TPH	Total petroleum Hydrocarbons
TRH	Total Recoverable Hydrocarbons
µg/L	Microgram per litre (or part per billion)
µS/cm	MicroSiemens per centimetre a measure of conductivity and salinity
UCL	Upper confidence limit of data set
UEL	Upper Explsoive Limit. The upper limit that explosive vapours may occur for a particular compound (also see LEL)
UST	Underground Storage Tank
VHC	Volatile Halogenated Compound
VOC	Volatile Organic Compound

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1.0 INTRODUCTION

This Remediation Action Plan (RAP) has been prepared by Golder Associates Pty Ltd (Golder) for the property located at Bathurst Street Pitt Town, NSW (hereafter referred to as the "Site"). The Site consists of two large parcels of land known as Bona Vista (Northern Site) and Fernadell (Southern Site)

The RAP has been prepared in general accordance with the NSW EPA Guidelines for Consultants Reporting on Contaminated Sites. Offsite disposal options are assessed in accordance with the NSW EPA Environmental Guidelines: Assessment and Classification and Management of Liquid and Non-Liquid Wastes.

In May 2005 Golder, completed a Detailed Site Investigation of the Site (DSI), and recommended that remedial actions be taken to remove and manage particular remediation areas (REM). A Remediation Action Plan was later requested by the Site Auditor.

Based on the NSW EPA Guidelines for Consultants Reporting on Contaminated Sites – 1997 this RAP includes:

- Executive Summary;
- Scope of Work;
- Site Identification;
- Summary of site history;
- Summary of the site conditions and surrounding environment;
- Summary of the geology and hydrogeology;
- Assessment Criteria;
- Summary of the Results of the Investigation;
- Site Characterisation;
- Remediation Action Plan including remedial strategies and assessment of each strategy.

2.0 SCOPE OF WORK

The scope of work for the RAP is to:

- Set remediation goals that allow the site to be suitable for residential and open space land use, and will pose no unacceptable risk to human health or the environment;
- Evaluate the range of remediation options available to address the existing site contamination, and thereby reduce risks to acceptable levels;
- Document the various safeguards required to complete the remediation work in a safe, environmentally friendly manner

3.0 SUMMARY OF INVESTIGATIONS AT THE SITE

3.1 Background Investigation Report

In 1998 Golder conducted a Preliminary Geotechnical and Contamination Assessment of the Site. The investigation consisted of a review of the Site history, collection of soil samples for environmental and geotechnical purposes and evaluation of the results.

Chemicals used on Site included pesticides and herbicides related with agricultural land use and hydrocarbons fuels for machinery use.

Sample locations were selected on a modified grid based sampling pattern, at selected locations based on potential for contamination, such as cultivated areas, areas adjacent and down gradient of drainage ditches and areas where hydrocarbon spillage was observed.

The potential contaminants of concern were heavy metals, OCPs, OPPs, TPH, BTEX and PAHs.

In total 59 test pits were excavated from 1.0 metre (m) to 3 m depth across the Site. At one location (SS60) a trowel was used to collect surface samples.

Soil samples were analysed as follow:

- 56 soil samples were analysed for heavy metals (16 for individual, 17 composite and 23 individual based on the results of the composite);
- 29 soil samples were analysed for OCP (12 for individual and 17 composite);
- 18 soil samples were analysed for OPP (12 for individual and 6 composite);
- 10 individual soil samples were analysed for TPH;
- 9 individual soil samples were analysed for BTEX compounds;
- 9 individual soil samples were analysed for PAH.

Results of laboratory analysis were assessed with respect to recommended NSW DEC guidelines.

The following samples were above the NSW DEC Criteria for residential (NEHF A) land use or Service Station Sites:

Analyte	NEHF A / Service Station Sites (mg/kg)	Sample ID	Depth (m)	Concentration (mg/kg)	Location
Copper	1,000	SS60	0.0 – 0.1	2,200	Adjacent to ASTs
Total TPH	1,000	SS60	0.0 – 0.1	22,100	

3.2 Detailed Site Investigation Report (Golder 2005)

The purpose of the investigation was to assess the site for in terms of suitability for residential landuse. The investigation targeted potential ground contamination and assessed other obvious contamination issues in the context of the proposed site redevelopment.

The investigation consisted of a review of previous investigations, site history, a site walkover and a soil and groundwater sampling and analysis program. Soil sampling was carried out from 74 boreholes drilled to a maximum depth of 10.6 m depth, 20 testpits excavated to depths up to 4.2 m depth. The sampling was carried out in accordance with the Site Auditor approved Sampling Analysis and Quality Plan (SAQP) and was designed to target potential areas of contamination and achieve overall site coverage. Samples were collected at surface and at various depth intervals. In addition three boreholes were converted to groundwater wells (BH101/MW1, BH172/MW2 and BH163/MW3). These were distributed for overall site coverage, such that one was located in the south western corner of the site, another was located on the north western part of the site with the remaining one located within the south-eastern part of the Site.

All surface soil samples were analysed for the primary contaminants of concern identified as heavy metals, organochlorine and organophosphorous pesticides (OCPs & OPPs) with selected soil and groundwater samples analysed for a range of potential organic and inorganic contaminants. Secondary contaminants of concern included, total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene and Xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyl compounds (PCBs) and asbestos. The results of laboratory analysis were interpreted by comparison with investigation levels recommended by the NSW EPA (NSW DEC), and agreed with the Site Auditor within the SAQP.

The results of the assessment are summarised as follows:

- The Site has a total area of about 72 ha consisting of two large parcels of land with the northern Site known as Bona Vista (40 ha) and the southern Site known as Fernadell (32 ha);
- Both sites have previously been cultivated and operated as orchards until about the early 1990's for Bona Vista and 2001 for Fernadell;
- Bona Vista is currently unoccupied with areas of cleared vegetation, and heavily vegetated bushland with a water easement transecting the western part of the site. Drainage depressions associated with former cultivation of the site were observed across the site ranging from depths of 0.5 to 2.0 metres. Water pipes within the easement appear to be constructed of asbestos piping and are visible at several locations within existing drainage depressions. These water pipes appear to be in relatively good condition in terms of drainage (i.e. no cracks little to no deterioration);

- Fernadell is predominantly cleared of the former orchard trees that have been stockpiled over several locations across the site. There are currently two structures within the south-western corner of the site. The structures consist of the former packing shed and residential dwelling. Two Aboveground Storage Tanks (ASTs) used for storage of agricultural diesel are also located within this area with surficial staining observed within close proximity of the ASTs. Several pieces of fragmented asbestos sheeting were observed within the area formerly occupied by the fruit packing and storage shed;
- Groundwater was measured at depths between 10.5 m AHD and 21.3 m AHD.

Results exceeding the guidelines for this investigation are presented in Table 1. Complete results can be found in the Detailed Site Investigation Report (Golder 2005)

Recommendations were provided to address and remediate the areas of concern (Refer to Detailed Site Investigation Report (Golder 2005)). The Site was assessed suitable for the proposed residential use subject to implementing the recommendations made i.e. remediation the areas identified as areas of concern.

4.0 SITE IDENTIFICATION

4.1 Site Description

The Site is located within the jurisdiction of Hawkesbury Council, County of Cumberland and Parish of Pitt Town and is zoned as rural land.

The Site comprises two large parcels of land known as the Bona Vista (northern parcel) and Fernadell (southern parcel), separated by the Bootles Lane.

The Bona Vista parcel is roughly rectangular in shape with an approximate area of about 40 ha. The parcel of land is identified as Lot 14 in DP865977 and Lot 132 in DP1025876. The Fernadell parcel is roughly rectangular shaped with an approximate area of about 32 ha. The parcel of land is identified as Lot 1 in DP133026.

A locality map is presented in Figure 1, the surrounding areas are reported in Figure 2 and the Site features are presented in Figure 3.

Bona Vista is currently unoccupied with areas of cleared vegetation, and with a water easement transecting the western part of the site. Drainage depressions associated with former cultivation of the site were observed across the site ranging from depths of 0.5 to 2.0 m. Water pipes within the easement appear to be constructed of asbestos piping and are visible at several locations within existing drainage depressions. These water pipes appear to be in relatively good condition in terms of drainage (i.e. no cracks little to no deterioration).

Fernadell is predominantly cleared of the former orchard trees that have been stockpiled over several locations across the site. There are currently two structures within the south-western corner of the site. The structures consist of the former packing shed and residential dwelling. Two Aboveground Storage Tanks (ASTs) used for storage of agricultural diesel are also located within this area with surficial staining observed within close proximity of the ASTs. Several pieces of fragmented asbestos sheeting were observed within the area formerly occupied by the fruit packing and storage shed.

4.2 Topography

The Site is located on an elevated dome within the Hawkesbury River Plain. The relative level of the site is between 13.0 m to 25 m AHD and is approximately 10 m to 20 m higher in elevation then the Hawkesbury River and adjacent flood plain.

The Soil Landscapes of the Penrith 1:100,000 Sheet 9030 (SCS NSW, 1989) indicates that the Site resides primarily on the Agnes Bank soil landscape comprising low parallel alluvial / aeolian sand dunes on flat tertiary terrace surface. Slopes are generally <5% gradient and vegetated with low woodland community.

The Site is located on a relatively flat land and gently slopes down from north-west to south-east.

The closest sensitive water receptors to the Site are:

- Bardenerang Creek located about 0.25 km west of the Site;
- Pitt Town Lagoon located about 0.5 km south-west of the Site; and
- Hawkesbury River located about 1 km north of the Site.

4.3 Geology and Hydrogeology

The Geological Series of the Penrith Sheet 9031 (SCS NSW, 1991) indicates that the Site is underlain by Quaternary Pitt Town Sand Formation comprising quartz sand, clay and minor pebbles. Middle Triassic Ashfield Shale comprising claystone-siltstone and fine sandstone-siltstone laminates are expected to be located close to or at the western boundary of the Site.

Environmental investigations conducted at the Site (Golder, 1998) revealed sand (medium to coarse grained) between 1.0 m to 2.5 m (BSL) depth, overlaying clayey sand (fine to medium grained) up to 3.0 m depth in the western part of the Site, and extending across the northern quarter of the Site.

In the eastern half of the Site the profile revealed silty sand, and silt up to 0.4 m depth, overlaying sandy clay, silty clay and clay to depth of 3.0 m (BSL). Fill was encountered at six locations to a maximum depth of 0.4 m (BH125, BH126 & BH127 at Bona Vista Site and BH172, BH180 & BH181 at Fernadell Site). At Bona Vista Site, the fill was a silty sand

associated to the adjacent drainage depression. On Fernadell Site, the fill is a gravelly clay associated with the old packaging shed and the associated driveway. No exceedences of site criteria were recorded in the fill materials.

Shallow groundwater at the Site is intercepted at depths between 1.9 m and 8.6 m (BSL) depth. The groundwater was interpreted to flow in a south to south easterly direction. Hydraulic conductivity of the silty sand is estimated as 10^{-4} m/s.

Assuming Darcy's Law applies to the silty sand aquifer of this Site, groundwater flow is related to hydraulic conductivity and head difference. It is estimated that groundwater flow in the area of the Site within the silty sand would be approximately 10^{-5} m/s to 10^{-6} m/s (i.e. $8.6x10^{-1}$ to $8.6x10^{-2}$ m/d). These estimates are provided at the request of the Site Auditor and would require specific testing to quantify, if these were deemed necessary in the future.

During the operation of the site as an orchard, the site was irrigated using water pumped from the Hawkesbury River to the north. It was noted during previous investigations (1998) that the groundwater level across parts of the site was relatively shallow (0.4 to 2.0 m BSL). Since the agricultural activities ceased, the groundwater level appears to have reduced at the Site.

There appears to be two aquifers beneath the Site. Based on available information it appears that there is a shallow aquifer within the sand and sandy clay deposits, as intercepted at MW1 in the northeast corner of the Site. There is also a deeper aquifer within the fractured shale and sandstone bedrock, as intercepted at MW2 and MW3 to the south of the Site . In March 2005, the shallow aquifer water level was observed at 21.26 mAHD, the deep aquifer water level was observed between 10.5 m AHD and 14.7 m AHD. This investigation has been focussed on assessment of soil and groundwater in the Quaternary sediments.

4.4 Surrounding Land Use

The properties immediately surrounding the site consist of a mixture of residential and semi rural properties. A more detailed summary of the surrounding properties is presented on Figure 2. As discussed previously the site consists of two parcels (Bona Vista and Fernadell Sites) of land with the properties immediately adjacent to each site consist of:

Bona Vista Site (Lot 132, DP1025876 & 14, DP865977)

The site is bounded by:

- Johnson Road to the north, beyond which are a mixture of residential and semi rural properties;
- Partially formed road bounds the eastern boundary of the site, beyond which are semi-rural properties;

- Bootles Lane bounds the southern boundary of the site beyond which is the Fernadell Site and semi-rural properties; and
- Semi- rural properties to the west.

The surrounding properties are at a similar relative level to the site.

Fernadell Site (Lot 1, DP 133026)

The Site is bounded by:

- Bootles Lane to the north, beyond which is the Bona Vista Site and residential properties;
- Semi-rural properties to the east;
- Buckingham Street, primary school and residential properties bound the southern boundary, beyond which are residential properties; and
- Residential properties and Bathurst Street to the west, beyond which are residential properties with low-lying areas associated with the Hawkesbury River floodplain.

The surrounding properties are at a similar relative level to the site.

4.5 Site History

The following information is the result of a land title search and an aerial photographs search. These documents are available in the Detailed Site Investigation Report (Golder, October 2005). Prior to 1950, the Site was a mix of bush land and agricultural land as was the case generally around the Site. Open pasture replaced the crops and orchards on part of the Site after the 1950's, the Site did not change much in the next 30 to 40 years until the 1990's when the area started developing as residential, the Site was then mostly grass and bush land, cultivation in the form of orchard only happening on parts of Fernadell Site.

Bona Vista Site (Lot 132, DP1025876 & 14, DP865977)

The Site is currently owned by Bona Vista Properties Pty Ltd who acquired the Site in 2001 by transfer. Prior to 2001 the owners of Lots 132 (formerly Lot 13 DP865977) and 14 were listed as Bona Vista Citrus Pty Ltd and Ian Johnstone. According to information previously obtained from the resident of the existing house, Mr Bill Timmerman:

- The Johnston family has owned the site since the last century;
- Parts of the site were developed as orchards from about 1968 to the late 1980's with the remaining areas used as grazing land;
- The use of the site prior to 1968 is not known with accuracy but was probably restricted to rural activity; and

- There has been occasional spraying of weedicide in the areas containing blackberry bushes and in the orchards.

Fernadell Site (Lot 1, DP 133026)

Lot 1 is currently by B.A and R.A Weatherstone. Although the information from the Department of Lands dates back to the mid 1970's, according to previously obtained information from the Manager of the orchard, Phil McDonald, the Weatherstone's have been the owners of the site for the past 35 years. Prior to this the 'Woods" family is believed to have been the owners, although no further details were available.

4.6 Regional Groundwater and Surface Water Usage

The Site is located within the Hawkesbury, Nepean Basin and adjacent to the floodplain. The area has historically and currently been used for agriculture within the vicinity of the Nepean and Hawkesbury River System. Water required to sustain the agriculture industry has generally been sourced from the Nepean and Hawkesbury River, sometimes to supplement Site groundwater bores. Agriculture and other water dependent industries within the general area include:

- Orchards (predominantly citrus fruits) within the Pitt Town area;
- Grass / lawn farms;
- Vegetables (including, lettuce and tomatoes); and
- Sand mining (specifically south of Richmond and North West of Windsor).

The general area also includes pastoral rural properties, with typical grazing farmyard animals such as horses and cattle. These properties are generally small with generally low animal water requirements supplied by small dams constructed on the property or pumping water from various creeks and the major Hawkesbury River system. Larger cattle properties (dairy farms) were located to the south west of Pitt Town, around Marsden Park and South Creek until about 5 to 10 years ago. South Creek flows into the Hawkesbury River about 1.5 km south west of the Site.

Properties immediately adjacent to the Nepean and Hawkesbury River are expected to source water from the river system for use on the property for agricultural and stock requirements. It is understood that the water is only suitable for stock irrigation and is not used as potable water.

The result of a bore search with the NSW Department of Natural Resources indicates that there are several groundwater bores registered adjacent to and in the general vicinity of the Site. These bores are identified as being for domestic use for gardens and domestic stock (such as cattle, sheep and horses). The quantity of water removed from these bores is unknown.

5.0 CURRENT SITE CHARACTERISATION

5.1 Current Development Proposal

We understand that the Site is proposed to be developed for primarily low-density residential use and rural housing, in accordance with the draft amendment No. 45 of the Hawkesbury Local Environmental Plan 1989.

5.2 Contaminants of Concern

5.2.1 Soil

The potential contaminants of concern identified prior to the Detailed Site Investigation were those related to potential imported material to fill the Site and the use of the Site for rural activities, such as orchards and grazing land. The potential contaminants of concern were identified as:

- Heavy metals (copper, lead, zinc, cadmium, chromium, arsenic, nickel and mercury);
- Pesticides (OCPs and OPP) and herbicides chemicals used on-site during orchards operations, occasional spray of herbicides has also occurred on-site.
- Asbestos potentially from drainage pipes located across the Site and structures such as houses and sheds;
- Total petroleum hydrocarbons (TPH) from potential fuels stored on Site;
- Monocyclic aromatic hydrocarbons (BTEX) from potential fuels stored on Site; and
- Polycyclic aromatic hydrocarbons (PAHs) from potential fuels stored on Site.

Previous investigations (Golder, 1998) have indicated no exceedences of metals, OPP, OCP, TPH, BTEX and PAH except for sample SS60 adjacent to the ASTs. The results of the detailed investigation have shown that the current contaminants of concern associated with the soil are:

- Asbestos (located with the former irrigation pipes) in Bona Vista and possibly extending under the road between Bona Vista and Fernadell then within Fernadell. Asbestos was also found at the location of the former packing shed. The dwelling has not been assessed for asbestos, the construction material could contain asbestos.
- TPH associated with the ASTs; and
- Copper

5.2.2 Groundwater

Low level concentrations of selected heavy metals above the ANZEC 2000 fresh water guidelines were encountered within the three monitoring wells. Whilst these concentrations may reflect background levels in the general area, in the absence of more information on

background groundwater quality in the area, this cannot be confirmed. However, it is established that similar levels of these metals have been observed in groundwater of many locations within the geological Sydney Basin. Based on available data it is concluded that groundwater at the Site is suitable for the proposed use.

To confirm the groundwater results of the laboratory analysis we propose to carry out a round of groundwater monitoring and sampling prior to the remediation to confirm the absence of contaminants within the groundwater.

5.2.3 Built Environment

The fate of the existing buildings at the Site is currently unknown, however it is likely that they could be demolished. An asbestos survey has not been conducted. Given the age of the buildings, it is possible that asbestos or ACM is present. An hazardous material survey will be required.

5.3 Exposure Routes

In the current situation, exposure is very limited as there is no activity at the Site, also contamination is contained in very superficial areas and is not bound to expand. Routes of exposure are variable with the type of contamination.

Exposure to asbestos is by inhalation and dermal contact with the asbestos. Asbestos may affect remediation workers and will be taken in consideration for the remediation strategies by implementation of a Safe Work Method Statement Plan for remediation works (to be compiled by the contractor) in accordance with WorkCover NSW guidelines (2005).

Routes for contamination associated with TPH include infiltration to deeper horizons and to the groundwater. Populations using the groundwater for irrigation or supply could then be affected. On site exposure by vapour inhalation could also occur. The observed contamination is confined to small areas and the risks related to the contamination are therefore low levels risks. Diesel is generally not of volatility sufficient to generate surface vapour adverse to human health.

Exceedences of copper in groundwater are believed to be representative of the regional hydrogeological conditions. These conditions are discussed later in this RAP.

6.0 CONTAMINATION RESULTS FROM PREVIOUS INVESTIGATIONS

The whole Site covers an area of 72 ha. The Site has been operating as orchards and grassland until recently. The last orchard activities stopped at Fernadell in 2001, Bona Vista having been grassland since the 1990's. Bona Vista now is now covered by heavily vegetated bushland on its eastern side.

A previous investigation conducted by Golder in 1998 identified one sample of surface soil collected from a hydrocarbon stained area near the ASTs (SS60) with concentrations of copper and total TPH in excess of the adopted site criteria.

Ninety four soil locations were investigated and three groundwater monitoring wells were installed and sampled during the detailed site investigation (2005). The results identified:

- In general the concentrations of potential contaminants in all soil samples were below the adopted health investigation levels recommended by the NSW EPA for residential land use.
- 71 samples had reported concentrations of total chromium exceeding the NEPM Environmental Investigation Levels (EIL) criteria of 1 mg/kg (CrVI), however all concentrations were below the Residential Health Investigation Level (HIL). Given the relatively low absolute concentrations of total chromium and the low likelihood that any chromium present would be in the CrVI form, the results were not considered significant. [Chromium is typically found in two forms, CrIII and CrVI (or hexavalent chromium). In soils under normal pH and Eh conditions (such as those encountered at the Site), CrVI is reduced in CrIII. Therefore the form anticipated at the Site is CrIII]; and
- One sample (BH176/1) reported the presence of contain Chrysotile Asbestos, Amosite & Crocidolite Asbestos.
- The results of groundwater analysis indicated concentrations for Cr, Pb, Cu, Ni and Zn above the adopted ANZECC freshwater criteria. Whilst these concentrations may reflect background levels in the general area, in the absence of more information on background groundwater quality in the area, this cannot be confirmed. It is believed that levels of these metals have been observed in groundwater of many locations within the geological Sydney Basin. Based on available data it was concluded that groundwater at the Site is suitable for the proposed use.

Exceedences from the 2005 DSI are presented in Table 1.

Based on the 1998 investigation, the DSI (2005) and on visual observations at the site (such as stains at surface, presence of ASTs), the DSI report identifies 5 areas of concern:

- Area of Concern 1 / Remediation Area 1 (REM1): this corresponds to the area with material identified as containing elevated concentrations of copper and TPH (SS60) in 1998. It is noted that the 2005 investigation did not identify any contamination at that location.
- Area of Concern 2 / Remediation Area 2 (REM2): some Asbestos Containing Material (ACMs) was identified at BH176 and at surface within the general area of the former fruit packing and storage shed.

- Area of Concern 3 & 4 / Remediation Area 3 (REM3) and Remediation Area 4 (REM4): visually stained areas within the vicinity of the ASTs. The ASTs historically contained diesel.
- Area of Concern 5 / Remediation Area 5 (REM5): Asbestos Containing Material (ACMs) within the water piping identified within western part of the Bona Vista and Fernadell Sites. The piping extends from the north to the south of Bona Vista, and is likely to continue beneath Bootles Lane and into the Fernadell Site. The piping location within Fernadell is unknown at this time.

Also, it was noted that some septic tanks located on the Fernadell Site (see Figure 3/3A) will be required to be removed from the area prior to site development. The removal of the septic tanks will include validation of the excavation for selected contaminants of concern..

7.0 BASIS FOR REMEDIATION ASSESSMENT CRITERIA

The primary technical responsibility for the regulatory management of contaminated sites in NSW is held by the Department of Environmental Conservation (DEC, formerly the NSW Environmental Protection Authority or NSW EPA). This responsibility is vested in the DEC by the provisions of numerous NSW Acts and Regulations, as well as through various NSW government polices, guidelines and undertaking. In particular, the Contaminated Land Management Act 1997 (CLM, 1997) specifically addresses the management of contaminated land and establishes a process for investigating and (where possible) remediating contaminated land which represents significant risk of harm to human health of the environment.

The CLM Act provides for the accreditation of auditors to ensure appropriate standards of managing contaminated land. The accreditation and responsibilities of a site auditor are detailed in the Guidelines for the NSW Site Auditor Scheme (NSW EPA, 1998). In auditing a site, the auditor is required under the CLM Act to have due regard to the guidelines provided by the DEC (NSW EPA).

7.1 Soil Criteria

The results of soil laboratory analysis for this investigation will be interpreted using criteria recommended by the New South Wales Environment Protection Authority Guidelines for the NSW Site Auditor Scheme (NSW DEC, 1998). The criteria will be as follows:

- NEPM HILs (Health Based Soil Investigation Levels). The health based Soil Investigation Levels (HILs) presented in the National Environmental Protection Measure (NEPM) are guideline criteria that represent the concentrations above which further investigation and evaluation of soils on a site are required. The HILs set levels that provide a 'tiered' set of soil criteria for different exposure settings from residential use through commercial/industrial land use and open space land use. For the present investigation, we have used NSW DEC Guidelines for Auditors Column 1 (referred to as Column 1) (NSW DEC, 1998) and NEPM Health Investigation Levels A - referred to as NEPM A (NEPM, 1999) for residential land use with garden and accessible soil (home-grown produce contributing less than 10% vegetables and fruit intake, no poultry);
- NSW EPA Guidelines for Assessing Service Station Sites, December 1994. The NSW EPA Guidelines for the NSW Site Auditor Scheme recommends the use of the threshold concentrations from the NSW EPA Guidelines for Assessing Service Station Sites (NSW EPA, 1994) when assessing TPH and BTEX concentrations in soil.
- USEPA Region 9 Guidelines Superfund Preliminary Remediation Goals, October 2004 for Assessing Herbicides (USEPA, 2004).

- NEPM EILs (ecological investigation levels). We have considered these criteria for the Site, however, as the Site will be developed for residential land use EILs will not be the selected criteria to assess the suitability of the Site for its proposed residential land use.
- Asbestos: No guidance is available from the DEC relating to safe levels of Asbestos or Asbestos Contained Material (ACM) on proposed land use of Sites. WorkCover guidelines, Your Guide to Working with Asbestos (March 2003) will be applied to the Site. As for testing, the test for asbestos and ACM is a pass/fail test (ACM is either present or it is not). However, soil samples collected from soil to remain onsite should have 'no asbestos detected' when analysed by polarised light microscopy with dispersion staining by a National Australian Testing Authority (NATA) registered laboratory and no visually identified ACM is allowed to remain on site.

The adopted soil investigation criteria are summarised below.

Table A Soil Investigation Criteria

Analyte	NEPM HIL – A (Column 1) mg/kg
Arsenic	100
Cadmium	20
Chromium VI	100
Copper	1000
Lead	300
Mercury	15
Nickel	600
Zinc	7000
Benzo(a) pyrene	1
Total PAH	20
Phenolics	8500
Total PCB	10
Aldrin + Dieldrin	10
DDT	200
Chlordane	50
Heptachlor	10
TPH C_6-C_9	65*
TPH C_{10}-C_{40}	1000*
Benzene	1*
Toluene	130*
Ethylbenzene	50*
Total Xylene	25*
2,4-D	690**
2,4,5-T	610**

*Criteria derived from Service Station Sites (NSW EPA, 1994), ** Criteria derived from USEPA, 2004 for Herbicides

7.2 Groundwater Criteria

Based on available data it is concluded that groundwater at the Site is suitable for the proposed use. Australian and New Zealand Guidelines for the Protection of Aquatic Organisms (ANZECC 2000, 95% protection level criteria for freshwater) will be used to assess groundwater at the Site during the remediation. Selection of this investigation level was based on the proposed landuse and the proximity of the Site to Hawkesbury River.

7.3 Soil Classification Criteria

The Soil resulting from the remediation excavations will need to be classified before off-site disposal or reuse on-site.

The criteria for assessment for off site disposal of stockpile material will be the Guidelines for Assessment, Classification and Management of Liquid and Non Liquid Wastes (NSW DEC, 1999)

8.0 REMEDIATION OPTION SELECTION RATIONALE

8.1 Remediation Goal

The Site is to be redeveloped for residential and open space landuse. The remediation goal for the Site is to:

- Complete remediation and validation works such that the land is rendered suitable for the proposed residential and open space land uses;
- Verify that there are no unacceptable off-site impacts at the Site during or following remediation; and
- Supervise the remediation works are conducted safely so as to protect on-site workers, and the public.

8.2 Decision Making Rationale

The appropriate remedial strategy for the site should ensure that the remediation goals be achieved. However, there are likely to be different options for the remediation of the REM's, each of which may be feasible. It will therefore be necessary to identify the preferred remediation strategy which provides the most efficient remediation. To achieve this, a decision making process is required to enable differentiation of different options. Therefore the following factors have been adopted to assess the relative merits of potential remedial options:

- Technical feasibility
- Environmental impact
- Relative cost benefit
- Ongoing maintenance requirements

From assessment of these issues, qualitative comparative analysis will be carried out. This is undertaken using the following decision making matrix:

	Decision Making Rating		
Decision Making Parameters	***High Rating***	***Medium Rating***	***Low Rating***
Technical Feasibility	Technically feasible remediation resulting in fit for purpose site suitability	Technically feasible remediation, requiring additional remedial supplementary measures or constraints on landuse	Not technically feasible for remediation of contaminant hazard
Environmental Impact	Creates minimal environmental impact both on site and offsite (flora, fauna, waste, life cycle impacts, sustainability impacts)	Creates adverse environmental impact either on site or offsite (flora, fauna, waste, life cycle impacts or sustainability impacts)	Creates adverse environmental impacts on site and offsite (flora, fauna, waste, life cycle impacts and sustainability impacts)
Relative Cost Benefit	Least expensive capital cost (or within 20% of the least expensive technically feasible option)	Intermediate capital cost	Most expensive capital cost (or within 20% of the highest technically feasible option)
Ongoing Maintenance	No maintenance required	Maintenance required, no ongoing environmental capital cost, not requiring expert environmental consultancy input	Maintenance required, ongoing environmental capital costs incurred, expert environmental consultancy required

It is important to note that in discussion of remedial strategy, there may be some decisions which are made on the basis of a single parameter. For example, if there is a single technically feasible option for a particular area of concern, then the other factors (such as environmental impact, relative cost benefit and ongoing maintenance) are irrelevant to the selection of remedial strategy. Consequently not all of these parameters need be assessed in each instance. However where multiple parameter decisions are required, the above table will be used as the appropriate guidance.

It is also noted that the proposed location of the roads and utilities are not known at this stage. This should not affect the remediation of the 5 remediation areas. It is noted that acid sulphate soils cannot be fully assessed at this stage until specific layout of the proposed development is available. The PASS issue will be re-addressed in a separate investigation prior to the development, when infrastructure layout is finalised..

8.2.1 Technical Feasibility

The most critical issue in the remedial strategy is that the technique be technically feasible. Unless the remedial strategy provides definitive remediation, it is of limited value, and will create environmental risk both during remediation and on an ongoing basis in the future. The technical feasibility assessment must enable that the remediation goals are met. The feasibility should be based on present technology and provide proven remedial success on similar issues.

8.2.2 Environmental Impact

The remedial strategy should be integrated with the ongoing environmental management requirements of the site. The intended use of the site is for residential and open space/ conservation landuse. The remedial strategy should not compromise the current or the ongoing environment. Consequently, the existing environment in the proposed open space area should be maintained to the extent practical. It is acknowledged that the environment in the proposed residential area will be impacted by the development, however the remediation activities in this area should complement the proposed development activities.

For a remedial strategy to be appropriate, it should also incorporate the principals of the Waste Avoidance and Resource Recovery Act, 2001 (WARR). The WARR documents the NSW DEC waste management hierarchy and reinforces waste avoidance as the primary goal in resource management. Disposal to landfill is regarded as the least favourable strategy. The most favourable strategy is resource recovery, including re-use, reprocessing or energy production. Accordingly, in the case of the site, disposal to landfill should be avoided if this is compatible with the other selection criteria (technical feasibility, relative cost benefit and ongoing maintenance requirements).

Another object of the WARR act is to ‘assist in the objectives of the Protection of the Environment Operations Act, 1997’ (PoEO). The main objective of the PoEO is to reduce risk to the human health and prevent the degradation of the environment.

8.2.3 Relative Cost Benefit

The remedial options should be assessed in terms of the qualitative costs which are likely to be incurred. These costs are not quantified within this document, but are assessed in relative terms to determine most expensive and least expensive remedial options. The cost benefit assessment will also take account of ongoing maintenance costs, in addition to initial capital costs.

8.2.4 Ongoing Maintenance Requirements

Ongoing maintenance required as part of the remedial strategy should be minimised. However it is acknowledged that in certain instances it may be preferred to accept some ongoing maintenance if this provides benefits to the other selection criteria.

9.0 REMEDIATION OPTIONS

Based on the investigations carried out to date the areas of remediation (Refer to Figure 3) have been identified as follows:

- Remediation Area 1 (REM1): area with material identified as containing elevated concentrations of copper and TPH (SS60).
- Remediation Area 2 (REM2): Asbestos Containing Material (ACMs) was identified at BH176 and at surface within the general area of the former fruit packing and storage shed.
- Remediation Area 3 (REM3) and Remediation Area 4 (REM4): visually stained areas within the vicinity of the ASTs, the ASTs contained diesel.
- Remediation Area 5 (REM5): some Asbestos Containing Material (ACMs) within the water piping identified within western part of the Bona Vista and Fernadell Sites. The piping extend from the north to the south of Bona Vista, is likely to continue beneath Bootles Lane and into Fernadell. The piping location within Fernadell is unknown.

The location of the remediation areas are presented in Figure 3 and 3a.

9.1 Remediation of Hydrocarbon Impacted Areas

Remediation Area One, Three & Four (REM1, REM3 & REM4)

Three areas were identified to be visually stained with hydrocarbons or have reported concentrations of copper and TPH (sample SS60) in exceedance of the on site criteria. Two remediation options are available:

Option 1: Excavate, validate, stockpile, classify and disposal off-site

This remediation option consists of:

- Excavating and stockpiling the impacted material initially to a depth of about 0.2m. The depth of the excavation may need to be increased based on site observations and olfactory results of the Photoionisation Detector (PID);
- Validation of the excavation base and walls in accordance with NSW DEC Site Auditor Guidelines. Screening samples from the excavation walls and base will be collected at a frequency of 1 sample every 5 linear metres using Golder sampling procedure and in accordance with regulatory requirements. The sample will be split between a new dedicated 250 mL glass container provided by the laboratory and a sealed bag for PID screening. A stainless steel trowel and a new pair of disposable Nitrile glove will be used for each sample. Each sample will be screened with a PID on-site. The PID screening will assist to determine the required excavation depth. At the bottom of the excavation and on the walls (if appropriate), the PID reading should not be more than 30 ppm (30 ppm being a screening value representating levels of volatile components above typical background levels). Based on the results of field screening selected samples will be analysed for TPH, BTEX, PAH and Copper. Laboratory analysis will be at a frequency of about one sample per 25m^2 of the wall and of the base of the excavation;

- Sampling the stockpile excavated material will be undertaken. The number of samples will be established from the total volume of the stockpile. Samples will be collected at the frequency of one sample for every 100 cubic metre of excavated material;
- Non disposable equipment used for the sampling will be decontaminated: the equipment will first be washed with clear water containing Decon 90 (or similar) and then rinsed in clear water;
- Submitting the samples for laboratory analysis. The samples should be analysed for TPH, BTEX, PAH, Metals and if required TCLP testing (metals and PAH).
- Classification of the stockpile material and disposal of the stockpile material for use on-site or off site to an appropriate licensed landfill in accordance with the NSW DEC Environmental Guidelines for Assessment, Classification and Management of Liquid and Non-Liquid Wastes (1999); and
- Backfill excavation with validated soil from on site or imported material. Imported material will only be used with appropriate supporting documentation.
- Also, the contractor will be required to supply as-built drawings (based on certified survey of excavation and backfill).

This remediation solution has the advantage of removal of all the contamination from the site in a relative short time frame. The disadvantage of this solution is that costs significantly increase with the quantity of excavated soil and its subsequent disposal to a landfill.

Option 2: Bioremediate and Re-Use on Site.

This remediation option consists of:

- Excavating the impacted material initially to a depth of 0.2 m. The depth of the excavation may need to be increased if presence of contaminated soil can be observed on-site at the initial depth. PID screening will be used to determine the required excavation depth. At the bottom of the excavation and on the walls (if appropriate), the PID reading should not be more than 30 ppm (30 ppm being a screening value representating levels of volatile components above typical background levels). Higher readings will require further excavation;
- Validating the base of the excavation by sampling and analysing the soil in the excavation in accordance with NSW DEC Site Auditor Guidelines. The frequency of sampling will be of one sample every 5 linear metres along each wall and base. Each sample will be collected using Golder sampling procedure. The sample will be split between a new dedicated 250 mL glass container provided by the laboratory and a sealed bag for PID screening. A new pair of disposable Nitrile glove will be used for each sample. Each sample will be screened with a PID on-site.
- Sampling of the excavated material to assess the current level of contamination.
- The excavated material will be laid in a specifically constructed landfarm on the site. Petroleum hydrocarbons are compounds that degrade with time from long carbon chains to shorter carbon chains.

- Non disposable equipment used for the sampling will be decontaminated: the equipment will first be washed with clear water containing Decon 90 (or similar) and then rinsed in clear water;
- Submitting the samples for laboratory analysis. The samples should be analysed for TPH, BTEX, heavy metals and pH.
- Regular sampling of the laid material will be done to follow the process of the biodegradation, regular turning of the material will accelerate the remediation. The remediation will be considered completed when the levels of contaminants will be below the adopted criteria.

Bioremediation is a remediation option that is usually carried out with significant volumes of soil or heavily contaminated soils. Bioremediation is often preferred when the cost of disposal of contaminated soil is prohibitive. It is a medium to long term remediation option which requires regular maintenance and monitoring (turning and sampling). This option has considerable uncertainty as to when appropriate remediation will be achieved.

Preferred option

Considering the size of the impacted areas and the quantity of material to be excavated, the remediation required is relatively minor. There is considerable uncertainty regarding the time required to bio remediate the impacted material on site. Therefore the preferred remediation option would be Option One. Option One is considered the most appropriate remediation strategy, as it would provide a cost affective, environmentally and technically feasible option.

9.2 Remediation of Asbestos Containing Materials (ACMs) – REM 2 & REM 5

WorkCover Your Guide to Working with Asbestos (March 2003) states:

Asbestos inappropriately buried (i.e. not in accordance to any environmental legislative requirements) is considered friable asbestos material.

Any asbestos cement product, which has been subjected to weathering, severely damaged by hail, damaged by heat/fire or other mechanical action, or illegal water blasting is a friable asbestos product and an Asbestos Removal Contractor with an AS1 Licence for friable asbestos is required for its removal.

The asbestos cement fragments present on site are therefore classified by WorkCover as a friable asbestos material, and will require clean-up by a contractor holding a Class AS1 asbestos removal licence.

9.2.1 Remediation Area 2 (REM2)

Fragmented ACM and impacted soil should be managed in accordance with NSW WorkCover and DEC guidelines (ie. handled, excavated and removal by an AS1 licensed contractor). Laboratory analysis identified Chrysotile asbestos fibres within the near surface. The impacted area will require the following remediation:

- A visual assessment of the immediate area and any fragmented pieces of ACM Fibro sheeting collected for off site disposal;
- Asbestos fibre impacted soil should be excavated;
- The excavation and visually searched area will be required to be validated in accordance with the remediation and validation goals outlined within the RAP;
- ACM and impacted soil should be disposed off site to a suitably licensed landfill; and
- Backfill excavation with suitable fill material either sourced from the Site or imported to the Site. Suitable soil material from the Site will be visually assessed and validated before re-use as backfill within the excavation. Soil / fill material will be required to be validated prior to being imported to the Site. Imported material will only be used with appropriate supporting documentation.
- Also, the contractor will be required to supply as-built drawings (based on certified survey of excavation and backfill).

Prior to the implementation of the remediation strategies the successful contractor shall prepare a Safe Work Method Statement (SWMS) incorporating an Excavation Management Plan detailing the proposed methods to safely and successfully carry out the proposed remediation. These should incorporate WorkCover NSW requirements, as well as NSW DEC requirements.

This remediation is technically feasible, has a low environmental impact and does not require ongoing management.

9.2.2 Remediation Area 5 (REM5)

Remediation for REM5 is associated with the removal of asbestos material along a irrigation pipe. Based on current legislation requirements there is a zero tolerance with respect to ACM remaining within residential developments. Therefore there is only one feasible remediation solution for REM5 which involves the excavation, removal and disposal of the ACM. This solution is technically feasible, has a low impact on the environment and does not require any ongoing maintenance.

An buried ACM irrigation pipe identified along the western part of the Bona Vista Site should be excavated and managed in accordance with NSW WorkCover and DEC (ie. handled, excavated and removal by an AS1 licensed contractor).

The pipe diameter is estimated to be about 200 mm in size and about 500 m in length and may extend beneath Bootles Lane and into the Fernadell Site. The pipe is between 0.5 m to about 0.8 m depth below existing surface level. The proposed remediation strategy is to:

- Pot hole (hand excavate) at about every 50 m to expose the irrigation pipe and confirm the cover of soil above the pipe; This would also confirm the location of the pipe on each side of the road, from these locations, an inferred location of the pipe below Bootles Lane can be interpolated;

- Excavate the over burden soils to 0.1m above the irrigation pipe and stockpile on one side of the trench. Provided the contractor employs appropriate controls during excavation, this soil material would be suitable for re-use as backfill material;
- Excavate the remaining soil to expose the ACM pipe. This material should be placed on the other side of the excavation of stockpiled separately to the overburden material to be validated. The pipe should be exposed in length of about 100m lengths and removed, taking care to remove the pipe without dispersing pieces of ACM pipe;
- The ACM pipe should be disposed off site to an appropriately licensed landfill;
- The material that surrounded the ACM pipe should be excavated to the former base of the ACM pipe and stockpiled with or separate to the material 0.1m above the pipe for validation testing;
- Validation sampling of the excavation and stockpiled material should be carried out in accordance with the remediation and validation gaols outlined in the RAP;
- Non disposable equipment used for the sampling will be decontaminated: the equipment will first be washed with clear water containing Decon 90 (or similar) then rinsed in clear water; and
- Backfill excavation with validated material from the site or importation of suitable fill material. Suitable soil / fill material from the Site will be visually assessed and validated before re-use onsite or backfill. Imported material should be validated for suitability prior to acceptance on site.
- Also, the contractor will be required to supply as-built drawings (based on certified survey of excavation and backfill).

As identified above the ACM pipe may extend beneath Bootles Lane and into the southern part of the site (Fernadell Site). If during remediation activities the ACM pipe is observed to continue into the Fernadell Site the excavation and removal of the ACM will continue until such time as the extent of the drainage line has been established and remediated.

10.0 PROPOSED VALIDATION PROGRAM

10.1 Validation sampling

Validation is required to ensure that remediation works have been conducted in accordance with the protocols established for the project in this RAP.

The soil remediation criteria described in Section 7.1 will be applied during the validation works to selected soils for which are to remain on the Site.

The data obtained from the Validation Program shall be statistically analysed to ensure that the upper 95% confidence limit on the arithmetic average concentration of the analytes of concern is below the relevant clean up criteria. Should individual samples exceed the criteria, the domain over which a 95% UCL will be applied shall be discussed with the Auditor.

Statistical analysis will not be undertaken when comparing data against environmental-based criteria (i.e. phytotoxicity-based criteria).

Generally, if an excavation validation sample fails a clean-up criterion, further excavation and subsequent validation of the affected area will be required.

10.2 Validation Schedule

Validation sampling will be carried out part of the remediation to show that the impacted areas have been remediated in accordance with regulatory requirements and is fit for purpose. The frequency of validation testing will be in accordance with the Validation / Characterisation Schedule presented in Table B below:

Table B Validation / Characterisation Schedule

Remediation Area	Contaminant of Concern	Remediation Task	Field Screening Frequency	Laboratory Analysis	Frequency of Testing
REM1, REM3 & REM4	Petroleum Hydrocarbons (Diesel) Heavy Metals	Characterise Excavated Material	One sample per 5 m^3 to be screened using PID	TPH, BTEX, PAH, Metals and TCLP were required	One Sample per 50 m^3 or at least one per sample stockpile (which ever is greater)
		Validation of Excavation	One sample per 25 m^2 of the base and one sample per 5 linear metres of the walls of the excavation	TPH, BTEX, PAH and Metals	One sample per 25 m^2 of the base and one sample per 5 linear metres of the walls of the excavation
		Validation of Imported Backfill		Asbestos, Metals, OCPs, OPPs, TPH, BTEX and	One Sample per 100 m^3.

		Material		PAH	
REM2	Asbestos	Characterise Excavated Material	N/A	Asbestos, Metals, OCPs, OPPs, TPH, BTEX, PAH and TCLP	One Sample per 50 m^3 or at least one per sample stockpile (which ever is greater)
		Validation of Excavation		Asbestos	One Sample per 25 m^2 or one sample per excavation face (which ever is greater)
		Validation of Imported Backfill Material		Asbestos, Metals, OCPs, OPPs, TPH, BTEX and PAH	One Sample per 100 m^3.
REM5	Asbestos	Characterise Excavated Material	N/A	Asbestos, Metals, OCPs, OPPs, TPH, BTEX, PAH and TCLP	One Sample per 50 m^3 or at least one per sample stockpile (which ever is greater)
		Validation of Excavation		Asbestos	One Sample per 50 linear metres of excavation face
		Validation of Imported Backfill Material		Asbestos, Metals, OCPs, OPPs, TPH, BTEX and PAH	One Sample per 100 m^3.

Notes:

TPH - Total Petroleum Hydrocarbons;
BTEX - Benzene, Toluene, Ethylbenzene and Total Xylene;
PAH - Polycyclic Aromatic Hydrocarbons; and
Metals - As, Cd, Cr, Ni, Pb, Cu, Hg & Zn; and TCLP testing as required

10.3 Validation Criteria

The validation criteria selected for the remediation project shall be sensitive, so as to permit residential and open space landuse. The following criteria are the criteria used in the detailed investigation study i.e.:

- NEPM HILs (Health Based Soil Investigation Levels) NEPM Health Investigation Levels A - referred to as NEPM A (NEPM, 1999) for residential land use with garden and accessible soil (home-grown produce contributing less than 10% vegetables and fruit intake, no poultry);
- NSW EPA Guidelines for Assessing Service Station Sites, December 1994 – only to assess TPH and BTEX concentrations in soil.

- No asbestos or ACM found is testing of validation samples.

Soils have been successfully validated if:

- All validation samples report concentrations below the validation criteria; or
- (for HILs only) the 95% UCL on the arithmetic average contaminant concentration for each contaminant within a particular area is below the respective validation criterion. The following conditions must also be met:
    - No single sample contains an analyte concentration greater that 2.5 times the relevant criteria; and
    - The data set upon which the UCL is calculated must be statistically valid (i.e. sufficient data must be available to calculate a meaningful UCL figure).

10.4 Validation Reporting

On completion of the works, a Remediation / Validation Report detailing the works carried out will be prepared, and submitted to the Auditor for review. The report will be structured in general accordance with the Guidelines for the NSW Site Auditor Scheme, and shall document:

- Any variations to the strategy undertaken during the implementation of the remedial works;
- Results of environmental monitoring undertaken during the course of the remedial works;
- Details of any environmental incidents occurring during the course of the remedial works and the actions undertaken in response to these incidents; and
- Other information as appropriate.

The report will serve to document the remediation works for future reference by JPG and any other relevant parties with an interest in the Site.

11.0 MANAGEMENT PLAN REQUIREMENTS

The Contractor will be required to provide:

- A Safe Work Method Statement
- An Excavation Management Plan
- An ACM Management Plan (including requirements of WorkCover NSW). The ACM Management Plan may be included in the Safe Work Method Statement
- An interim and final Site Management Plan, the final Site Management Plan should include potential environmental monitoring.
- A remediation schedule
- A community relation Plan

11.1 Health and Safety Issues

The implementation of health and safety and environmental control issues onsite are the responsibility of the Site contractor and project managers during the remediation works. If ongoing maintenance is required, the implementation of environmental control measures will be the responsibility of the future landowner.

11.2 Hours of Operation

The remediation will not require overnight and weekend activities, the normal working hours (7am -5 pm) will be applied to the on-site remediation work.

11.3 Contingency Plan

The selected remediation strategy is pragmatic, and involves low risk, thus a contingency plan is not considered applicable. If further contamination is encountered, it will be dealt with in accordance with Section 9 and Appendix A of this RAP.

11.4 Site Management

During the remediation work, the Site will be closed and the contaminated soil will be managed as described in this RAP. Dust emission will be kept at a minimum level by disposing of the soil quickly and applying wetting and capping techniques when required. The Site will be reinstated at the end of the remediation as described in this RAP.

The remediation schedule is not know at this stage and cannot be discussed on. It is proposed the remediation work be carried out all in one time. Once the remediation is done, the Site will not require long term management plan or environmental monitoring.

Golder fieldwork manager will be responsible onsite for liaison with liaising during the works with the local community.

12.0 QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

12.1 Data Quality Objectives

The data quality objectives for the field work, sampling and analysis will consist of the following:

- The sampling program should meet with the objectives if characterising the residual soils after the removal of contaminated materials;
- The Laboratory Limits of Reporting (LOR's) will be targeted to be below the adopted criteria;
- Field duplicates will be collected and analysed at a minimum frequency of 10% of field samples. The Relative Percentage Differences (RPDs) will be targeted to be below 50%;
- Field wash blanks will be collected, where relevant and analysed to provide evidence that no cross-contamination had occurred during field sampling;
- Laboratory spikes, controls and surrogates are targeted to be within 70% and 130% to demonstrate the reliability of the laboratory results reported;
- Laboratory duplicates will be targeted to have RPD values less than 30%.

12.2 Field Quality Control

Standard QA/QC procedures will be adopted during the entire remediation process including those for sample collection, management and handling. Specific requirements will include the use of laboratory prepared jars and containers, decontamination of sampling equipment between locations, collection of an appropriate number of quality control samples, preservation of samples in ice chests and transport to laboratories under chain of custody documentation. Calibration of all field measuring equipment such as PID will be carried out at an appropriate frequency which will not be less than once a day when in use. All calibration results will be documented in a log book, dated and signed by the person who calibrated the equipment.

12.3 Field Quality Control Samples

Field quality control (QC) samples will comprise:

- Field split duplicates: Individual samples will be split in the field and placed in two separate containers. One sample will be sent to the primary laboratory and the duplicate sent to an independent check laboratory.
- Blink duplicates: Both the primary and duplicate samples generated in the field will be sent to the same laboratory however, the duplicate sample will be blind coded.

The frequency of duplicate samples analysed will be a minimum of 10% field samples.

12.4 Laboratory Quality Control

Laboratory analysis will be conducted in accordance with the standard test methods outlined in Schedule B(3) of the NEPM (1999) for soils or equivalent modified methods supported by adequate quality control. The laboratories will be registered by NATA for all the test methods used on this project.

The practical quantitation limits (PQLs) will be set at a level below the relevant assessment criteria.

Laboratory quality control samples will typically include:

- Laboratory duplicate samples;
- Spiked samples;
- Certified reference standards;
- Surrogate standards/spikes;
- Laboratory blank.

All basic analytical methods will be those endorsed by the NEPM 1999. The laboratory will be NATA registered for all analysis performed on this project.

12.5 Completeness

The completeness of the sampling and analysis program will be calculated as a percentage of samples with acceptable results to the total number of samples scheduled for analysis. The targeted completeness will be 95%.

13.0 CONCLUSION

The purpose of this remediation is to render the Site suitable to low density residential development.

Five areas of concern / Remediation Areas have been identified as a result of the previous investigations:

- Area of Concern 1 / Remediation Area 1 (REM1): area with material identified as containing elevated concentrations of copper and TPH (SS60) in 1998. REM1 will be remediated for surface staining.
- Area of Concern 2 / Remediation Area 2 (REM2): Asbestos Containing Material (ACMs) identified at BH176 and at surface within the general area of the former fruit packing and storage shed. These areas will be remediated for ACMs.
- Area of Concern 3 & 4 / Remediation Area 3 (REM3) and Remediation Area 4 (REM4): visually stained areas within the vicinity of the disused and empty diesel ASTs. REM3 and REM4 will be remediated for surface staining and surface contamination related to the diesel ASTs.
- Area of Concern 5 / Remediation Area 5 (REM5): Asbestos Containing Material (ACMs) within the water piping identified within western part of the Bona Vista and Fernadell Sites. REM5 will be remediated for ACMs.

The proposed remediation solutions for the different contaminations are:

- REM1, REM3 and REM4: excavate the contaminated soil, validate the excavation, classify the excavated soil and dispose off-site, reuse onsite of the material will only be possible if the material has been correspondingly validated.
- REM2 and REM5: excavate the asbestos and soil associated with the asbestos, validate the excavation and dispose off-site of the excavated material.

The remediation solution will be conducted in accordance with the NSW DEC Guidelines for Assessment, Classification and Management of Liquid and Non-Liquid Wastes (1999), the NSW DEC Site Auditor Guidelines and WorkCover NSW Guidelines.

The remediation criteria used for the soil are the National Environmental Protection Measure NEPM Health Based Soil Investigation Levels (NEPM HILs), 1999, column A or NEPM A for residential land use and the NSW EPA Guidelines for Assessing Service Station Sites (NSW EPA, 1994) when assessing TPH and BTEX concentrations in soil.

Acid sulphate soil will not be assessed in this remediation. It is recommended it be assessed separately when details of development design are determined.

It is proposed a new round of groundwater monitoring be conducted to confirm the first round of groundwater results and validate the suitability of the groundwater at the Site for the future activities.

14.0 LIMITATIONS

Your attention is drawn to the following limitations, which must be read in conjunction with this report. This report has been prepared in accordance with the agreement between JPG and Golder Associates Pty Ltd (Golder Associates). The services performed by Golder Associate have been conducted in a manner consistent with the level of quality and skill generally exercised by members of its profession and consulting practice. No warranty or guarantee of site conditions is intended.

This report is solely for the use of the client and any reliance of this report by third parties shall be at such party's sole risk and may not contain sufficient information for purposes of other parties or for other uses. This report shall be presented in full and may not be used to support any other objective than those set out in the report, except where written approval with comments are provided by Golder Associates. Golder Associates will not be responsible for the real or perceived decrease in a property value, its saleability or ability to gain financing suffered by any third party as a result of decision made or actions based on this report.

15.0 IMPORTANT INFORMATION

Your attention is drawn to the document - "Important Information about your Environmental Site Assessment", which is included in Appendix B of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be, and to present you with recommendations on how to minimise the risks associated with this project. The document is not intended to reduce the level of responsibility accepted by Golder Associates, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

We would be pleased to answer any questions about this important information from the reader of this report.

GOLDER ASSOCIATES PTY LTD

Glen Fuller
Senior Environmental Officer

Colm Molloy
Associate

GJF/FH/CPM
J:\05Proj\001-050\Enviro\05623002_Johnson - Pitt Town NSW\002_017_RAP draft_RL0.doc

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NSW EPA, 1994, Guidelines for Consultants Reporting on Contaminated Sites,

NSW EPA, 1997, Contaminated Land Management Act 1997 (CLM, 1997)

NSW EPA, 1998, Guidelines for the NSW Site Auditor Scheme

Sulphate Soils Management Advisory Committee (ASSMAC), 1998, Acid Sulphate Soil Manual

USEPA Region 9, 2004, Guidelines Superfund Preliminary Remediation Goals for Assessing Herbicides (USEPA, 2004).

Sample Location	Sample Date	Sample Depth	Site	Chromium	Sample Location	Sample Date	Sample Depth	Site	Chromium
BH101	4/03/2005	0-0.2	Bona Vista	**2**	BH152	21/03/2005	0-0.2	Fernadell	**8**
BH102	10/03/2005	0-0.2	Bona Vista	**2**	BH153	21/03/2005	0-0.2	Fernadell	**13**
BH103	10/03/2005	0-0.2	Bona Vista	**4**	TP154	15/03/2005	0-0.2	Fernadell	**5**
TP108	14/03/2005	0-0.2	Bona Vista	**1**	BH155	21/03/2005	0-0.2	Fernadell	**5**
BH110	10/03/2005	0-0.2	Bona Vista	**2**	BH156	21/03/2005	0-0.2	Fernadell	**3**
BH111	10/03/2005	0-0.2	Bona Vista	**1**	TP157	15/03/2005	0-0.2	Fernadell	**3**
BH112	10/03/2005	0-0.1	Bona Vista	**1**	BH158	21/03/2005	0-0.2	Fernadell	**3**
TP116	14/03/2005	0-0.2	Bona Vista	**3**	BH159	21/03/2005	0-0.2	Fernadell	**5**
TP119	14/03/2005	0-0.2	Bona Vista	**1**	TP160	15/03/2005	0-0.2	Fernadell	**9**
BH124	10/03/2005	0-0.15	Bona Vista	**6**	BH161	21/03/2005	0-0.2	Fernadell	**21**
BH125	10/03/2005	0-0.2	Bona Vista	**6**	BH162	21/03/2005	0-0.2	Fernadell	**8**
BH126	10/03/2005	0-0.2	Bona Vista	**3**	BH163	4/03/2005	0-0.2	Fernadell	**11**
BH127	10/03/2005	0-0.2	Bona Vista	**2**	BH164	21/03/2005	0-0.2	Fernadell	**4**
BH128	10/03/2005	0-0.2	Bona Vista	**2**	TP165	15/03/2005	0-0.2	Fernadell	**7**
BH131	14/03/2005	0-0.2	Bona Vista	**2**	BH166	21/03/2005	0-0.2	Fernadell	**5**
TP132	14/03/2005	0-0.2	Bona Vista	**4**	TP167	15/03/2005	0-0.2	Fernadell	**4**
BH133	10/03/2005	0-0.2	Bona Vista	**2**	BH168	21/03/2005	0-0.2	Fernadell	**4**
BH134	10/03/2005	0-0.2	Bona Vista	**2**	BH169	21/03/2005	0-0.2	Fernadell	**7**
BH136	10/03/2005	0-0.2	Bona Vista	**2**	TP170	15/03/2005	0-0.2	Fernadell	**3**
BH137	14/03/2005	0-0.2	Bona Vista	**5**	TP171	15/03/2005	0-0.2	Fernadell	**2**
BH138	14/03/2005	0-0.2	Bona Vista	**9**	BH172	4/03/2005	0-0.2	Fernadell	**12**
TP139	14/03/2005	0-0.2	Bona Vista	**11**	BH173	21/03/2005	0-0.2	Fernadell	**4**
BH141	5/05/2005	0-0.1	Bona Vista	**3**	BH174	21/03/2005	0-0.2	Fernadell	**4**
BH142	5/05/2005	0-0.1	Bona Vista	**5**	BH175	21/03/2005	0-0.2	Fernadell	**3**
BH143	5/05/2005	0-0.1	Bona Vista	**6**	BH176	21/03/2005	0-0.2	Fernadell	**2**
BH144	5/05/2005	0-0.1	Bona Vista	**5**	BH177	21/03/2005	0-0.2	Fernadell	**8**
TP140	15/03/2005	0-0.2	Fernadell	**6**	BH178	21/03/2005	0-0.2	Fernadell	**3**
BH141	14/03/2005	0-0.2	Fernadell	**7**	BH179	21/03/2005	0-0.2	Fernadell	**5**
BH142	14/03/2005	0-0.2	Fernadell	**5**	BH180	23/03/2005	0.1-0.3	Fernadell	**5**
TP143	15/03/2005	0-0.2	Fernadell	**4**	BH180	23/03/2005	0.4-0.6	Fernadell	**5**
BH144	14/03/2005	0-0.2	Fernadell	**14**	BH181	23/03/2005	0.1-0.3	Fernadell	**6**
BH145	14/03/2005	0-0.2	Fernadell	**10**	BH181	23/03/2005	0.4-0.6	Fernadell	**4**
TP146	15/03/2005	0-0.2	Fernadell	**10**	BH190	5/05/2005	0-0.1	Fernadell	**2**
BH147	14/03/2005	0-0.2	Fernadell	**7**	BH191	5/05/2005	0-0.1	Fernadell	**4**
BH148	14/03/2005	0-0.2	Fernadell	**4**	BH192	5/05/2005	0-0.1	Fernadell	**10**
BH149	21/03/2005	0-0.2	Fernadell	**6**	BH193	5/05/2005	0-0.1	Fernadell	**5**
BH150	21/03/2005	0-0.2	Fernadell	**4**	BH194	5/05/2005	0-0.1	Fernadell	**10**
BH151	21/03/2005	0-0.2	Fernadell	**3**					
NEPM EIL - Interim urban				**1***	**NEPM EIL - Interim urban**				**1***
NEPM HIL - A (Column 1)				**-**	**NEPM HIL - A (Column 1)**				**-**

* applicable for CrVI (EIL criteria for CrIII is 400 mg/kg)
All units in mg/kg

Table 1: Summary of exceedances - Detailed Site Investigation (Page 1of 2)
Remediation Action plan
Johnson Property Group

Sample Location	Sample Date	Sample Depth	Site	Copper
BH141	14/03/2005	0-0.2	Fernadell	**120**
BH142	14/03/2005	0-0.2	Fernadell	**100**
BH149	21/03/2005	0-0.2	Fernadell	**140**
BH169	21/03/2005	0-0.2	Fernadell	**140**
TP170	15/03/2005	0-0.2	Fernadell	**120**
BH177	21/03/2005	0-0.2	Fernadell	**130**
BH194	5/05/2005	0-0.1	Fernadell	**110**
NEPM EIL - Interim urban				**100**
NEPM HIL - A (Column 1)				**1000**

Sample Location	Sample Date	Sample Depth	Site	Copper
BH176	21/03/2005	0-0.2	Fernadell	Chrysotile Asbestos, Amosite & Crocidolite Asbestos detected
NEPM EIL - Interim urban				
NEPM HIL - A (Column 1)				**YES**

Table 1: Summary of exceedances - Detailed Site Investigation (Page 2 of 2)

Remediation Action plan
Johnson Property Group

Figures

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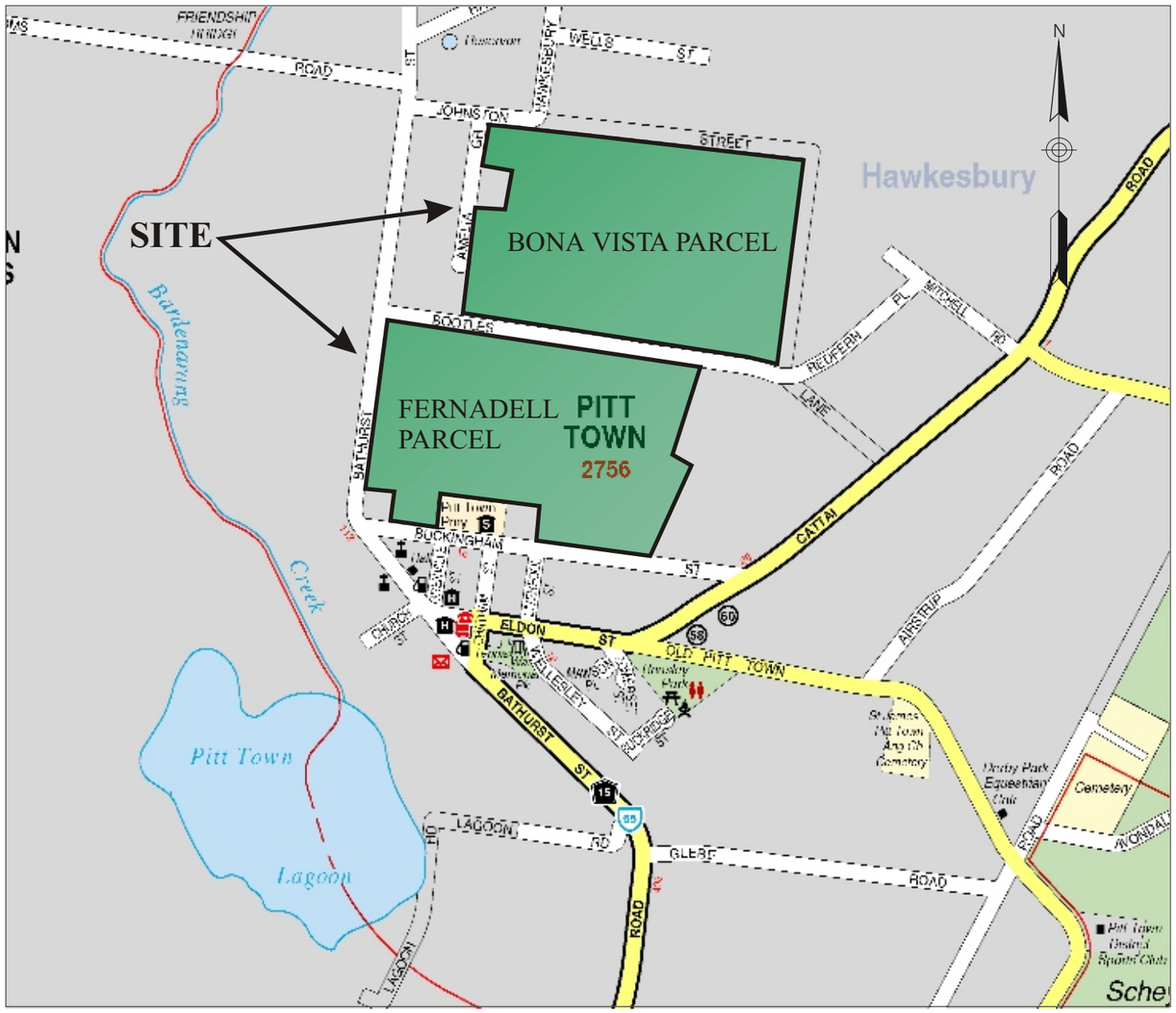

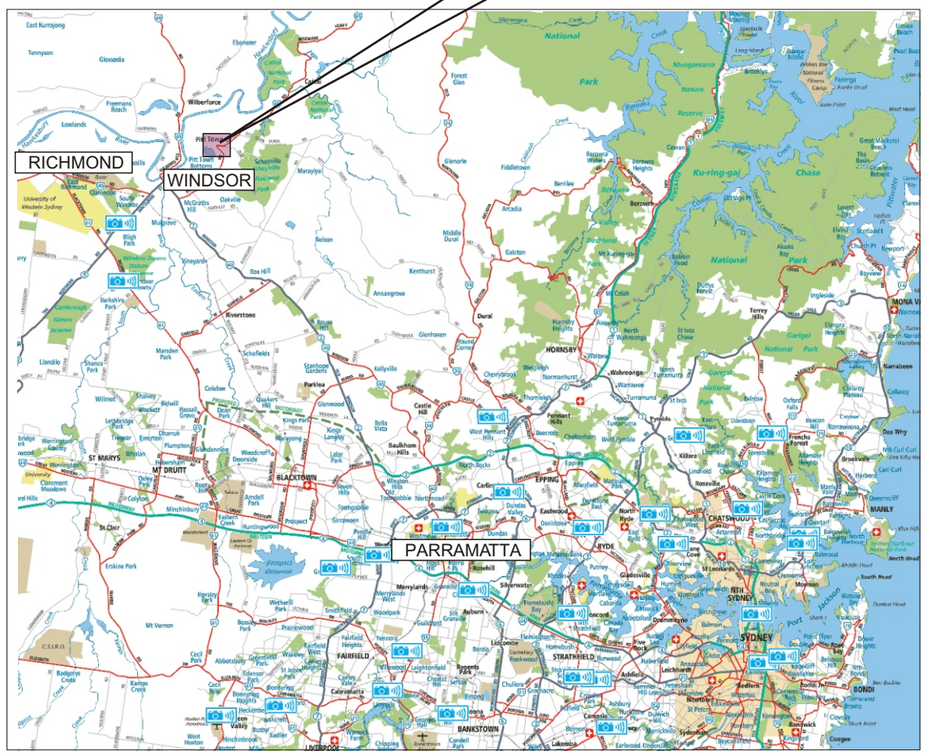

SOURCE: BASE MAP 2004 UBD CITY LINK 16TH EDITION

Golder Associates	CLIENT: Johnson Property Group Pty Ltd	PROJECT: Remediation Action Plan, Bona Vista and Fernadell, Pitt Town NSW	
	DRAWN: SL / DATE: 17 Oct. 2005	TITLE: SITE LOCALITY PLAN	
	CHECKED: / DATE:		
	SCALE: N.T.S	PROJECT No: 05623002/017	FIGURE No: 1 / REV No: 1 / A3

FILE LOCATION: 05623002\Figures\Report17\05623002 Fig 1 (SiteLocPlan).cdr

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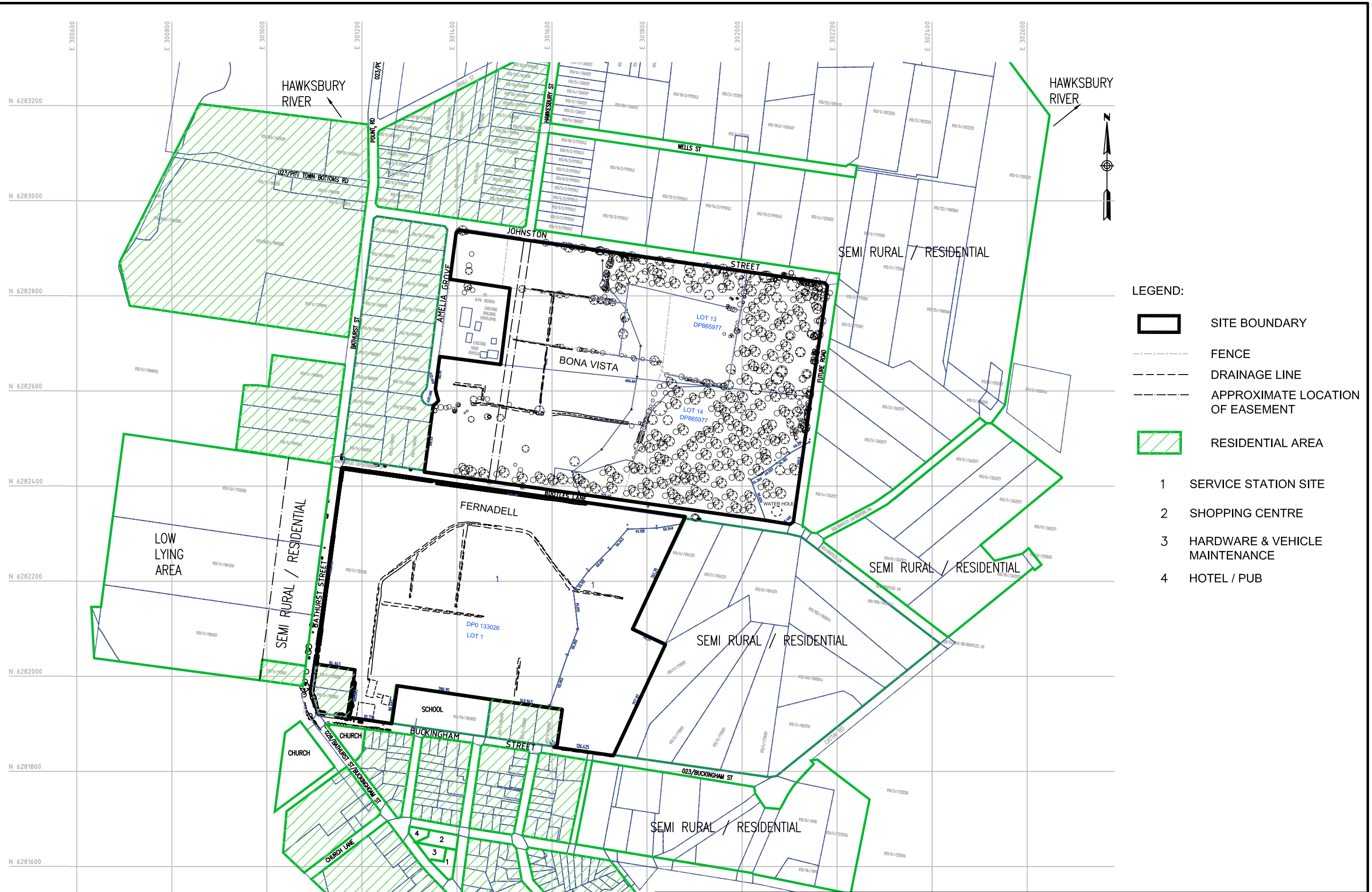

LEGEND:

- SITE BOUNDARY
- FENCE
- DRAINAGE LINE
- APPROXIMATE LOCATION OF EASEMENT
- RESIDENTIAL AREA

1 SERVICE STATION SITE

2 SHOPPING CENTRE

3 HARDWARE & VEHICLE MAINTENANCE

4 HOTEL / PUB

PITT TOWN LAGOON
(≈ 0.5KM FROM SITE)

BASE PLAN SUPPLIED BY BROWN CONSULTING PTY LTD

CLIENT: Johnson Property Group		PROJECT: Remediation Action Plan, Bona Vista and Fernadell, Pitt Town NSW	
DRAWN: SL	DATE: 17 Oct. 2005	TITLE: SITE BOUNDARY AND SURROUNDING PROPERTIES	
CHECKED	DATE		
SCALE: 1:7500		PROJECT No: 05623002 / 017	FIGURE No: 2 / REV No: 1 / A3

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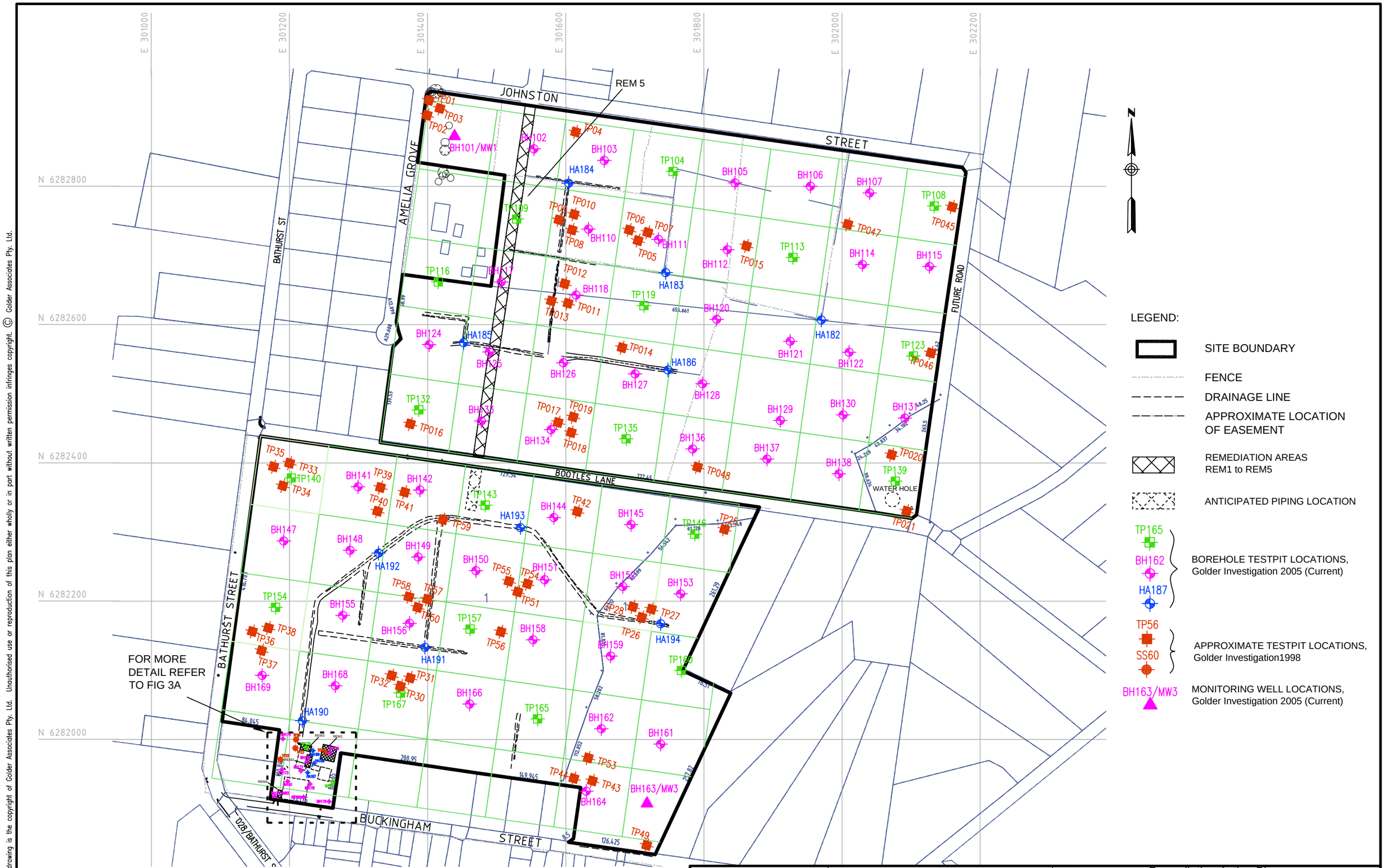

BASE PLAN SUPPLIED BY BROWN CONSULTING PTY LTD

CLIENT: Johnson Property Group		PROJECT: Remediation Action Plan, Bona Vista and Fernadell, Pitt Town NSW	
DRAWN: SL	DATE: 17 Oct. 2005	TITLE: REMEDIATION AREAS	
CHECKED	DATE		
SCALE: 1:5000		PROJECT No: 05623002 / 017	FIGURE No: 3 / REV No: 1 / A3

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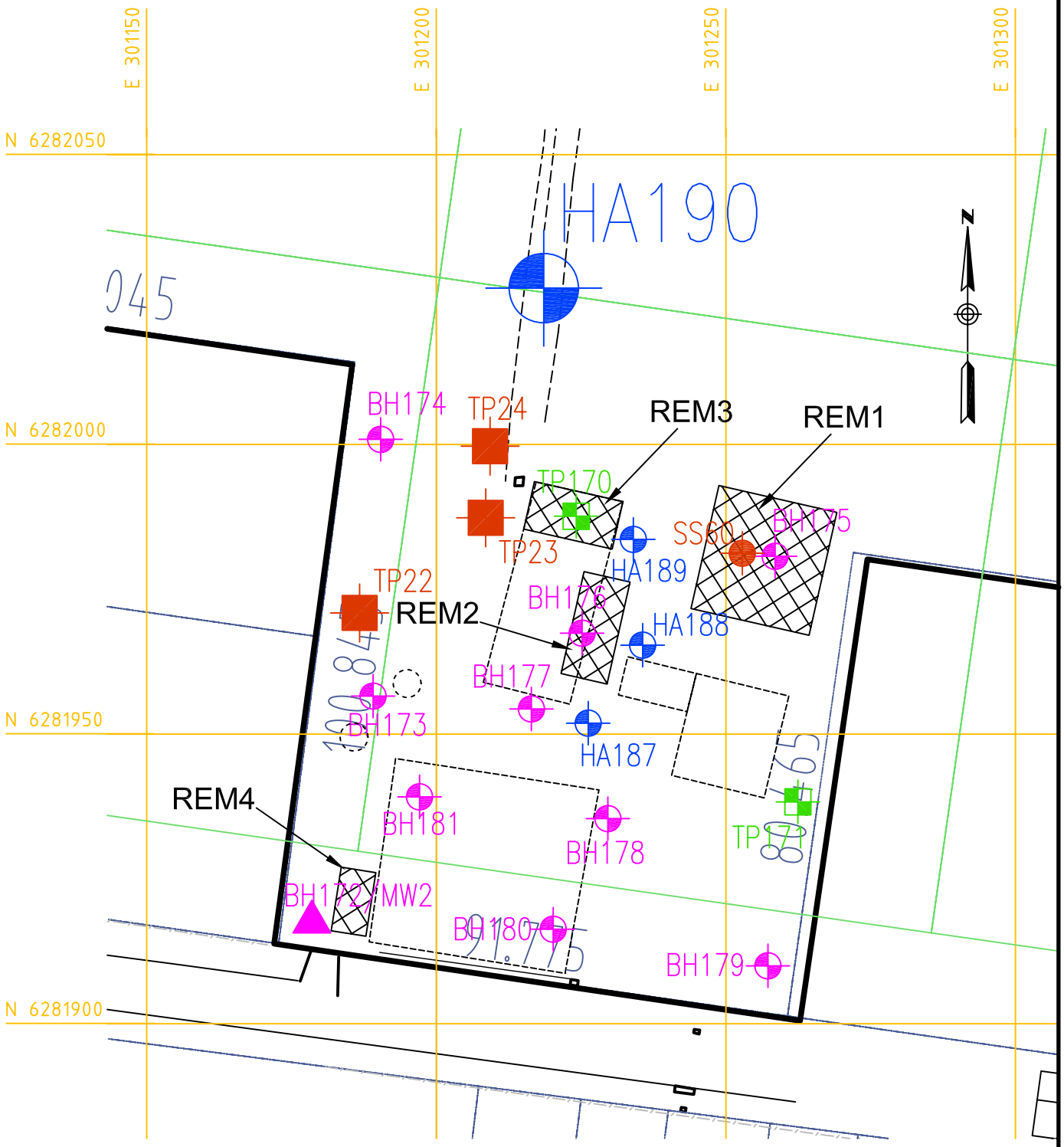

LEGEND:

- BUILDING LINES
- SEPTIC TANKS (APPROX. LOCATION)
- SITE BOUNDARY
- FENCE
- DRAINAGE LINE
- APPROXIMATE LOCATION OF EASEMENT
- REMEDIATION AREAS REM1 to REM5
- TP165, BH162, HA187 — BOREHOLE TESTPIT LOCATIONS, Golder Investigation 2005 (Current)
- TP56, SS60 — APPROXIMATE TESTPIT LOCATIONS, Golder Investigation1998
- BH163/MW3 — MONITORING WELL LOCATIONS, Golder Investigation 2005 (Current)

BASE PLAN SUPPLIED BY BROWN CONSULTING PTY LTD

CLIENT: Johnson Property Group		PROJECT: Remediation Action Plan, Bona Vista and Fernadell, Pitt Town NSW	
DRAWN: SL	DATE: 17 Oct. 2005	TITLE: REMEDIATION AREAS	
CHECKED	DATE		
SCALE: 1:1000	PROJECT No: 05623002 / 017	FIGURE No: 3A	REV No.: 1 — A4

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Appendix A
Asbestos Containing Materials Management Plan

Asbestos Containing Materials Management Plan

A1 INTRODUCTION

This management plan has been prepared for a property located at Bathurst Street Pitt Town, NSW (hereafter referred to as the "Site"). This plan specifically outlines the proposed management of potential ACM if encountered during the construction of infrastructure associated the proposed development such as roadways, drainage and utilities.

A Detailed Site Investigation (DSI) carried out on the Site identified ACM which will be remediated in accordance with the remediation strategies outlined within the Remediation Action Plan developed for the Site. Based on the results of the DSI the risk of Asbestos Containing Materials (ACM) being present on the site other than those identified is considered low.

The objective of this management plan is:

- Provide information on potential ACM that may be encountered during bulk earthworks;
- Provide management plans for the safe handling and disposal of ACM if encountered during site works; and
- Provide a validation process if ACM is encountered.

A2 TYPES OF POTENTIAL ACM ON THE SITE

ACM on the Site was identified within an existing irrigation pipe located on the north western part of the site (Fernadell Site) and surfical fragment pieces of asbestos identified on the south western corner of the Site (Fernadell Site) and will be remediated in accordance with the Remediation Action Plan (RAP).

Types of ACM that may be encountered during bulk earthworks would be those associated with construction of stormwater, water supply pipes (irrigation pipes) and former structures constructed of fibro cement sheeting.

Experience shows that semi rural properties within Australia have generally contained waste disposal areas such as burial pits were waste materials such as obsolete building materials (potential ACM) may have been buried. Based on available information from the current owner, all waste materials were disposed of site including construction materials associated with the former maintenance shed located on the Fernadell Site. We understand that this structure was previously constructed of timber, sheet metal and ACM fibro cement sheeting. Considering the large aerial extent of the site and duration of time that the site has been occupied the potential for buried waste materials can not be ruled out completely, However, the risk of buried waste materials on the site is considered low.

A3 ROLES AND RESPONSIBILTY DURING SITE WORKS

The parties involved in the project to which this ACM-MP applies (ie bulk excavation and construction), are as follows:

- Principal (Developer) – To Be Advised (TBA);
- Civil Engineering Superintendent - TBA;
- Project Manager – Brown Consulting Pty Ltd;
- Civil Contractor – TBA;
- Environmental Consultant – Golder Associates Pty Ltd; and
- Asbestos Management Contractor (AS1) - TBA

Project Management Team

The Developer, Civil Superintendent and Project Manager will be responsible for the overall health and safety aspects of the project including:

- Reviewing Occupational Health and Safety procedures;
- Reviewing the SSSP, the SWMS and EMP prepared by contractors and sub contractors;
- Reviewing and authorising accident and emergency procedures considered necessary;
- Reviewing and authorising underground services search;
- Facilitate briefing subcontractors on the content and need to implement the SSSP, SWMS and EMP prior the works be carry out;
- Advising subcontractors of the need to maintain all licences and permits relating to OHS requirements and to provided SWMS;
- Identifying safety training needs that are specific to the work being carried out;
- Monitoring compliance with safe work methods (controls);
- Auditing the project to assess compliance out in accordance with the plans; and
- Initiating any disciplinary action required for non-compliances on the site.

Civil Contractor and Sub Contractors

Contractors on the site will be responsible for implementing the SSSP, SWMS and EMP during the works and the main roles and responsibility will include:

- Obtain Dial B4 U Dig plans from service providers (services search);
- Implementing Occupational Health Safety procedures and maintaining site first aid equipment;
- Assisting with implementation of any additional specific work procedures that may be required during fieldwork (including implementation of accident and emergency procedures considered necessary);

- Carry out site inductions to subcontractors prior to commence fieldwork activities;
- Conduct daily tool box meetings;
- Advising all site personnel involved with field work on the content and need to implement work in accordance with the Site Safety Rules, SSSP, SWMS and EMP during the project;
- Monitoring subcontracting companies for compliance with the SSSP, SWMS and EMP with respect to implementation of procedures and use of appropriate Personal Protection Equipment (PPE);
- Recording incidents relating to OHS issues;
- Consultation and liaison with the Project Director and Landcom representative for site specific changes in the SSSP, SWMS or EMP that may be required once work has commenced;
- Conducting Site inspections to assess if fieldwork is carried out in accordance with the SSSP, SWMS and EMP;
- Recording projects deviations with respect to original plans; and
- Review the SWMS where necessary and communicate changes to all employees onsite.

A3 RELEVANT LEGISLATION

The NSW Occupational Health and Safety Regulation 2001 states that:

A controller of premises that contains asbestos or asbestos-containing material must ensure that risk assessment and control measures are carried out in accordance with the document entitled "Guide to the Control of Asbestos Hazards in Buildings and Structures [NOHSC: 3002 (1998)] published by the NOHS Commission, as in force from time to time.

The Code of Practice for the Management and Control of Asbestos in Workplaces [NOHSC:2018 (2005)] requires that where asbestos containing materials have been identified in a workplace, an assessment of risks associated with asbestos containing materials be undertaken.

The risk assessment should consider a range of factors such as nature, age, layout and condition of asbestos materials as well as the nature of work and likely disturbance of asbestos materials. The risk assessment must identify the actions necessary to eliminate or control the identified risks and should be regularly reviewed to ensure the control measures and risks are valid.

WorkCover Your *Guide to Working with Asbestos* (March 2003) states:

- *Asbestos inappropriately buried (i.e. not in accordance to any environmental legislative requirements) is considered friable asbestos material; and*
- *Any asbestos cement product, which has been subjected to weathering, severely damaged by hail, damaged by heat/fire or other mechanical action, or illegal water blasting is a friable asbestos product and an Asbestos Removal Contractor with an AS1 Licence for friable asbestos is required for its removal.*

A4 HEALTH HAZARD ASSESSMENT

The identified risks, along with a risk assessment are documented in Table 1 presented below. The risk assessment has been performed on a 5 by 5 matrix.

The likelihood of inhalation of asbestos fibres was considered to be rare due to the bonded form of asbestos likely to be present, the low likelihood of the bonded asbestos materials releasing respirable asbestos fibres (see AS4964-2004), and the requirement to wear PPE including respirators during ACM remediation works. The consequence of inhalation of asbestos fibres was considered to be catastrophic, due to the potential for developing asbestosis or mesothelioma.

Table 1 Risk Assessment

Risk	Consequence Rating	Likelihood Rating	Risk Level	Classification
Inhalation of asbestos fibres, with potential development of asbestosis or mesothelioma.	5	1	5	Low

RISK CONTROL

Proposed risk controls to be implemented during the earthworks will include:

- Asbestos removal works to be performed by a Contractor holding a Class AS1 asbestos removal licence according to *Code of Practice for the Safe Removal of Asbestos.*
- Appropriate personal protective equipment (PPE) to be worn during remedial works.
- Work area to be barricaded, with signs, from the remaining park area during remedial site works.
- Work method statement by Contractor will address the issue of potential slip/fall injuries.
- Monitoring for air-borne asbestos fibres to be performed during remedial works.

A5 AIR MONITORING

If ACM is identified on the site we recommend air quality samples be collected in accordance with the NOHSC Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition {NOHSC:3003(2005)} to determine the concentration of airborne asbestos fibres.

Control levels for airborne asbestos fibres are documented in the Code of Practice for the Safe Removal of Asbestos [NOHSC:2002 (2005)]. For an airborne asbestos fibre concentration of

less than 0.01fibres/mL the recommended course of action is to continue with the existing control measures. It should be noted that the control levels are not Exposure Standards, but are considered to be occupational hygiene best practice.

A6 WASTE DISPOSAL & HANDLING

All identified ACM shall be handled in accordance with NSW DEC and WorkCover requirements and disposed of site to a suitably licensed landfill.

The NSW EPA "Waste Management of Liquid and Non-Liquid Waste – 1999" states that Asbestos is classified as an Industrial Waste.

A7 PERSONAL PROTECTIVE EQUIPMENT

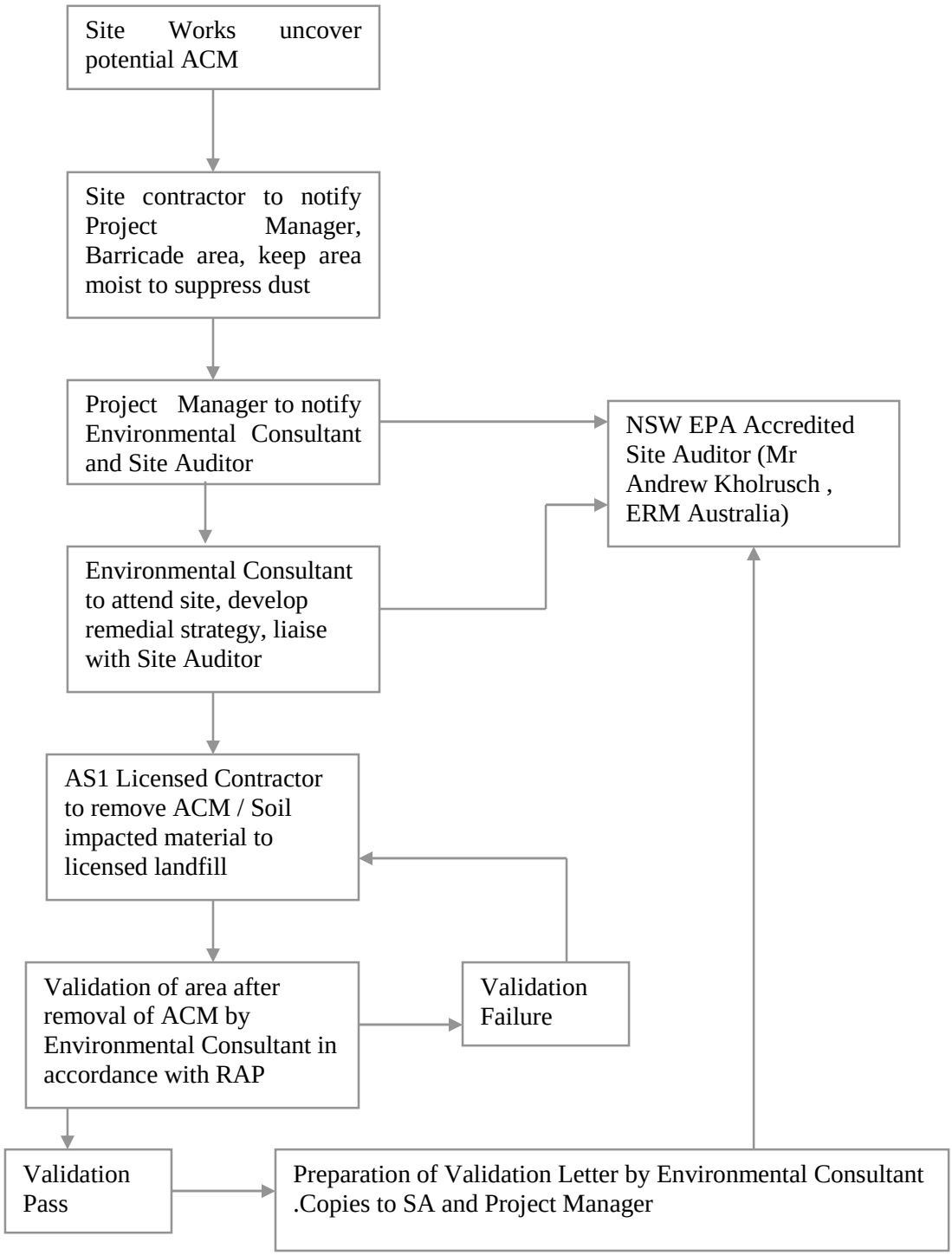
Based on the results of the DSI (2005) the risk of Asbestos Containing Materials other than those identified is considered low. Therefore it is considered that on completion of the proposed remediation works detailed within the RAP site personnel are unlikely to be required to wear personal protective equipment (ppe) during bulk earthworks and construction of infrastructure. However, we recommend that a quantity of ppe suitable for handling Asbestos be made available to site personnel and may include:

- Safety boots;
- Disposable overalls;
- Safety vest;
- Hard hat; and
- Respirator.

PPE should be designed to be one use only and discarded on completion of daily site activities due to the risk of contamination. Due to the presence of asbestos cement fragments in soil identified on the site, and the need for all personnel to have unobstructed peripheral vision, it is considered that the minimum required respirator type appropriate for the site works would be a half-face respirator fitted with filter (cartridge) for personnel working in the asbestos contaminated area of the site.

A8 WORKING GUIDE

The proposed methodology to be adopted if ACM is identified during bulk earthworks is presented as the following flowchart:



Appendix B
Important Information about your Environmental Site Assessment

Important Information About Your

Environmental Site Assessment

These notes have been prepared by Golder Associates Pty Ltd using guidelines prepared by ASFE; The Association of Engineering Firms Practising in the Geosciences, of which Golder Associates Pty Ltd is a member. They are offered to help you in the interpretation of your Environmental Site Assessment (ESA) report.

Reasons For Conducting An ESA

ESA's are typically, though not exclusively carried out in the following circumstances :

- as pre-acquisition assessments, on behalf of either purchaser or vendor, when a property is to be sold;
- as pre-development assessments, when a property or area of land is to be redeveloped or have its use changed, for example, from a factory to a residential subdivision;
- as pre-development assessments of greenfield sites, to establish "baseline" conditions and assess environmental, geological and hydrogeological constraints to the development of, for example, a landfill; and
- as audits of the environmental effects of an ongoing operation.

Each of these circumstances requires a specific approach to the assessment of soil and groundwater contamination. In all cases, however, the objective is to identify and if possible quantify the risks which unrecognised contamination poses to the proposed activity. Such risks may be both financial, for example, clean-up costs or limitations on site use, and physical, for example, health risks to site users or the public.

The Limitations of An ESA

Although the information provided by an ESA can reduce exposure to such risks, no ESA, however diligently carried out, can eliminate them. Even a rigorous professional assessment may fail to detect all contamination on a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which showed no signs of contamination when sampled.

An ESA Report Is Based On A Unique Set of Project Specific Factors

Your environmental report should not be used :

- When the nature of the proposed development is changed, for example, if a residential development is proposed instead of a commercial one;
- When the size or configuration of the proposed development is altered;
- when the location or orientation of the proposed structure is modified;
- When there is a change of ownership; or
- For the application to an adjacent site.

To help avoid costly problems, refer to your consultant to determine how any factors which have changed subsequent to the date of the report may affect its recommendations.

ESA "Findings" Are Professional Estimates

Site assessment identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists who then render an opinion about overall subsurface conditions, the nature and extent of contamination, its likely impact on the proposed development and appropriate remediation measures. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, but steps can be taken to help minimise its impact. For this reason, owners should retain the services of their consultants through the development stage, to identify variations, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

Subsurface Conditions Can Change

Subsurface conditions are changed by natural processes and the activity of man. Because an ESA report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on an ESA report whose adequacy may have been affected by time. Speak with the consultant to learn if additional tests are advisable.

ESA Services Are Performed For Specific Purposes And Persons

Every study and ESA report is prepared in response to a specific Brief to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. A report should not be used by other persons for any purpose, or by the client for a different purpose. No individual other than the client should apply a report even apparently for its intended purpose without first conferring with the consultant. No person should apply a report for any purpose other than that originally contemplated without first conferring with the consultant.

An ESA Report Is Subject To Misinterpretation

Costly problems can occur when design professionals develop their plans based on misinterpretations of an ESA. To help avoid these problems, the environmental consultant should be retained to work with appropriate design professionals to explain relevant findings and to review the adequacy of their plans and specifications relative to contamination issues.

Logs Should Not Be Separated From The Engineering Report

Final borehole or test pit logs are developed by environmental scientists, engineers or geologists based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples.

Only final logs are customarily included in our reports. These logs should no under any circumstances be redrawn for inclusion in site remediation or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimise the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To reduce the likelihood of boring log misinterpretation, the complete report must be available to persons or organisations involved in the project, such as contractors, for their use. Those who do not provide such access may proceed under the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing all the available information to persons and organisations such as contractors helps prevent costly construction problems and the adversarial attitudes which may aggravate them to disproportionate scale.

Read Responsibility Clauses Closely

Because an ESA is based extensively on judgement and opinion, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, model clauses have been developed for use in written transmittals. These are not exculpatory clauses designed to foist liabilities onto some other party. Rather, they are definitive clauses which identify where your consultant's responsibilities begin and end. Their use helps all parties involved recognise their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your ESA report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.