Remedial Action Plan

Nine Network Australia

24 Artarmon Rd, Willoughby, NSW

November 2012
JBS 42410-52334 (Rev A)
JBS Environmental Pty Ltd

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List of Abbreviations

A list of the common abbreviations used throughout this report is provided below.

ACM	Asbestos Containing Material (e.g. fibre cement sheet)
AHD	Australian Height Datum
As	Arsenic
bgs	below ground surface
Cd	Cadmium
COPC	Contaminants of Potential Concern
CSM	Conceptual site model
Cr	Chromium
Cu	Copper
BTEX	Benzene, toluene, ethylbenzene and xylenes
B(a)P	Benzo(a)pyrene
DQOs	Data Quality Objectives
EMP	Environmental Management Plan
EPA	NSW Environment Protection Authority
GILs	Groundwater investigation levels
ha	Hectare
Hg	Mercury
HIL	Health based investigation level
JBS	JBS Environmental
LOR	Limit of Reporting
Ni	Nickel
OCP	Organochlorine Pesticides
OPP	Organophosphorus Pesticides
PAHs	Polycyclic aromatic hydrocarbons
Pb	Lead
PCBs	Polychlorinated Biphenyls
PIL	Phytotoxicity based investigation level
PQL	Practical Quantitation Limit
PSI	Preliminary Site Investigation
QA/QC	Quality Assurance/Quality Control
RAP	Remedial Action Plan
RPD	Relative Percentage Difference
SPLP	Synthetic Precipitation Leaching Procedure
TCLP	Toxic Characteristic Leaching Potential
TPH	Total Petroleum Hydrocarbons
UST	Underground Storage Tank
Zn	Zinc

1 Introduction

1.1 Background

JBS Environmental Pty Ltd was engaged by Nine Network Australia (Nine Network) to develop a Remedial Action Plan (RAP) for the property located at 24 Artarmon Rd, Willoughby, NSW (also known as 14 Artarmon Rd, Willoughby, NSW)(the site). The site is legally defined as Lot 10 and 12 DP1162507, Lot 13 DP6849, Lot 1 DP820327 and Lot 1 DP327266 and has an approximate area of 3 hectares (ha) (**Figures 1 and 2**). It is understood that the parcel of land containing the television tower (Lot 11 DP1162507) with an area of approximately 1600 m^2 is not owned by Nine Network, subsequently this area was not included as part of this investigation.

The site has been assessed previously by Douglas Partners (DP 2008[1]), although only limited information from that assessment has been made available. The information provided to JBS indicates that 21 boreholes were sampled. Elevated concentrations of hydrocarbons and BTEX compounds were reported in borehole locations downgradient of the underground storage tanks (USTs). Asbestos fibres were detected in one soil sample in fill material beneath the bituminous concrete carpark within the northern portion of the site. The preliminary report recommended further assessment and remediation within the vicinity of the USTs.

An environmental site assessment (ESA) was subsequently completed (JBS 2012[2]) to assess the character and extent of contamination at the site. Soil samples were collected from 20 locations and groundwater samples from 2 locations. The DSI identified total petroleum hydrocarbon (TPH), benzene and total xylene impacts (hydrocarbon impacts) exceeding adopted soil criteria in natural soils at BH13 (**Figure 6**). The ESA concluded that the hydrocarbon and asbestos impacts identified represented a potentially unacceptable risk to human health, and recommended a RAP be prepared to guide remediation of these impacts. In addition, the DSI also recommended the petroleum infrastructure USTs and above ground storage tanks (ASTs) to be abandoned and that groundwater be further assessed across the site.

It is understood that the property is proposed to be developed for mixed use (residential/commercial) and the RAP is required to render the site suitable for the proposed mixed use.

The RAP provides for management of identified contamination under scenarios for redevelopment of the land for the proposed mixed use (residential and commercial).

This RAP has been prepared with reference to relevant Australian Standards and guidelines made or approved by the NSW Environmental Protection Authority (EPA).

1.2 Objective

The objective of this RAP is to document the procedures and standards to be followed in order to remove the potential risks posed by the identified impacts to make the site suitable for the proposed mixed use (residential/commercial).

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[1] *Advanced Notice of Results for Phase 1 Contamination Assessment Corner of Richmond Avenue and Artarmon Road Willoughby*, Douglas Partners, January 2008 (DP 2008)

[2] *Environmental Site Assessment, 24 Artarmon Rd, Willoughby, NSW*. JBS Environmental, JBS42410 – 52068, November 2012 (JBS 2012)

2 Site Condition & Surrounding Environment

2.1 Site Identification and Condition

Detailed information of the site condition, physical characteristics, history and surrounding land uses are provided in the previous ESA (JBS 2012). The following is a summary of relevant information.

Table 2.1 Summary Site Details

Lot/DP	Lots 10 and 12 DP1162507, Lot 13 DP6894, Lot 1 DP820327 and Lot 1 DP327266.
Address	24 Artarmon Rd, Willoughby, NSW
Local Government Authority	Willoughby City Council
Site Zoning	Lot 10 DP 1162507 Special Uses A (Television Station) (As defined by Willoughby Local Environmental Plan 1995) SP2 Infrastructure (As defined by Draft Willoughby Environmental Plan 2012)
Approximate co-ordinates (MGA 56) of the centre of the site	E: 333096 N: 6257349
Current Use	Television related services and offices
Previous Use	Agricultural and residential
Site Area	Total site area is 3 ha, however area of focus is 2.6 ha

The site layout is shown in **Figure 2** and site features are shown in **Figure 3**.

During the DSI (JBS 2012) the site comprised a large studio/technical block building, several office buildings and carpark areas, maintenance shed, helipad, satellite dishes, and a television tower. The site was bound by a brick wall to the east beyond Scott St, a black steel fence to the north and west, and a combination of chainlink and steel fencing to the south.

It is understood that the parcel of land containing the television tower (Lot 11 DP1162507) is not owned by Nine Network, subsequently this area was not included as part of this investigation.

Lot 1 DP820327 as shown in **Figure 3** was located on the western boundary of the site. This area comprised a bituminous concrete carpark to the south and east of Scott St. A two storey brick building was located to the east of Scott Street (Lot 1 DP327266).

Lot 10 DP1162507 comprised the main area of the site in which this investigation focuses. The eastern portion of Lot 10 DP1162507 comprised a bituminous concrete carpark within the northern portion, three satellite dishes along the southern boundary, and nine brick cottage office buildings.

The western portion of Lot 10 DP1162507 was elevated approximately 1.5 m above the eastern portion and comprised a large studio/technical block building constructed from a combination of concrete, corrugated steel and brick. Bituminous concrete carpark areas were located to the north, south and west of the studio/technical block building.

Six USTs and an above ground storage tank (AST) were located within the southern portion of the carpark located to the west of the studio/technical block building **(Photos 1 and 2)(Figure 4)**. There was no staining observed within the vicinity of the USTs and AST. Groundwater monitoring wells were observed approximately 15 m south of the USTs **(Photo 3)**. A helipad was located to the south of the studio/technical block building and comprised an elevated grassed platform approximately 0.5 m above the surrounding site areas. An AST was located to the east of the helipad containing JET A-1 fuel **(Photo 4)**.

The AST was located on a concrete slab and surrounded by a brick retaining wall. There was no staining observed within the vicinity of the AST.

A summary of petroleum storage infrastructure is provided as **Table 2.2**.

Table 2.2 Summary of USTs and ASTs

Tank ID	Type	Capacity (L)	Contents
Petrol Tank 1	UST	21 000	Unleaded petrol
Petrol Tank 2	UST	21 000	Unleaded petrol
Tank 1	UST	20 000	Unleaded petrol
Tank 2	UST	27 000	Diesel
Tank 3	UST	27 000	Diesel
Tank 4	UST	27 000	Diesel
New Oil Sump	AST	2000	Sump oil
AST Helipad	AST	20 000	JET A1 Fuel

Photo 1 – Dip points and Danger sign associated with USTs tanks 2 and 3.

Photo 2 –Danger sign associated with USTs petrol tanks 1 and 2.

Photo 3 –Groundwater monitoring wells downgradient of USTs.

Photo 4 –AST located to the east of the helipad.

The helipad and surrounding carpark were elevated approximately 2-3 m above the surrounding site areas to the east and west, a steep gully was located to the south, indicating substantial filling has taken place in this portion of the site.

Four brick cottage offices, four demountable office buildings and a building maintenance shed and generator building were located within the southwestern portion of Lot 10 DP1162507 (including Lot 13 DP6849) (**Figure 4**). The maintenance shed was constructed of steel and brick with a concrete slab. The shed and slab were in good condition. The areas between buildings were grass covered with occasional trees and shrubs.

An area of the site located south of the television tower (Lot 12 DP1162507) was vacant land at the time of the inspection. This area of the site was fenced by a chainlink fence to the north and west. The area was heavily vegetated with shrubs and small trees with an exposed area of soil in the northwest portion of the lot. There was no evidence of staining or stressed vegetation in this portion of the site.

Residential properties are located north of the site across Artarmon Rd. A BP petrol station is located approximately 100 m east north east of the site on the corner of

Artarmon Rd and Willoughby Rd. Residential unit complexes are located east of the site. Hallstrom Park is located further east across Willoughby Rd. Vacant vegetated land is located immediately south of the site as well as residential properties along the western end of Walter St. The Gore Hill Freeway is located beyond the vacant land to the south. Residential properties are located west of the site across Richmond Ave. Artarmon Reserve is located further west beyond the residential properties.

2.2 Topography

JBS (2012) reported that in general the site sloped down moderately to the southeast. The eastern portion of the site was approximately 1.5 m lower than the western portion of the site. The helipad and surrounding carpark were relatively flat and elevated approximately 2-3 m above surrounding site areas, a steep gully was located to the south. Boreholes within the vicinity of the helipad encountered fill to depths up to 5.7 m bgs. The northern portion of Scott St sloped down to the north, whilst the southern portion sloped down to the south. Artarmon Rd slopes down to the east. Land to the west of Richmond Rd slopes down to the southwest.

The site lies between 70 and 80 m Australian Height Datum (AHD) and the local topography of area slopes down to the southeast.

2.3 Hydrology

The nearest surface water receptor is Flat Rock Creek located approximately 100 m south of the site, beyond the Gore Hill Freeway. Flat Rock Creek flows to the east before entering into Long Bay, located 2.2 km to the southeast.

Infiltration of precipitation is expected to be minor given the generally sealed areas on the site. Storm water is likely to drain into on-site drainage infrastructure or towards the southeast in line with the local topography. Infiltration in unsealed areas will commensurate with soil and fill characterising.

2.4 Geology

The ESA (JBS 2012) indicated the site lies within Triassic Hawkesbury Sandstone of the Wianamatta Group. The Hawkesbury Sandstone is characterised by medium to coarse grained quartz sandstones with very minor shales and laminate lenses.

The site lies within the Gymea soil landscape group. The typical Gymea landscape is characterised by undulating to rolling rises and low hills on Hawkesbury Sandstone. Local relief is between 20-80 m with gentle slopes (10-25%), broad convex crests, moderately inclined sideslopes with benches, and localised rock outcrop on broken scarps. Soils are generally shallow to moderately deep yellow earths and earthy sands on crests and inside of benches, gleyed podzolic soils and yellow podzolic soils on shale lenses and shallow to moderately deep siliceous sands and leached sands along drainage lines.

Limitations of the Gymea landscape group are localised steep slopes, high soil erosion hazards, rock outcrops, shallow highly permeable soil with very low soil fertility.

Fill material was identified across the site ranging from 0.2 m to 5.7 m below the ground surface. Deepest filling was encountered within the vicinity of the helipad. Fill generally comprised silty clay with inclusions of sandstone, igneous and bituminous gravels and concrete pieces. Fill material was generally underlain by orange/brown silty and sandy

clay with some ironstone gravels and then sandstone bedrock. Sandstone rock was encountered between depths of 0.3 m bgs up to 1.7 m bgs.

There is a low probability of acid sulphate soil occurrence in the vicinity of the site.

2.5 Hydrogeology

A preliminary groundwater assessment was undertaken as part of the ESA (JBS 2012). The groundwater assessment comprised sampling of two existing groundwater monitoring wells located downgradient of the USTs within the western portion of the site.

Groundwater gauging indicated that water was present at depths of 4.75 m and 4.47 m below the ground surface in groundwater monitoring wells MW01 and MW02 respectfully.

Results from a search of registered groundwater bores within the vicinity of the site identified two bore located to the south of the site used for domestic purposes. Due to their location, across the Gore Hill Freeway, groundwater contamination from the site is unlikely to impact on groundwater use at these locations.

As there was only two wells present on the site groundwater flow direction could not be determined by the gauged groundwater depth. The anticipated flow direction for the shallow groundwater encountered at the site based on local topography was to the south and southeast (**Figure 9**).

3 Site History

3.1 Site History Summary

The following summary of site history was provided in JBS 2012 based on review of the documented history of the site.

Table 3.1 Summary Site History

Period	Activity	Source
1906	The central portion of the site was owned by Robert Henry Foster, a dairyman.	Title documentation
1930	Residential properties within eastern and western portion of the site. An Elongated building possible used for milking sheds or similar and bare ground potentially associated with animal use were identified within the northern portion of the site.	Aerial photograph (1930)
1950	The elongated building was demolished and its footprint is visible suggesting material may have been left on the ground.	Aerial Photograph (1951)
1955	The central portion of the site was transferred to Television Corporation Limited	Title documentation
1961	A building was constructed in the central portion, in the location of the current studio building, with an adjoining building constructed to the northwest. A carpark was constructed to the south of the building and a garden area established to the north. Evidence of cut and fill within the vicinity of the current helipad. A transmitting tower has been constructed on the west boundary of the site	Aerial photograph (1961)
1972	The adjoining building to the northeast has been extended further north. The garden area identified in the 1950 aerial photograph has been removed and a carpark constructed.	Aerial photograph (1972)
1978	Nine Network licence was approved to install two USTs to store 21 000 L of petrol in the western portion of the site.	WorkCover Documents (1977/1978)
1980	Nine Network logo visible on roof of current studio building. Vacant land to the south of the building in the central portion of the site has been cleared of vegetation, levelled and a concrete slab has been constructed for a helipad. A small shed has been erected to the east of the helipad. One residence in the northeast portion of the site has been demolished and the backyards of several residences along Scott St have been turned into a carpark, as per the current site layout. The tower on the west boundary of the site has been removed and replaced by a carpark, as per the current site layout. Nine Networks licence was approved to install additional three USTs (one 27 000 L petrol and two 27 000 L distillate) in the western portion of the site. Plans for an AST located to the east of the helipad were also approved.	Aerial photograph (1980) WorkCover Documents (1980)
1986	The central portion of the site was transferred to TCN Channel Nine Pty Ltd	Title Documentation
1991	Satellite dishes have been constructed to the southeast of the building as per the current site layout.	Aerial photograph (1991)
1993	Nine Network applied for an amendment to their licence to include a AST located to the east of the helipad.	WorkCover documentation (1993)
2002	Two residential properties within the northwest portion of the site, on Artarmon Rd, have been redeveloped into a single residential or commercial complex. A carpark to the west of the helipad has been constructed.	Aerial photograph (2002)
2005	The site and surrounding areas appear unchanged since the previous photograph and similar to the current site layout	Aerial photograph (2005)
2012	The site comprised a large studio/technical block building, several office buildings and carpark areas, maintenance shed, helipad, satellite dishes, and a television tower.	Site inspection (2012)

3.2 Previous Investigations

3.2.1 Environmental Site Assessment (DP 2008)

Douglas Partners conducted a preliminary assessment of the site in 2008 comprising 21 boreholes. Information made available from this investigation is included in **Appendix A**. It is understood that two groundwater monitoring wells located south of the USTs were

also installed as part of the investigation. Only limited information from the assessment was available for review.

Geology encountered during the investigation included fill to depths greater than 2.1 m below the ground surface (bgs) underlain by natural clays and sandstone/siltstone bedrock. At one location near the helipad fill was encountered to depths greater than 4 m bgs. Approximate DP soil sampling locations are shown in **Figure 5**.

Two borelogs identified the presence of hydrocarbon odours within fill, clay and sandstone at bore locations DP-B4 and DP-B5 to depths up to 2.2 and 2.3 m respectively, where the boreholes were discontinued. No information was provided to indicate the location of the boreholes or the borehole identifications. The results from the investigation identified the presence of hydrocarbon impacted soils immediately to the south of the petrol tanks 1 and 2 at DP-BH4 (0.8 – 1.5 m bgs) and DP-BH5 (0.1 – 1.5 m bgs) (**Figure 6**). Chrysotile asbestos was detected at DP-BH14 (0.3-0.4 m bgs) within the northern carpark (**Figure 6**).

The letter compared soil analytical results to commercial land use criteria and concludes that there appears to be a leak from the unleaded fuel storage system (petrol tanks 1 and 2) resulting in hydrocarbon impact within this area, however the vertical extent of the contamination is limited by sandstone rock. The letter recommends additional assessment and remediation within the area of the USTs.

3.2.2 Detailed Site Investigation (JBS 2012)

JBS conducted an ESA in order to characterise the nature and extent of potential contamination across the site. Environmental data from the investigation is included in **Appendix A**. Sampling locations are shown on **Figure 5** and soil and groundwater exceedences shown in **Figures 6 and 7** respectively**.**

20 sampling locations were investigated in accessible areas and targeting identified areas of environmental concern (AECs). Based on the objectives of the investigation this density of sampling was considered appropriate. Sample locations were extended to the base of fill and underlying natural soils where possible. Sampling was completed with a combination of hand auger and drill rig. The boreholes were extended into natural materials at 17 locations.

Fill material was identified across the site ranging from 0.2 m to 5.7 m below the ground surface. Deepest filling was encountered within the vicinity of the helipad. Fill generally comprised silty clay with inclusions of sandstone, igneous and bituminous gravels and concrete pieces. Fill material was generally underlain by orange/brown silty and sandy clay with some ironstone gravels and then sandstone bedrock. Sandstone rock was encountered between depths of 0.3 m bgs up to 1.7 m bgs.

Hydrocarbon odour and elevated photo-ionisation detector (PID) readings (up to 232.6 ppm) were identified in natural soils and in sandstone rock at sampling location BH13 to depths up to 6 m bgs. No odours were identified at other sampling locations within the vicinity of the USTs.

Two groundwater monitoring wells located on the site were gauged, purged and sampled during the investigation.

Soil samples were analysed for a range of contaminants of potential concern (COPC) including: heavy metals; total petroleum hydrocarbons (TPH); benzene, toluene,

ethylbenzene and xylenes (BTEX); polycyclic aromatic hydrocarbons (PAHs); organochlorine and polychlorinated biphenyls (OCP/PCBs) and asbestos.

The report included the following findings:

- Asbestos fibres detected in fill material at sample location DP-BH14 0.3-0.4 m located within the carpark in the northern portion of the site (DP 2008) poses a potential health risk if disturbed. Based on the location it is likely that the fill material containing the asbestos fibres is concealed beneath the bituminous concrete carpark area. If the soil remains undisturbed beneath the bituminous concrete, there is no complete exposure pathway therefore mitigating potential risk posed to site users;
- TPH C_6-C_9 (150 mg/kg), benzene (3 mg/kg) and xylenes (61 mg/kg) were identified above adopted threshold criteria in natural soils at sample location BH13, immediately south of petrol tanks 1 and 2. In addition odours were identified at depth within sandstone at this location (up to 6 m bgs). No odours or elevated PID readings were identified at any other sampling location. Results from the previous investigation (DP 2008) identified TPH C_6-C_9, benzene, ethyl-benzene and xylenes above threshold criteria within a similar location (**Figure 6**). Based on results from this investigation and limited information from the previous investigation the hydrocarbon impact may be restricted to the natural soils above the sandstone bedrock. Given the concentrations of TPH C_6-C_9 and BTEX compounds are above the threshold criteria, the TPH C_6-C_9 and BTEX compounds pose a potential risk to human health;
- Due to access restrictions, boreholes could not be installed immediately downgradient of tanks 1, 2, 3 and 4 (**Figure 4**). Boreholes installed further downgradient (BH01 to BH06) did not identify any odours or elevated PID readings;
- The elevated concentration of benzo(a)pyrene reported by DP (2008) at DP-BH20 (**Figure 5**) is likely to have resulted from inclusions of bituminous gravels from the road base material. Under a residential scenario, elevated benzo(a)pyrene at DP-BH20 (1.6 mg/kg) is less than 250% the criterion (1 mg/kg) and the 95% UCL average (0.42 mg/kg) is less than half the criterion. As such the result is not a contamination 'hot spot', based on statistical assessment of the fill data from across the site, and the 95% benzo(a)pyrene UCL does not pose a potential risk;
- Elevated heavy metal concentrations in the silty clay soils may pose a phytotoxic risk to the normal growth of vegetation in exposed soils at the site, however no heavy metal concentrations exceeded the adopted health-based criteria;
- A minor TPH C_6-C_9 impact was identified within one of the groundwater monitoring well locations (MW01). The TPH present in the groundwater indicates that contamination identified at BH13 has impacted the groundwater. The absence of concentrations of TPH and BTEX compounds above LORs within MW02 suggests that the TPH impact identified is relatively minor; and
- Concentrations of remaining COPCs identified for the site were reported below the health based investigation criteria for both commercial/industrial and residential land use scenarios.

Conclusions and Recommendations

It was considered the site can be made suitable for the intended land uses subject to development and implementation of an appropriate management strategy. The management strategy must address USTs and associated petroleum hydrocarbon impacted soil and groundwater at the western boundary, asbestos in fill material within the current carpark in the northern portion of the site and any other potentially unidentified impacts in fill.

On the basis the site will be redeveloped for commercial and residential use, it was recommended that a Remedial Action Plan be developed in accordance with relevant regulatory requirements and implemented to render the site suitable for the proposed mixed use. As part of the remediation all petroleum storage infrastructure (USTs and ASTs) will require to be removed appropriately in addition to the remediation of the hydrocarbon impacted soils identified at BH13. Further assessment of groundwater within the vicinity of the USTs should be completed during and following the remediation to determine any further impacts not identified in the current investigation. Delineation and removal of asbestos impacted soils within the carpark in the northern portion of the site should also be included, as well as an unexpected find protocol (UFP) to manage any potential impacts in areas not investigated.

4 Remedial Action Plan

4.1 Remediation Objectives

The remediation objectives are outlined as follows:

- Remove potential unacceptable risks to human health and the environment;
- Validate the remedial works in accordance with the relevant EPA guidelines; and
- Document the validation process.

The RAP is consistent with the following guidelines:

- *Managing Land Contamination, Planning Guidelines, SEPP 55 – Remediation of Land.* Department of Urban Affairs and Planning and EPA (DUAP 1998);
- *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*, published by Australian and New Zealand Environment and Conservation Council and the National Health and Medical Research Council (NHMRC), January 1992 (ANZECC/NHMRC 1992);
- *National Environment Protection (Assessment of Site Contamination) Measure* (NEPM), National Environment Protection Council, 1999 (NEPC 1999);
- *Contaminated Sites: Guidelines for Assessing Service Station Sites,* NSW EPA, 1994 (EPA 1994).
- *Contaminated Sites: Sampling Design Guidelines*, September 1995 (EPA 1995);
- *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*, November 1997 (EPA 1997); and
- *Contaminated Sites: Guidelines for NSW Site Auditor Scheme, April 2006* (DEC 2006).
- *Guidelines for the Assessment and Management of Groundwater Contamination, 2007* (DEC 2007).

In preparing the RAP, consideration has also been given to the following:

- *Code of Practice for the Safe Removal of Asbestos, 2nd Edition, National Occupational Health and Safety Commission,* April 2005 *(*NOHSC 2005*).*
- *Guidelines for Implementing the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2008*. Department of Environment, Climate Change and Water NSW 2009;
- *AS1940-2004: Storage and handling of flammable and combustible liquids* (AS 2004);
- *Willoughby City Council Asbestos Policy 2006 Handling and Disposal of Asbestos.* 2006 (WCC 2006a);
- *Willoughby Development Control Plan* 2006 (WCC 2006b);
- *Work Health and Safety Regulation 2011*; and
- *How to safely remove asbestos. Code of practice.* WorkCover NSW 2011 (WorkCover 2011).

4.2 Extent of Remediation

Based on the findings of the previous ESA (JBS 2012) and subject to the limitations of that investigation, the anticipated extent of remediation/management of impacted soils is shown in **Figure 8**. Based on the currently available information, the following areas[3] require remediation:

- The TPH, benzene and xylene impact (hydrocarbon impact) identified in soil at BH13 comprises an area of approximately 386 m^2 to an approximate depth of 1.6 m, resulting in an approximate volume of 618 m^3. Elevated PID readings and odours were identified to depths up to 6 m bgs. Subsequently, the depth of excavation may require to be extended to remove the aesthetic impacts.
- The extent of asbestos fibre impacted soils (ACM impacted soils) identified within the carpark in the northern portion of the site (DP 2008) is expected to be minimal. However, due to the limited sampling in the vicinity of the impacted soils, further sampling is required to delineate its extent.
- USTs within the western portion of the site, and associated infrastructure, and any associated contaminated soils within the vicinity of the fuel infrastructure.
- AST in the western portion of the site (oil) and the AST to the east of the helipad, associated infrastructure, and any associated contaminated soils within the vicinity of the fuel infrastructure.

As noted in the limitations of the ESA (JBS 2012), subsurface conditions can vary between investigation locations and no investigation was undertaken beneath buildings and immediately downgradient of some USTs due to presence of buildings and structures. Subsequently, there is the potential during any future earthworks that the extent of remediation may vary from that anticipated based on previous investigations. Based on the results of a WorkCover search undertaken for the site (JBS 2012) there is potential for additional USTs to be present on the site not included in current plans (**Figure 4**). There may also be other unidentified impacts (eg. asbestos) beneath main office/studio building where former structure existed. This is taken into consideration in preparation of the RAP by incorporating further assessment following the removal of structures and provision of a protocol for managing unexpected finds.

4.3 Possible Remedial Options

The *Contaminated Sites: Guidelines for the NSW Auditor Scheme* (DEC 2006) states that the policy of the then Australian and New Zealand Environment and Conservation Council (ANZECC) and the National Health and Medical Research Council (NHMRC) on the remediation of contaminated sites is published in the *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites* (ANZECC & NHMRC 1992) and is followed in NSW. This means that soil remediation and management is implemented in the following preferred order:

- On-site treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level;

[3] The areas, depths and volumes discussed in the following paragraphs are estimations based on current site knowledge. It is recommended that more accurate measurements be taken based on survey before volumes for remediation are finalised.

- Off-site treatment of excavated soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site;
- Removal of contaminated soil to an approved site or facility, followed ,where necessary, by replacement with clean fill; and
- Consolidation and isolation of the soil on-site by containment within a properly designed barrier.

Consideration of each of these options is presented in **Table 4.1**.

Abandonment of the USTs and ASTs in accordance with the guidelines comprises removal of the USTs and associated infrastructure for destruction and recycling at an appropriately licensed facility

Table 4.1 Remedial Options Screening Matrix

Option	Discussion	Conclusion
Option 1 On-site treatment of the soil so that the contaminants are either destroyed or the associated hazards are reduced to an acceptable level.	ACM impacted soil This option is not appropriate for the remediation of the ACM impacted soils.	Not a suitable option[1]
	Hydrocarbon impacted soils Bioremediation via landfarming requires space to create landfarms, and time for bioremediation to occur. Due to the anticipated limited extent and low volume and low reported concentrations of material requiring remediation, implementation of bioremediation is considered not to be cost or time effective.	Not a suitable option.
Option 2. Off-site treatment of the soil so that the contaminants are either destroyed or the associated hazards are reduced to an acceptable level, after which the soil is returned to the site.	ACM impacted soils This option is not appropriate to the remediation of ACM impacted soils.	Not a suitable option.
	Hydrocarbon impacted soils As above (Option 1) due to the anticipated limited extent and low volume of material requiring remediation, implementation of bioremediation is considered not to be cost or time effective.	Not a suitable option.
Option 3. Excavation and offsite removal of the impacted material.	ACM impacted soils For the small volume and extent of asbestos impacted soils anticipated, excavation and off-site disposal of impacted soil is a viable option, involving a short timeframe and relatively low cost.	A preferred option
	Hydrocarbon impacted soils For the anticipated small volume and extent of hydrocarbon impacted soil involved, excavation and off-site disposal of impacted soil is a viable option, involving short timeframe and relatively low cost.	A preferred option.
Option 4 Consolidation and isolation of the soil by on-site containment within a properly designed barrier and ongoing management.	ACM impacted soils On site containment is viable, however given the minor volume of ACM impacted soils anticipated this is not a recommended option.	Not the preferred option.[2]
	Hydrocarbon impacted soils Due to the anticipated limited extent and low volume of material requiring remediation, containment of the hydrocarbon impacted soils is considered not to be cost or time effective. Due to the nature of the contaminants greater design consideration and monitoring may be required.	Not a suitable option.

[1]Option 1 may be an appropriate contingency for hydrocarbon impacted material if reduction in concentration is required to reduce waste classification.
[2]Option 4 may be an appropriate contingency for asbestos impacted soil if greater extent is identified in areas not investigated.

4.4 Preferred Remediation Strategy

A number of potential remediation options have been outlined in **Table 4.1**. With consideration to established hierarchies for soil remediation options, and to the site specific contaminants and proposed environmental setting, the preferred remediation strategy is outlined below:

- Pre and post remediation groundwater monitoring to enable an assessment to be made on whether the groundwater quality may impact on future site use or the surrounding environment;
- Further delineation and subsequent removal and off-site disposal of ACM soil identified within fill material within the carpark in the northern portion of the site to an appropriately licensed waste disposal facility. Excavation and disposal must be undertaken in accordance with:
    - *How to safely remove asbestos. Code of practice.* WorkCover NSW 2011 (WorkCover 2011);
    - *Willoughby City Council Asbestos Policy 2006 Handling and Disposal of Asbestos* (WCC 2006a)*;* and
    - DECCW (2009) *Waste Classification Guidelines Part 1: Classifying Waste*.
- Assessment of the building footprints following demolition;
- Excavation and off-site disposal of hydrocarbon impacted soils at BH13 to an appropriately licensed waste disposal facility;
- Abandonment (by removal) of all USTs and associated infrastructure and surrounding impacted soil in accordance with the *Work Health and Safety Regulation 2011* and the *Guidelines for Implementing the POEO (Underground Petroleum Storage Systems) Regulation 2008* (UPSS guidelines) with consideration to the following Australian standards:
    - *AS1940-2004: Storage and handling of flammable and combustible liquids* (AS 2004); and
    - *AS4976-2008: Removal and disposal of underground petroleum storage tank* (AS 2008);
- Abandonment (by removal) of the two ASTs and associated infrastructure in accordance with the *Work Health and Safety Regulation 2011* with consideration to the following Australian Standards:
    - *AS1940-2004: Storage and handling of flammable and combustible liquids* (AS 2004); and
    - *AS4976-2008: Removal and disposal of underground petroleum storage tank* (AS 2008);
- Validation of excavations following the removal of impacted soils and removal of petroleum infrastructure; and
- Reinstatement of site levels using validated imported fill or material sourced from within the site.

4.5 Groundwater Pre and Post Monitoring

Based on existing groundwater quality data (JBS 2012) minor TPH impact identified in the groundwater is not anticipated to impact on the future intended site use or to be migrating of site. However, further assessment of groundwater is required as part of the remediation to assess groundwater conditions within the vicinity of the USTs pre and post remediation. Two additional groundwater monitoring wells are to be installed at strategic locations downgradient of USTs and one upgradient of the USTs to delineate the source and extent of groundwater contamination at the site. Based on groundwater quality data obtained from pre and post remediation sampling of additional and existing groundwater monitoring wells, an assessment as to whether groundwater quality may impact on the proposed future site use or the surrounding environment and if so, whether further assessment or management is warranted.

4.6 Remediation Scope of Works

The remediation and validation works will be supervised by an appropriately qualified and experienced environmental consultant and undertaken by an appropriately licensed remedial contractor. It is anticipated that the following activities will be implemented during the works.

4.7 Approvals, licences and notifications

As noted in WorkCover (2011), for the safe removal of friable ACM, a Class A licence is required. In addition, a friable asbestos removal supervisor must be present during the removal work. Written notification to WorkCover must be submitted at least five days prior to the commencement of the asbestos removal works. As noted in Willoughby City Councils asbestos policy (WCC 2006a), written notification to adjoining residents is required five working days prior to the removal works and on completion of the disposal of the ACM impacted soil all tipping receipts must be lodged to council.

WorkCover are to be notified of the abandonment of the USTs and ASTs within 7 days using the prescribed approval form, so the tanks can be removed from their database.

Appropriate licences and consent for groundwater bores must be obtained from the Department of Natural Resources (DNR) prior to installing the groundwater monitoring wells. In addition, if the wells are required to be abandoned following the remediation they will be done so in accordance with DNR requirements.

The WCC Development Control Plan (WCC 2006b) has no additional council specific requirements and refers to provisions made in SEPP 55.

In consideration of provisions of SEPP 55 Remediation of Land the works are considered to be Category 2 remediation works. Based on this, development approval is not considered necessary for the remedial works. However, council must be informed no later than 30 days prior to the remedial works commencing. The validation report, upon completion of remediation activities, is required to be submitted to council.

4.8 Site establishment

The boundary of the contaminated areas will be defined and the areas secured to ensure that all safety and environmental controls are implemented. These controls will include:

- Locate and isolate all required utilities in the proximity of the works;
- Work area security fencing;

- Site signage and contact numbers;
- Sediment fencing (attached to security fencing); and
- Stormwater runoff and sediment controls.

4.9 Remediation of ACM Impacted Soil

Prior to excavation works further delineation sampling is required to assess the extent of ACM impacted soils within this area (**Figure 8**). Delineation sampling will consist of either test pits on a 5 to 10 m grid. Soil samples will be collected at near surface and at intervals of depth to the base of fill. Spoil from the test pits will be inspected for the presence of any ACM. Selected soil samples will be analysed for asbestos fibres in soil.

Following delineation the impacted soils shall be excavated and loaded directly onto trucks for removal from the site, or stockpiled prior to loading and removal from the site.

Details of validation requirements are discussed in **Section 5**.

Soils to be disposed off-site require a waste classification in accordance with the *Waste Classification Guidelines* (DECCW 2009). The classification of the material is discussed further in **Section 4.16**.

Documentation verifying the safe removal and appropriate disposal of the ACM is required to be incorporated within the validation report (**Section 5.5**).

4.10 Assessment of Building Footprints

Due to the limitations of JBS (2012) further assessment of building footprints are required following their demolition to assess any potential contamination. Assessment requirements for the building footprints are discussed in **Section 5.**

4.11 Remediation of Hydrocarbon Impacted Soils

The extent of impacted soils at BH13, DP-BH4 and DP-BH5 as shown on **Figure 8**, shall be excavated and loaded directly onto trucks for removal from the site, or stockpiled for waste classification prior to loading and removal from the site. It is anticipated that the impacted soils will be removed in in conjunction with the removal of Unleaded Tanks 1 and 2 (**Figure 4**), as per section **4.12**.

Soils to be disposed off-site require a waste classification in accordance with the *Waste Classification Guidelines* (DECCW 2009). The classification of the material is discussed further in **Section 4.16**.

4.12 Removal of USTs and Associated Infrastructure

A plan of USTs present at the site is provided as **Figure 4** and listed below:

- Petrol Tank 1:Approximately 21 000 L
- Petrol Tank 2: Approximately 21 000 L
- Tank 1: Approximately 20 000 L
- Tank 2:Approximately 27 000 L
- Tank 3: Approximately 27 000 L
- Tank 4: Approximately 27 000 L

The USTs are to be appropriately abandoned prior to removal. Particular attention must be paid to the WorkCover fact sheet 3_1 '*Abandoning Disused Underground Tanks'* (**Appendix B**), UPSS guidelines and relevant Australian standards. Abandonment will include, but is not limited to:

- Removal of any residual liquid contents from the UST and off-site disposal in accordance with the NSW *Waste Classification Guidelines* DECCW (2009);
- Removal of the bituminous concrete and concrete surfaces overlying and surrounding the UST locations, any connecting fuel transfer lines and remote access points;
- The concrete anchors are to be removed, broken up with an excavator and stockpiled for future backfilling use or removal from site;
- Removal of the USTs and associated infrastructure for appropriate off-site destruction (retaining destruction documentation for validation purposes);
- Excavation of any surrounding and underlying impacted backfill and natural soils (including hydrocarbon impact identified at BH13) to be stockpiled and classified, prior to offsite disposal to a licensed waste facility;
- Notification to NSW WorkCover of abandonment of the USTs must be completed within a maximum of seven days following their removal from the site;
- Sediment fencing (attached to security fencing); and
- Stormwater runoff and sediment controls.

There is potential for additional USTs to be present at the site (JBS 2012). Subsequently, prior to removal of the tanks, the areas within the vicinity of the USTs should be screened with a ground penetrating radar (GPR) to define the locations of the known USTs and identify locations of additional USTs (if any). If additional USTs are identified, steps outlined in the unexpected finds protocol will be implemented (**Section 6**).

4.13 Removal of ASTs and Associated Infrastructure

The following ASTs are present at the site:

- One 20 000 L AST located to the east of the helipad **Figure 3**; and
- One 2000 L Sump Oil AST of unknown quantity, shown on **Figure 4**.

ASTs should be abandoned appropriately by removal similar to the method outlined above, including but not limited to:

- Removal of any residual liquid contents from the ASTs and off-site disposal in accordance with the NSW *Waste Classification Guidelines* DECCW (2009);
- Removal of any connecting fuel transfer lines and remote access points;
- Removal of the ASTs and associated infrastructure for appropriate off-site destruction (retaining destruction documentation for validation purposes);
- Excavation of any underlying impacted soils for offsite disposal to a licensed waste facility;
- Notification to NSW WorkCover of abandonment of the USTs must be completed within a maximum of seven days following their removal from the site;
- Sediment fencing (attached to security fencing); and

- Stormwater runoff and sediment controls.

4.14 Residual Groundwater / Seepage Water from Excavations

Based on the site investigation activities undertaken (JBS 2012) it is not anticipated that significant groundwater seepage will be encountered during the excavation works unless rainfall events occur during the work period. However, in the event that seepage is encountered within the excavations, or if significant rainfall events result in impacted water requiring to be removed from the excavation during the remediation works, the water will be pumped from the excavation by a licensed contractor and disposed of off-site as "liquid waste" in accordance with DECCW (2009).

4.15 Backfilling of Excavations

Where excavations need to be backfilled, suitable validated materials shall be selected from either available on site material or 'validated' imported fill material. Material imported onto the site is required to be either virgin excavated natural material (VENM) or considered suitable for beneficial reuse, such as material compliant with an appropriate EPA waste exemption approval such as excavated natural material (ENM). Appropriate documentation must be obtained prior to importation verifying the material meets VENM or ENM or other relevant EPA waste exemption requirements appropriate for proposed use at the site.

Geotechnical requirements for imported fill characteristics, placement and compaction are beyond the scope of this RAP.

4.16 Waste Classification

Impacted soils to be disposed off-site shall require a waste classification in accordance with DECCW (2009) *Waste Classification Guidelines Part 1: Classifying Waste*.

Where material to be excavated for off-site disposal meets an existing specific EPA immobilisation approval, the requirements of the immobilisation approval must be met.

4.17 Validation

Visual validation and validation sampling and analyses of samples from remediated areas will be conducted to verify the remediation works have extended to the necessary extent (both laterally and vertically), as described in **Section 5**. Validation will also include assessment of results from the pre and post groundwater monitoring and assessment of results from the building footprints.

At the completion of the remedial works a Validation Report will be prepared in general accordance with the NSW EPA *Guidelines for Consultants Reporting on Contaminated Sites* (EPA 1997), documenting the works completed.

4.18 Site Dis-establishment

On completion of the remediation works all plant/equipment and safety/environmental controls shall be removed from the site. Details are provided in the Site Management Plan in **Section 7**.

5 Validation Plan

From revision of the proposed remediation methods for the site, validation activates will be required for the following areas:

- Assessment of building footprints and validation of any unexpected finds;
- Assessment of pre and post groundwater monitoring results;
- Validation of ACM impacted soil within the northern portion of the site;
- Validation of hydrocarbon impacted soils at location BH13;
- Validation of excavations where UST petroleum infrastructure were removed and hydrocarbon impacted soils have been removed;
- Validation of footprints where AST petroleum infrastructure were removed; and
- Validation of material imported to backfill the excavations.

5.1 Groundwater Sampling Pre and Post Remediation

Installation of additional groundwater wells is detailed as follows:

- Following the removal of buildings and infrastructure downgradient of USTs, groundwater wells will be installed at locations proposed (**Figure 9**) to a maximum depth of 10 m below ground surface (bgs) or 2 m below the encountered groundwater depth, whichever is shallower;
- The wells will be constructed from 50 mm uPVC screen and casing, combined with a lockable cap and exposed standpipe; and
- A relative height survey of the monitoring well lcoations will be undertaken to allow interpretation of groundwater flow directions at the site.

The monitoring wells will be allowed to settle for 5 days after development prior to the commencement of the pre remediation gauging and sampling. Pre and post remediation sampling of all new and existing groundwater monitoring wells is detailed as follows:

- Prior to sampling, the wells will be purged to remove the standing water. Field parameters of pH, conductivity, redox and temperature are to be taken and samples obtained once the parameters settle to within approximately 10%;
- Groundwater samples will to be obtained through the use of a low flow peristaltic pump and flow cell;
- Groundwater samples will be immediately filtered (as necessary) and transferred to laboratory supplied sample bottles. The sample containers are then to be transferred to a chilled iced box for sample preservation prior to and during shipment to the testing laboratory. A chain-of-custody form will be completed and forwarded with the samples;
- Samples shall be analysed by a primary laboratory which shall be NATA accredited for the required analyses. The secondary (check) laboratory responsible for analysing a certain proportion and type of QA/QC samples shall also be NATA accredited for the required analyses. Both laboratories will also be required to meet the environmental consultant's own internal quality assurance requirements; and
- Groundwater samples shall be analysed for heavy metals, TPH/BTEX and PAHs (low-level).

5.2 Validation Inspections and Sampling

5.2.1 Assessment of Building Footprints

The validation/sampling program for the assessment of building footprints is detailed as follows:

- Following the removal of buildings/infrastructure from the site the footprints will be inspected for any signs of potential contamination;
- The footprint of the main office/studio building (**Figures 2 and 3**) and any building footprints where the visual assessment identified signs of potential contamination (ie. anthropogenic material, ACM, staining or odours) the footprints will be further assessed via testpitting at an appropriate density as per sample design guidelines (EPA 1995); and
- Selected samples collected from the assessment of the building footprints shall be analysed for contaminants of potential concern identified during the assessment, and as a minimum TPH/BTEX, PAH, heavy metals and asbestos.

If the identified impact is not acceptable to remain on site under the proposed site use, it should be appropriately remediated and validated;

5.2.2 ACM Excavation

The validation program for excavation to remove ACM impacted soil identified within the northern portion of the site is detailed as follows:

- The base and walls of the excavation will be inspected (where possible) for any indication of ACM. Where ACM is identified the area will be further excavated, and the areas inspected again;
- Validation samples will be collected from the base and walls of the excavation on a 25 m grid (or 5 m linear);
- Each validation sample will be analysed for asbestos in soil. Should a validation sample detect asbestos above the limit of reporting, further excavation and subsequent validation of the affected area will be required; and
- If an excavation validation sample fails the assessment criteria (provided in **Section 5.2.1**), further excavation and subsequent validation of the affected area will be required.

5.2.3 Hydrocarbon Excavation

It is anticipated that the hydrocarbon impacted soils identified in the west boundary of the site will be in conjunction with excavation of the Unleaded Tanks 1 and 2, as per section **5.2.4**.

5.2.4 Excavation of Tank Pits

Sampling of the tank pits and associated excavations generated by the removal of the sub-surface infrastructure shall be in accordance with the NSW EPA (1994). Sampling requirements include:

- One sample collected at each wall area of the UST excavations. A minimum of one sample per 10 linear metres is required. Each lateral sample should be replicated for each 1 m interval of depth of the excavation;
- One sample collected below the bottom of each of the USTs;

- One sample collected for each fuel line trench; and
- One sample collected for each area of fuel dispensers and/or fill points.

Samples shall be collected from depth of 0.2 m into these soils.

Each sample shall be submitted to a NATA accredited laboratory and analysed for:

- TPH C_6-C_9 and C_{10}-C_{36};
- Benzene, toloune, ethylbenzene and xylenes (BTEX compounds);
- Polycyclic aromatic hydrocarbons (PAHs); and
- Lead.

Due to the proposed mixed use including residential as well as commercial, any odours or staining will be considered during the excavation and validation of the impacted material, as per DEC (2006).

If an excavation validation sample fails the assessment criteria (provided in **Section 5.2.1**), further excavation and subsequent validation of the affected area will be required. In some cases if the elevated sample only slightly exceeds the assessment criteria, is an isolated occurrence, and there are no visual indications to suggest extensive contamination, statistical methods such as those advised in NSW EPA (1995) may be used to determine if the excavation has been adequately validated.

5.2.5 Removal of ASTs

Validation of the footprint of the ASTs and associated infrastructure shall be in accordance with the NSW EPA (1994). Sampling requirements include:

- Sample collected every 25 m^2 beneath of each of the ASTs at the surface (0-0.2 m) and shallow sub-surface (0.2-0.5 m);
- One sample collected each fuel line (if applicable); and
- One sample collected for each area of fuel dispensers and/or fill points.

Each sample shall be submitted to a NATA accredited laboratory and analysed for:

- TPH C_6-C_9 and C_{10}-C_{36};
- Benzene, toloune, ethylbenzene and xylenes (BTEX compounds);
- Polycyclic aromatic hydrocarbons (PAHs); and
- Lead.

If a validation sample fails the assessment criteria (provided in **Section 5.2.1**), further excavation and subsequent validation of the affected area will be required. In some cases if the elevated sample only slightly exceeds the assessment criteria, is an isolated occurrence, and there are no visual indications to suggest extensive contamination, statistical methods such as those advised in NSW EPA (1995) may be used to determine if the excavation has been adequately validated.

5.2.6 Imported Fill Material

Imported soils to be placed on the site will require to be validated prior to placement on the site in accordance with NSW EPA (1994).

The proposed soil validation sampling for imported soils is outlined in **Table 5.1**.

Table 5.1 Soil Validation Sampling Program

Material	Sampling Frequency	Sampling Analysis
VENM (imported or sourced from site)	Minimum of 3 samples or 1/250 m^3	8 metals TPH/BTEX PAHs OCPs/PCBs Asbestos
Imported Soils – ENM or similar exemption materials (as per appropriate EPA waste exemption)	As per sampling requirements for appropriate EPA waste exemption	For ENM: 8 metals TPH/VCH PAHs RTA 276 pH and EC Asbestos

5.2.7 Validation Sampling Methodology

Samples shall be collected by appropriately trained and experienced personnel from a depth of 0.2 m into the excavation base and walls by the use of a hand trowel or where required, directly from an excavator bucket. The hand trowel will be thoroughly decontaminated using phosphate free detergent and distilled water between each sampling location. In the event that deeper samples are required within large excavations, batter slopes or stockpiles, samples shall be collected using an excavator. Samples shall be collected from the centre of the excavator bucket ensuring that no part of the sample has contacted the sides of the excavator bucket.

During the collection of soil samples, features such as seepage, discolouration, staining, odours, presence of ACM and other indicators of contamination will be noted on the field documentation.

Collected soil samples will be immediately transferred to sample containers of appropriate composition. Sample labels will record: job number; sample identification number; samplers initials; and date and time of sampling. In addition, soil samples collected for asbestos fibre validation will be placed in plastic bags which will subsequently be sealed.

Sample containers will be transferred to a chilled ice box for sample preservation prior to and during shipment to the testing laboratory. A chain-of-custody form will be completed and forwarded with the samples to the testing laboratory.

Soil validation samples shall be analysed by a primary laboratory which shall be NATA accredited for the required analyses. The secondary (check) laboratory responsible for analysing a certain proportion and type of QA/QC samples shall also be NATA accredited for the required analyses. Both laboratories will also be required to meet the environmental consultant's own internal quality assurance requirements.

5.3 Soil Validation Criteria

5.3.1 Remediation Criteria Rationale

Given the proposed mixed land use for the site (residential and commercial) soil results will be compared against the more sensitive '*standard residential*' DEC (2006) HIL-A land use criteria in **Table 5.2**. The criteria are based on EPA endorsed investigation levels, which, while being used as clean-up levels instead of site-specific criteria derived through a process of risk assessment, are considered adequately conservative for the purposes of validating the site.

Table 5.2 Soil Criteria (all units in mg/kg)

	Limit of Reporting	Laboratory Method	Adopted Validation Criteria for Residential Use [1]	Provisional Phytotoxicity-based Investigation Levels[3]
METALS				
Arsenic	4.0	ICP-AES (USEPA 200.7)	100	20
Cadmium	1.0	ICP-AES (USEPA 200.7)	20	3
Chromium (VI)	1.0	ICP-AES (USEPA 200.7)	100	1
Copper	1.0	ICP-AES (USEPA 200.7)	1,000	100
Nickel	1.0	ICP-AES (USEPA 200.7)	600	60
Lead	1.0	ICP-AES (USEPA 200.7)	300	600
Zinc	1.0	ICP-AES (USEPA 200.7)	7,000	200
Mercury (inorganic)	0.1	ICP-AES (USEPA 200.7)	15	1
PETROLEUM HYDROCARBONS				
C6 – C9 Fraction	25	Purge Trap-GCMS (USEPA8260)	65[2]	-
C10 – C36 Fraction	250	Purge Trap-GCFID (USEPA8000)	1000[2]	-
BTEX				
Benzene	1.0	Purge Trap-GCMS (USEPA8260)	1[2]	-
Toluene	1.0	Purge Trap-GCMS (USEPA8260)	130[2]	1.4[2]
Ethylbenzene	1.0	Purge Trap-GCMS (USEPA8260)	50[2]	3.1[2]
Total Xylenes	3.0	Purge Trap-GCMS (USEPA8260)	25[2]	14[2]
POLYCYCLIC AROMATIC HYDROCARBONS				
Benzo(a)pyrene	0.05	GCMS (USEPA8270)	1	-
Total PAHs	1.55	GCMS (USEPA8270)	20	-
ORGANOCHLORINE PESTICIDES				
Aldrin + Dieldrin	0.2	GCECD (USEPA8140,8080)	10	-
Chlordane	0.1	GCECD (USEPA8140,8080)	50	-
DDT + DDD + DDE	0.3	GCECD (USEPA8140,8080)	200	-
Heptachlor	0.1	GCECD (USEPA8140,8080)	10	-
PCBs				
PCBs (total)	0.9	GCECD (USEPA8140,8080)	10	-
OTHER				
Asbestos	Presence	PLM / Dispersion Staining	No visible fragments of asbestos and no respirable asbestos fibres observed using NATA accredited analysis	-

[1] Column 1 (NEHF - A), Health-based Investigation Levels (DEC 2006)
[2] Table 3 (EPA 1994)
[3] Column 5 (PIL), Soil Investigation Levels for Urban Redevelopment Sites (DEC 2006).

5.3.2 Application of Soil Criteria

For soil to be considered as validated (i.e., not posing an unacceptable risk), either: all reported concentrations are below the site remediation criteria; or the following statistical criteria shall be adopted with respect to the health based criteria:

- The upper 95% confidence limit on the average concentration for each analyte (calculated for samples collected from consistent soil horizons, stratigraphy or material types) must be below the adopted criterion;
- No single analyte concentration shall exceed 250% of the adopted criterion; and
- The standard deviation of the results must be less than 50% of the criterion.

In addition to the numerical criteria, consideration shall be given to the presence of odorous soils that may have been caused by contamination.

5.3.3 Imported Soil Criteria

The importation of material to reinstate excavations may be necessary during the proposed remediation works. In accordance with current EPA policy, only material that does not represent an environmental or health risk at the receiving site may be considered for resource recovery. In accordance with this, only VENM as defined in the *Protection of the Environment Operations Act* (1997) Schedule 1; ENM as defined in DECC (2008b); or any other suitable material granted an applicable exemption under the *Protection of the Environment Operations (Waste) Regulation 2005* may be imported to reinstate the excavations.

5.4 Groundwater Assessment Criteria

As noted in EPA endorsed guidelines (DEC 2007), the EPA regards protection of aquatic ecosystems and drinking water as default environmental values in all preliminary assessments of groundwater contamination. Subsequent, more detailed assessments, may demonstrate that these environmental values do not apply.

Given that the closest receiving water bodies are fresh water environments, threshold values for freshwater environments have been adopted for this assessment.

Where existing default groundwater assessment criteria are exceeded and there is a potential for current or future exposure to the contaminant, further investigation, remediation or management may be required. Where the most sensitive criterion for an individual contaminant of concern is less than the limit of reporting (LOR) or background levels (if known), then the LOR or the background level (if known) can be used as the adopted groundwater assessment criteria.

Table 5.3 Groundwater Criteria (all units in µg/L unless indicated)

Substance	Limit of Reporting	Laboratory Method	Aquatic Ecosystem Criteria[1]	Drinking Water Guidelines[2]
TPH/BTEX				
TPH (C_{10} – C_{36})	250	GCFID (USEPA8000)	600[3]	-
Benzene	1	Purge/trap (USEPA8020A)	950	1
Toluene	1	Purge/trap (USEPA8020A)	180	800
Ethylbenzene	1	Purge/trap (USEPA8020A)	80	300
Xylene (M+O+P)	3	Purge/trap (USEPA8020A)	625	600
Metals				
Arsenic (V)	1	ICP-MS (USEPA200.8)	24	7
Cadmium	0.1	ICP-MS (USEPA200.8)	0.2	2
Chromium (III)	1	ICP-MS (USEPA200.8)	3.3	50
Copper	1	ICP-MS (USEPA200.8)	1.4	2,000
Lead	1	ICP-MS (USEPA200.8)	3.4	10
Mercury	0.1	ICP-MS (USEPA200.8)	0.06	1
Nickel	1	ICP-MS (USEPA200.8)	11	20
Zinc	1	ICP-MS (USEPA200.8)	8	-
PAHs				
Naphthalene	0.1	GCMS(USEPA8270)	16	-
Phenanthrene	0.1	GCMS(USEPA8270)	2	-
Anthracene	0.1	GCMS(USEPA8270)	0.4	-
Fluoranthene	0.1	GCMS(USEPA8270)	1.4	-
Benzo(a)pyrene	0.1	GCMS(USEPA8270)	0.2	-

[1] (ANZECC (2000) Trigger values for the protection of 95% of aquatic ecosystems (Fresh Water)
[2] NHMRC/NRMMC (2004) Drinking Water Guidelines
[3] Dutch Intervention value adopted in absence of NSW EPA endorsed value (VROM 2000[4]).

[4] *Circular on Target Values and Intervention Values for Soil Remediation.* Netherlands Ministry of Housing, Spatial Planning and the Environment (VROM 2000).

5.4.1 Quality Assurance / Quality Control

The objective of the project is to remediate the site to a standard which is suitable for the continued industrial land use. To document the remediation works, validation sampling and analyses will be conducted. The quality of the validation data must be sufficient to draw conclusions regarding the suitability of the site. Hence, the quality assurance / quality control (QA/QC) program employed as part of remediation works will involve the pre-determined data quality objectives (DQOs). The data quality indicators (DQIs) and associated data quality criteria are shown in **Table 5.3** and discussed further below.

- **Precision** - measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques is assessed by calculating the Relative Percent Difference (RPD)[5] of duplicate samples.
- **Accuracy** - measures the bias in a measurement system. The accuracy of the laboratory data that are generated during this study is a measure of the closeness of the analytical results obtained by a method to the 'true' value. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards.
- **Representativeness** –expresses the degree which sample data accurately and precisely represent a characteristic of a population or an environmental condition. Representativeness is achieved by using an adequate number of sample locations to characterise the site to the required accuracy.
- **Comparability** - expresses the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in techniques used to collect samples, ensuring analysing laboratories use consistent analysis techniques and reporting methods.
- **Completeness** – is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study.

[5] $$RPD(\%) = \frac{|C_o - C_d|}{C_o + C_d} \times 200$$

Where C_0 is the analyte concentration of the original sample
C_d is the analyte concentration of the duplicate sample

Table 5.3 Summary of Quality Assurance / Quality Control Program

Data Quality Objective	Frequency	Data Quality Indicator
Precision		
Blind duplicates (intra laboratory)	1 / 20 samples	<50% RPD
Blind duplicates (inter laboratory)	1 / 20 samples	<50% RPD
Accuracy		
Surrogate spikes	All organic samples	70-130%
Laboratory control samples	1 per lab batch	<LOR
Matrix spikes	1 per lab batch	70-130%
Representativeness		
Sampling appropriate for media and analytes		-
Samples extracted and analysed within holding times.	-	pH (7 days), organics (14 days), inorganics (6 months)
Trip spike	1 per sampling event	70-130% recovery
Trip blank	1 per sampling event	<LOR
Comparability		
Standard operating procedures for sample collection & handling	All Samples	All samples
Standard analytical methods used for all analyses	All Samples	All samples
Consistent field conditions, sampling staff and laboratory analysis	All Samples	All samples
Limits of reporting appropriate and consistent	All Samples	All samples
Completeness		
Soil description and COCs completed and appropriate	All Samples	All samples
Appropriate documentation	All Samples	All samples
Satisfactory frequency and result for QC samples	All QA/QC samples	-
Data from critical samples is considered valid	-	Critical samples valid

If any of the DQIs were not met, further assessment was necessary to determine whether the non-conformance significantly affected the usefulness of the data. Corrective actions might have included requesting further information from samplers and/or analytical laboratories, downgrading of the quality of the data or alternatively, re-collection of the data.

5.5 Validation Reporting

At the completion of the remedial works, a validation report will be prepared in general accordance with the NSW EPA *Guidelines for Consultants Reporting on Contaminated Sites* (EPA 1997), documenting the works as completed. The report will contain information including:

- Results of previous investigations conducted at the site;
- Details of the remedial works conducted;
- Information demonstrating that the objectives of the RAP have been achieved, in particular the validation sample results and assessment of the data against both the pre-defined data quality objectives and the remediation acceptance (validation) criteria;
- Information demonstrating compliance with appropriate regulations and guidelines;
- Any variations to the strategy outlined in the RAP and that undertaken during the implementation 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, including requirements (if any) for ongoing monitoring / management.

The validation report will serve to document the remediation works for future reference.

5.6 Site Contingency Plan

5.6.1 Soil

In the unforeseen event that the proposed remediation works do not meet the validation criteria, or if the selected remedial strategy is unsuccessful, the following actions will be considered to ensure firstly the safety and health of people and the environment and secondly that the overall project objectives are achieved:

1. Continued controlled excavation and off-site disposal of contaminated soil until validation is achieved;
2. Reassessment of remedial options for excavated materials, including:
    - Onsite treatment; or
    - Onsite containment.

5.6.2 Groundwater

In the event that groundwater water quality data from the post remediation sampling do not meet the validation criteria and the contamination is considered to potentially be an ecological or human health risk, consideration will be given to appropriate management responses as per *Guidelines for the Assessment and Management of Groundwater Contamination* (DEC 2007), including restricting groundwater use, plume containment or remediation. If required a groundwater management plan (GMP) will be developed for the site as per the DEC (2007). The purpose of the GMP will be to manage risks associated with potential exposure to contaminants in groundwater while the groundwater is remediated.

Considering that the primary contamination source is being removed as part of the remediation of the site, monitored natural attenuation (MNA) should be considered as a potential groundwater remediation strategy, given the identified impacts (petroleum hydrocarbon) tend to attenuate with time. MNA involves natural processes of biodegradation, dispersion, diffusion, sorption, volatilisation and chemical or biological stabilisation, transformation or destruction which may reduce the concentrations of contaminants in the groundwater (DEC 2007).

6 Unexpected Finds

Environmental sampling is based on chemical analytes identified as a potential concern during a documented process of reviewing historical site activities. However, ground conditions between sampling points may vary, and further hazards may arise from unexpected sources and/or in unexpected locations. The nature of any additional hazards which may be present at the site are generally detectable through visual or olfactory means, for example:

- Fragments of previously unidentified ACM (visible);
- Petroleum hydrocarbon impacts (visible and odorous);
- Construction / Demolition Waste (visible); and
- Ash and/or slag contaminated soils / fill materials (visible).

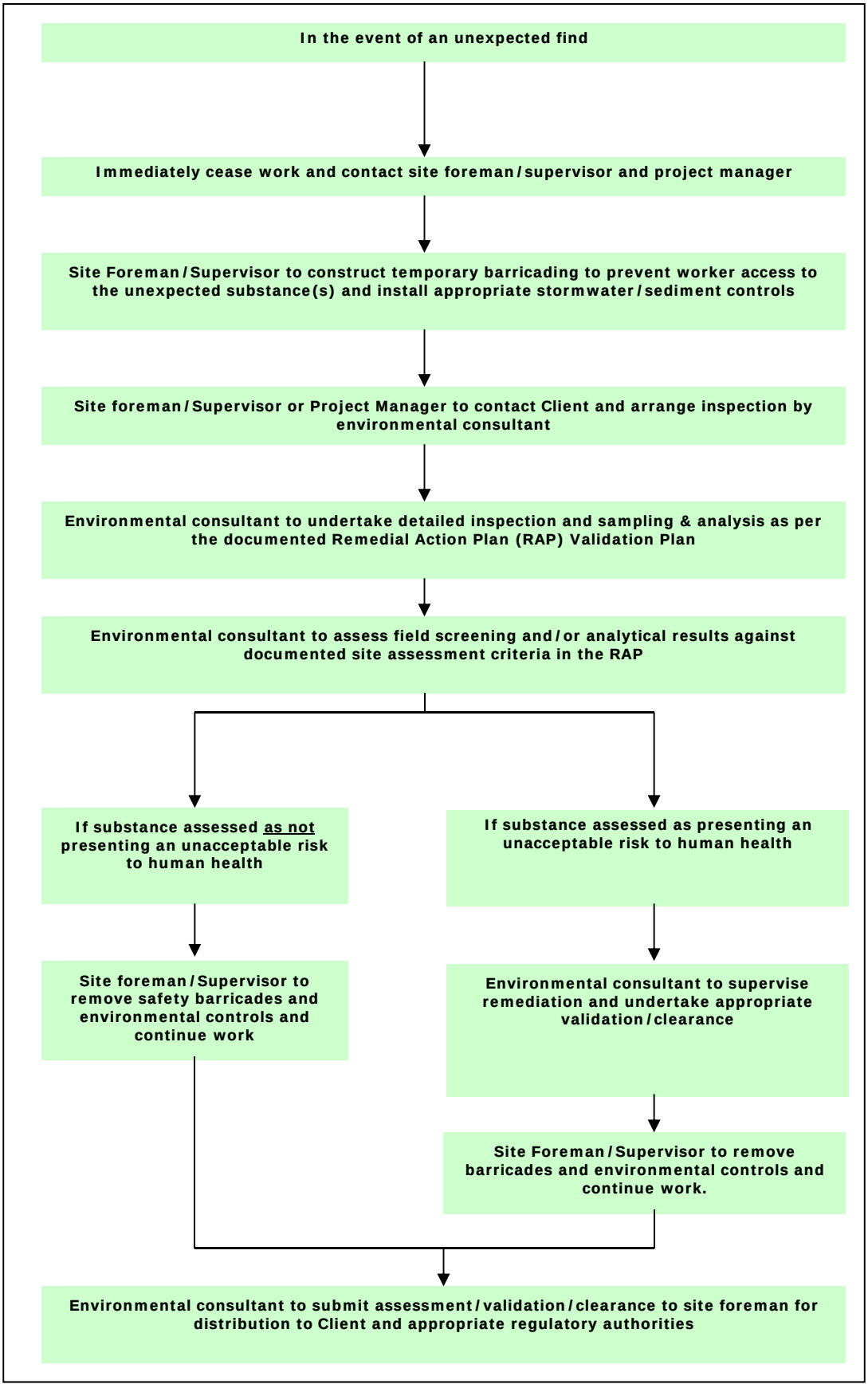
As a precautionary measure to ensure the protection of the workforce and surrounding community, should any of the abovementioned substances or any other unexpected potentially hazardous substance be identified, the procedure summarised in **Flowchart 6.1** and detailed in the following sections is to be followed.

An enlarged version of the unexpected finds protocol, suitable for use on site, should be posted in the Site Office and referred to during the Site Specific Induction by the Principal Contractor (**Appendix C**).

The sampling strategy for each unexpected find shall be designed by a suitably qualified environmental consultant. The strategy will, however, be aimed at determining the nature of the substance – that is, whether it is hazardous and, if so, is it at concentrations which pose an unacceptable risk to human health or the environment.

The sampling frequency of the identified substance / materials shall meet the requirements the NSW EPA *Sampling Design Guidelines* (1995).

Flowchart 6.1 - Unexpected Finds Protocol



7 Site Management Plan

This section contains procedures and requirements that are to be implemented as a minimum requirement during the remedial works at the site. This site management plan is in accordance with requirement in the Willoughby City Councils asbestos policy (2006) and Willoughby City Councils Development Control Plan (2006) –Part C – Contaminated Land.

Site management is typically the responsibility of the remediation contractor or principal contractor.

7.1 Hours of Operation

Remediation works shall only be permitted during the following hours:

Monday to Friday: 7:00 am to 5:00 pm

Saturdays: 8:00 am to 12:00 pm

Sundays and Public Holidays: No work permitted.

7.2 Soil and Water Management

All remedial works shall be conducted in accordance with a Soil and Water Management Plan, which is to be kept onsite. All erosion and sediment measures must be in place before works commence and be regularly inspected and maintained in a functional condition throughout remediation works. Erosion and sediment controls shall be implemented in accordance with the *Managing Urban Stormwater Soils and Construction Manual*.

To prevent the migration of impacted soil off site, silt fences shall be constructed at the down-gradient site boundaries. Any material which is collected behind the sediment control structures shall be removed off site with the contaminated soil.

In a storm event, the structures located on site for sediment control shall be monitored and replaced or altered if necessary. Collected material shall be managed in accordance with remediation works.

7.2.1 Stockpiles

The following procedures will be implemented:

- No stockpiles or other materials shall be placed on footpaths or nature strips without prior approval obtained from Council;
- All stockpiles shall be placed away from water bodies and stormwater infrastructure (including drainage lines, stormwater pits, gutters, etc);
- All stockpiles likely to generate substantial dusts or potential asbestos fibres shall be covered and, if left for more than 24 hours, be stored in a secure area; and
- All stockpiles will be placed on a level area as a low elongated mound.

7.2.2 Site Access

During remediation works, temporary fencing will be installed which will restrict access to remedial areas on the site. Only authorised persons will be able to enter the remedial areas.

Vehicle access to the site shall be stabilised to prevent the tracking of materials from the site and the adjoining driveway/access point to the road will be swept, shovelled or cleaned by means other than washing, on a daily basis or as-needed. Soil washings from wheels shall be collected and disposed in a manner that does not pollute waters.

7.2.3 Excavation Pump-out

Any excavation pump out water shall be analysed for total suspended solids, pH and the identified contaminants of concern identified prior to release to stormwater with permission from Council, provided results meet relevant ANZECC water quality standards. Other allowable options for disposal include disposal to sewer (only if trade waste permit obtained from Sydney Water) or licensed liquid waste contractor.

7.2.4 Landscaping/Rehabilitation

All exposed areas shall be progressively stabilised and revegetated on the completion of remedial works. Any revegetation should use a diversity of locally native trees, shrubs and groundcover species appropriate to the site and propagated from local genetic stock, where possible.

7.3 Noise

The remediation works shall comply with the NSW EPA's *Environmental Noise Control Manual* for the control of noise from construction sites which specifies that:

- For a cumulative period of up to 4 weeks, the noise level as measured by the LA10 (15 minute) emitted by the works to specific residences should not exceed the background noise level, LA 90 (15 minute), by more than 20dB(A).
- For a cumulative period of between four to 26 weeks, the emitted LA10 noise level should not exceed the LA90 level by more than 10dBA.

All machinery and equipment used on site will be in good working order and operated in an efficient manner to minimise noise, and be fitted with appropriate silencers when necessary.

Remediation work shall not give rise to 'offensive noise' as defined in the *Protection of the Environment Operations (POEO) Act 1997*. All equipment and machinery associated with the remediation work shall be operated in accordance with the POEO Act 1997 and its *Noise Control Regulations 2000*.

7.4 Vibration

The use of plant and machinery shall not cause vibrations to be felt or capable to be measured at neighbouring premises.

7.5 Air Quality

During remedial works, dust emissions and any odours will be confined within the site boundary.

7.5.1 Air Monitoring

During the removal of the asbestos impacted soils perimeter air monitoring will be conducted around the ACM remedial works.

Air monitoring will be conducted in accordance with the requirements of the National Occupational Health and Safety Commission (NOHSC) Asbestos Code of Practice and

Guidance Notes, in particular the Guidance note for the estimation of airborne asbestos dust [NOHSC 3002:2005].

7.5.2 Dust Control

During the removal of the ACM impacted fill material from the site, the excavation area will be wetted down using a water spray to minimise the potential for dust to be generated.

Dust shall also be controlled by ensuring vehicles leave via the designated (stabilised) site access and all equipment have dust suppressors fitted.

7.5.3 Odour

Given the extent of the impacted soils being disturbed during the remedial works, there are unlikely to be any significant odour issues. However, should odour be detectable at the site boundary, appropriate actions will be taken to reduce the odours, which may include: increasing the amount of covering of excavations / stockpiles; mist sprays; odour suppressants; or maintenance of equipment.

Records of volatile emissions and odours shall be kept on site and be made available to Council Officers on request. Equipment and machinery will be adequately maintained to minimise exhaust emissions. No materials shall be burnt on the site.

7.6 Groundwater

It is not anticipated that seepage water will be encountered during excavation within the remediation area. Nor is it anticipated that true groundwater will be encountered.

During remediation, if any seepage water or groundwater collects in excavations and requires removal it shall be subject to testing, and, if appropriate, released to stormwater subject to appropriate results. Other disposal options include disposal to sewer under approval from Sydney Water or collected and disposal/treatment by licensed waste contractor.

If dewatering is required, a licence shall be obtained from the NSW Office of Water under the provisions of the *Water Act 1912*.

7.7 Material Transporting

Trucks will be loaded in a designated area away from the contaminated material excavations. The transporting contractor shall ensure that there is no material tracked out onto the street and that the load is securely covered. In addition, all site vehicles must leave the site in a forward direction. Material deliver to or removed from the site shall be completed during hours of remediation as per **Section 7.1**.

All appropriate road rules shall be observed and state roads will be selected as far as practicable over local roads when deciding on the transport route to the off-site material disposal location. Council should be consulted prior to selecting a suitable transport route.

7.8 Hazardous Materials

Any hazardous and/or intractable wastes shall be removed and disposed of in accordance with the relevant regulatory requirements. In particular, any hazardous wastes will be transported by an appropriately licensed transporter. Any non-licensed transporting of waste must comply with the POEO (Waste) Regulation.

7.9 Disposal of Contaminated Soil

All soil will be classified, managed and disposed in accordance with the *Waste Classification Guidelines* (DECCW 2009). Documentary evidence for all soil disposal shall be kept and made available to Council's officer on request. Disposal documentation will be required for inclusion in the validation report.

7.10 Imported Fill

If any materials are required to be imported on site to re-establish existing ground levels, then clean validated material (either VENM or ENM) shall be used. Documentary evidence of material classification by the providing or receiving site will be required prior to importation, and for inclusion in the validation report. This shall include details of appropriate sampling and laboratory analysis in accordance with relevant EPA endorsed guidelines. Council may require such documentation on request.

7.11 Site Signage and Contact Numbers

A sign shall be displayed adjacent to the site access throughout the duration of the works with the contact details of the remediation contractor and project manager. Council shall also be notified of these details at least 14 days prior to commencing works. Asbestos removal signs shall be placed in accordance with WorkCover (2011).

7.12 Community Consultation

Adjoining residents must be notified five working days prior to undertaking the ACM remedial activities. Notification must provide the date the work will commence, WorkCover NSW phone number and Willoughby City Councils phone number.

Owners and/or occupants of premises adjoining and across the road from the site will be notified at least two days prior to the commencement of remediation.

Any complaints from adjoining residents or workers on site will be directed initially to the civil contractor on site. Following that, discussion with the environmental consultant and the complainant will investigate the issue and remedy it as required or applicable.

7.13 Site Security

The remedial areas shall be secured against unauthorised access by means of an appropriate fence.

7.14 Occupational Health and Safety

It is the employer's responsibility to ensure that all site remediation works comply with all Occupational Health and Safety and Construction Safety Regulations of the NSW WorkCover Authority. A Health and Safety Plan is provided in **Section 8**.

8 Health and Safety

This health and safety plan contains procedures and requirements that are to be implemented as a minimum during the remediation works.

The objectives of the health and safety plan are:

- To apply standard procedures that reduce risks resulting from the above works;
- To ensure all employees are provided with appropriate training, equipment and support to consistently perform their duties in a safe manner; and
- To have procedures to protect other site workers and the general public.

These objectives will be achieved by:

- Assignment of responsibilities;
- An evaluation of hazards;
- Establishment of personal protection standards and mandatory safety practices and procedures; and
- Provision for contingencies that may arise while operations are being conducted at the site.

This health and safety plan does not provide safety information specific to construction and other demolition or excavation activities carried out by contractors, such as the safe operation, maintenance and inspection of plant, etc. Contractors will be required to prepare their own Safe Work Method Statements (SWMS) for their work activities. All parties working on the site shall comply with all applicable Health and Safety legislation, regulations, codes and guidelines.

8.1 Responsibilities

Remediation/Principal Contractor

The remediation contractor is responsible for ensuring that the work is carried out in accordance with the health and safety plan. Specific SWMS will be developed by the remediation contractor for additional tasks. Responsibilities of the remediation contractor will include:

- Ensuring a copy of the health and safety plan and SWMS are available at the site during the remediation/validation activities;
- Confirming individuals are competent in performing allotted tasks;
- Liaison with the contractor representatives, as appropriate, regarding safety matters; and
- Investigation and reporting of incidents and accidents.

The remediation contractor contact details are to be completed in **Table 8.1** once appointed.

Table 8.1 Contact details

Project Manager	Details
Name	TBA
Company	TBA
Address	TBA
Contact Phone	TBA

Environmental/Asbestos Consultant

The appointed environmental/asbestos consultant will be responsible for air monitoring and reporting during asbestos removal works.

The appointed environmental consultant will be responsible for the monitoring of odours during the remedial activities.

Other Members of the Site Workforce

Every individual worker is responsible for conducting their allocated tasks in a safe manner and in accordance with their training and experience. They must give due consideration to the safety of all others in their proximity and cooperate in matters of health and safety. All workers must leave their work areas in such a condition that the location will not be hazardous to others at any time.

8.2 Hazards

The known or potential hazards associated with the work activities described in **Section 4.5** are listed below:

- Inhalation hazards associated with the presence of ACM impacted soil.
- Chemical hazards associated with the presence of contaminated soil;
- Physical hazards, including:
  - work in or near excavations;
  - operating machinery;
  - heat stress and UV exposure;
  - underground or overhead services;
  - manual handling; and
  - noise.

In the event of the discovery of any condition that would suggest the existence of a situation more hazardous than anticipated, or of any new hazard that could potentially cause serious harm to personnel or the environment, work will be suspended until the Project Manager has been notified and appropriate instructions have been provided to field personnel.

8.2.1 Inhalation Hazards

The main inhalation hazards from the remediation/validation works are consequent of the presence of asbestos.

Measures require to be put in place to prevent/ minimise the generation of airborne fibres. These have been described in the environmental controls for the works. Where airborne emissions are likely to be generated, Personal Protective Equipment (PPE) shall be required to be worn to prevent potential exposure, as described in **Section 8.3**.

8.2.2 Chemical Hazards

The main chemical hazard associated with the remediation/validation works are hydrocarbons.

When working with contaminated materials in general, care must be taken to ensure that the contamination is not introduced to the worker via ingestion, inhalation or absorption.

Personal protective equipment (PPE) and decontamination requirements related to the remedial works are summarised in **Sections 8.3 and 8.4**.

8.2.3 Physical Hazards

Operating Machinery

Heavy plant and equipment operating in the vicinity of field personnel presents a risk of physical injury. Personnel should be cognisant of their position in relation to operating machinery at all times.

Never walk behind or to the side of any operating equipment without the operator's knowledge. Do not assume that the operator knows your position. Personnel should stay at least 1 m from the operational area of heavy equipment and should not stand directly below any load or piece of equipment (eg. backhoes).

Work In or Near Excavations

All excavations shall be shored, sloped or otherwise constructed so as to minimise the potential for collapse.

Cuts and Abrasions

The manual work associated with the remediation works gives rise to the risk of cuts and abrasions to personnel working in the area. As well as the direct consequences of any cut or abrasion, such injuries can lead to the possibility of exposure to contaminants through the wound as well as diseases such as tetanus. To minimise the risk of direct or indirect injury, personnel will wear the personal protective equipment described in **Section 8.3**.

Heat Stress and UV Exposure

Site personnel may experience heat stress due to a combination of elevated ambient temperatures and the concurrent use of personal protection equipment; this depends in part on the type of work and the time of year.

In addition to heat stress, overexposure to UV radiation in sunlight can result in sunburn to exposed skin. The use of a high protection sunscreen (SPF15 or greater) on all exposed skin is recommended. Hats (including hard hats in specified areas) will also provide additional sun protection during the peak (i.e. 10:00 am to 3:00 PM) sun period. Sunglasses should be worn (where appropriate) to protect eyes from effects of UV exposure.

Underground Services

There is the potential for underground services (electricity, natural gas lines, water, telephone, sewer, and stormwater) to be present beneath the work area. The remediation contractor shall ensure that appropriate procedures will be taken to minimise the risk associated with excavation near services.

Aboveground Electrical Hazards

All electrical plant and equipment must comply with the requirements of Australian Standard AS 3000. Hand held portable tools shall comply with AS/NZS 3160 *Hand-held Portable Electric Tools* and shall be double insulated. Cord connected portable hand lamps shall comply with AS/NZS 3118. A Residual Current Device (RCD) shall protect plug-in portable equipment, which is connected to a supply above Extra Low Voltage - 12-24volts (including equipment supplied from a generator or welding set). RCD protection shall be provided during use of portable electrical equipment at all times while the equipment is connected to a power supply above Extra Low Voltage, irrespective of whether power is

switched ON or OFF. RCD's shall comply with AS 3190 and shall be type II units, rated to trip at or below 30 milliamps within 40 milliseconds.

All equipment shall be operated in compliance with the NSW WorkCover (2006) *Work Near Overhead Power Lines: Code of Practice*. Minimum approach distances for all equipment should exceed:

- 3.0m for nominal phase to phase ac voltage lines up to 132 000 Volts;
- 6.0m for 132 000 to 330 000 Volts;
- 8.0m for greater than 330 000 Volts; and
- 3.0m for nominal pole to earth dc voltage up to and including 1500 +/- volts.

Manual Handling

When lifting or handling heavy objects, use correct lifting techniques, bending the knees not the back. If the item to be lifted is too heavy or awkward for one person to lift, seek assistance from other company employees or use mechanical help.

Noise

Long-term exposure to high levels of noise is unlikely. However, operating machinery may cause significant noise exposures for short periods. Earplugs or earmuffs should be worn in any situation where noise levels make normal conversation difficult.

8.3 Personal Protective Equipment

All workers who may come into direct contact with contaminated soil will wear the following personal protective equipment:

- Overalls or long sleeved collared shirt;
- Heavy duty outer gloves (eg. leather) where there is a risk of cuts or abrasions, otherwise PVC outer gloves if in direct contact with contaminated soil;
- Steel capped boots;
- Safety glasses;
- High visibility vest or jacket; and
- Hard hat.

In addition to the above, the following personal protective equipment will be worn by the licensed personnel responsible for removing the ACM impacted fill material, or potentially exposed to airborne emissions:

- During any work in the asbestos impacted area prior to final clearance, overalls worn should be made from either 100% synthetic material or a mixed natural/synthetic fabric capable of providing adequate protection against fibre penetration. Gloves, rubber soled work shoes or gum boots should be provided for personnel involved in the wet work. These shoes will remain inside the work area for the duration of the work.
- Approved respirators shall be worn in the asbestos impacted area at all times to provide respiratory protection. The minimum protection is an approved properly fitting disposable respirator or half faced respirator fitted with a particulate cartridge. However it is expected that the contractor will conduct a risk assessment in relation to the works and should consider the requirement for

positive pressure, hood or full-face powered air-purifying respirator fitted with an approved Class M filter.

- The contractor shall supply and keep in good order, two complete sets of protective clothing and respirators for authorised inspection personnel. These will remain the property of the contractor at the end of the contract.
- Respirators should be issued for personal use only and shall be kept in a clean condition. Alcohol based antiseptic swabs should be made available for the cleaning of respirators.
- Any respirator defects should be reported for subsequent repair. They should be maintained in a clean and safe working condition.
- Employees must receive instruction in the correct method of using the respirator and on the importance of correct facial fit and maintenance. No person with a beard shall be allowed within the asbestos work area except using an approved positive pressure continuous airflow hood.

In the event that workers will be exposed to highly odorous soil conditions during remediation works, the following additional PPE should be adopted:

- Impermeable disposable overalls; and
- Half or full face respirator with organic vapour cartridge (as per action levels identified in **Table 8.2**).

A PID shall be used to monitor the concentrations of VOCs within the workspace, with the following action levels at which the additional PPE mentioned above is required.

Table 8.2 Action Levels for Respirator Use

Instrument	Airborne Levels*	Level of Protection
PID	< 80 ppm	No additional protection
	>80 ppm	Half or full faced respirator

8.4 Asbestos Monitoring procedures

It is prudent practice to conduct monitoring for airborne asbestos fibres during asbestos works. The results of air monitoring can be used:

- To identify failures in containment;
- To identify poor work practices; and
- To provide proof of containment for occupiers and regulatory authorities and to provide evidence of good work practices for both present and future needs.

Monitoring will be conducted in accordance with the National Occupational Health & Safety Commission (NOHSC) membrane filter method as approved by the National Association of Testing Authorities (NATA).

The appropriate TWA (NOHSC) levels are:

- Amosite - 0.1 fibre/mL;
- Chrysotile – 0.1 fibre/mL;
- Crocidolite - 0.1 fibre/mL;
- Other forms of asbestos - 0.1 fibre/mL; and
- Any mixture of these, or where the composition is unknown - 0.1 fibre/mL.

With consideration to these levels the following trigger levels have been developed:

- If airborne fibre levels reach 0.01 fibres/mL the source of fibre release is to be found and rectified. Work in the affected area does not have to stop; and
- If airborne fibre levels reach 0.02 fibres/mL work in the work area should stop and additional controls measures employed. This will involve additional water spraying during excavations.

Air monitoring results will be obtained within 24 hours of sample collection. While this precludes "real time" monitoring, visual indications will be made during all excavation works and, if there is any visible dusts, light water spays will be used to wet the excavation and prevent the release of any airborne asbestos fibres.

8.5 Decontamination Procedures

The decontamination procedures specified below will be followed whenever personnel, plant or equipment leave the site.

Personnel

The following steps should be taken to ensure personnel do not leave the site with potentially contaminated clothing:

1. Wash boots in clean water
2. Remove outer gloves and store for reuse
3. Remove overalls and store for reuse (during the day) or place in the skip for the asbestos wastes for disposal.
4. Remove respirator and goggles (if used) and store clean for reuse or decontamination, as appropriate.
5. Thoroughly wash hands and face.

If any part of a worker's body comes into direct contact with any potentially contaminated material, the affected part(s) should be immediately washed with clean water.

Vehicle, Plant and Equipment

All equipment, including personal protective equipment, will be washed or otherwise cleaned to ensure that contaminated soil, water or dust is removed before it leaves the Site. All plant and equipment will have their outer bodies thoroughly cleaned of soil and sediment before moving off the site.

8.6 Emergency Response

The remediation contractor will be responsible for preparing an emergency response plan, which will provide details on appropriate action and evacuation procedures in the event of an emergency.

In the event of an emergency arising on the site, appropriate action should be taken. Site evacuation procedures should be followed, as necessary.

In the event of an accident: evaluate the seriousness of the injury, and contact emergency services, if necessary; provide first aid, as appropriate, and if safe to do so evacuate the injured person via the Decontamination Zone; make the area as safe as possible without jeopardising safety.

If a serious accident occurs, do not disturb the scene, except to make safe and prevent further injury or damage, and keep all unauthorised people out, and report all accidents to the Project Manager.

9 Regulatory Approvals / Licensing

9.1 State Environment Planning Policy Number 55 (SEPP55) Remediation of Land

The proposed remediation works are classified as “Category 2” Remediation Works – i.e., not requiring consent. SEPP 55 requires Council to be notified 30 days before Category 2 remediation works commence. However, if the remediation works are incorporated in a proposed demolition and bulk earthworks proposed for the site, separate consent may not be required.

9.2 Protection of the Environment Operations Act 1997

In relation to the licensing requirements under the *Protection of the Environment Operation Act 1997*:

- The works do not fall within the licensing requirements for Contaminated Soil Treatment Works; and
- The works do not fall within the licensing requirements for Crushing, Grinding or Separating Works.

All material to be excavated and removed from the site (including associated activities such as classification) will be undertaken in strict accordance with the requirements of the POEO Act 1997. Such requirements include:

- Ensuring waste is classified appropriately and in accordance with relevant guidelines;
- Waste materials are disposed of at appropriately licensed facilities;
- Other materials are removed to facilities lawfully able to accept such materials.

9.3 Protection of the Environment Operations (Waste) Regulation 2005

The regulations make requirements relating to non-licensed waste activities and waste transporting. The proposed works on the site will not require to be licensed. Section 48 of the Regulation requires that wastes are stored in an environmentally safe manner. It is also stipulated that vehicles used to transport waste must be covered when loaded.

9.4 Waste Classification Guidelines (DECCW 2009)

All wastes generated shall be assessed, classified and managed in accordance with this guideline.

9.5 Asbestos Removal Regulations and Code of Practice

The removal and disposal of asbestos will be managed in accordance with the National Occupational Health & Safety Commission (NOHSC) "Asbestos: Code of Practice and Guidance Notes", the Work Health and Safety Act and Regulations, NSW WorkCover Guidelines and the NSW EPA *Waste Classification Guidelines* (DECCW 2009).

Excavation and removal of ACM impacted soils are required to be conducted by a Class A licensed contractor. Before starting the affected works, the appointed contractor is required to obtain a site-specific permit approving the asbestos works from NSW WorkCover. A permit will not be granted without a current licence and the permit application must be made at least seven days before the work is due to commence.

As noted in Willoughby City Council's asbestos policy (WCC 2006a), written notification to adjoining residents is required five working days prior to the removal works and on completion of the disposal of the ACM impacted soil all tipping receipts must be lodged to council.

9.6 Willoughby City Council Requirements

The WCC Development Control Plan (WCC 2006b) has no additional council specific requirements and refers provisions made in SEPP 55.

In consideration of provisions of SEPP 55 Remediation of Land the works are considered to be Category 2 remediation works. Development approval is not necessary for Category 2 remedial works.

In accordance with SEPP 55, prior notice of category 2 remediation work to Council is required at least 30 days before commencement of works.

Willoughby City Council's asbestos policy (WCC 2006a) requires written notification to adjoining residents five working days prior to the removal works and on completion of the disposal of the ACM impacted soil all tipping receipts must be lodged to council.

10 Conclusion

Subject to the successful implementation of the measures detailed in this RAP and subject to the limitations in **Section 11**, it is considered that the site can be made suitable for the proposed mixed use (commercial/residential).

11 Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the project brief only, and has been based in part on information obtained from the client and other parties. The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose. JBS Environmental Pty Ltd accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client, or amended in any way without prior approval by JBS Environmental Pty Ltd, and should not be relied upon by other parties, who should make their own enquires.

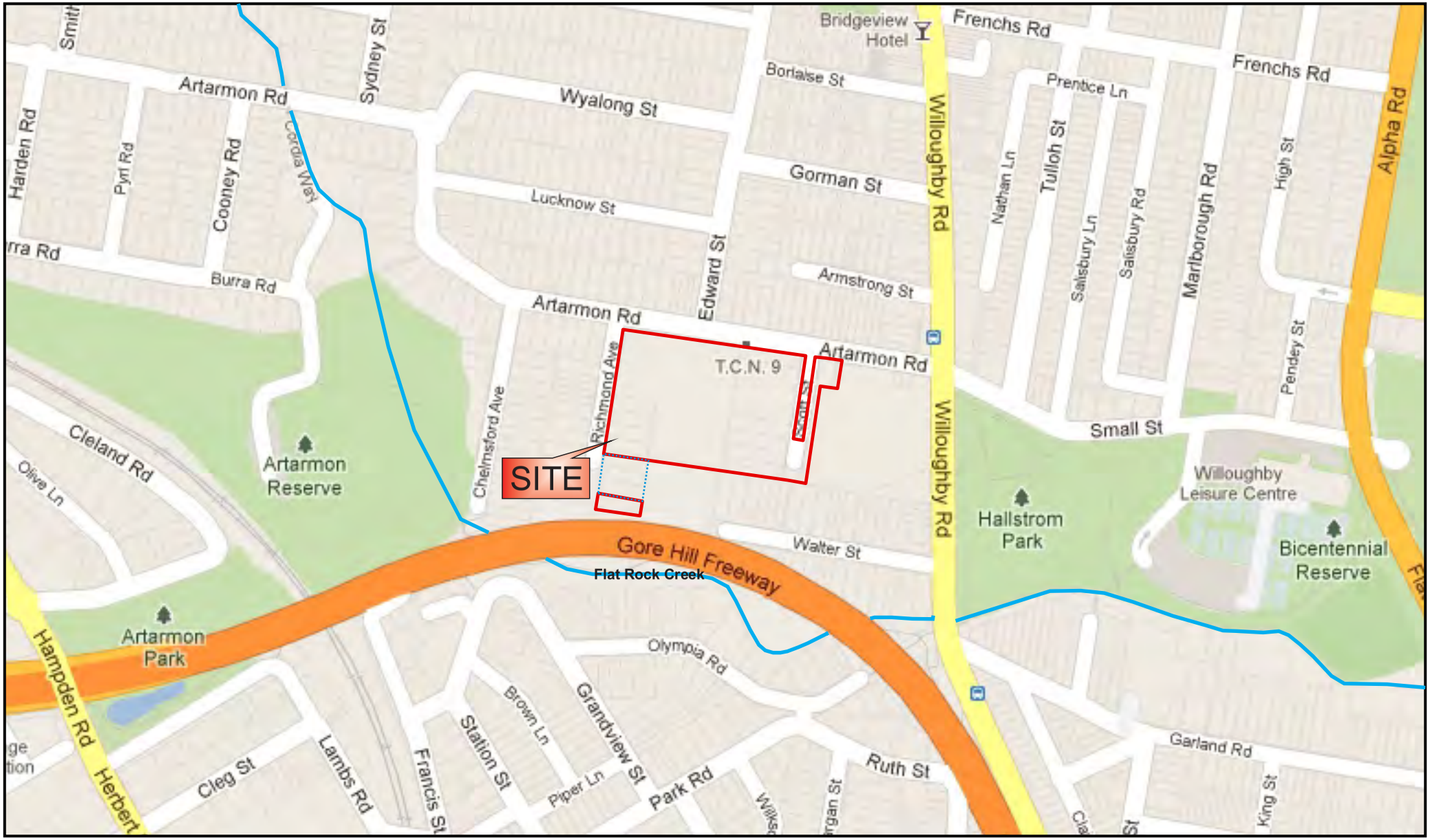
Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements and site history, not on sampling and analysis of all media at all locations for all potential contaminants.

Limited sampling and laboratory analyses was undertaken as part of the investigations, as described herein. Ground conditions between sampling locations may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history and which may not be expected at the site.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS Environmental Pty Ltd reserves the right to review the report in the context of the additional information

Figures



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Datum: MGA94 Zone 56 - AHD

Rev	Description	Drn.	Date
A4			
0	Original Issue - R02	SE	15-11-2012

Legend:
- Approximate Site Boundary
- Approximate Lot 11 DP 1162507 Boundary (not included in Site)

JBS ENVIRONMENTAL

Figure 1: Site Location

Client: Nine Network Australia

Project: Artarmon Rd, Willoughby NSW

Job No: 42410 File Name: 42410_01

Source: Base Image - Google Maps www.maps.google.com 11-10-2012

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Scale: 1:2,000

Datum: GDA 1994 MGA Zone 56 - AHD

A4			
0	Original Issue - R02	SE	12-11-2012
Rev	Description	Drn.	Date:

Legend:

- Approximate Site Boundary
- Approximate Lot 11 DP 1162507 Boundary (not included in Site)
- Approximate Cadastral Boundary

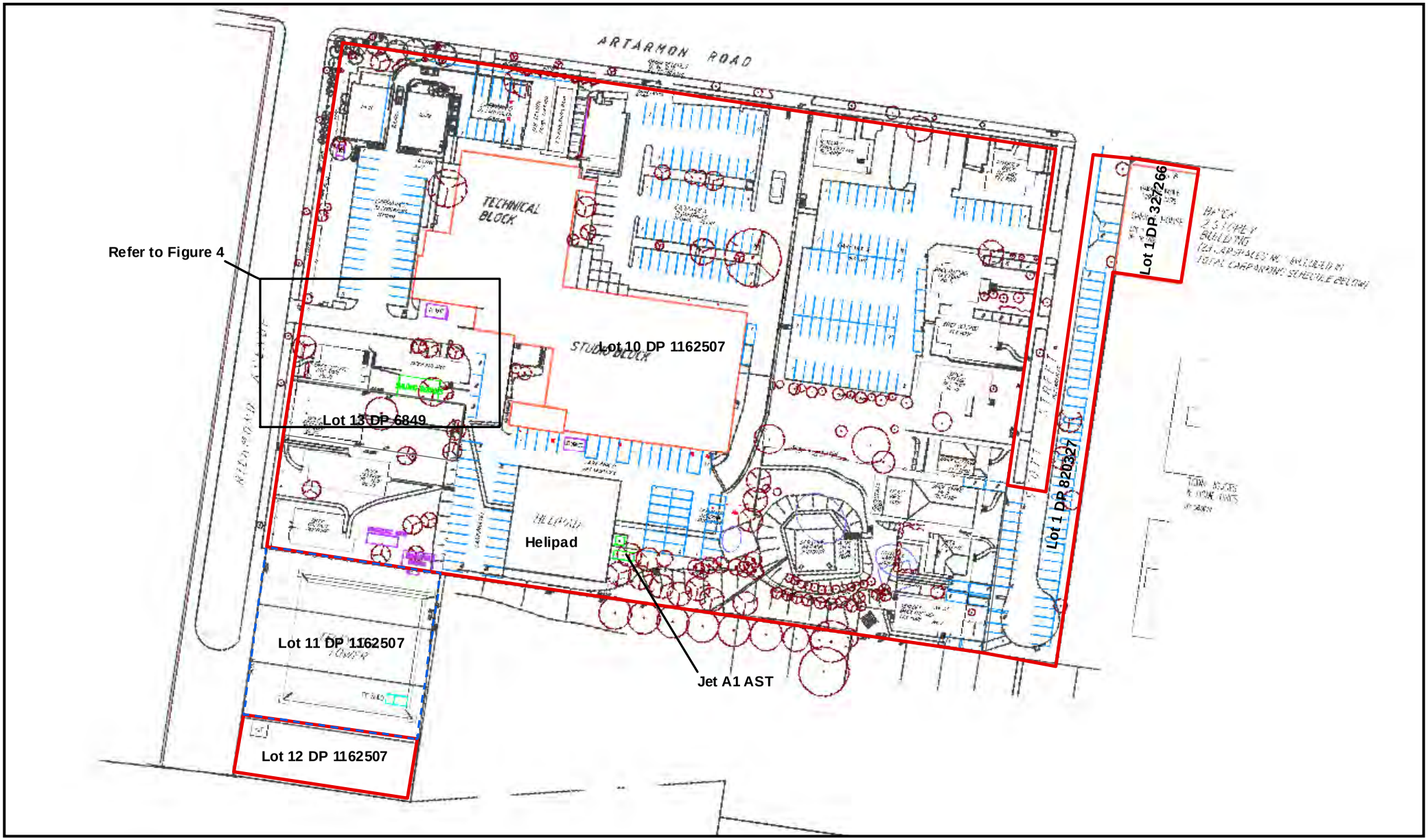
JBS ENVIRONMENTAL

Figure 2: Site Layout

Client: Nine Network Australia

Project: Artarmon Rd, Willoughby NSW

Job No: 42410 File Name: 42410_02



Source: Base Image - Nine Network Australia Pty Ltd, TCN 9 Site Plan, 001P 14-08-2007

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Datum: GDA 1994 MGA Zone 56 - AHD

Rev	Description	Drn.	Date:
A4			
0	Original Issue - R02	SE	12-11-2012

Legend:

- Approximate Site Boundary
- Approximate Lot 11 DP 1162507 Boundary (not included in Site)
- Approximate Cadastral Boundary

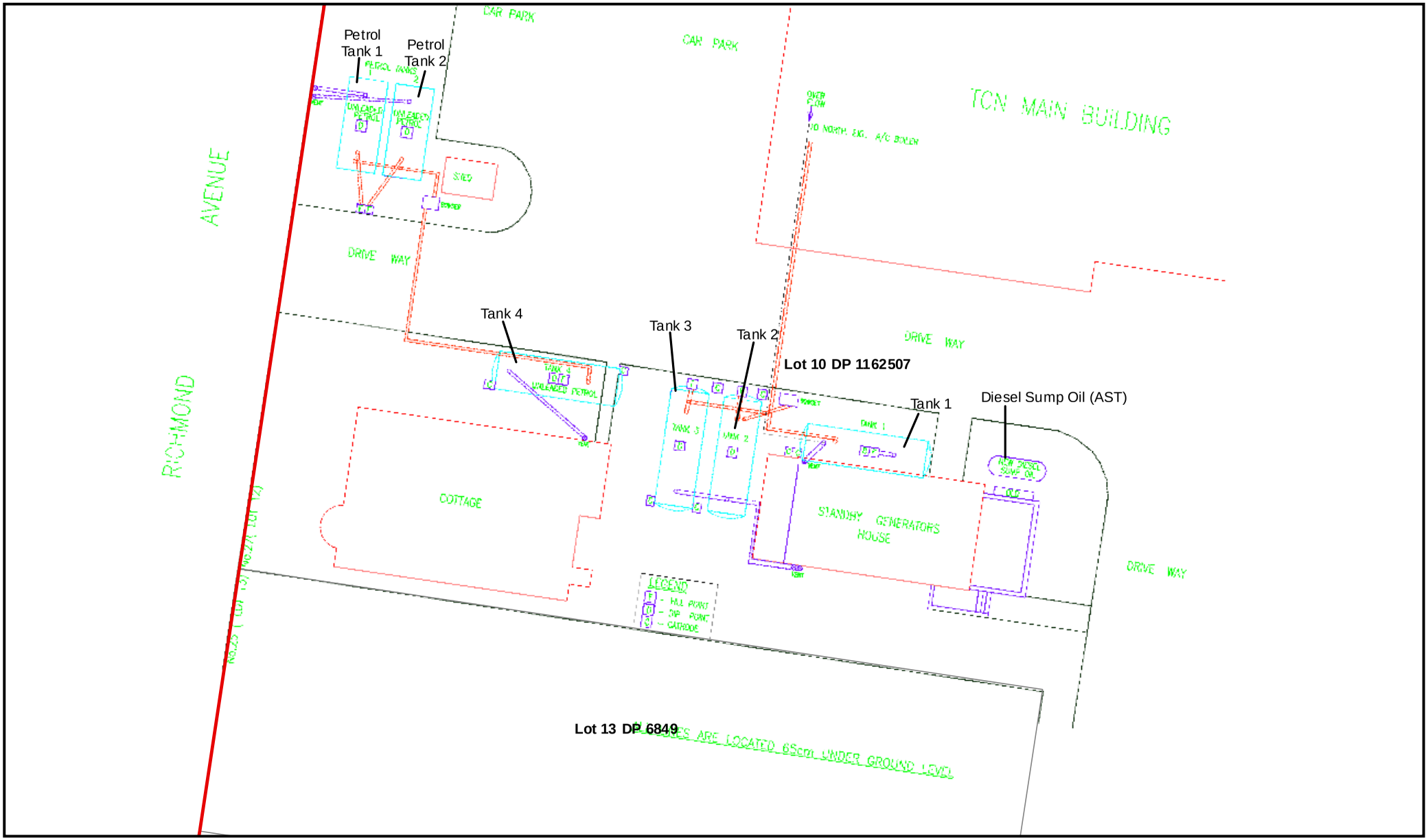
JBS ENVIRONMENTAL

Figure 3: Site Features

Client: Nine Network Australia

Project: Artarmon Rd, Willoghby NSW

Job No: 42410 File Name: 42410_03



Source: Base Image - Nine Network Australia Pty Ltd, Fuel Tanks Underground Storage Location and Connections, 7027Y 06-04-1998

0 3 6 12 m

Scale: 1:300

Datum: GDA 1994 MGA Zone 56 - AHD

Rev	Description	Drn.	Date:
A4			
0	Original Issue - R02	SE	12-11-2012

Legend:

- Approximate Site Boundary
- Approximate Lot 11 DP 1162507 Boundary (not included in Site)
- Approximate Cadastral Boundary

JBS ENVIRONMENTAL

Figure 4: Underground Storage System

Client: Nine Network Australia

Project: Artarmon Rd, Willoghby NSW

Job No: 42410 File Name: 42410_04

Source: Base Image - Google Maps www.maps.google.com 11-10-2012

0 12.5 25 50 m

Scale: 1:1,300

Datum: GDA 1994 MGA Zone 56 - AHD

Rev	Description	Drn.	Date:
A4			
0	Original Issue - R02	SE	12-11-2012

Legend:

- Approximate Site Boundary
- Approximate Lot 11 DP 1162507 Boundary (not included in Site)
- Approximate Borehole Location - Douglas Partners 2008
- Borehole Location
- Monitoring Well Location
- Hand Auger Location

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Figure 5: Sample Locations

Client: Nine Network Australia

Project: Artarmon Rd, Willoghby NSW

Job No: 42410 File Name: 42410_05

DP-BH14	Depth
Constituent	(m bgs)
Chrysotile Asbestos Detected	0.3-0.4

BH13	Depth	Exceedance	Criteria
Constituent	(m bgs)	(mg/kg)	(mg/kg)
Benzene	15-16	3	1
Xylenes	15-16	61	25
TPH C6-C9	15-16	150	65

DP-BH4	Depth	Exceedance	Criteria
Constituent	(m bgs)	(mg/kg)	(mg/kg)
TPH C6-C9	0.8-10	77	65
TPH C6-C9	12-15	300	65
Benzene	12-15	2.8	1
Xylenes	0.8-10	69	25
Xylenes	12-15	152	25

DP-BH5	Depth	Exceedance	Criteria
Constituent	(m bgs)	(mg/kg)	(mg/kg)
TPH C6-C9	0.1-0.3	160	65
TPH C6-C9	13-15	150	65
Benzene	0.1-0.3	18	1
Xylenes	0.1-0.3	91	25
Xylenes	13-15	59	25

Source: Base Image - Google Maps www.maps.google.com 11-10-2012

0 12.5 25 50 m

Scale: 1:1,300

Datum: GDA 1994 MGA Zone 56 - AHD

Rev	Description	Drn.	Date:
A4			
0	Original Issue - R02	SE	22-11-2012

Legend:

- Approximate Site Boundary
- Approximate Lot 11 DP 1162507 Boundary (not included in Site)
- Approximate Borehole Location - Douglas Partners 2008
- Borehole Location
- Hand Auger Location

JBS ENVIRONMENTAL

Figure 6: Soil Exceedances - Commercial/Residential Criteria

Client: Nine Network Australia

Project: Artarmon Rd, Willoghby NSW

Job No: 42410 File Name: 42410_06

MW02	Exceedance	Criteria
Constituent	(µg/L)	(µg/L)
Copper	2	15
Zinc	37	8

MW01	Exceedance	Criteria
Constituent	(µg/L)	(µg/L)
Zinc	53	8
TPH C6-C9	20	-

Source: Base Image - Google Maps www.maps.google.com 11-10-2012

0 12.5 25 50 m

Scale: 1:1,300

Datum: GDA 1994 MGA Zone 56 - AHD

Rev	Description	Drn.	Date:
A4			
0	Original Issue - R02	SE	12-11-2012

Legend:

- Approximate Site Boundary
- Approximate Lot 11 DP 1162507 Boundary (not included in Site)
- Monitoring Well Location

JBS ENVIRONMENTAL

Figure 7: Groundwater Exceedances

Client: Nine Network Australia

Project: Artarmon Rd, Willoghby NSW

Job No: 42410 File Name: 42410_07

Source: Base Image - Google Maps www.maps.google.com 11-10-2012

0 12.5 25 50 m

Scale: 1:1,300

Datum: GDA 1994 MGA Zone 56 - AHD

Rev	Description	Drn.	Date:
A4			
0	Original Issue - R02	SE	21-11-2012

Legend:

- Approximate Site Boundary
- Approximate Lot 11 DP 1162507 (not included in Site)
- ACM Impacted Soils
- Hydrocarbon Impacted Soils
- Approximate AST Location
- Approximate UST Location
- Borehole Location
- Monitoring Well Location
- Hand Auger Location
- Borehole Location - Douglas Partners 2008

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Figure 8: Approximate Area of Impacted Soils

Client: Nine Network Australia

Project: Artarmon Rd, Willoghby NSW

Job No: 42410 File Name: 42410_08

Source: Base Image - Google Maps www.maps.google.com 11-10-2012

0 12.5 25 50 m

Scale: 1:1,300

Datum: GDA 1994 MGA Zone 56 - AHD

Rev	Description	Drn.	Date:
A4			
0	Original Issue - R02	SE	22-11-2012

Legend:

- Approximate Site Boundary
- Approximate Lot 11 DP 1162507 (not included in Site)
- Anticipated Groundwater Flow Directions
- Approximate AST Location
- Approximate UST Location
- Proposed Monitoring Well Locatoin
- Monitoring Well Location

JBS ENVIRONMENTAL

Figure 9: Proposed Groundwater Monitoring Well Locations

Client: Nine Network Australia

Project: Artarmon Rd, Willoghby NSW

Job No: 42410 File Name: 42410_09

Appendix A

Environmental Data from Previous Investigations (JBS 2012 and DP 2008)

Job No. 42410
24 Artarmon Rd, Willoughby, NSW
Table B - Summary Soil Laboratory Results

Notes:
(1) Phytotoxicity based Investigation Levels (PILs) (Column 5, DEC 2006)
(2) Standard residential with accesible soil (Column 1, DEC 2006)
(3) Commercial/Industrial (Column 5, DEC 2006)
(4) Threshold concentrations for sensative land use - soils (Table 3, EPA 1994)

Italics	above PILs
bold	above HIL (A)/Threshold concentrations
bold	above HIL (A)/Threshold concentrations

Sample Number	Metals								BTEX				TPH		PAHs		Organochlorine Pesticides				PCBs	
	Arsenic	Cadmium	Chromium (Total)	Copper	Lead	Mercury	Nickel	Zinc	Benzene	Ethyl-benzene	Toluene	Xylenes	C6-C9	C10-36	Benzo(a) pyrene	Total PAHs	Aldrin + Dieldrin	Chlordane	DDT + DDD + DDE	Heptachlor	Total PCBs	Asbestos
LOR	4	1	1	1	1	0.1	1	1	0.5	1	0.5	3	25	250	0.05	1.55	0.2	0.2	0.3	0.1	0.7	0.1g/kg
Landuse criteria (mg/kg)																						
Phytoxicity (PIL)[3]/TC[4]	20	3	400	100	600	1	60	200	-	3.1	1.4	14	-	-	-	-	-	-	-	-	-	-
Residential (HIL - A)[2]/TC[4]	100	20	120 000	1000	300	15	600	7000	1	50	130	25	65	1000	1	20	10	50	200	10	10	NIL
Commercial/Industrial (HIL - F)[3]/TC[4]	500	100	600 000	5000	1500	75	3000	35 000	1	50	130	25	65	1000	5	100	50	250	1000	50	50	NIL
BH01 2.0-2.1	-	-	-	-	-	-	-	-	<0.2	<1	<0.5	<3	<25	<250	<0.05	<1.55	-	-	-	-	-	-
BH02 0-0.1	5	<0.5	14	13	56	<0.1	4	150	<0.2	<1	<0.5	<3	<25	<250	0.09	0.29	<0.2	<0.2	<0.3	<0.1	<0.7	NIL
BH02 2.5-2.6	-	-	-	-	-	-	-	-	<0.2	<1	<0.5	<3	<25	<250	<0.05	<1.55	-	-	-	-	-	-
BH03 0-0.1	<4	<0.5	17	28	160	0.2	6	*280*	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.3	<0.1	<0.7	NIL
BH03 2.0-2.1	-	-	-	-	-	-	-	-	<0.2	<1	<0.5	<3	<25	<250	-	-	-	-	-	-	-	-
BH04 1.5-1.6	-	-	-	-	-	-	-	-	<0.2	<1	<0.5	<3	<25	<250	-	-	-	-	-	-	-	-
BH05 2.0-2.1	-	-	-	-	-	-	-	-	<0.2	<1	<0.5	<3	<25	<250	-	-	-	-	-	-	-	-
BH06 0-0.1	5	<0.5	12	29	210	0.1	4	*400*	-	-	-	-	-		-	-	-	-	-	-	-	-
BH06 1.0-1.1	-	-	-	-	-	-	-	-	<0.2	<1	<0.5	<3	<25	<250	-	-	-	-	-	-	-	-
BH07 0.7-0.8	<4	<0.5	7	4	41	<0.1	2	77	<0.2	<1	<0.5	<3	<25	<250	<0.05	<1.55	-	-	-	-	-	NIL
BH08 0.2-0.3	-	-	-	-	-	-	-	-	<0.3	<1	<0.5	<3	<25	<250	-	-	-	-	-	-	-	NIL
BH08 1.5-1.6	<4	<0.5	7	1	12	<0.1	<1	8	<0.2	<1	<0.5	<3	<25	<250	<0.05	<1.55	-	-	-	-	-	-
BH09 0-0.1	-	-	-	-	-	-	-	-	<0.2	<1	<0.5	<3	<25	610	-	-	-	-	-	-	-	-
BH09 2.4-2.5	7	<0.5	6	<1	3	<0.1	<1	4	<0.2	<1	<0.5	<3	<25	<250	-	-	-	-	-	-	-	-
BH10 0-0.1	-	-	-	-	-	-	-	-	<0.2	<1	<0.5	<3	<25	<250	-	-	-	-	-	-	-	-
BH10 0.2-0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.3	<0.1	<0.7	-
BH10 1.5-1.6	7	<0.5	12	5	22	<0.1	3	21	<0.2	<1	<0.5	<3	<25	<250	0.32	3.82	-	-	-	-	-	NIL
BH11 0.4-0.5	<4	<0.5	4	36	4	<0.1	2	36	<0.2	<1	<0.5	<3	<25	<250	<0.05	<1.55	-	-	-	-	-	-
BH12 2.0-2.1	5	<0.5	8	6	14	<0.1	<1	21	<0.2	<1	<0.5	<3	<25	<250	<0.05	<1.55	-	-	-	-	-	-
BH13 1.5-1.6	5	<0.5	7	<1	15	<0.1	<1	1	**3**	*5*	*23*	**61**	**150**	120	<0.05	2.2	-	-	-	-	-	-
BH13 4.5-4.6	-	-	-	-	-	-	-	-	<0.2	<1	<0.5	<3	<25	<250	-	-	-	-	-	-	-	-
BH14 0.7-0.8	6	<0.5	8	<1	10	<0.1	<1	13	<0.2	<1	<0.5	<3	<25	<250	-	-	-	-	-	-	-	-
BH14 2.5-2.6	6	<0.5	12	3	9	<0.1	3	19	<0.2	<1	<0.5	<3	<25	<250	<0.05	<1.55	-	-	-	-	-	-
BH15 0.2-0.3	<4	<0.5	20	26	13	<0.1	39	37	-	-	-	-	-	-	-	-	-	-	-	-	-	NIL
BH16 0.2-0.3	<4	<0.5	7	1	20	<0.1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	NIL
BH17 0.2-0.3	<4	<0.5	10	80	3	<0.1	57	32	-	-	-	-	-	-	-	-	-	-	-	-	-	NIL
BH18 0.2-0.3	<4	<0.5	12	2	10	<0.1	<1	11	-	-	-	-	-	-	-	-	-	-	-	-	-	NIL
BH19 0.2-0.3	4	<0.5	11	23	140	<0.1	3	*320*	-	-	-	-	-	-	-	-	-	-	-	-	-	NIL
BH20 0-0.1	8	<0.5	16	20	98	<0.1	11	*270*	-	-	-	-	-	-	-	-	<0.2	<0.2	<0.3	<0.1	<0.7	-
QA/QC																						
QC01 (Duplicate of BH02 0-0.1)	8	<0.5	11	24	56	<0.1	5	150	<0.2	<1	<0.5	<3	<25	<250	0.07	0.27	<0.2	<0.2	<0.3	<0.1	<0.7	NIL
QC01/A (Triplicate of BH02 0-0.1)	6	<1	105	20	61	<0.1	6	182	<0.2	<0.5	<0.5	<1	<10	<50	<0.5	<0.5	<0.05	<0.05	<0.05	<0.05	<0.10	NIL
Trip Spike	-	-	-	-	-	-	-	-	90%	103%	98%	103%	-	-	-	-	-	-	-	-	-	-
Trip Blank	-	-	-	-	-	-	-	-	<1	<1	<1	<3	-	-	-	-	-	-	-	-	-	-
Rinsate 01	<0.01	<0.001	<0.01	<0.01	<0.01	<0.0005	<0.01	<0.02	<1	<1	<1	<3	<10	<250	<1	<8	-	-	-	-	-	-

Job No. 42410
24 Artarmon Rd, Willoughby, NSW
Table C - Soil Relative Percent Difference Calculations

		Metals								BTEX				TPH		PAHs		Organochlorine Pesticides				PCBs	
	Sample ID	Arsenic	Cadmium	Chromium (Total)	Copper	Lead	Mercury	Nickel	Zinc	Benzene	Toluene	Ethyl-benzene	Xylenes	C6 - C9	C10 - C36	Benzo (a) pyrene	Total PAHs	Aldrin + Dieldrin	Chlordane	Heptachlor	DDT + DDD + DDE	Total PCBs	Asbestos
Laboratory LOR		4.0	1.0	1.0	1.0	1.0	0.1	1.0	1.0	0.5	0.5	1.0	3.0	25	250	0.05	1.55	0.2	0.2	0.1	0.3	0.6	0.1g/kg
Blind Duplicate Pairs																							
Primary	BH02 0-0.1	5	<0.5	14	13	56	<0.1	4	150	<0.2	<1	<0.5	<3	<25	<250	0.09	0.29	<0.2	<0.2	<0.3	<0.1	<0.7	NIL
Duplicate	QC01 (Duplicate of BH02 0-0.1)	8	<0.5	11	24	56	<0.1	5	150	<0.2	<1	<0.5	<3	<25	<250	0.07	0.27	<0.2	<0.2	<0.3	<0.1	<0.7	NIL
RPDs (Dup.)		46%	NA	24%	**59%**	0%	NA	22%	0%	NA	NA	NA	NA	NA	NA	25%	7%	NA	NA	NA	NA	NA	0
Blind Triplicate Pairs																							
Primary	BH02 0-0.1	5	<0.5	14	13	56	<0.1	4	150	<0.2	<1	<0.5	<3	<25	<250	0.09	0.29	<0.2	<0.2	<0.3	<0.1	<0.7	NIL
Triplicate	QC01/A (Triplicate of BH02 0-0.1)	6	<1	105	20	61	<0.1	6	182	<0.2	<0.5	<0.5	<1	<10	<50	<0.5	<0.5	<0.05	<0.05	<0.05	<0.05	<0.10	NIL
RPDs (Dup.)		18%	NA	**153%**	42%	9%	NA	40%	19%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0

bold Exceeds target of 50%
Note: RPDs were not calculated for analytes which had reported results below detection limits

Job No. 42410
24 Artarmon Rd, Willoughby, NSW
Table E - Summary Groundwater Laboratory Results

Notes:
(1) See Section 6.2 for groundwater assessment criteria
All units in µg/L unless indicated.

bold Above Adopted Groundwater Assessment Criteria[1]

Sample number	Metals								BTEX				TPH		PAHs				
	Arsenic	Cadmium	Chromium (Total)	Copper	Lead	Mercury	Nickel	Zinc	Benzene	Toluene	Ethylbenzene	Xylenes	TPH C6-C9	TPHC10-C36	Naphthalene	Phenanthrene	Anthracene	Fluoranthene	Benzo(a)pyrene
LOR	1	0.1	1	1	1	0.5	1	1	1	1	1	3	10	250	0.1	0.1	0.1	0.1	0.1
Aquatic Ecosystem Criteria (µg/L)[1]	24	0.2	3.3 (CrIII)	1.4	3.4	0.6	11	8	950	180	80	625	-	600	16	0.6	0.01	1	0.1
Drinking Water Guidelines (µg/L)[1]	7	2	50 (CrIII)	2000	10	1	20	-	1	800	300	600	-	-	-	-	-	-	-
MW01	<1	<0.1	<1	1	2	<0.05	9	**53**	<1	<1	<1	<3	**20**	<250	<0.1	<0.1	<0.1	<0.1	<0.1
MW02	<1	0.1	<1	**2**	<1	<0.05	5	**37**	<1	<1	<1	<3	<10	<250	<0.1	<0.1	<0.1	<0.1	<0.1
QA/QC																			
QC03 (Duplicate of MW02)	<1	0.1	<1	**2**	<1	<0.05	5	**38**	<1	<1	<1	<3	<10	<250	<0.1	<0.1	<0.1	<0.1	<0.1
QC03/A (Triplicate of MW02)	<1	0.1	<1	1	<1	<0.1	6	**44**	<1	<2	<2	<2	<20	<250	<0.1	<0.1	<0.1	<0.1	<0.05
Rinsate 02	<1	<0.1	<1	<1	<1	<0.05	<1	<1	<1	<1	<1	<3	<10	<250	<0.1	<0.1	<0.1	<0.1	<0.1

Douglas Partners
Geotechnics - Environment - Groundwater

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NLE/VK/WFY
Project 45339
25 January 2008

Charter Hall Holdings Pty Ltd
Level 6
110 Walker Street
NORTH SYDNEY NSW 2060

Attention: Mr Shaun Farren

By fax: 98908 4040

Dear Sirs

ADVANCED NOTICE OF RESULTS FOR
PHASE 1 CONTAMINATION ASSESSMENT
CORNER OF RICHMOND AVENUE AND ARTARMON ROAD
WILLOUGHBY

This letter provides preliminary advice on the results of a Phase 1 Contamination Assessment currently being conducted at the Channel 9 site at the corner of Richmond Avenue and Artarmon Road, Willoughby. It is understood that the assessment is currently required for due diligence purposes, and that no change in landuse is proposed.

The assessment includes a site history review, with currently available information indicating that a large portion of the site was operated as a dairy farm prior to development into a television station in the mid 1950's. Most of the remainder of the site was previously owned by a number of different stakeholders and appears to have been predominantly residential houses prior to gradual acquisition by TCN Channel Nine Pty Ltd. Lot 1, D.P. 327266 appears to have been under commercial use (ie occupied by a large building) since the 1970's prior to acquisition by TCN Channel Nine in 1992.

A steep slope, possibly a natural feature (eg gully) or the results of some quarrying, is visible at the southern boundary of the site, which included part of the southern portion of the site in the pre 1970 aerial photographs. It appears that this area of the site has since been filled/ levelled. This is supported by anecdotal information from site personnel indicating that the south of the site near the helipad and Bore 9 was previously filled/ "used for disposal".

Six underground storage tanks (USTs), three storing unleaded petrol (ULP) and three storing diesel are present near the western boundary of the site and one above-ground storage tank (AST) used to store aviation fuel is present to the east of the helipad.

Soil samples were collected from 21 test bores drilled over the accessible parts of the site. Bores were placed to provide site coverage, with selected bores also targeting areas of identified contamination concern viz the aviation fuel AST (Bore 10) and the petrol and diesel

USTs (Bores 3, 4, 5 and 6). It is noted that bores could not be placed immediately down-gradient of the unleaded petrol UST ULP3 or diesel USTs due to the presence of site structures/ buildings. Bore 8 was placed further down-gradient of these USTs.

The approximate sampling locations are provided in the site sketch, which is attached along with the draft bore logs.

Test bores encountered filling underlain by natural clays and sandstone/siltstone bedrock. Filling materials where generally observed over the site to depths between 0.2 m to 1.2 m bgl, however deeper filling was observed in Bore 14B (2.1m bgl) in the visitors carpark and Bore 9 (greater than 4 m bgl) near the helipad where there was a reported history of filling.

Hydrocarbon odours were noted in Bores 4 and 5, down-gradient of two of the unleaded USTs and bowser. The odours were noted from beneath the pavement materials to bore completion in sandstone (at 2.3 and 2.2 m bgl respectively). It is noted that Bores 4 and 5 were located in close proximity (approximately 5 m) to each other.

Selected soil samples were analysed for various suites of commonly occurring contaminants of concern including heavy metals, TPH, BTEX, PAH, OCP, PCB, Phenols, VOCs and Asbestos.

Given that it is anticipated that the land use will remain commercial/industrial, results were compared to Site Assessment Criteria (SAC) sourced from the NSW DEC (2006), *Contaminated Sites Guidelines for the NSW Site Auditor Scheme 2nd Edition*, Health Based Investigation Levels for Commercial or industrial [HIL Column 4] and NSW EPA Contaminated Sites: *Guidelines for Assessing Service Station Sites* (1994) for petroleum hydrocarbons (in the absence of other comprehensive guidelines for these analytes).

All samples were found to be well within the relevant guidelines with the exceptions detailed below. A summary of the laboratory results is attached in Table 1.

TPH C_6-C_9 and BTEX in BH4 and BH5 (down-gradient of ULP USTs)

TPH C_6-C_9, benzene, toluene, ethyl benzene and total xylenes are light fraction petroleum hydrocarbons associated with fuel. Samples 4/0.8-1 and 4/1.2-1.5 from Bore 4 and 5/0.1-0.3 and 5/1.3-1.5 from Bore 5 recorded concentrations of one or more of these petroleum contaminants above the SAC.

Deeper samples collected from the sandstone bedrock in these bores (4/ 2-2.3 and 5/ 2.1-2.2) were found to contain TPH C_6-C_9 and BTEX at concentrations within the SAC.

Based on the current results there appears to have been leakage from the unleaded fuel storage system, however, the contamination seems to have been limited vertically by the sandstone bedrock. The horizontal extent of the contamination has not been defined, and attempts to define the contamination plume at this time are likely to be limited by site structures.

Potential contamination could be occurring from the ULP3 UST and diesel USTs, however, assessment in the immediate down-gradient vicinity is not currently practicable. Bore 6 up-gradient of these UST's and Bore 8 further down-gradient did not record detectable levels of TPH or BTEX.

Further assessment and remediation is recommended in this area.

GRAPHIC SYMBOLS FOR SOIL & ROCK

SOIL

BITUMINOUS CONCRETE

CONCRETE

TOPSOIL

FILLING

PEAT

CLAY

SILTY CLAY

SANDY CLAY

GRAVELLY CLAY

SHALY CLAY

SILT

CLAYEY SILT

SANDY SILT

SAND

CLAYEY SAND

SILTY SAND

GRAVEL

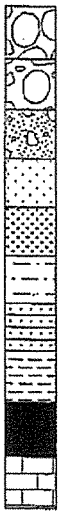
SANDY GRAVEL

CLAYEY GRAVEL

COBBLES/BOULDERS

TALUS

SEDIMENTARY ROCK



BOULDER CONGLOMERATE

CONGLOMERATE

CONGLOMERATIC SANDSTONE

SANDSTONE FINE GRAINED

SANDSTONE COARSE GRAINED

SILTSTONE

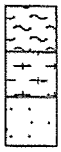
LAMINITE

MUDSTONE, CLAYSTONE, SHALE

COAL

LIMESTONE

METAMORPHIC ROCK



SLATE, PHYLITTE, SCHIST

GNEISS

QUARTZITE

IGNEOUS ROCK

GRANITE

DOLERITE, BASALT

TUFF

PORPHYRY

Douglas Partners
Geotechnics · Environment · Groundwater

PROJECT: Phase 1 Contamination Assessment
LOCATION: Cnr Richmond Avenue & Artarmon Road, Willoughby

EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PROJECT No: 45339
DATE: 10 Jan 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.18	CONCRETE							
	0.35	FILLING - light brown gravelly silty sand filling (basecourse)							
		FILLING - orange-brown clay filling, with traces of gravel and ironstone (hydrocarbon odour)		A	0.35 0.5		PID=14ppm		
	0.8	FILLING - grey mottled orange clay filling, with traces of ironstone and gravel (hydrocarbon odour)		A	0.8 1.0		PID=15ppm		
	1.2	SILTY CLAY - orange mottled grey silty clay (hydrocarbon odour)		A	1.2 1.5		PID=19ppm		
	1.6	SILTY CLAY - red-brown silty clay (hydrocarbon odour)		A	1.7		PID=14ppm		
	1.9	SANDSTONE - red-brown sandstone (hydrocarbon odour)		A*	1.9 2.0		PID=11ppm		
	2.3	Bore discontinued at 2.3m - refusal on medium strength sandstone			2.3				

RIG: DT100 **DRILLER:** L Cooper **LOGGED:** W Yuan **CASING:** Uncased

TYPE OF BORING: Solid flight auger with TC-bit

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *Field replicate sample BD5/100108 collected

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED	
Initials:	
Date:	

Douglas Partners
Geotechnics · Environment · Groundwater

PROJECT: Phase 1 Contamination Assessment
LOCATION: Cnr Richmond Avenue & Artarmon Road, Willoughby

EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PROJECT No: 45339
DATE: 09 Jan 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.1	CONCRETE							
		FILLING - brown silty clay filling, with some gravel and rootlets (hydrocarbon odour)		A	0.1		PID=13ppm		
	0.3	SILTY SANDY CLAY - grey mottled orange and			0.3				
	0.4	orange-brown silty sandy clay (hydrocarbon odour)			0.4				
		SILTY CLAY - red-brown silty clay, with some ironstone nodules (hydrocarbon odour)		A					
	0.7	SILTY CLAY - grey mottled red-brown silty clay, with some ironstone nodules (hydrocarbon odour)			0.7				
					0.8				
				A			PID=1ppm		
1					1.0				1
					1.3				
				A			PID=13ppm		
					1.5				
	1.7	SILTY CLAY - red-brown mottled orange-brown silty clay, with traces of ironstone gravel (hydrocarbon odour)							
					1.8				
				A			PID=3ppm		
2					2.0				2
	2.1	SANDSTONE - grey and red-brown sandstone			2.1				
	2.2	(hydrocarbon odour)		A	2.2		PID=6ppm		
		Bore discontinued at 2.2m - refusal on medium strength sandstone							
3									3
4									4

RIG: DT100 DRILLER: L Cooper LOGGED: W Yuan CASING: Uncased

TYPE OF BORING: Solid flight auger with TC-bit

WATER OBSERVATIONS: No free groundwater observed

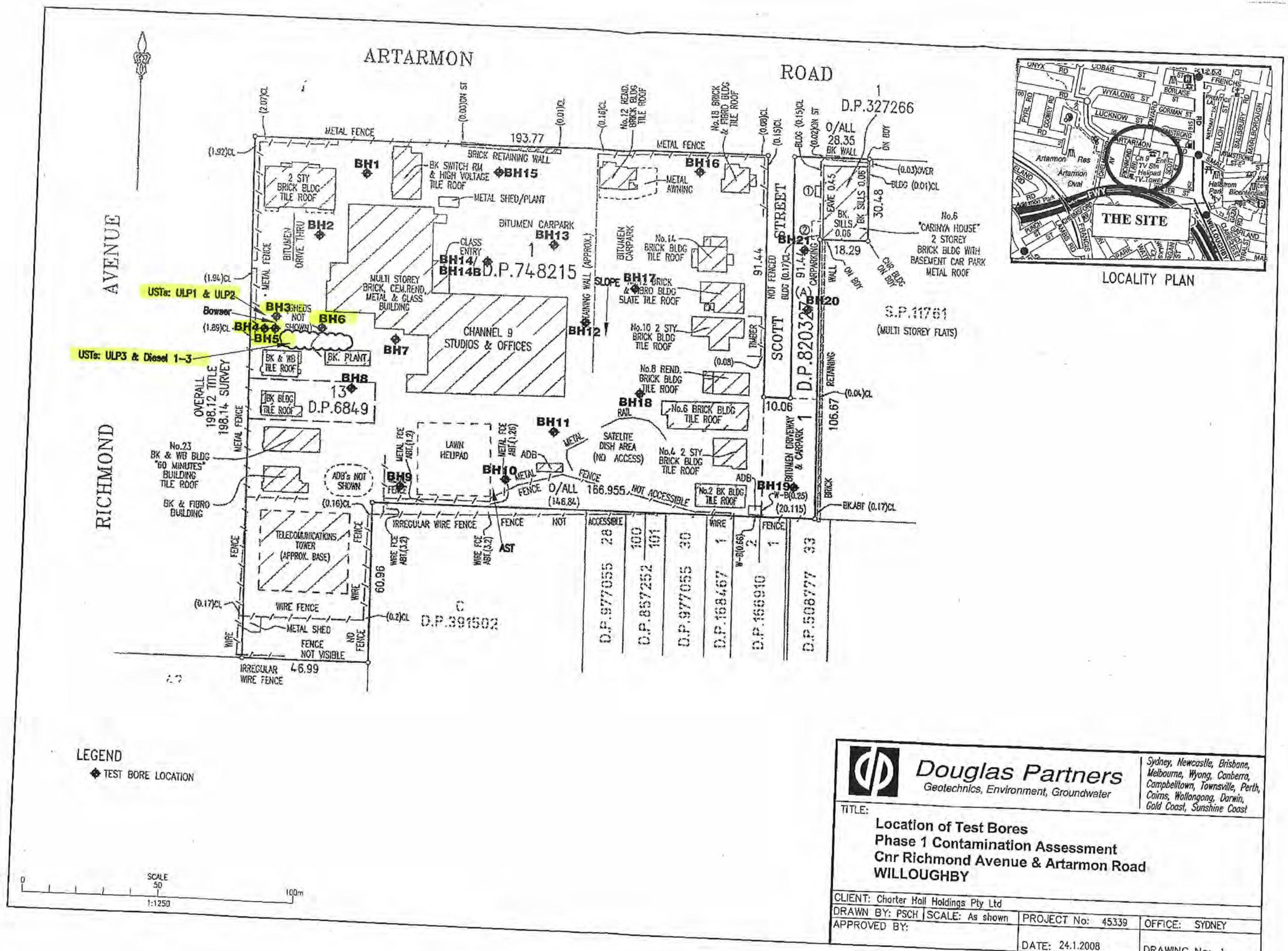
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater



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Geotechnics, Environment, Groundwater

Sydney, Newcastle, Brisbane, Melbourne, Wyong, Canberra, Campbelltown, Townsville, Perth, Cairns, Wollongong, Darwin, Gold Coast, Sunshine Coast

TITLE:

Location of Test Bores
Phase 1 Contamination Assessment
Cnr Richmond Avenue & Artarmon Road
WILLOUGHBY

CLIENT: Charter Hall Holdings Pty Ltd			
DRAWN BY: PSCH	SCALE: As shown	PROJECT No: 45339	OFFICE: SYDNEY
APPROVED BY:		DATE: 24.1.2008	DRAWING No: 1

P:\45339 WILLOUGHBY, Ph 1 Contamination Assessment RT1\Drawings\45339-1.dwg, 1/25/2008 9:52:31 AM

Douglas Partners
Geotechnics - Environment - Groundwater

Table 1 - Results of Soil Analysis (All results in mg/kg unless otherwise stated)

Sample ID	Depth	F/N	Heavy Metals								PAH		TPH		Benzene	Toluene	Ethylbenzene	Total Xylene	Total PCB	OCP^	Phenols	VOC	Asbestos
			As	Cd	Cr~	Cu	Pb	Hg	Ni	Zn	B(a)P	Total +ve PAH	C6-C9	C10-C36									
C9 Willoughby																							
BH1	0.1-0.3	F	<4	<1	11	84	6.4	<0.1	56	34	<0.05	<PQL	<25	<100	<0.5	<0.5	<1	<2	-	-	-	-	ND
BH2	0.2-0.5	F	9	<1	19	2.4	19	<0.1	1.3	4.8	<0.05	<PQL	<25	190	<0.5	<0.5	<1	<2	<PQL	<PQL	<PQL		ND
BD6/150108[9]	-	-	9.2	<1	19	2	19	<0.1	1.6	5.7	<0.05	<PQL											
BH2	1.0-1.2	N	9	<1	9	1	14	<0.1	<1	2.6	<0.05	<PQL	<25	<100	<0.5	<0.5	<1	<2					
BH3	0.2-0.3	F	5.4	<1	16	17	88	<0.1	9.9	140	0.1	0.8	<25	<100	<0.5	<0.5	<1	<2	-	-	-	-	ND
	1.7-2.0	N	-	-	-	-	-	-	-	-	-	-	<25	<100	<0.5	<0.5	<1	<2	-	-	-	-	-
	2.1-2.5	N	-	-	-	-	-	-	-	-	-	-	<25	<100	<0.5	<0.5	<1	<2	-	-	-	-	-
BH4	0.8-1	F	-	-	-	-	-	-	-	-	-	-	77	<100	<0.5	15	7.6	69	-	-	-	-	-
	1.2-1.5	N	<4	<1	5.6	<1.0	12	<0.1	<1	<1.0	<0.05	1.2	300	140	2.8	71	18	152	-	-	-	D	-
	2-2.3	N	<4	<1	12	1.8	13	<0.1	<1	1.8	<0.05	<PQL	<25	<100	<0.5	0.6	<1	4.2	-	-	-	-	-
BH5	0.1-0.3	F	7.7	<1	21	2.5	19	<0.1	2.2	5.9	<0.05	10.4	160	810	1.8	17	5.8	91	<PQL	<PQL	<PQL	-	ND
	1.3-1.5	N	12	<1	24	3.9	19	<0.1	<1	4.7	<0.05	0.3	150	<100	<0.5	17	6.8	59	-	-	-	D	-
	1.8-2.0	N	-	-	-	-	-	-	-	-	-	-	26	<100	<0.5	2.2	1.7	16	-	-	-	-	-
	2.1-2.2	N	4.5	<1	12	2.1	14	<0.1	<1	1.4	<0.05	0.4	<25	<100	<0.5	1.3	1.6	<2	<PQL	<PQL	<PQL	-	-
BD5/100108[6]	-	-	4	<1	13	2	8	<0.1	<1	<5	<PQL	<PQL	-	-	-	-	-	-	-	-	-	-	-
BH6	0.2-0.4	F	4.8	<1	13	670	120	0.13	2.3	110	0.4	3.3	<25	<100	<0.5	<0.5	<1	<2	<PQL	<PQL	<PQL	-	ND
	1.3-1.75	N	-	-	-	-	-	-	-	-	-	-	<25	<100	<0.5	<0.5	<1	<2	-	-	-	-	-
BH7	0.3-0.5	F	5.7	<1	12	4.7	33	<0.1	1.6	88	<0.05	<PQL	<25	<100	<0.5	<0.5	<1	<2	<PQL	<PQL	<PQL		ND
BH8	0.2-0.5	N	7.3	<1	21	9	42	<0.1	2.5	98	<0.05	<PQL	<25	<100	<0.5	<0.5	<1	<2	<PQL	<PQL	<PQL	<PQL	ND
	1.5-1.7	N	<4	<1	7.4	<1.0	9.3	<0.1	<1	3.7	<0.05	<PQL	<25	<100	<0.5	<0.5	<1	<2					
BH9	0.45-0.6	F	4.9	<1	18	11	51	<0.1	6.8	45	0.09	0.39	<25	<100	<0.5	<0.5	<1	<2	<PQL	<PQL	<PQL	-	ND
	3.2-3.5	F	7.4	<1	23	30	120	<0.1	7.6	140	<0.05	<PQL	<25	<100	<0.5	<0.5	<1	<2	<PQL	<PQL	<PQL	-	ND
BH10	0.3-0.5	N	7.6	<1	27	26	41	<0.1	16	66	<0.05	<PQL	<25	<100	<0.5	<0.5	<1	<2	-	-	-	<PQL	-
BH11	0.35-0.5	N	95	<1	12	60	12	<0.1	57	46	<0.05	<PQL	<25	<100	<0.5	<0.5	<1	<2	-	-	-	-	-
BH12	0.2-0.3	F	<4	<1	13	76	8.3	<0.1	78	46	<0.05	<PQL	<25	<100	<0.5	<0.5	<1	<2	<PQL	<PQL	<PQL	-	ND
BH13	0.1-0.2	F	4	<1	14	23	19	<0.1	27	44	<0.05	<PQL	<25	<100	<0.5	<0.5	<1	<2	-	-	-	-	ND
	1.3-1.5	N	5.1	<1	14	2.5	19	<0.1	1.9	11	0.4	4	<25	<100	<0.5	<0.5	<1	<2	-	-	-	-	-
BD1/090108[3]	-	-	6.2	<1	15	4.1	21	<0.1	2.9	18	<0.05	<PQL	-	-	-	-	-	-	-	-	-	-	-
BD1A/090108[4]	-	-	3	<1	9	2	14	<0.1	<1	10	<PQL	2	-	-	-	-	-	-	-	-	-	-	-
BH14	0.3-0.4	F	5.5	<1	5.7	17	17	<0.1	6.5	24	<0.05	<PQL	<25	<100	<0.5	<0.5	<1	<2	-	-	-	-	Chrysotile
BH14B	1-1.4	F	<4	<1	<1	<1	1.6	<0.1	<1	3.7	<0.05	<PQL	<25	<100	<0.5	<0.5	<1	<2	<PQL	<PQL	<PQL	-	ND
BH15	0.1-0.2	F	<4	<1	19	64	5.8	<0.1	120	50	<0.05	<PQL	<25	<100	<0.5	<0.5	<1	<2	<PQL	<PQL	<PQL	-	ND
BH16	0.15-0.2	F	<4	<1	24	26	77	<0.1	23	100	0.3	4.6	<25	480	<0.5	<0.5	<1	<2	-	-	-	-	ND
BH17	0.8-1	F	4.9	<1	16	11	39	<0.1	5	46	0.1	0.3	<25	<100	<0.5	<0.5	<1	<2	<PQL	<PQL	<PQL	-	ND
BH18	0.18-0.2	F	8.1	<1	15	50	150	0.1	4.3	240	0.3	2.1	<25	<100	<0.5	<0.5	<1	<2	-	-	-	-	ND
BH19	0.2-0.3	F	7.1	<1	73	33	34	<0.1	73	100	0.5	3.5	<25	<100	<0.5	<0.5	<1	<2	<PQL	<PQL	<PQL	-	ND
BH20	0.2-0.5	F	13	<1	41	43	95	0.97	42	180	1.6	12	<25	<100	<0.5	<0.5	<1	<2	<PQL	<PQL	<PQL	<PQL	ND
	1-1.2	F	26	<1	8.3	7.5	26	<0.1	2.2	25	0.1	0.6	<25	<100	<0.5	<0.5	<1	<2					
BH21	0.2-0.7	F	<4	<1	6.7	3.3	5.2	<0.1	5	4	<0.05	<PQL	<25	<100	<0.5	<0.5	<1	<2	<PQL	<PQL	<PQL		ND

Sample ID	Depth		Heavy Metals								PAH		TPH		Benzene	Toluene	Ethylbenzene	Total Xylene	Total PCB	OCP^	Phenols	VOC	Asbestos
			As	Cd	Cr~	Cu	Pb	Hg	Ni	Zn	B(a)P	Total +ve PAH	C6-C9	C10-C36									
C9 Willoughby																							
TS1/100108[1]	-		-	-	-	-	-	-	-	-	-	-	-	-	60%	75%	106%	184%	-	-	-	-	-
TB1/100108[2]	-		-	-	-	-	-	-	-	-	-	-	<25	<100	<0.5	<0.5	<1	<2	-	-	-	-	-
RB1/100108[7]	-		-	-	-	-	-	-	-	-	-	-	<10	<PQL	<1	<1	<1	<PQL	-	-	-	-	-
PQL	-		4	1	1	1	1	0.1	1	1	0.05	-	25	100	1	1	1	2	0.1	0.1	5	1	-
HIL COLUMN 4			500	100	60%	5000	1500	75	3000	35000	5	100	65	1000	1	1.4	3.1	14	10	50/250/1000 /50		-	NA

Notes:

~ All Chromium are assumed to exist in the stable Cr(III) oxidation state, as Cr(VI) will be too reactive and unstable under the normal environment Guidelines for the NSW Site Auditor Scheme (2nd Edition)

PPIL Provisionaly phytoxicity investigation levels
HIL Health based investigation levels for commercial/industrial
^ Denotes Aldrin+Dieldrin/Chlordane/ DDD+DDE+DDT/Heptachlor

1 Trip Spike (BTEX)
2 Trip Blank (TRH/BTEX)

ND Not detected
D Some VOC's >PQL
NA No asbestos present on the ground surface (Correspondence from NSW EPA Director of Contaminated Sites to Accredited Site Auditors)

F/N Fillling/Natural
PQL Practical Quantitation Limit
Exceeds HIL
Hotspot (exceeds 2.5 times SAC)

3 - Intra-laboratory replicate of BH13/1.3-1.5
4 - Inter-laboratory replicate of BH13/1.3-1.5
5 - Inter-laboratory replicate of BH5/2.1-2,2
6 - Intra-laboratory replicate of BH2/0.2-0.5
7 - Rinsate Sample (TRH/BTEX)

Appendix B

WorkCover Fact Sheet 3_1 '*Abandoning Disused Underground Tanks*

WorkCover
NEW SOUTH WALES

FACTSHEET 3_1
DANGEROUS GOODS – ABANDONING DISUSED UNDERGROUND TANKS

Any work on underground tanks used to store flammable or combustible liquids (including petrol, kerosene and diesel), and associated piping is potentially dangerous and may cause explosions. Fatal accidents have been known to occur.

Welding the tank vent pipe caused vapours in the tank to explode.

WHEN SHOULD A TANK BE ABANDONED?

If flammable or combustible liquids have not been taken from or put into the underground tank for a continuous period of two years, the tank must be abandoned in compliance with AS4976 *The removal of underground petroleum storage tanks*.

WHO IS RESPONSIBLE?

The occupier of the premises is responsible for ensuring that the tank is abandoned safely.

HOW DO I NOTIFY WORKCOVER?

Within seven days of the abandonment a written notification **must** be sent to:

WorkCover NSW
Dangerous Goods Notification Section
Locked Bag 2906
Lisarow NSW 2252

The notification should include information regarding the tank size, location and method of abandonment, together with a site sketch that clearly identifies the location of the abandoned tank in relation to other tanks and buildings on the site, and the site boundaries. A copy of the contractor's letter confirming abandonment needs to be provided.

WHAT METHODS CAN BE USED TO ABANDON A TANK?

A tank can be removed from the ground and taken to an appropriate disposal area, or it can be filled with an inert solid material, such as concrete slurry or sand.

If it is likely that the tank will be used again within 2 years, on written application WorkCover may grant an exemption to allow the tank to be filled with water and corrosion inhibitor for a brief period of time ('temporary' abandonment).

WHO SHOULD DO THE WORK?

Only WorkCover Licensed Demolition Contractors with a chemical endorsement should carry out decommissioning or abandonment of petroleum storage systems.

Generally, it should not be assumed that builders, demolition contractors and plumbers have the necessary experience to carry out the work required under AS4976.

A list of appropriate contractors is available from the Petroleum Industry Contractor's Association (www.pica.net.au). Contractors are also listed in the yellow pages under 'Petrol Pumps and Marketing Equipment'. Ask for written confirmation that the work will be done according to AS4976 requirements by a WorkCover Licensed demolition contractor.

SAFETY CONSIDERATIONS

Any work on old tanks and piping is potentially dangerous and requires experience and special safety precautions. Safety and work permit procedures must be strictly followed.

Only an experienced person who has done the overall risk assessment for the whole tank and pipe system, or who is familiar with all aspects of the whole risk assessment, should issue a work permit. The procedures for site preparation, work and work permit procedures of AS4976 and should be observed.

AS4976 is available from Standards Australia on 1300 65 46 46, or visit www.standards.com.au

Safety issues to consider include:

- don't use an oxyacetylene torch, angle grinder or any other heat or spark-producing equipment without a written hot-work permit
- empty the tank of all flammable or combustible liquid - even when the dispenser has lost suction, some liquid will still be left in the tank
- if the tank is to be removed, it must be checked to ensure that it is still on good enough condition to be lifted and transported. The tank should be gas freed in accordance with AS4976. Obtain advice from the Department for Environment and Conservation (Dangerous Goods Section) about road transport on (02) 9995 5974.
- gas-freeing is a specialist task. Any testing for flammable vapours tests only one small area of the tank, at a moment in time. A gas-free certificate may no longer be valid if some time has elapsed, or if the circumstances change. A gas-free certificate is not a substitute for a work permit
- tar-like deposits, or oily rust and sludge, may have accumulated in tanks and pipes. Flushing with water will not remove them and vapour testing will not detect them. Exposure to the heat of the day or work involving heat (such as welding, oxyacetylene cutting or use of angle grinders) is likely to release vapours, which may then ignite and explode

- **when the tank is abandoned, all associated pipes should be disconnected and made safe (or preferably removed).** Filling pipes with water or concrete slurry is no guarantee of safety, as dead legs or low points may still contain flammable liquid and if the pipes are cut some time in the future, the possible dangers may be unknown
- dry rust or scale may ignite spontaneously, so keep it wet until safe disposal can be arranged
- placards and signs that relate solely to an abandoned tank should be removed from the premises
- after a tank is abandoned, a review should be conducted of the risk assessment, placarding, manifest and emergency requirements of the premises.

There may be requirements from other departments and authorities, and these should also be followed.

The Department of Environment and Climate Change (www.environment.nsw.gov.au) has guidelines for testing and soil remediation. Further information on these guidelines is available in *Information Sheet 6 Underground Fuel Tanks.*

FURTHER INFORMATION

Contact the WorkCover Assistance Service on 13 10 50 and/or seek expert advice, such as that available from a member of the Australian Institute of Dangerous Goods Consultants www.aidgc.com.au

Catalogue No. **WC05218** WorkCover Publications Hotline **1300 799 003**

WorkCover NSW 92-100 Donnison Street Gosford NSW 2250
Locked Bag 2906 Lisarow NSW 2252 WorkCover Assistance Service **13 10 50**
Website **www.workcover.nsw.gov.au**

Appendix C

Unexpected Finds Protocol

JBS ENVIRONMENTAL

BE AWARE

UNEXPECTED HAZARDS MAY BE PRESENT

drums

asbestos

chemical bottles

blood stains

odour

ash / slag

demolition waste

if you <u>SEE</u> or <u>SMELL</u> anything unusual

↓

<u>STOP WORK</u> & contact the Site Foreman

↓

do not restart working before the area has been investigated and cleared by an Environmental Consultant

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ENVIRONMENTAL

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