



5. Field and Laboratory Investigations

5.1 Analytical Data Quality Objectives

The purpose of establishing data quality objectives (DQOs) is to ensure the field investigations and analyses are undertaken in a way that enables the collection and reporting of reliable data on which to base the site assessment. The DQOs for this investigations are summarised below:

1. Sufficient data was required for sound statistical analysis (if required) in order to appropriately characterise the suspected heterogenous fill material or contaminant horizon; and
2. The data collected was required to be precise, accurate and representative of site conditions in order to provide recommendations based on interpretation of the data.

The DQOs were assessed by reference to data quality indicators as follows:

- **Data Representativeness** –expresses the degree to which sample data accurately and precisely represents a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples on a systematic basis across the site. Supplementary (targeted) sampling was undertaken in areas of known or potential contamination (such as the ash bands). An adequate number of sample locations were chosen to characterise the site to the required accuracy in accordance with the stated objectives. Consistent and repeatable sampling techniques and methods were utilised throughout the sampling.
- **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. This includes adjusting sample density and number in order to sufficiently delineate between fill and natural material on site. If there is insufficient valid data, as determined by the other data quality objectives, then additional data are required to be collected.
- **Comparability** - is a qualitative parameter expressing 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. Reporting of results was done in consistent units and nomenclatures, and comparability was achieved by ensuring that precision and accuracy objectives are met.
- **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) of duplicate samples. The criteria used for the assessment of RPDs are based on guidelines given in AS4482.1, 1997. If duplicate results are not within the acceptable RPDs, investigation into the cause is initiated. If a cause cannot be determined, the validity of the data is questioned.



- **Accuracy** - measures the bias in a measurement system. Accuracy can be undermined by such factors as field contamination of samples, poor preservation of samples, poor sample preparation techniques and inappropriate selection of analytical techniques by the testing laboratory. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards. Accuracy of field works is checked by ensuring no contamination is detected in equipment blanks. The accuracy of the laboratory data that is generated during this study is a measure of the closeness of the analytical results obtained by a method to the 'true' value. For reference laboratory methods (eg, USEPA methods) the following levels of accuracy should generally be achievable within $\pm 15\%$ of:
 - the expected value of a certified reference material of similar matrix; or
 - the value obtained by a separately validated and recognised quantitative method for the sample matrix.

5.2 Rationale for Sampling Quality and Analysis Plan

The *NSW EPA (1995) Sampling Design Guidelines* nominally recommends a minimum number of sampling locations to characterise contamination within a site of a certain area. Minimum number of sampling locations are based on the detection of circular hotspots with a 95% degree of confidence.

As the objective of the current investigation is to delineate the vertical and horizontal extent of contamination in the vicinity of the hotspot located at TP44, GHD considered that a targeted sampling strategy would be the most effective method of delineating contamination around TP44.

The sampling strategy was based on the principal of first locating TP44 and then stepping out from TP44 on a 5m and 10m grid spacing (i.e. to the north, south, west and east). Note sampling was not conducted to the south of TP44 as that area is located on the Gasworks area, which is not part of the current redevelopment area. Instead, three test pits that would nominally have been excavated south of TP44 were instead excavated immediately adjacent to TP44.

Execution of the sampling strategy resulted in the excavation of 11 test pits with three pits (TP1 to TP3) located on the southern side of the chain wire fence in the immediate vicinity of TP44, and the remaining eight test pits (TP4 – TP11) located on the northern side of the chain wire fence in the Cleaning Sheds area.

5.3 Pre-Excavation Site Works

5.3.1 Site Inspection

A GHD Senior Environmental Scientist undertook a site inspection prior to test pitting on Wednesday 17 August 2005. A summary of the relevant information includes:

- At the time of the works, the site was vacant and covered with grass and weeds;



- ▶ A chain wire fence was located across the southern portion of the site and is the demarcation line between the former Cleaning Sheds area and the former Gasworks area to the south;
- ▶ A timber post and rail was located north of the site adjacent to the main access road;
- ▶ A brick retaining wall was located about 4m to the south of the chain wire fence in the Gasworks area, and formed the southern boundary of the site investigation area. The ground level is approximately 1.5m lower on the southern side of the retaining wall;
- ▶ A thin grass cover, over railway ballast formed the ground surface in the majority of the site;
- ▶ Physical evidence of gross contamination or other potential sources of contamination were not observed in the delineation sampling area during the site walk over.

Based on the observations made during the site walkover, the sampling and analysis strategy presented in the tender did not require alteration or addition.

5.3.2 Services Clearance

Prior to commencement of investigation works, GHD cleared test pit locations of underground services by completing the following:

- ▶ Review of site plans and service clearance certificates provided by RailCorp/RIC for all rail-related utilities, including electrical, signal, civil, building and communications;
- ▶ Review of all available Dial-before-You Dig services plans for all non rail related underground utilities; and
- ▶ Clearance of each test pit location by a professional cable locator (Dags Locating Services).

5.3.3 Surveying

Prior to field investigations, former test pit TP44 was located on the ground so that delineation test pits could be correctly positioned on 5m and 10m grid spacings out from TP44. GHD employed the services of registered surveyor (Simon Berrisford from SPB Surveying) to set up on site and locate the position of TP44 based on the ISG coordinates provided by CH2M Hill on the TP44 soil log.

The surveyor located TP44 on the southern side of the chain wire fence approximately 1m into the Gasworks area on the thin raised patch of land between the brick retaining wall and the chain wire fence. This position correlates to that of TP44 on CH2M Hill's report figures that place TP44 approximately 2m to the north of the retaining wall.

Following the correct positioning of TP44, the location of the delineation test pits were marked out using a survey tape. Following actual test pitting, two points on the pits (north and south of pit) were surveyed.



5.4 Soil Investigation

Soil investigations were undertaken on the 17 August 2005. Sampling was undertaken by excavating test pits with the aid of a backhoe. Test pit locations are shown on **Figure 3**.

Test pits were continued to depths ranging from 0.7m to 2.0m. Test pits were terminated either due to refusal on man made objects (such as former building footings) or at a designated depth in residual soils. Test pits were backfilled with pit spoil cuttings with nominal compaction.

Soils encountered during the investigations were described in general accordance with the Unified Soil Classification System (USCS) and GHD's standard logging procedures, with features such as constituents of debris, discolouration, staining, odours and other indications of contamination being noted. This information was recorded on the field log, completed for each of the sampling locations. Test pit logs are provided in **Appendix A**.

Soil samples were collected from test pit locations generally at the surface (0-0.2m), and then at different geological horizons (such as fill / topsoil; ash; clay) to assess the vertical extent of contamination. Additional samples were collected from soil horizons or fill that exhibited staining, odours, elevated PID¹ readings, or other physical evidence of potential contamination.

Where possible, samples were collected from the centre of the backhoe bucket or from the sides of the exposed test pit walls. Samples were field screened using a PID (calibration certificates are provided in **Appendix B**).

Soil samples were immediately transferred to sample containers that had been pre-treated in a manner appropriate for the laboratory analysis. The sample containers were transferred to a "chilled" esky for sample preservation before and during shipment to the testing laboratory. A chain-of-custody form was completed, and was forwarded with the samples to the testing laboratory. Disposable latex gloves were used to collect each sample. Sample jars were Teflon lined with the Teflon side of the septum facing the sample.

5.5 Soil Laboratory Program

The laboratory program is presented in **Table 5.1**. Samples suitable for laboratory analysis, but not selected for analysis, were stored at the laboratory for future testing if required. The primary laboratory used for analyses was Envirolab Services Pty Ltd which is NATA accredited for the analyses undertaken. All samples collected were handled under chain of custody conditions.

¹ The photoionisation detector (PID) is a hand held device used to measure volatile organic concentrations in ambient air. It can therefore be used as a preliminary "check" for the possible presence of volatile contaminants such as BTEX, and light fraction TPH species.