AEC	Potential Contaminating Activity	COC	Likelihood of Contamination
	Minor refuse noted.		
Area F - Two sheds north of Area E	Storage of mechanical equipment (tractor).	TRH, BTEX, PAH and heavy metals.	Low
Area G – Two sheds north west of Area E	Storage of disused motor vehicles.	TRH, BTEX, PAH and heavy metals.	Low
Area H – South west corner of Lot 384 DP 755952	Empty intermediate bulk containers (IBC) formally storing dye and adhesives used in paper manufacturing (no ground staining or vegetation die back noted in the area).	TRH, BTEX, PAH and heavy metals .	Low
Area I - Shed south of area D	Contents of shed unknown (no access). Minor refuse noted.	TPH, BTEX,PAH, OCP/OPP, heavy metals and asbestos.	Low
Area J – Shed south west corner of Lot 3 DP755952s	Contents of shed unknown (no access). Minor refuse noted.	TPH, BTEX, PAH,OCP, OPP, heavy metals and asbestos.	Medium
Site paddocks	Agricultural use (crop growing and livestock grazing).	Heavy metals and OCP/OPP.	Medium
Site rubbish piles - Seven identified across site	Stockpiles contain building material, asbestos sheeting, plastics and general refuse.	TPH, PAH, BTEX, OCP/ OPP, heavy metals and asbestos.	Medium
Dams - Four dams identified across site	Potential accumulation of contamination from agricultural activities.	Heavy metals, OCP/OPP and herbicides.	Low
Site stockpile - Two identified on sites	Stockpiles of soil from unknown origin mixed with builder's rubble and bitumen road shavings.	TPH,BTEX,PAH and heavy metals.	Medium

4 Field and Laboratory Investigations

4.1 Field Programme

AEC and COC identified were utilised to develop a field investigation programme to detail prevailing site contamination condition. Intrusive investigation (Table 3) was conducted across the site. Sampling was completed in accordance with the sampling design guidelines outlined in NSW EPA (1995).

4.2 Sampling Methodology and Quality Assurance / Quality Control

Sampling methods are discussed in Table 3.

Table 3: Soil sampling methods

Type	Number of Locations	Equipment	Description
Borehole	10	Solid flight hydraulic auger	Soils were collected at a range of depths, generally 0.05, 0.25, 0.5 and then at 0.5m intervals (as required to characterise contamination).
Test pit	2	Spade	Soils were collected at 0.05 and 0.25m
Stockpile	2	Spade	Soil samples collected directly from stockpile centre.
Surface	34	Spade	Soil samples collected from 0.0 - 0.2m.

Soil samples were selected for laboratory analysis based on likely zones of contamination and/or visual and olfactory evidence of contamination.

Sample depths were generally designed to provide information on the contamination status of shallow soils by identifying above ground potential contamination activities. Deeper soil samples were recovered to assess the vertical extent of contamination or where visual or olfactory evidence of contamination was observed.

Soil sampling methodology (Table 4) was completed to meet data quality objectives.

Table 4: Soil sampling methodology

Activity	Detail / Comments
Soil logging	Boreholes were logged by an environmental engineer in accordance with MA SOP.
Soil sampling	Soil sampling was completed by the supervising environmental engineer. Each sample was placed into a laboratory-supplied, acid-rinsed 250mL glass jar, labelled with a unique identification number and no headspace to limit volatile loss.
QA / QC sampling	Duplicate samples were collected at a rate of approximately 1 in 10 samples for intra-laboratory analysis.
Sample handling and transportation	Sample collection, storage and transport were conducted according to Martens and Associates SOP. Collected samples were placed into ice chilled cooler-boxes. Samples were dispatched to NATA-accredited laboratories under chain of custody documentation within holding times.
Decontamination of sampling equipment	Sampling equipment was decontaminated between sampling locations by pressurised water spray with a solution of Decon-90™, a phosphate-free detergent, followed by rinsing with potable water.

A review of QA/QC procedure has been completed and is presented in the data validation report (Attachment D). The report concludes that data is suitable for the purposes of the assessment.

4.3 Laboratory Analytical Suite

Laboratory analysis was carried out by Envirolab Pty Ltd a NATA accredited laboratory and reports are available in Attachment B.

48 primary soil samples were selected for a suite of laboratory analyses (Table 5) based on COC identified in Table 2.

Two duplicate samples, one trip blank and one trip spike were analysed.

Table 5: Summary of primary soil laboratory analyses

COC	Number of Samples Analysed
BTEX	13
TRH	13
PAH	13
Heavy metals [1]	48
OCP / OPP	48
PCB	13
Asbestos in soil	20
Herbicides [2]	11

Notes:

[1] Heavy metals – Arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc.

[2] Herbicides – Phenoxy acid and Triazine.

Heavy metal and OCP / OPP analysis was generally conducted by testing dual and triple composites for samples taken from site paddocks and AEC identified in Table 2. Some samples from identified AEC were analysed as discreet samples based on visual or olfactory evidence of contamination or a high likelihood of contamination based on past use.

A summary of site sampling and analysis is presented in Table 6.

Table 6: Summary of site testing and analyses

Sampling Location	Sample Description
Area A- Area J	Two surface samples (sample A and B) taken from each identified area. Samples from Area C – G and Area H - I tested in dual composite samples (each composite comprised sample A and B). All other areas, a single sample was selected for analyses as a discrete sample.
Site paddocks	12 samples from a depth of 0.05 tested in 4 triple composite samples.
Rubbish piles	7 surface samples from a depth range of 0.05 - 0.1 directly adjacent to identified rubbish pile. Each sample was analysed as a discreet sample.
Dams	4 sediment samples taken from the base of each dam. Each sample was analysed as a discrete sample.
Stockpiles	2 samples taken directly from the soil stockpiles each analysed as a discrete sample.

5 Assessment Criteria

5.1 Soil Contamination Assessment Criteria

Investigation levels for soil are established based on the following references:

- NEPC (1999) National Environmental Protection (Assessment of Site Contamination) Measure (NEPM);
- NSW DEC (2006) Guidelines for the NSW Auditor Scheme (Second Edition); and
- NSW EPA (1994) Guidelines for Assessing Service Station Sites.

Human health based soil investigation levels (HIL) for residential land use, provided in Column A of Table 11-A in the NEPC (1999) *Guidelines on Health-Based Investigation Levels* (and reproduced in NSW DEC, 2006) have been adopted as the soil investigation levels as the site's proposed future use is a residential development. Adopted HIL for BTEX and TRH is derived from NSW EPA (1994). Adopted criteria are summarised in Table 7.

Table 7: Adopted soil health investigation levels (HIL)

COC	Soil Criteria (mg/kg)	LOR [1]
TRH (C_6-C_9)	65	25
TRH (C_{10}-C_{40})	1,000	250
Benzene	1	0.2
Toluene	1.4	0.5
Ethyl benzene	3.1	1
Xylene (total)	14	3
Total PAH	20	1.55 / 15.5 [4]
Benzo(a)pyrene	1	0.05 / 0.5 [4]
Aldrin + Dieldrin	10/5 [2]/3.3 [3]	0.2 / 2 [4]
Chlordane	50/25 [2]/16.7 [3]	0.1
DDT + DDD + DDE	200/100 [2]/67 [3]	0.3 / 3 [4]
Heptachlor	10/5 [2]/3.3 [3]	0.1 / 1 [4]
PCB (total)	10	0.1 / 1 [4]
Arsenic (total)	100/50 [2]/33 [3]	4
Cadmium	20/10 [2]/6.7 [3]	0.5
Chromium (VI)	100/50 [2]/33 [3]	1
Copper	1,000/500 [2]/333 [3]	1
Lead	300/150 [2]/100 [3]	1
Mercury	15/7.5 [2]/5 [3]	0.1
Nickel	600/300 [2]/200 [3]	1
Zinc	7,000/3500 [2]/2333 [3]	1

Notes
[1] Limit of reporting (Envirolab).
[2] HIL for dual composite.
[3] HIL for triple composite.
[4] LOR for sample 2193/AreaB/A was raised by the laboratory due to a high concentration of analytes (other than those being tested).

6 Results

6.1 Field Observations

6.1.1 Soil / Rock Profile

A summary of observations during intrusive investigation is presented in Table 8 with detailed borehole logs presented in Attachment C.

Table 8: Summary of site subsurface conditions

Lithology [1]	Depth Range (mBGL) [2]
Silt	0.0 – 0.2 (variable)
Natural sands – silty / clayey	0.05 – 1.0 (variable)
Extremely weathered sandstone	0.7 – 1.0 (variable)

Notes:
[1] For detailed material description see borehole logs.
[2] Indicative depth range; may vary across site.

6.2 Laboratory Analytical Results

6.2.1 Soil

Soil analytical laboratory results from the investigations were compared against adopted soil investigation levels and are summarised below:

- **2193/AreaB/A** exceeded adopted HIL for TRH (C_{10}-C_{-36}) **(58,053 mg/kg).** Remaining samples analysed for TRH (C_{10}-C_{-36}) were below LOR or below adopted HILs.
- All samples analysed for BTEX compounds were below LOR.
- All samples analyses for Benzo(a)pyrene and total PAH concentrations were below LOR or below adopted HILs**.**
- Heavy metal concentrations were below adopted HIL for all samples analysed.
- Samples analysed for OCP/OPP and PCB were below LOR and HIL.
- No asbestos in soil was detected at reporting limit of 0.1g/kg

7 Discussion and Recommendations

7.1 Discussion

Testing to date indicates that site contamination is confined to AEC "Area B" located in the south east corner of Lot 3 DP 568613. Refuse in the area included empty fuel cans, motor oil containers, lubricants and disused motor vehicles.

TRH (C_{10}-C_{-36}) contamination was identified in sample 2193/Area B/A with levels exceed adopted HIL. Further remediation and / or management will be required prior to proposed future site use.

Fibrous cement sheeting identified in rubbish piles is likely to include asbestos. These materials are to be removed as part of site clearing works. Following removal, rubbish stockpile footprints are to be inspected and validated through visual inspection, soil sampling and laboratory testing as determined by Martens and Associates.

7.2 Recommendations

Based on the findings of this investigation a remediation action plan is required to render the site fit for the intended use. Further analysis of site areas inaccessible during site sampling (sheds in Areas I and J, areas under existing residential dwellings) is recommended following site clearing / demolition to address these areas of previously unaddressed contamination.

The nature of observed and identified potential site contamination is relatively minor. Following demolition of structures and removal of waste stockpiles, the remediation of identified contamination shall require comparatively simple works. The nature of assessed contamination is such that the remediation to render the site fit for use shall be readily implemented with standard land remediation practices. Site contamination is not considered sufficiently severe or extensive that is shall significantly impact on the site's potential for redevelopment.

8 Limitations

This Stage 2 contamination assessment was undertaken in accordance with current industry standards.

It is important to note that no land contamination study can be considered to be a complete and exhaustive characterisation of a site nor can it be guaranteed that any assessment shall identify and characterise all areas of potential contamination or all past potentially contaminating land-uses. Therefore, this report should not be read as a guarantee that only contamination identified shall be found on the site. Should material be exposed in future which appears to be contaminated, additional testing may be required to determine the implications for the site.

Martens & Associates Pty Ltd has undertaken this assessment for the purposes of assessing potential site contamination. No reliance on this report should be made for any other investigation or proposal. Martens & Associates accepts no responsibility, and provides no guarantee regarding the characteristics of areas of the site not specifically studied in this investigation.