Photo 13 Tar Well #2 showing coal tar and gravel contents.

Photo 14 Facing west toward sample location MG06 at Tar Well #2 showing tar seepage from brickwork.

Photo 15 Facing west toward sample location RP and brick Retention Pit.

Photo 16 Facing south toward former Retort House area showing historic brickwork. Shows sample location MG09A (foreground) and MG09B (background with excavator).

Photo 17 Facing north toward sample location MG09B. Showing tar pipe from which a sample was collected.

Photo 18 Subsurface conditions showing ash and coke surface fill layer. Profile at sample location MG10.

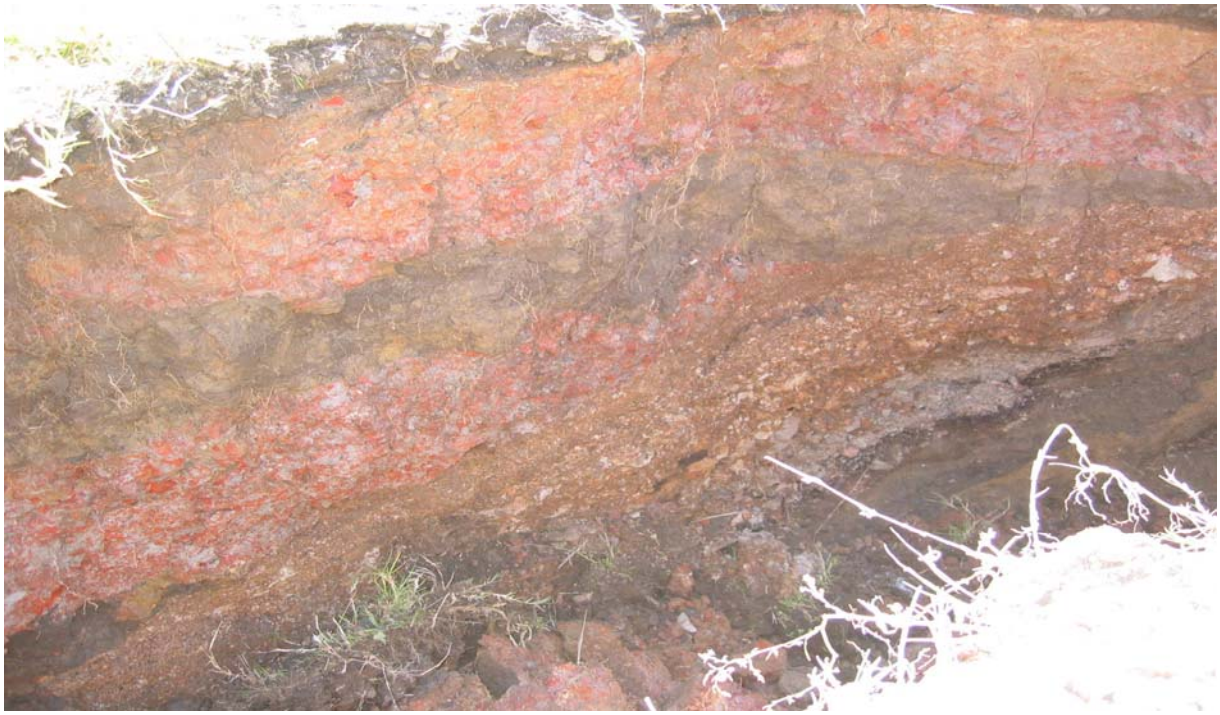

Photo 19 Subsurface conditions showing stratified fill materials at sample location MG01. Indicative material of Gravel, Sand and Clay with Minor Ash across Southwest Area.

Photo 20 Subsurface conditions of Retaining Wall Area at sample location TP18. Indicative material of Gravel, Sand and Demolition Wastes.

Photo 21 Subsurface conditions of Retaining Wall Area at sample location TP12. Indicative material of Gravel, Sand and Demolition Wastes.

Photo 22 Soil core sample showing free tar in natural soil at sample location BHF at 6.2mbgl.

Photo 23 Subsurface conditions showing free tar in deep red/grey natural clays at sample location MG08 at 3.1mbgl.

Photo 24 Subsurface conditions showing dark staining in deep weathered shale fractures at sample location BHA at 7.0mbgl.

Appendix B
QA/QC Assessment

EVALUATION OF QUALITY ASSURANCE AND QUALITY CONTROL OF PAST INVESTIGATIONS – MACDONALDTOWN GASWORKS

The overall quality of the data for past soil investigations at the Macdonaldtown Gasworks has been assessed by review of the information presented in the referenced reports. A summary of the findings are provided in the following tables.

Reports reviewed:

CLR01052: *Macdonaldtown Triangle, Erskineville Phase I and II Environmental Site Assessments* (CH2M HILL 2000)

CLR01053: *Vegetable, soil and sediment sampling from the Former Gasworks Area of the Macdonaldtown Triangle, Erskineville, New South Wales – Letter Report* (CH2M HILL 2000)

CLR01221: *Macdonaldtown Triangle, Erskineville Soil and Groundwater Investigations of the Former Gasworks Area and Offsite* (CH2M HILL 2001)

CLR01707: *Macdonaldtown Triangle (Former Cleaning Sheds) Delineation and Classification Sampling* (GHD 2005)

CLR01905: *Macdonaldtown Triangle (Former Gasworks Site) Human Health & Ecological Risk Assessment (SKM 2006)*

QA/QC Evaluation – Sampling and Analysis Methodology Assessment

Sampling and Analysis Plan and Sampling Methodology	Comments
Sample Collection Method	**CLR01052:** Sampling was stated to be in accordance with the NSW EPA (1995) *"Sampling Design Guidelines"* (EPA 1995). Soil samples were collected either directly from the pushtube, excavator bucket or edge of test pit walls. **CLR01053:** Sample collection method was not specifically discussed, but soil samples were collected from the surfical 10-15cm soil (plant root depth uptake) and sediment samples were from an open drain. **CLR01221:** Samples were collected from a truck mounted auger. The consultant stated that soil samples were collected directly from the last section of the deepest portion of the auger blade. The consultant did not consider push tubes to be necessary, a clear reason for this was not provided however did state in the report that "*the sample returns were generally competent and did not disintegrate prior to collection*". **CLR01707:** Sampling was undertaken by excavating test pits with the aid of a backhoe. The consultant

Sampling and Analysis Plan and Sampling Methodology	Comments
	reported that where possible, samples were collected from the centre of the backhoe bucket or from the sides of the exposed test pit walls. **CLR01905:** Boreholes were drilled with a solid stem auger. Samples were collected as undisturbed samples using a split-tube sampler.
Decontamination Procedures	**CLR01052:** Decontamination of soil sampling equipment included replacement of disposable outer nitrile gloves and/or, an initial rinse and scrub with tap water, a scrub with a detergent of known chemical composition (decon 90), a tap water rinse, a 10 percent nitric acid rinse and a deionised water rinse. A new liner was used for each push of the push-tube. The tip of the push-tubes underwent decontamination by a scrub in a solution containing detergent of a known chemical composition (decon 90). **CLR01053:** All field equipment (trowels, spatula's, etc.) were reported to be decontaminated prior to the use and between samples to prevent cross contamination. Decontamination of equipment involved scrubbing the equipment in clean potable water to remove gross contamination, scrubbing in a solution of 10 percent nitric acid and water, rinsing in distilled water and air dry. **CLR01221:** The consultant did not provide any clear discussion regarding decontamination procedures for soil sampling, for example within Section 11 (Investigation Strategy), Section 12 (Site Work), Section 13 (QA/QC Data Evaluation) or Appendix D (SAQP) of the report. However the consultant did report that the "*field methodology was designed to produce repeatable, high quality results in a scientifically manner*". **CLR01707:** Decontamination procedures reportedly included the use of new disposable gloves for the collection of each sample, decontamination of the sampling equipment between each sampling location if required (using DECON 90 – a phosphate free detergent). Disposable latex gloves were used to collect each sample. **CLR01905:** All field equipment was reported to be decontaminated. This was done in accordance with the summary procedures specified in the relevant Sampling Analysis Program which further details are provided in "SKM Work Instruction WI-CS-11 Decontamination".
Sample handling and containers	**CLR01052:** Samples were placed within an ice filled cooler. No specific discussion regarding sample jar type, such as Teflon lids, laboratory preparation was provided. **CLR01053:** Samples were placed into laboratory supplied containers, within a cooler containing ice and

Sampling and Analysis Plan and Sampling Methodology	Comments
	transported directly to the analytical laboratory. **CLR01221:** The consultant stated that as part of the adopted DQIs, collection of soil samples were to be placed into appropriately pre-treated jars/bottles with Teflon lined lids. All samples were reported to be stored in an esky of ice. **CLR01707:** Consultant reported the use of sampling containers provided by the laboratory. Soil samples were transferred to a "chilled" esky for sample preservation before and during shipment to the laboratory. **CLR01905:** All samples were reported to have been received at the laboratory in appropriately preserved containers, with preservation including packing samples with ice packs in eskies.
Chain of Custody	**CLR01052:** Provided in Appendix F of the report **CLR01053:** Provided in Appendix C of the report **CLR01221:** Provided in Appendix A of the report **CLR01707:** Provided in Appendix C of the report **CLR01905:** All samples were reported to have been logged and transferred under appropriately completed Chain of Custody forms
Detailed description of field screening protocols including calibration	**CLR01052:** Field screening for volatiles was undertaken using a PID, however instrument calibration was not discussed or reported. **CLR01053:** Field screening for volatiles was not undertaken. **CLR01221:** Field screening for volatiles was undertaken using a PID, however instrument calibration was not discussed. **CLR01707:** Field screening for volatiles was undertaken using a PID, calibration certificates provided in Appendix B. **CLR01905:** Field screening for volatiles was undertaken using a PID. The PID was used to obtain head-space concentrations of volatile gases emitted from bagged soil samples. PID sampling results were summarised on the borehole logs provided in Appendix A. All equipment was reported to have been calibrated prior to use in the field.
Sampling Logs	**CLR01052:** Soil logs are provided within the report, indicating sample depth and lithology. PID readings were not recorded on all logs. **CLR01053:** Soil logs were not provided (soil samples were sediment or surface).

Sampling and Analysis Plan and Sampling Methodology	Comments
	CLR01221: Borehole logs are provided in Appendix A. **CLR01707:** Borehole logs are provided in Appendix A. **CLR01905:** Borehole logs are provided in Appendix A.

QA/QC – Field and Lab Quality Assurance and Quality Control

Field and Lab QA/QC	Comments
Field quality control samples and results	**CLR01052:** A trip spike or wash/rinsate blanks were not collected. One trip blank was included. 11 field duplicates were collected where RPDs of 50% & analyte concentrations > 10 times were reported, which were attributed to "*heterogeneous fill material*". **CLR01053:** Soil and sediment field duplicates was collected although results not discussed. The consultant did state though "*the overall quality of the analytical data produced is considered to be of an acceptable standard*". **CLR01221:** Field duplicates, which included inter- and intra-laboratory, trip blanks and trip spikes were all included in the sampling programme. Trip blank concentrations were reported to be < LOR, recoveries of trip spikes were >90% and method blanks contained no detectable concentrations of analytes. The majority of duplicate RPD were <50% or <10xLOR. A couple of metal RPD exceedances were reported for the inter- and intra-lab dups, however analyte concs were less than site criteria. **CLR01707:** The consultant stated that the field soil QC included intra-laboratory (blind), duplicates, trip spike, trip blank. The collection of duplicate samples during the field investigation exceeded the 10% frequency target (3 duplicates for 21 samples analysed), and therefore complied with project DQOs. 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%. However, RPD exceedances were noted for arsenic, chromium and zinc. Where the RPD's in the duplicate samples exceeded the acceptable criteria of +/-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

Field and Lab QA/QC	Comments
	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. The consultant stated that it is considered likely that the poor reproducibility may be due to heterogeneity of the fill material and its ashy constituents. The consultant also reported that the poor reproducibility of the data should be taken into account when interpreting the overall data set. Overall, however, the consultant considered that the results of the field QA/QC indicate that the precision of the data was generally acceptable quality upon which to draw conclusions regarding the environmental condition of the site at the time of the investigation. **CLR01905:** Rinsate blanks were collected once every field day. Inter- & intra-laboratory blind field duplicates were collected at a frequency of at least 1 in 20. The majority of RPDs were <50% with one exception for TPH(C_{16-28}). The consultant did not consider the RPD exceedance to be significant because analyte concentrations were close to PQLs
NATA registered laboratory and NATA endorsed analytical methods	**CLR01052:** Analytical work was performed by AMDEL Analytical Laboratories which was reported to be NATA accredited. **CLR01053:** The NATA accredited laboratory AGAL was used. **CLR01221:** The NATA accredited laboratory ALS was used as the primary lab, AMDEL which is also NATA accredited was used as the secondary lab. **CLR01707:** Envirolab Services was used which was reported to be a NATA certified laboratory. **CLR01905:** The NATA accredited laboratories AMDEL and ALS were used. It was noted by the consultant that AMDEL's analysis for speciated TPH (method E1224) was not covered by NATA accreditation.
Holding times	**CLR01052:** Soil samples were collected between 18 and 20 April 2000 with all of the samples received by the laboratory on 20 April 2000. The laboratory reported that samples were received at the laboratory within the holding times and analysis undertaken within the required quality assurance requirements. **CLR01053:** Samples were reported to be analysed within the holding times relevant to the selected analytes. **CLR01221:** The consultant stated that all samples were analysed within their nominated holding times. **CLR01707:** The consultant did not provide discussion regarding holding times. However, lab certificates states samples were received 18/08/05 and chain of custody forms indicated samples were transported to the lab on this date as well.

Field and Lab QA/QC	Comments
	CLR01905: All extraction and analyses were reported by the consultant to be within standard guidelines.
Laboratory quality control samples and results	**CLR01052:** Laboratory quality control samples and results were not discussed by the consultant, however laboratory was NATA accredited (lab reports not included within the report reviewed). **CLR01053:** The consultant did not provide discussion regarding lab QA, however lab control samples were for the majority between 70%-130% and lab control duplicates were less than 50%. **CLR01221:** Laboratory duplicates, surrogate spikes, method blanks and matrix spikes were used by laboratory where the results were reported to have conformed to adopted DQIs. **CLR01707:** The consultant stated that the 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. The consultant also stated that the 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 concentrators. When this outcome is applied to the data set, the true concentration of TPH compounds may be higher than what is reported. The consultant stated that this should be taken into account when interpreting the data for areas where TPH was detected in soil. The consultant also stated that 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. **CLR01905:** Reagents were reportedly not contaminated, RPDs of lab duplicates were reported to be within the specified criteria of 50%, lab control samples were performed at a frequency of 1 in 20 or at least one per analytical run. Matrix spikes and Matrix spike duplicates were for the majority reported to be between 70%-130% and less than 50%, respectively. A small number of MSD > 50% occurred, however concentrations of analytes were reported to be less than or near PQLs. Lab control limits for phenols were consistently <70% in a range of 50%-60%, however all phenol concentration s were <PQLs.
Data Quality Objectives and Data Evaluation (completeness,	**CLR01052:** The consultant did not define DQOs and did not undertake a formal QA/QC data evaluation against the five category areas. They did, however, conclude that "*The analysis of the soil field duplicate results indicate that the soil data should be considered as indicative, displaying the range of*

Field and Lab QA/QC	Comments
comparability, representativeness, precision, accuracy)	*concentrations that are present in the soil. The analysis of the surrogate recoveries and holding times indicate that the soil analytical results reported are a true and accurate representation of the concentrations of the identified chemicals present in the soil*" . **CLR01053:** The consultant did not define DQOs and did not undertake a formal QA/QC data evaluation against the five category areas. They did, however, conclude that "*overall quality of the analytical data produced is considered to be of an acceptable standard for interpretive use*". **CLR01221:** Predetermined data quality objectives (DQOs) were discussed. There was limited discussion regarding actions required if data do not meet the expected objectives. **CLR01707:** Predetermined data quality objectives (DQOs) were discussed. There was limited discussion regarding actions required if data do not meet the expected objectives. **CLR01905:** Predetermined data quality objectives (DQOs) were set for laboratory analyses including blanks, replicates, duplicates, laboratory control samples, matrix spikes, surrogate spikes and internal standards. There was limited discussion regarding actions required if data do not meet the expected objectives.

In consideration of the above, it is noted that there are a few minor discrepancies contained within the QA/QC of the past investigations, such as reporting of certain aspects sampling procedures and the occasional field duplicate RPDs not meeting the adopted DQIs, the data as a whole is likely to be reliable and useable.

QA/QC Assessment

Laboratory Reports

The primary results and the QAQC results were reported in Australian Laboratory Services (ALS) Certificates of Analysis ES0609995, ES0610062, ES0610135, ES0610221, ES0610613, ES0612955, ES0613014 and ES0613192. The inter-laboratory duplicates were reported in Labmark Certificate of Analysis E028016. The data quality assessment detailed below refers to the data provided in these laboratory reports.

Data Quality Indicators

Data Quality Indicators (DQIs) are typically developed to provide goals for the quality of data required to sufficiently meet the site-specific objectives of Environmental Site Assessments and Validation Assessments. Precision, Accuracy, Representativeness, Comparability and Completeness (PARCC parameters), are all indicators of data quality. The DQIs used to assess the PARCC parameters for this assessment are detailed in **Table 1**.

Table 1 – Summary of Data Quality Indicators

Data Quality Indicator	Data Quality Indicators	Non-conformance Action
Precision		
Field Duplicate RPDs (inter-laboratory and intra-laboratory).	CH2M HILL has developed the following DQIs for field duplicates, given the heterogeneity expected within samples: • Result is <10 times LOR, no limit • Result is between 10-20 times LOR, <50% RPD • Result is >20 times LOR, <50% RPD (inorganic analyte) and <100% RPD (organic analyte).	Assess sample matrix. Request Lab confirmation and if necessary re-analysis.
Laboratory duplicate RPDs	The following DQIs have been adopted for laboratory duplicates (based on ALS documented RPD limits): • Result is <10 times LOR, no limit • Result is between 10-20 times LOR, 0-50% RPD • Result is > 20 times LOR, 0-20% RPD	Request Lab confirmation
Method Blanks	Not detected above Laboratory Limit of Reporting	Request Lab confirmation
Accuracy		
Laboratory Control Samples (inorganics)	70% to 130% recovery for inorganics	Request Lab Confirmation
Single Control Spikes (organics)	Specified by Australian Laboratory Services in the SCS sections of the Organics Quality Control Report attached to the Certificates of analysis. Recovery should be between 70-130%.	Request Lab Confirmation
Matrix Spikes	70% to 130% recovery	Request Lab Confirmation
Matrix Spike Duplicates and Duplicate Control Spikes	<20% RPD (except for MS/MSD for PAHs) <35% RPD for MS/MSD for PAHs	Request Lab Confirmation

Data Quality Indicator	Data Quality Indicators	Non-conformance Action
Surrogate Spikes	Based on US EPA surrogate recovery limits as follows: • Decachlorobiphenyl 10 – 164% • Dibromo-DDE 10 – 136% • Nitrobenzene-D5 23 –120% • 1.2-Dichlorobenzene-D4 32 – 129% • 2-Fluorobiphenyl 25 – 121% • Anthracene-d10 27 – 133% • p-Terphenyl-D14 18 – 137% • 1.2-Dichloroethane-D4 80 – 120% • Toluene-D8 81 – 117% • 4-Bromofluorobenzene 74 – 121% • 2-Fluorophenol 21 – 100% • Phenol-D6 10 – 94% • 2-Chlorophenol-D4 23 – 134% • 2.4.6-Tribromophenol 10 – 123%	Request Lab Confirmation
Representativeness		
Trip Blanks and Rinsates	Not detected above Laboratory Limit of Reporting	Request Lab Confirmation
Trip Spikes and Trip Spike Controls	RPD <50%	Request Lab Confirmation
	All fieldwork including decontamination procedures to be undertaken in accordance with CH2M HILL's SOPs.	
	QA/QC to be conducted in accordance with NEPC (1999).	
	Samples analysed for the analytes requested on the COC	Refer any non-conformances to Lab request explanation
	Sample handling, storage and transport to be in accordance with NEPC (1999).	
	Samples to be extracted and analysed within appropriate holding times	Refer any non-conformances to Lab request explanation
	Samples to be transported under full chain of custody documentation. The laboratory to return a copy of the signed CoC acknowledging the receipt data and time and identity of samples included in the shipment.	
	Include Laboratory Certificates of Analysis which detail any standard and non-standard methods used	
Completeness	100% of results requested for analysis to be reported by Analytical Laboratory	Request Laboratory Confirmation
	– Total representative data set to be >95% complete after data validation procedures	Resample if necessary
Comparability	– Soil samples to be collected using CH2M HILL's SOPs.	
	– Detailed soil logs to be completed for each sample location noting any observed variations between soil conditions and signs of potential contamination.	
	– Primary samples to be stored, handled and transported under the same conditions and analysed by one laboratory using consistent methods.	
	– DQIs to indicate acceptable Precision and Accuracy.	

Precision

The precision of a duplicate determination was measured as relative percent difference (RPD), calculated from the following equation:

$$RPD = \left[\frac{X1 - X2}{\left(\frac{X1 + X2}{2} \right)} \right] \times 100$$

where: X1 is the primary sample analyte value
X2 is the duplicate sample analyte value

Field Precision

Intra-laboratory field duplicates are taken and analysed as an indicator of the effect of the field sampling protocol on the precision of analytical results. These duplicates also provide an indication of the nature of the field samples in terms of their relative heterogeneity and media variance. Intra-laboratory duplicate samples were collected at a rate of one per 20 samples in accordance with NEPC (1999).

Inter-laboratory field duplicates are taken and analysed as an indicator of the precision between different laboratories, as well as field sampling protocol and the nature of the field sample heterogeneity. Inter-laboratory duplicate samples are also required to be collected at a rate of one per 20 samples in accordance with NEPC (1999).

14 soil intra-laboratory duplicates and three soil inter-laboratory duplicates, representing 17 of 136 primary samples (13%), were submitted, while one water intra-laboratory duplicate representing one of six primary samples (17%), were submitted. This frequency of duplicates is in congruence with the DQIs specified in Table 1.

A summary of the assessment of the field intra-laboratory and inter-laboratory duplicates is provided below:

Field Duplicate

The RPDs for analytes, that were detected above the laboratories Limit of Reporting (LOR), ranged from 0 – 167.2%. The majority of RPDs were in congruence with the stipulated DQIs, with the exception of some intra-laboratory duplicates, as follows:

Parent_Field_ID	Matrix	Compound	Primary	Duplicate	Unit	EQL	RPD [%]
TP08/1.0	Soil (FILL)	Chromium	26.0	9.0	mg/kg	2	97.1
TP08/2.0	Soil	Chromium	22.0	12.0	mg/kg	2	58.8
MG05/0.5	Soil(FILL)	Chromium	32.0	18.0	mg/kg	2	56.0
MG05/0.5	Soil(FILL)	Lead	325	29	mg/kg	5	167.2
MG05/0.5	Soil(FILL)	Nickel	41.0	340.0	mg/kg	2	157.0
MG05/0.5	Soil(FILL)	TPH C15-C28	10,800	2,680	mg/kg	100	120.5
TP15/2.8	Soil	TPH C15-C28	1400.0	3740.0	mg/kg	100	91.1

There are seven duplicate results which are not in accordance with the specified DQI's. Five samples were collected from fill material. Fill material can be heterogeneous and variations

in analysis results within the same sample can occur. Two of the field duplicate results where taken from natural soil. These duplicate results are within an order of magnitude of the parent samples. CH2M HILL considers that the discussed exceedences will not affect the overall precision of the data.

Laboratory Precision

Precision is a measure of the variation in results from a laboratory method. The laboratory measures the precision of the analyses performed on a particular batch of samples using laboratory duplicates. Laboratory duplicate samples are analysed by ALS at a minimum rate of one in every twenty samples for both organic and inorganic analytes.

Acceptable RPDs for parameters are specified by the testing laboratory. In the situation where no limit is specified, CH2M HILL limits are employed.

A summary of the assessment of the laboratory duplicates is provided below:

Laboratory Duplicate

The RPDs for analytes, which were outside the laboratories reporting limits, are presented in the table below. The majority of the RPDs were in congruence with the stipulated DQIs, with the exception of some intra-laboratory duplicates, as follows:

Lab Duplicate	Compound	Primary	Duplicate	Unit	LOR	RPD [%]
283416-004_ES0609995	Chlorpyrifos	3.08	2.24	mg/kg	0.05	32
285483-004_ES0610062	Naphthalene	142	94	mg/kg	0.5	41
286773-058_ES0610135	Zinc	362	260	mg/kg	5	33

The above duplicate results are not in accordance with the specified DQI's. However, the exceedences are close to the stipulated DQI. The inconsistency in the duplicate samples reflects the heterogeneity of the soil. Therefore CH2M HILL considers that these DQI exceedences will not affect the overall precision of the data.

Accuracy

Accuracy is a measure of the closeness of the analytical result obtained by a method to the 'true' value. The laboratory measures accuracy using matrix spikes, laboratory control samples, control spikes, method blanks and surrogate spikes.

Matrix Spikes

Matrix spikes are prepared by spiking a field sample with a known concentration of a recommended spiking compound in order to ascertain the effects of the specific sample matrix on the recovery of analytes.

Accuracy as indicated by matrix spikes is measured in terms of percentage recovery as defined by the following equation:

$$\%R = \frac{SSR - SR}{SA} X\ 100$$

where: %R = percentage recovery of the spike
SSR = spiked sample result
SR = sample result (native)
SA = spike added

All matrix spike analyses undertaken were within the specified limits, with the exception of the following:

Batch No	Analyte	Recovery [%]	Recovery Limits [%]
ES0610135	Gamma BHC	60.4	75.7 - 110.4
ES0610135	Heptachlor	38.4	72.2 – 106.7
ES0610135	Aldrin	46.3	77.5 - 107.0
ES0610135	Dieldrin	56.0	76.4 - 109.7
ES0610135	4,4 DDT	22.5	67.1 - 118.1
ES0610135	Diazinon	56.5	75.0 - 107.1
ES0610135	Chlorpyrifos-methyl	46.6	74.8 - 107.91
ES0610135	Pirimphos-ethyl	41.1	68.0 - 109.4
ES0610135	Bromophos-ethyl	45.6	74.9 - 107.4
ES0610135	Prothiofos	70.1	75.5 - 106.1

Each of the abovementioned non-conformances are marginally below the stipulated recovery limits and occur within one sample batch. Therefore CH2M HILL considers that these DQI non-conformances will not affect the overall accuracy of the data.

Laboratory Control Samples

Laboratory control samples are prepared by spiking a clean matrix (i.e. a matrix with one of the target analytes above the LOR), with known quantities of an organic or inorganic spiking compound. Laboratory control samples are analysed at a rate of one per analytical batch for analytes.

Accuracy as indicated by laboratory control samples is measured in terms of percentage recovery as defined by the following equation:

$$\%R = LCSR/LCSC$$

where: %R = percentage recovery of the laboratory control sample
LCSR = laboratory control sample result
LCSC = laboratory control sample concentration

The DQI used to assess the performance of laboratory control samples was 70-130% recovery for inorganics and organics (or otherwise reported in the laboratory report).

The LCS recoveries for the inorganic parameters analysed in during this assessment are all within the DQIs (and recovery limits) specified.

The LCS recoveries for the organic parameters analysed during this assessment are reported within the DQIs (and recovery limits) specified, with the exception of the following:

Matrix	Batch No	Compound	Recovery [%]	DQI [%]
SOIL	ES0609995	Methyl Azinphos	26.4	29.8 - 137
SOIL	ES0610221	Methyl Azinphos	42.6	45.6 - 138
SOIL	ES0610062	Benzo(k)fluoranthene	120	74.2 - 117

All of the above results are close the DQI. CH2M HILL considers that these inconsistencies do not adversely affect the accuracy of the data for the purpose of this investigation.

Method Blanks

Method blanks monitor the externally introduced contaminants, which potentially derive from glassware, cleaning reagents and digestion reagents during the analysis process. The laboratory blank is treated as a sample in the laboratory, going through the same sample preparation and analysis procedures as corresponding samples.

Method blanks were analysed for all solid tests for inorganic and organic parameters. All method blank results were reported at below the LOR.

Surrogate Spikes

Both primary and QAQC samples analysed for organic parameters are spiked prior to extraction with surrogate compounds that are representative of the target analysis, however, are not commonly found in samples taken from the natural environment.

Accuracy as indicated by surrogate spikes is measured in terms of percentage recovery as defined by the following equation:

$$\%R = SSR/Sa \times 100$$

where: %R = percentage recovery of the spike
SSR = spiked sample result
SA = spike added

The DQIs used for the assessment are based on US EPA surrogate recovery limits as provided in Table 1.

The following surrogate recoveries were not within the DQIs specified in Table 1:

Sample ID	Matrix	Analyte	Recovery	Limits
DUP20	Soil	Phenol-d6	126%	10 - 94%

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents a characteristic of a population, parameter variations at a sample point or an environmental condition. Representativeness is a qualitative parameter, which is most concerned with the proper design and implementation of the sampling program.

To ensure representativeness is likely to be of acceptable quality the following procedures were undertaken:

Trip Spikes

Trip Spikes are a matrix of clean sand (for soil samples) or water (for groundwater samples) spiked with a known concentration BTEX and TPH C_6–C_9, these were transported with the samples collected during the sampling program. Recovery rates for each trip spike sample were within the specified DQI with the exception of the following:

Batch No	Analyte	Recovery	Unit	Trip Spike	Trip Spike Control
ES0613014	Benzene	64.5%	mg/kg	2.0	3.1
ES0613014	TPH C_6–C_9	60.4%	mg/kg	29.0	48

Trip Blanks

None of the analytes were detected above LOR.

CH2M HILL considers that these results reflect satisfactory representativeness.

Other general parameters were employed to ensure representativeness, including:

- The sampling and analysis program was developed by experienced professionals based on adequate site history and a thorough site inspection in accordance with NSW EPA guidelines and the NEPC (1999).
- Critical sample locations were identified and all critical samples were collected and analysed in accordance with the sample and analytical plan and data generated is validated to be of acceptable quality.
- Samples were placed in clean, preserved/unpreserved laboratory supplied containers suitable for the target analytes. Samples were stored, transported and handled at a temperature of less than 4 degrees Celsius and in accordance with NEPC (1999).
- Samples were transported under full chain of custody documentation including the sampler, nature of the sample, collection date, analyses to be preformed, sample preservation method and departure time from the site. The laboratory returned a copy of the signed CoC acknowledging the receipt data and time and identity of samples included in the shipment. The CoC documentation is included as **Appendix G.**
- All fieldwork was undertaken in general accordance with CH2M HILL's SOPs.

Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Sample data should be comparable with other measurement data for similar samples and sample conditions. Data comparability was maintained by undertaking the investigations as follows:

- The samples were collected by the same CH2M HILL field personnel in general accordance with CH2M HILL's SOPs;
- Detailed soil logs were completed for each sample location noting any observed variations between soil conditions and signs of potential contamination;
- Primary samples were stored, handled and transported under the same conditions and analysed by the same laboratory using consistent methods; and
- DQIs indicated acceptable Precision and Accuracy.

Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is that a sufficient amount of valid data is generated. CH2M HILL considers that the DQIs for completeness is fulfilled within this investigation and the data is considered to be valid.

Laboratory Accreditation

Australian Laboratory Services (ALS) and Labmark are registered by the National Association of Testing Authority (NATA) for the requested analyses and conduct all the requested analyses in accordance with the guidelines outlined in NEPC (1999). Extraction and analysis methods and the LORs for the primary laboratory are provided in the ALS Certificates of Analysis found in **Appendix G**.

Conclusions

Although there were some minor non-conformances, the majority of the PARCC parameters were within the specified DQIs and, overall, the data is considered to be of sufficient quality to meet the objectives of the investigation.

Appendix C
CH2M HILL Bore Logs

CH2M Hill (Australia) Pty Ltd
Level 7, 9 Help Street
CHATSWOOD, NSW, 2067

Soil Bore Log: BH12A

Project No.: 347496
Project: Macdonaldtown Gasworks
Site/Client: Railcorp
Date: 17/10/06 - 18/10/06
Logged By: Adam Sullivan

Final Depth (m bgs): 9.0
Bore Diameter (mm): 100
Weather: overcast with showers

SUBSURFACE PROFILE			SAMPLE			
Depth (m)	Graphic Log	Description	Number	USCS Class	PID (ppm)	Comments
0		Ground Surface				
		FILL gravel, sand, crushed rock, dry, with ash, coke and clinker layers				
1		***FILL*** sand, yellow, wet, with bands of clay				
2		***FILL*** silty Clay (original surface?), low plasticity, dark brown, black staining, wet, becoming more clay with depth				
3						very high HC odour
		CLAY - Natural medium plasticity, stiff, moist, red and grey mottled, weathered shale interlayered at 5 m BGS				
4			BH12A/4.2		324	very high HC odour, visible tar in pores
5			PID		73	strong volatile odour like cleaner or bleach, no tar in pores visible
6		***SHALE*** extremely weathered, red ironstone gravel fractures, becoming moderately weathered shale with red ironstone fractures	BH12A/6.0		2.0	slight HC odour
7						
		SHALE no recovery of core				
8						
9		End of Borehole	BH12A/9.0		2.0	

Contractor: Macquarie Drilling
Project Manager: Matt Bennett
Equipment/Drill Method: Geoprobe
Easting (AMG): 317150.333
Northing (AMG): 1247715.240
Ground Elevation (m AHD): 18.63

CH2M Hill (Australia) Pty Ltd
Level 7, 9 Help Street
CHATSWOOD, NSW, 2067

Soil Bore Log: BH14A

Project No.: 347496
Project: Macdonaldtown Gasworks
Site/Client: Railcorp
Date: 18/10/2006
Logged By: Adam Sullivan

Final Depth (m bgs): 2.8
Bore Diameter (mm): 100
Weather: sunny, windy

SUBSURFACE PROFILE			SAMPLE			
Depth (m)	Graphic Log	Description	Number	USCS Class	PID (ppm)	Comments
0		Ground Surface				
		FILL gravelly sand, dry, loose, grey to black, with ballast				no odour, no visible contamination
1		***FILL*** reworked clay, very stiff, low plasticity, dark grey with red mottles, some rootlets				
		FILL Clay (original surface?), high plasticity, spongy, dark brown, moist, stiff, with gravel component	BH14A/1.4		24.0	strong HC odour
		CLAY high plasticity, spongy, moist, stiff,grey with red and yellow mottles				
2		***CLAY- Natural*** medium plasticity, very stiff, grey with weathered red mottles	PID		2.0	no odour
			BH14A/2.4		0.1	
		SHALE extremely weathered, friable				
		End of Borehole				
3						

Contractor: Macquarie Drilling
Project Manager: Matt Bennett
Equipment/Drill Method: Geoprobe PT
Easting (AMG): 317162.534
Northing (AMG): 1247754.287
Ground Elevation (m AHD): 18.89

CH2M Hill (Australia) Pty Ltd
Level 7, 9 Help Street
CHATSWOOD, NSW, 2067

Soil Bore Log: BHA (angled bore)

Project No.: 347496
Project: Macdonaldtown Gasworks
Site/Client: Railcorp
Date: 16/10/06
Logged By: Adam Sullivan

Final Depth (m bgs): 10.2
Bore Diameter (mm): 100
Weather: overcast with showers

SUBSURFACE PROFILE			SAMPLE			
Depth (m)	Graphic Log	Description	Number	USCS Class	PID (ppm)	Comments
0		Ground Surface				
		FILL Ballast gravel, small to cobble size, firm, clay lumps, low plasticity, minor ash component.				Some ash gravels, no odours
1		***FILL*** Reworked clay, low to medium plasticity, rootlets, red with orange hues, moist, firm				No visual contamination, no odour
2		***FILL*** Reworked clay, low to medium plasticity, rootlets, red with orange hues, moist, firm, red and grey mottled, with ironstone gravels, coarse grain				Ash
		FILL sandy clays, ash gravels, wet				HC odour
3		***FILL*** silty Clay (original surface?), low plasticity, grey				HC odour
		CLAY - Natural soft, low to medium plasticity, green and grey hues, red weathered gravels, moist, red and grey mottled				
4		***CLAY*** grey and red, medium plasticity, moist, with weathered shale, friable, grey, black staining in grey clay. Red weathered shale with yellow hues from 5 m BGS	PID		0.0	
5			BHA/5.0		0.0	Strong HC odour
			DUP20			
6		***CLAY*** grey, very dark stained, with red weathered gravel, possible solicified tar in micropores.	PID		0.0	Change to smaller PT diameter, clay becoming very tight
7			BHA/7.0		15.0	Photo taken, high odours
8		***SHALE*** weathered shale, red with grey clay	BHA/8.4		86.0	Photo taken, very odorous, dark staining
9		***SHALE*** grey weathered shale, with beds of porous red gravels. Some dark stains in red material	BHA/9.6		150	
10			BHA/10.2		364	Refusal on red shale, dry friable, high odour
		End of Borehole				

Contractor: Macquarie Drilling
Project Manager: Matt Bennett
Equipment/Drill Method: Geoprobe PT
Easting (AMG): 317118.769
Northing (AMG): 1247672.561
Ground Elevation (m AHD): 18.46

CH2M Hill (Australia) Pty Ltd
Level 7, 9 Help Street
CHATSWOOD, NSW, 2067

Soil Bore Log: BHB (angled bore)

Project No.: 347496
Project: Macdonaldtown Gasworks
Site/Client: Railcorp
Date: 17/10/06-19/10/06
Logged By: Adam Sullivan

Final Depth (m bgs): 9.6
Bore Diameter (mm): 100
Weather: overcast with showers

SUBSURFACE PROFILE			SAMPLE			
Depth (m)	Graphic Log	Description	Number	USCS Class	PID (ppm)	Comments
0		Ground Surface				
		FILL gravelly Sand, loose, brown, dry, ballast gravels				no odours
1		***FILL*** reworked Clay, stiff moist, red/orange to grey, with minor coarse ironstone gravel component				
		FILL silty Clay (original surface?), grey to green, wet, soft, with rootlets	PID		180.0	high HC odours, minor ash gravels, oily sheen
2						
3		***CLAY - Natural*** medium plasticity, grey/red, minor fine to medium grain gravels, moist, stiff				high HC odours
			PID		380.0	
4		***CLAY*** medium plasticity, red, weathered, minor fine to medium grain gravels, moist, stiff				
		BRICK Brick annulus				borehole moved out 0.5 m
5		***CLAY*** medium plasticity, red, weathered, minor fine to medium grain gravels, moist, stiff				
6		***CLAY*** very stiff, grey, interlayed with red gravel ironstone fractures. Prominent fracture with dark stained gravels @ 7.6 m BGS. Fracture @ 8.4m, 9,0 m and 9.5 m.	BHB/6.0		63.0	refusal on brick, move hole
7			BHB/7.2		50.0	high odours, no visible staining, no tar
						moderate HC odour, no tar
8			PID		98.0	
						root macro pores with black stains, photo taken
9			BHB9.0		49.0	high odours in fractures
			PID		33.0	
10		End of Borehole				

Contractor: Macquarie Drilling
Project Manager: Matt Bennett
Equipment/Drill Method: Geoprobe PT
Easting (AMG): 317125.223
Northing (AMG): 1247689.823
Ground Elevation (m AHD): 18.49

CH2M Hill (Australia) Pty Ltd
Level 7, 9 Help Street
CHATSWOOD, NSW, 2067

Soil Bore Log: BHC1 (angled bore)

Project No.: 347496
Project: Macdonaldtown Gasworks
Site/Client: Railcorp
Date: 19/10/2006
Logged By: Adam Sullivan

Final Depth (m bgs): 8.0
Bore Diameter (mm): 100
Weather: sunny

SUBSURFACE PROFILE			SAMPLE			
Depth (m)	Graphic Log	Description	Number	USCS Class	PID (ppm)	Comments
0		Ground Surface				
		Drilling rods driven to 7.2 m BGS without sample recovery				
7		***SHALE*** extremely weathered, grey, friable, interlayed with red ironstone fractures	PID		40.0	Slight HC odour in fractures, minor dark staining
8		End of Borehole	BHC1/8.0 DUP23		N/A	

Contractor: Macquarie Drilling
Project Manager: Matt Bennett
Equipment/Drill Method: Geoprobe PT
Easting (AMG): 317122.983
Northing (AMG): 1247714.522
Ground Elevation (m AHD): 18.75

CH2M Hill (Australia) Pty Ltd
Level 7, 9 Help Street
CHATSWOOD, NSW, 2067

Soil Bore Log: BHC2

Project No.: 347496
Project: Macdonaldtown Gasworks
Site/Client: Railcorp
Date: 19/10/2006
Logged By: Adam Sullivan

Final Depth (m bgs): 8.0
Bore Diameter (mm): 100
Weather: sunny

SUBSURFACE PROFILE			SAMPLE			
Depth (m)	Graphic Log	Description	Number	USCS Class	PID (ppm)	Comments
0		Ground Surface				
		Drilling rods driven to 4.8 m BGS without sample recovery				
5		***SHALE*** extremely weathered shale/grey clay, with red ironstone fractures, becoming extremely to moderately weathered shales. Ironstone fracture at 7.0m and 8.0 m BGS	PID		2.0	Minimal dark staining, no prominent HC odour
6			BHC2/6.0		1.0	
7			PID		2.0	Moderate HC odour, no prominent staining
8		End of Borehole	BHC2/8.0		2.0	No staining

Contractor: Macquarie Drilling
Project Manager: Matt Bennett
Equipment/Drill Method: Geoprobe PT
Easting (AMG): 317128.955
Northing (AMG): 1247714.323
Ground Elevation (m AHD): 18.66

CH2M Hill (Australia) Pty Ltd
Level 7, 9 Help Street
CHATSWOOD, NSW, 2067

Soil Bore Log: BHC (angled bore)

Project No.: 347496
Project: Macdonaldtown Gasworks
Site/Client: Railcorp
Date: 19/10/2006
Logged By: Adam Sullivan

Final Depth (m bgs): 9.2
Bore Diameter (mm): 100
Weather: sunny

SUBSURFACE PROFILE			SAMPLE			
Depth (m)	Graphic Log	Description	Number	USCS Class	PID (ppm)	Comments
0		Ground Surface				
		No log, drilling rods driven to the base of the gasholder annulus				
1						
2						
		FILL mixture of ironstone gravels and clays, black stains, wet, sloppy				High HC odours
3			PID		12.7	
			BHC/3.6		5.0	
4		crushed rock, saturated, black - gas holder annulus				
		Hit brick annulus, hole moved 1 m out				
5						
		Pierced through brick base annulus; free tar in bricks				Very high HC odours
6		Drive drilling rods to refusal. No sample recovery	BHC/6.0		550	Saturated soil
7						
8						
		SHALE - Natural moderately weathered, grey, moist, friable. Sample too small to determine fractures				
9			no sample			Minor HC odour
		End of Borehole				

Contractor: Macquarie Drilling
Project Manager: Matt Bennett
Equipment/Drill Method: Geoprobe PT
Easting (AMG): 317122.014
Northing (AMG): 1247714.141
Ground Elevation (m AHD): 18.78

CH2M Hill (Australia) Pty Ltd
Level 7, 9 Help Street
CHATSWOOD, NSW, 2067

Soil Bore Log: BHD (angled bore)

Project No.: 347496
Project: Macdonaldtown Gasworks
Site/Client: Railcorp
Date: 20/10/2006
Logged By: Adam Sullivan

Final Depth (m bgs): 8.4
Bore Diameter (mm): 100
Weather: sunny

SUBSURFACE PROFILE			SAMPLE			
Depth (m)	Graphic Log	Description	Number	USCS Class	PID (ppm)	Comments
0		Ground Surface				
		Disturbed location of previous sample location MG05, no sample recovery				
6		***CLAY - Natural*** saturated grey, green with ironstone gravels				Minor HC odour Pocket of black ooze and discoloration, HC odour
7		***CLAY*** wet, red and grey mottles. Prominent fractures.	BHD/7.0		92	Slight HC odours in fractures
8			PID		241	
		SHALE extremely weathered, grey	BHD/8.4		220	
		End of Borehole				
9						

Contractor: Macquarie Drilling
Project Manager: Matt Bennett
Equipment/Drill Method: Geoprobe PT
Easting (AMG): 317107.953
Northing (AMG): 1247721.225
Ground Elevation (m AHD): 18.86

CH2M Hill (Australia) Pty Ltd
Level 7, 9 Help Street
CHATSWOOD, NSW, 2067

Soil Bore Log: BHE

Project No.: 347496
Project: Macdonaldtown Gasworks
Site/Client: Railcorp
Date: 17/10/06
Logged By: Adam Sullivan

Final Depth (m bgs): 8.4
Bore Diameter (mm): 100
Weather: overcast with showers

SUBSURFACE PROFILE			SAMPLE			
Depth (m)	Graphic Log	Description	Number	USCS Class	PID (ppm)	Comments
0		Ground Surface				
		FILL fine sand, with ballast, grey brown, dry, rootlets				no odours
1		***FILL*** silty sand, dry, black				
		FILL reworked clay, orange, grey mottles, hard, high to medium plasticity, moist				slight HC odour
			BHE/1.6		1.0	very strong HC odour, oily sheen
2		***FILL*** medium sand, yellow to white, with clay component, orange to red				
			BHE/2.2		75.0	strong HC odour
		FILL silty Clay (original surface?), yellow and grey, soft, low plasticity, moist, brown, green and black staining. Clay getting firmer and more plastic in depth.				
3		***CLAY - Natural*** grey with dark grey and orange mottles, stiff, high plasticity, rootlets, stiffer with depth, very hard and stiff @ 3.5 m BGS				
			BHE/3.5		5.0	HC odour
4		***CLAY*** medium to high plasticity, red and grey mottles, moist, very stiff				
			PID		2.7	photo of soil pore and root with black staining, strong HC odour
5		***CLAY*** high weathered fractured zone, bands of stiff grey clay				
			PID		120.0	high HC odour, visible tar in pores and fractures
6						large fracture in red weathered material, photo taken
7			BHE/7.2		203.0	
		shaley CLAY large porous fractures of red ironstone gravels, interlayered with very stiff to hard, friable, shales, grey				high odour
8			PID		532.0	high odour in fractures, low odour in shale
		End of Borehole	BHE/8.4		180.0	
9						

Contractor: Macquarie Drilling
Project Manager: Matt Bennett
Equipment/Drill Method: Geoprobe
Easting (AMG): 317131.954
Northing (AMG): 1247692.932
Ground Elevation (m AHD): 18.5

CH2M Hill (Australia) Pty Ltd
Level 7, 9 Help Street
CHATSWOOD, NSW, 2067

Soil Bore Log: BHF

Project No.: 347496
Project: Macdonaldtown Gasworks
Site/Client: Railcorp
Date: 17/10/06 - 18/10/06
Logged By: Adam Sullivan

Final Depth (m bgs): 9.0
Bore Diameter (mm): 100
Weather: overcast with showers

Depth (m)	Graphic Log	Description	Number	USCS Class	PID (ppm)	Comments
0		Ground Surface				
		FILL gravels, rail ballast, sandy, brown, dry, ash gravels and clinker				No odours
1		***FILL*** reworked Clay, red/brown, gravels of ash and coke throughout, moist, hard	BHF/1.0		2.0	
		FILL Sand, wet, soft, bands of clay				
2		***FILL*** as above, becoming silty clay, low plasticity, dark brown, black staining, wet				High odour
		CLAY - Natural medium plasticity, red and grey mottles, with fine gravels, stiff, moist, fractured clay at 3.8m, 4.0m, 4.6m.	BHF/2.6		4.0	Some odour
3						
			BHF/3.6		6.0	Refusal with push tube, continue with solid stem auger
4						
			BHF/4.6		5.0	Some odour
5		***CLAY*** grey with yellow and red mottles, very stiff, medium plasticity, prominent weathered zones				Strong odour in weathered zones, tar in pores
6			PID		174	Photo of pores Tar in pores, moderate HC odour
7		***CLAY*** very stiff, grey, no mottles, weathered zones of red and grey clay	BHF/7.0 DUP22		65.0	Moderate HC odour
8		***SHALE*** weathered, fractured shale	BHF/8.4		246	
			BHF/8.5		88.0	Tar in pores, strong odour
			BHF/9.0		64.0	
9		End of Borehole				

Contractor: Macquarie Drilling
Project Manager: Matt Bennett
Equipment/Drill Method: Geoprobe
Easting (AMG): 317135.889
Northing (AMG): 1247701.057
Ground Elevation (m AHD): 18.56

CH2M Hill (Australia) Pty Ltd
Level 7, 9 Help Street
CHATSWOOD, NSW, 2067

Soil Bore Log: BHG

Project No.: 347496
Project: Macdonaldtown Gasworks
Site/Client: Railcorp
Date: 20/10/2006
Logged By: Adam Sullivan

Final Depth (m bgs): 8.1
Bore Diameter (mm): 100
Weather: sunny

SUBSURFACE PROFILE			SAMPLE			
Depth (m)	Graphic Log	Description	Number	USCS Class	PID (ppm)	Comments
0		Ground Surface				
		Disturbed location of previous sample location MG06 Drive drilling rods to 4.8 m BGS, no sample recovery				
5		***CLAY - Natural*** medium plasticity, grey, moist, very stiff, some ironstone fractures.	PID		305	high odour of tar, free tar in majority of pores and fractures
6		***SHALE*** gradually becoming extremely weathered shale, grey with vertical fractures.	BHG/6.0		185	
			PID		35	
7			BHG/7.2		47	very minimal tar in pores, only one small pocket at 7.2 m
		SHALE moderately weathered with bands of fractured ironstone gravels	PID		5.0	
8			BHG/8.1		3.0	minor odours
		End of Borehole				
9						

Contractor: Macquarie Drilling
Project Manager: Matt Bennett
Equipment/Drill Method: Geoprobe PT
Easting (AMG): 317117.288
Northing (AMG): 1247724.529
Ground Elevation (m AHD): 18.61

CH2M Hill (Australia) Pty Ltd
Level 7, 9 Help Street
CHATSWOOD, NSW, 2067

Soil Bore Log: MG01

Project No.: 347496
Project: Macdonaldtown Gasworks
Site/Client: Railcorp
Date: 15/8/06
Logged By: Adam Sullivan

Final Depth (m bgs): 4.6
Bore Diameter (mm): N/A
Weather: sunny, with storm and hail

Depth (m)	Description	Sample Number	USCS Class	PID (ppm)	Comments
0	Ground Surface				
	FILL sandy Gravel, loose, nonplastic, brown, medium to coarse grained sand,coarse gravel, dry, with rootlets	MG01/0.1		3.0	Coke fragments, ballast, fibro sheeting fragment; no odours
		MG01/0.2		1.0	No visual cont. no odour
	FILL clay, red and grey mottles, fine grained sand component, medium plasticity	MG01/0.5		0.0	No visual contamination, no odour
1	***FILL*** silty Clay, low plasticity, yellow-brown, with some gravel, medium grained, round, moist				No visual contamination, no odour
	FILL Clay, red and grey mottles, fine grained sand component, high plasticity, withgravel, yellow and iron, medium to coarse grained, moist, with yellow clay mottles, Ø: 5 cm	MG01/1.8		0.0	Minor HC odour, small pockets of ash material (<1 cm)
		MG01/1.4		0.0	Aromatic odour
	FILL Clay, medium to high plasticity, grey with brown hues, cobble sized shale fragments, moist, with large roots				
2	***FILL*** black ash and white shale mixture, coke gravels (Ø: 2 cm), loose, moist	MG01/2.2		1.0	Minor HC odour
	FILL sitly Clay (original surface?), high silt content, brown, wet, low plasticity				Clay pipe at 2.5 m BGS
	silty CLAY - Natural brown, low plasticity, moist	MG01/2.8		N/A	
3		MG01/3.2		0.3	
	CLAY high plasticity, with red and grey mottles, moist				
		MG01/3.6		0.2	No visual contamination, faint HC odour
4					
		MG01/5.0		1.2	
5	***shale CLAY*** highly weathered with red and grey mottles, very stiff				

Contractor: Online
Project Manager: Matt Bennett
Equipment/Drill Method: 20 t Excavator
Easting (AMG): 317116.34
Northing (AMG): 1247667.86
Ground Elevation (m AHD): 18.58 (western end of trench)

CH2M Hill (Australia) Pty Ltd
Level 7, 9 Help Street
CHATSWOOD, NSW, 2067

Soil Bore Log: MG02

Project No.: 347496
Project: Macdonaldtown Gasworks
Site/Client: Railcorp
Date: 15/8/06
Logged By: Adam Sullivan

Final Depth (m bgs): 4.7
Bore Diameter (mm): N/A
Weather: sunny, with storm and hail

SUBSURFACE PROFILE			SAMPLE			
Depth (m)	Graphic Log	Description	Number	USCS Class	PID (ppm)	Comments
0		Ground Surface				
		FILL Black ash, coke gravel, clinker material (vesicular), loose, dry	MG02/0.2		50	Visual contamination, high odours Exposed old monitoring well at 0.4 m BGS (SKM MW33)
		FILL Clay, red and grey mottles, moist, medium plasticity	MG02/0.4		25	Steel pipe at 3m, 7m, 8m from west side along the trench
1		***FILL*** Seam of black ash and coke gravel				Tar pipe at 1.2 m BGS and 5 m along the trench, water seepage from service conduit, water has sheen, high HC odour
		FILL Silty Clay (original surface?), spongy, wet, dark brown to black, low plasticity, black ooze, tar	MG02/1.5 MG02/1.8		68 600	High odour
2		***CLAY - Natural*** red and yellow mottles, moist	MG02/2.0		170	
			MG02/2.7		40	HC odours
3			MG02/3.3		75	
			MG02/3.7		75	
4						
		shale CLAY increased grey clay content, becoming weathered shale rock	MG02/4.7		66	
		End of Borehole				
5						

Contractor: Online
Project Manager: Matt Bennett
Equipment/Drill Method: 20 t Excavator
Easting (AMG): 317122.41
Northing (AMG): 1247701.92
Ground Elevation (m AHD): 18.72