



- ▶ TP3 0.2-0.3 (fill and black ash): BaP @ 1.4mg/kg.

It is noted that the TP1 0.1-0.3m sample recorded total PAH and B(a)P at concentrations in excess of the SCC industrial waste criteria of 800mg/kg and 23mg/kg respectively. As such, this material would nominally classify as hazardous waste in accordance with the NSW EPA (1999) Environmental Guidelines and would require remediation and / or treatment before offsite disposal. However, due to the presence of significant quantities of ash in the fill it is considered appropriate to apply the *NSW EPA General Approval of Immobilisation, No. 1999/05*. Therefore, the total concentration (SCC) limits for total PAH and BaP do not apply and the material can be classified according to the concentrations of other contaminants and the TCLP concentration of BaP, which would result in a solid waste classification. However, the duplicate of sample TP1 0.1-0.3m recorded a TPH C₁₀ – C₃₆ concentration of 18510mg/kg, in excess of the SCC solid waste criteria. Therefore GHD consider it prudent to nominally classify this material as **industrial waste** (alternatively, additional sampling after the material has been excavated and stockpiled could be conducted to confirm this).

Based on the leachable and total concentrations of contaminants detected in samples of ashy fill from the site, it is concluded that the majority of the material classifies as **solid waste** on the basis of the B(a)P data with the exception of material near TP1 that may have to be treated as a 'hot spot' of **industrial waste**.

8.4 Assessment of Quality Control Results

8.4.1 Field Program

Relative Percentage Differences (RPD) are an established method of comparing primary and duplicate results. Analytical data for all blind duplicate samples collected during sampling are provided in **Summary Tables, Table C** at the rear of this report.

Duplicate pairs analysed in the program included:

- ▶ TP1 0.1-0.3 = DUP1
- ▶ TP7 0.4-0.6 = DUP2
- ▶ TP8 0.4-0.6 = DUP3

The nominal criteria used for the assessment of RPDs are +/- 30% for inorganic parameters and +/- 50% for organic parameters as provided in Australian Standard AS4482.1 (1997). However, variations from these RPD criteria can be expected in heterogeneous material or where low concentrations of analytes are detected.

The collection of duplicate samples during the field investigation exceeded the 10% frequency target (3 duplicates for 21 samples analysed), and thus complies with the data quality objectives for the project.

The RPDs could not be calculated for BTEX in the three duplicate pairs analysed as duplicate pairs reported concentrations below the PQL.



The majority of RPDs for metals were below the acceptable RPD of ± 30 (inorganic). However, RPD exceedances were noted for arsenic, chromium and zinc. Where the RPD's in the duplicate samples exceeded the acceptable criteria of $\pm 30\%$, concentrations were generally low or close to the PQL. However, zinc in duplicate pair TP1 0.1-0.3 / DUP1 was detected at elevated concentrations above the PQL and hence the RPD in this instance demonstrates a lack of reproducibility between the primary and duplicate sample.

In addition, RPD's for total TPHs and several of the PAH compounds demonstrate poor reproducibility in duplicate pair TP1 0.1-0.3 / DUP1. In most instances, concentrations of contaminants in DUP1 were approximately double that of the primary sample. It is considered likely that the poor reproducibility may be due to heterogeneity of the fill material and its ashy constituents.

The poor reproducibility of the data should be taken into account when interpreting the overall data set.

Overall, however, the assessment of the field QA/QC results indicate that the precision of the data is of generally acceptable quality upon which to draw conclusions regarding the environmental condition of the site at the time of this investigation.

8.4.2 Laboratory Program

EnviroLab Services, a NATA certified laboratory, undertook internal quality assurance and quality control including the analysis of laboratory control spikes, method blanks, single and duplicate control spikes, surrogate spikes, matrix spikes and matrix duplicate control spikes. The results of these analyses indicated that the laboratory analysis of samples and the methods used were precise, accurate, reliable and reproducible for the sample matrix, and that the laboratory was obtaining results within their control limits for the period during which the samples were analysed.

It should be noted that TPH surrogate and matrix spike recoveries fell below the laboratory acceptance limit of 70%, with several TPH surrogates and matrix spikes consistently $< 70\%$. This exceedance of the control limits suggests that the laboratory is under extracting some compounds during analysis and hence potentially 'under' reporting concentrations. When this outcome is applied to the data set, the true concentration of TPH compounds may be higher than what is reported. This should be taken into account when interpreting the data for areas where TPH was detected in soil (namely around TP1).

The meeting of the DQOs for the project in terms of frequency of duplicate sampling and acceptance of laboratory data indicates that the data set generated for the current investigation, with the exception of the above exceedances of the control limit, is generally suitable for use.



9. Discussion

9.1 Observations Made on the Filling History of the Site

As previous investigations have noted (CH2M Hill 2000), a subsurface concrete slab is located in the north of the site (delineation area). Test pits TP5 and TP6 intersected the southern edge of the slab and TP9 and TP10 found the slab at the base of the test pits at approximately 1.0m below ground level. The slab is approximately 100mm thick with an additional 100mm layer of road base material beneath it (in some locations).

A schematic cross section of the investigation area is presented in **Figure 5**.

As evidenced in test pits TP4, TP7, TP8 and TP11, old footings, brick walls and foundations of former site infrastructure are located approximately 0.4m below ground level in the vicinity of the site. Based on observations made during test pitting, it is considered likely that fill material observed in the pits, including man made debris, rail ballast, ash, coal and clay (of varying composition) was used to backfill over the top of former site infrastructure. In addition, based on the inferred geometry and layout of the remnant brick walls (**Figure 4**), it appears that fill material has been placed down in between the brick walls on top of the concrete slab up to the level of the top of the brick walls (approximately 0.4m below ground level). Rail ballast and other fill material was imported to fill from the top of the walls to surface level. The distance between the observed brick walls varies from 0.5-1.0m. It is not clear how many brick walls there are located beneath the site, nor the length and exact layout of the former infrastructure. The brick walls appear to run parallel to the chain wire fence that is currently located on site.

On the southern side of the chain wire fence, observations made at depth in TP1, TP2 and TP3 indicate that filling (namely fill and ash bands) appears to have increased in depth from north to south abutting against the brick retaining wall that is located about 4m south of the chain wire fence in the Gasworks area. The filling is consistent with the lay of the land, although it should be kept in mind that both sites have a highly modified topography. However, given that the former Gasworks area south of the retaining wall is lower than the site by approximately 1.5m, it is considered likely that more fill material was needed towards the south of the site and immediately adjacent to the brick retaining wall.

9.2 Soil Investigations

Previous investigations at the site by CH2M Hill indicated that PAH and BTEX contamination was located in the vicinity of CH2M Hill Test Pit TP44 at concentrations that would warrant further investigation, delineation and / or remediation.

Delineation sampling around TP44 in the current investigation involved:

- ▶ Locating the position of TP44 by a registered surveyor;
- ▶ Where practical, positioning delineation test pits in a 5m and 10m radius from TP44; and



- Collection and analysis of samples for BTEX and other contaminants of concern.

It should be noted that, although the former Cleaning Sheds area is bounded by the chain wire fence to the south, surveying of the original position of TP44 located this pit on the southern side of the fence and hence in the former Gasworks area.

Three test pits (TP1 to TP3) were excavated in the former Gasworks area in the immediate vicinity of TP44. The remaining test pits (TP4 to TP11) were located on the northern side of the chain wire fence on a 5m and 10m spacing stepping away (to the north, east and west) from TP44.

Sub surface investigations indicated that fill material underlies the majority of the site to depths of between 0.3 – 1.0m. The fill material comprised a coarse-grained sandy gravel predominantly comprising ash / coal / coke and rail ballast with large fragments up to 150mm. The proportion of rail ballast in the fill material was greater on the northern side of the fence (Cleaning Sheds area) than on the southern side of the fence (former Gasworks area). The proportion of ash and coke fill material was greater on the Gasworks area than the Cleaning Sheds area.

A summary of the geology of both sides of the chain wire fence and the associated chemicals of concern detected in samples analysed is presented in the following **Table 9.1**.

Table 9.1: Summary of Geology and Soil Results

Former Gas Works Area (TP1 – TP3) (South side of fence)					Former Cleaning Sheds Area (TP4 – TP11) (North side of fence)					
Soil Type	Depth	BTEX	PAH	TPH	Soil Type	Depth	BTEX	PAH	TPH	Asbestos
Fill + black ash	0.0-0.4	ND - 179	ND - 898	ND - 9390	Fill + rail ballast	0.0-0.4	ND	NA	NA	NA
Fill + grey ash	0.4-0.7	ND - 1.6	ND - 15.6	ND	Fill / clay / ash	0.4-1.0	ND - 2.4	NA	NA	Fragments containing chrysotile
Clay	>0.7	ND	ND	ND	Fill / clay	>1.0	ND	NA	NA	NA

ND – Not Detected above PQL

NA – Not analysed

All soil results are in mg/kg.

Depth ranges are averaged between test pits at that site.

TPH, BTEX and total PAHs were reported at concentrations exceeding the relevant guideline in the upper geological horizon (0.0-0.4m) at TP1 and TP3 situated adjacent to TP44. This geological horizon corresponds to having significant amounts of black ash, coal and coke mixed in with the fill material. Deeper samples analysed from the same locations indicate that the concentrations of BTEX, TPH and PAH decreases