



Kirklees Council
Design & Property Services
Kirkgate Buildings
Byram Street
Huddersfield
HD1 1BY

**Phase II Environmental & Geotechnical Site Assessment
and Generic Risk Assessment
Land off Forge Lane
Thornhill Lees
Dewsbury
WF12 9EN**

**June 2011
962340101**

Prepared by:

ARCADIS (UK) Limited
1 Whitehall
Riverside
Leeds
LS1 4BN
Tel: 01132 845 322
Fax: 01132 845 301
www.arcadis-uk.com

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Land off Forge Lane, Dewsbury
962340101_02 / October 2011**

Report Details

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		Consultant	Principal/Senior Consultant	Director

If you have any queries regarding this project, please contact Darren Calvert or Andrew Smith.

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List of Abbreviations that may be used in this report

ARCADIS	ARCADIS (UK) Limited
BGS	British Geological Survey
BRE	British Research Establishment
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CAT	Cable Avoidance Tool
CIRIA	Construction Industry Research and Information Association
CL:AIRE	Contaminated Land: Applications In Real Environments
CoP	Code of Practice
CPT	Cone Penetration Testing
CS	Characteristic Situation
DQRA	Detailed Qualitative Risk Assessment
EA	Environment Agency
EDD	Electronic Data Deliverable
EDMS	Environmental Data Management System
EQS	Environmental Quality Standard
GAC	Generic Assessment Criteria
GPR	Ground Penetration Radar
GPS	Global Positioning System
GSV	Gas Screening Values
HDPE	High Density Polyethylene
l/hr	Litres Per Hour
m AOD	Metres Above Ordnance Datum
m bgl	Metres Below Ground Level
MDL	Method Detection Limit
MTBE	Methyl Tertiary Butyl Ether
NAPL	Non-Aqueous Phase Liquid
NRA	National Rivers Authority
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
PID	Photo Ionisation Detector
ppm	Parts Per Million
PSD	Particle Size Distribution
SGV	Soil Guideline Value
SPT	Standard Penetration Test
SPZ	Source Protection Zone
SSAC	Site Specific Assessment Criteria
SSSI	Site Special Scientific Interest
SVOC	Semi-Volatile Organic Compounds
TOC	Total Organic Content
TPH	Total Petroleum Hydrocarbons

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VOC Volatile Organic Compounds
WAC Waste Acceptance Criteria
% v/v Percentage by Volume

1 INTRODUCTION

In January 2011 ARCADIS (UK) Limited (ARCADIS) was commissioned by Kirklees Council to carry out an environmental and geotechnical site assessment at land located off Forge Lane Dewsbury (the site).

A site location plan is presented as Figure 1.

The works were conducted in general accordance with the proposal for *Forge Lane, Dewsbury - Stage 1B Assessment (Issue_04)*, December 2010, ARCADIS document reference 962340001_04. This report represents Stages 3A and 3B documenting works conducted as part of Stage 2 of the works as set out in the Site investigation Frameworks Agreement.

1.1 Background Information

Several reports detailing assessments relevant to the site have been compiled by others. The reports considered to include information salient to the Stage 2 and 3 assessments are listed below in chronological order:

- Exploration Associates Volume 1_Factuial Report on Ground Investigation (May 1997)
- Exploration Associates Volume 2_Interpertive Report on Ground Investigation (April 1997)
- Exploration Associates Interpretive Report on Ground Investigation (April 2000)
- CL Associates Advice on Proposed Development Report
- Bullen Consultants Phase 1 Desk Study (July 2004)
- CL Associates Review of Existing Reports (December 2005)
- RPS Consultant Site Check Review (September 2010)

In addition to the above reports, Kirklees Council has also provided the following report, detailing validation of the remedial works conducted on the land to the east of the site, the site of the newly commenced residential scheme being undertaken by Miller Homes.

- Encia Environmental Ltd *Verification Report for the Remediation & Preparatory Works of Land at Brewery Lane, Dewsbury*, Report No: 9292/4 February 2009 prepared for Miller Homes Limited

Outline planning permission was granted for the proposed development in December 2006. It is understood that the reserved matters submission was submitted in December 2010, with a decision pending. Of the various conditions to be discharged, conditions numbers 19 to 23 refer to remediation of the site. Previous assessments conducted have identified the requirement for remediation to render the site suitable for the proposed residential development.

The outline planning permission is presented as Appendix A.

1.2 Objectives

It is understood that the ultimate objective of works at site is to provide information on potential remedial strategies and abnormal cost estimates that can be passed to a prospective developer. It is understood that the client recognises that the site investigation will represent the first stage of a multi-staged assessment approach.

The project has been carried out within the existing legislative framework and regulatory guidance, which is outlined in Appendix B.

1.3 Reliability of Information / Limitations

A complete list of ARCADIS Study Limitations is presented in Section 12.

This assessment is based on one round of groundwater sample collection and monitoring. As detailed in Section 2.7, the EA have stated a requirement for three rounds of monitoring to be conducted. The final assessment should be conducted following completion of the additional two rounds of monitoring.

2 BACKGROUND INFORMATION AND ENVIRONMENTAL SETTING

The following subsections provide a summary of the findings of the work carried out to date and have been compiled in reference to previous site investigation conducted by others. The final subsection provides details of the agreed investigation strategy employed.

2.1 Site Location and Setting

The site is located off Forge Lane in Thornhill Lees, Dewsbury (see Figure 1). The centre of the site can be approximately located by National Grid Coordinates 423700, 419708. The Ordnance Survey map for Bradford and Huddersfield (Sheet 288, 1:25,000 scale) indicates the site lies between approximately 40 and 45 metres above ordnance datum (mAOD).

The site is approximately rectangular with maximum dimension of approximately 200m north-east to south-west and approximately 350m north-west to south-east. The north-western site boundary is bound by Forge Lane, the north-eastern boundary is marked by the Hebble and Calder Navigation. To the east of the site is the current Miller Homes residential development. The south-western site boundary was bound primarily by allotment gardens and residential properties.

The western third of the site is predominantly covered by hardstanding associated with demolished structures previously located in this part of the site. The remainder of the site is covered with rough vegetation which was dense in several areas..

A pond is located in the southern central portion of the site. It is understood that the volume of water within the pond fluctuates depending upon on the prevailing weather conditions. To the north of the pond is a raised embankment associated with the former rail line that ran through across the site.

A surface water ditch enters the site from the southern boundary (approximately 100m from the eastern site boundary) with water emerging from the ground at a point immediately south of the site. The ditch crosses the site towards the north and at approximately 20m south of the canal turns to the west and runs parallel to the canal. At the approximate site midpoint the water within the ditch is culverted. The culvert runs parallel to the canal towards the north-west corner of the site at which point it is diverted northwards and understood to flow beneath the canal and off site. The main features of the site can be seen on Figure 2.

2.2 Previous Site Investigation Findings

As detailed in Section 1.1 above, a number of previous investigations and reports of the site have been carried out. The information below is a brief summary of the pertinent information relevant to this report:

2.2.1 Exploration Associates Factual and Interpretative Reports (1997 & 2000)

Exploration Associates undertook a ground investigation at the site in 1997 comprising 15 cable percussion boreholes (between 6.5m and 11.5m bgl) and 13 trial pits (up to 5.0m bgl). Separate factual and interpretative reports were produced.

In 1999 an additional investigation was undertaken comprising five cable percussion boreholes (between 6.0m and 11.0m bgl) and 10 trial pits (up to 4.8m bgl). An interpretative report was produced for this phase of site investigation.

Exploratory holes were located across the entirety of the site, with the additional site investigation aimed to address data gaps and comments from regulatory bodies following the previous investigation. The additional investigation was targeted to further investigate the western portion of the site representing the location of the previous works on site.

Ground conditions encountered across site generally comprised made ground overlying Alluvium (including some peat), sands and gravels, Glacial Till and bedrock (generally mudstone, rarely sandstone).

Groundwater was shown to be resting between 36.20m AOD and 36.70m AOD in standpipes monitored across site.

The soil contamination assessment was based on now outdated ICRL (Interdepartmental Committee for the Redevelopment of Contaminated Land) guidelines. The water contamination assessment was based on the cut off values for uncontaminated leachate (proposed in guidelines for waste disposal) and Dutch Intervention Guidelines, also now outdated.

Both assessments in the 1997 and 2000 reports have shown elevated concentrations of several heavy metals and inorganic compounds in soils, specifically arsenic, together with some elevated concentrations of polycyclic aromatic hydrocarbons (PAH) and pH. The reports stated that a hazard to human health exists and that either the receptors should be protected from the material through a capping layer of clean material, or the impacted material be removed from site.

Laboratory results of both groundwater and surface water (both the canal and pond) have shown elevated levels of ammoniacal nitrogen. The interpretative report from 2000 concluded that the elevated levels are a result of an off site source and that remedial options may prove unsuccessful.

The current proposed development is different to that at the time of issue of these previous reports; it is therefore considered that any conclusions and recommendations set out in previous reports in reference to the proposed layout may not be applicable. The geotechnical recommendations presented in the previous reports will be referenced and discussed where applicable as part to the Geotechnical appraisal included in this report (Section 11).

2.2.2 Bullen Consultants Phase 1 Desk Study (2004) and RPS Consultants Site Check Review (2010)

Both of these desk studies report details of the site history and potential sources of contamination. Historical maps have shown the site to contain various industrial works since at least 1855 including a glass works, steel and iron works, mineral railway line and gravel pit. The works were confined to the western portion of the site as represented by the current hardstanding. Previous site uses were deemed to have the potential to be a source of contamination including a variety of heavy metals, inorganics, PAH, chlorinated aromatic hydrocarbons, asbestos, PCBs and petroleum hydrocarbons. A number of off site potentially contaminative sources were also identified; however, they did not highlight any additional sources of contamination to those from on site sources.

2.2.3 CL Associates Review of Existing Reports (2005)

CL Associates carried out a brief review which summarised all of the reports carried out to 2005. This report highlighted that a former electricity substation is present in the north-west corner of site which may be a source of PCBs. The report concluded that the previous reports have generally characterised the site, however, petroleum hydrocarbons or volatile organic

compounds (VOC) were not scheduled on soil samples. It recommended that further laboratory testing and detailed quantitative risk assessment (DQRA) may be required.

2.2.4 Encia Environmental Verification Report of land at Brewery Lane, Dewsbury (2009)

A verification report was prepared for the site immediately to the east of the Forge Lane site. The report details the remedial strategies undertaken to make the site suitable for the residential development. Pertinent to the Forge Lane site, petroleum hydrocarbons and PCBs dissolved into groundwater were present prior to remediation. Remedial techniques involving pumping dissolved oxygen into the groundwater to encourage micro-organisms to break down the contaminants were conducted. The verification report stated that remedial targets were met on completion of the remediation.

2.3 Site History

Historical information from the EnviroCheck and SiteCheck reports (contained within the previous desk studies - Bullen Consultants, 2004 and RPS Consultants, 2010) was reviewed to ascertain the site's history.

The site has historically been split into the eastern and western portions. The eastern portion has been generally undeveloped with embankments and earthworks taking place from the mid 20th Century to present.

The western portion of site has been used for industrial purposes from before the mid 19th Century when a glass works was present. The works expanded towards the centre of the site by the turn of the 20th Century and by 1908 a gravel pit was marked in the southern-central portion of site. By the 1920's the northern portion of the glass works had been changed into the "Thornhill Iron and Steel Works" with the gravel pit now marked as a pond feature. By the middle of the century the glass works had been fully replaced by the iron and steel works. The main factory buildings underwent several changes until the late 1980's when they were demolished.

2.3.1 Anecdotal Evidence

Anecdotal evidence from a local neighbour suggested that the pond on site was formerly used as a slurry pit for low grade coke coal. The coal coke was generated at Ingham Pit and arrived at site through drains from Ingham Pit. Cranes located on concrete pads adjacent to the slurry pit were used to dredge out the slurry from the pond. The material dredged out was mounded up on to the south of the slurry pit and left to drain, forming the mounds which are still present on site. It was further detailed that a drainage ditch was previously located to the south of the dredge mounds, used to collect surface runoff which was collected and diverted around the site perimeter. The resident informed ARACDIS staff that testing of soils within his allotment gardens adjacent to the dredge mounds were reported to contain elevated concentrations of arsenic.

It was also suggested material generated from the demolition of a local former power station, including cooling towers, was 'dumped' in the centre of the site forming the current raised mound in the central portion of the site to west of the north-south trending draining ditch.

The land to the east of the north-south trending ditch was the original ground surface level (i.e. no made ground/landfilling activities).

2.4 Environmental Setting

The salient points for the geology, hydrology and hydrogeology have been summarised below.

2.4.1 Geology

The 1:50,000 Series British Geological Survey (BGS) map sheet 77, Huddersfield (solid and drift) indicates the near surface geology underlying the site to comprise Recent and Pleistocene Alluvium overlying undifferentiated River Terrace Deposits. Lower Coal Measures mudstones and sandstones underlie the drift deposits with a coal seam running north-south through the site (desk study details relevant to coal seams are included in Section 3).

The 1:10,000 series BGS sheet SE21NW shows the site to be underlain by Alluvium which is in turn underlain by Lower Coal Measures. Two coal seams, one un named (recorded as up to 0.4m in thickness) and the Green Lane (or Middleton Little) seam, (recorded as 0.3 to 0.7m thick) outcrop in an approximate north-south strike. The sheet also records an area of made ground in the eastern part of the site..

The County Geological map of Yorkshire Sheet 247NE shows the site to be underlain by Middle Coal Measures with the New Hards Coal running through the site in a north-south strike.

2.4.2 Hydrogeology

The Environment Agency (EA) website shows that the site is not located within a source protection zone. It also shows that the site is located over a Secondary A aquifer¹ (both superficial deposits and bedrock). The Environment Agency defines Secondary A aquifers as:

permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers

2.4.3 Hydrology

There are two surface water features located on site, a pond a ditch (which is culverted in part). The Calder and Hebble Navigation forms the site's northern boundary. The River Calder is located approximately 500m to the west of site at its nearest point. The EA website designates the River Quality Grade C – Fairly Good (chemistry only).

2.4.4 Groundwater and Surface Water Abstractions

There are nine surface water and four groundwater abstractions within 1km of the site, none of which are within 250m. Uses are generally industrial and commercial including spray irrigation, laundry, mineral washing and cooling.

2.5 Other Environmental Reports

Several other environmental reports were provided to ARCADIS. These included flood risk assessments, ecology reports, transport assessments, acoustic assessments arboriculture assessment and landscape assessment.

Information pertinent to the site investigation presented in this report comprised the presence of Japanese Knotweed (JK), asbestos and badger setts on site. To mitigate the risks associated with the asbestos, Kirklees Council provided a drawing marking out areas of the site which were identified to contain asbestos cement sheet fragments. These were adopted as 'exclusion zones'. ARCADIS implemented a JK management plan, based on current best practice and guidance to mitigate the potential spread of JK across the site. Exclusion zones (20m and 30m for drilling and excavating respectively) were established surrounding the setts located within the embankment to the north of the pond.

2.6 Proposed Development

Details of the proposed development were provided to ARCADIS. The development generally comprises low density residential housing with associated gardens and access roads. The pond is to be retained as is the drainage ditch in the east of the site. The proposed layout is shown on the West and Machell drawing 2776(1)P007b, presented as Appendix D.

2.7 Discussions with the Regulators

A meeting was held with Kirklees Council Environmental Health Officers in order to design the intrusive investigation works. Kirklees Council had reviewed the previous reports as part of the outline planning application submission. It was recognised that the previous reports contained information that was set against standards of assessment that are now outdated. Kirklees Council was in general agreement with the proposed strategy set out in the Stage 1B Assessment. The potential requirement for a detailed quantitative risk assessment following the site investigation (Stage 2 and 3) was discussed as previous reports had highlighted this requirement. It was recognised that to some extent the remedial strategy is pre-defined as a result of the requirement to raise levels (i.e. create capping layer) to meet minimum finished floor levels as set out in the outline planning permission.

Kirklees Council had specific comments regarding the gas monitoring programme and it was agreed that the monitoring to be conducted would likely form an initial ground gas assessment. The potential requirement for further monitoring would be based on the findings of the initial monitoring to be conducted.

The EA had the following comments to make following review of the Stage 1B Assessment.

Without having seen the previous reports and history of the site we are limited in the detail of our response. However, the recommendations seem reasonable.

In addition to what has been proposed we recommend you:

- 1) *Survey the monitoring locations to get accurate ground and groundwater level information.*
- 2) *Include a quantitative risk assessment*
- 3) *Carry out at least three rounds of groundwater monitoring*
- 4) *Follow the risk management framework provided in CLR11, Model Procedures for the Management of Land Contamination, when dealing with land affected by contamination.*

The response from the EA is included as Appendix C. The EA response was discussed with the client and it was deemed that item 1 was to be included as part of the current workscope. In reference to item 2, it was discussed that the Stage 3 report (i.e. this document) would include a generic quantitative risk assessment and that the requirement for a detailed

quantitative risk assessment would be borne out of the generic assessment. In reference to item 3, it was agreed that one groundwater monitoring visit would be conducted as part of the current workscope with a second and third monitoring event to be conducted at a later date following review of initial findings.

2.8 Investigation Strategy

The scope of work was developed in accordance with the document Model Procedures for the Management of Land Contamination (Contaminated Land Report 11), published by DEFRA and the EA in 2004. An overview of the process is presented in Appendix E.

The outline scope of works is as follows and is discussed in more detail in Section 5:

- Establish exclusion zone around asbestos encountered on site;
- Coal Mining Desk Study Assessment;
- Implementation of a Japanese Knotweed Management Plan (JKMP) to allow work to be conducted in areas infested with Japanese Knotweed;
- Demarcate an exclusion zone around badger set(s) identified on site;
- Advancement of up to 20 No. trial pits to an approximate depth of 4.0m bgl;
- Advancement of up to 18 No. window sample boreholes;
- Advancement of up to 6 No. cable percussion boreholes to a nominal depth of 10m bgl;
- Soil, groundwater and surface water sampling
- Geotechnical and environmental laboratory testing;
- Advancement of up to 5 No. rotary probing boreholes to a nominal depth of 25m bgl in areas of potential historic mine workings;
- Conduct up to 6 No. in-situ California Bearing Ratio tests;
- Conduct up to 8 No. rising head tests in monitoring wells across the site;
- Ground gas monitoring of window sample boreholes;
- Surveying of newly installed monitoring wells, trial pits and sampling points to determine location and elevation relative to Ordnance Datum (conducted by third party under instruction of Kirklees Council with data made available to ARACDIS); and
- Report detailing the works on site, presenting the laboratory results conducting a generic quantitative risk assessment and revising the conceptual site model.

The existing site layout plan with the exploratory hole locations is presented as Figure 2.

3 COAL MINING DESK STUDY

A Coal Authority coal report was provided to ARCADIS by Kirklees Council. The report stated that there were recorded workings in two seams of coal at depth, but that any surface settlement with these workings should now be complete. The report also noted that the site may have coal at or close to the surface (in addition to two seams at greater depth) which may also have been worked..

The Coal Authority do not hold records of historic coal mining prior to 1872. It is therefore possible in areas where coal is present at shallow depth that abandoned workings may be present, but for which there are no records that exist.

The coal report is presented as Appendix F.

As part of further correspondence, the Coal Authority stated that the shallow coal at or close to the surface (as detailed in the presented in the Mining Report) was in reference "to the possibility of unrecorded shallow coal workings in the Middleton Little and the Low Fenton seams. The two seams referred to in the report that contain recorded coal workings are the Top Beeston (120m depth) and the Black Bed (240m depth) seams

ARCADIS attended the Coal Authority Mining Records Office to view abandonment plans however no abandoned mine plans exist for workings in the two shallow seams at this locality.

Review of BGS Geology Map Sheet SE21NW (Grange Moor) Solid and Drift, 1:10 000 series details the presence of two coal seams that are projected to outcrop beneath the site. The Green Lane/Middleton Little Coal (GL), 0.3-0.7m thickness, is shown to outcrop trending north south across the eastern portion of the site, younging to the east. The vertical section included on the BGS map indicates that the second seam projected to outcrop, trending north south across the western portion of the site, corresponds to an unnamed coal seam, up to 0.4m thickness. This unnamed coal is indicated to be approximately 10.5m stratigraphically below the GL seam. The stratigraphic succession of strata details a younging direction to the east. The next coal seam indicated as stratigraphically below the unnamed seam (i.e. conjectured to outcrop to the west of the site) is the New Hards/Middleton Main Coal (NH). The NH seam, 0.2 to 0.4m thickness, is shown to be approximately 21m below the unnamed coal. Given the thickness and anticipated depth, the NH seam is not considered likely to be within the zone of influence of future developments on site.

BGS borehole log SE21NW102 Borehole 2, located to the North of Brewery Lane Bridge (included in Bullen Consultants Desk Study) detailed the presence of 0.5m thick unit of coal at approximately 15m bgl, with depth to mudstone bedrock recorded at approximately 13m bgl. The Exploration Associates Ground Investigation report details strata dip south east. It is considered that the coal seam recorded on this log corresponds to the Third Brown Metal/Stone Coal, projected on the BGS Geology Map to outcrop immediately east of the site. Given a younging direction to the east, this coal seam is not indicated to be present beneath the site.

Guidance set out in CIRIA 'Special Publication 32 (reprinted 2002) – Construction Over Abandoned Mine Workings' states that "voids resulting from mineral extraction are unlikely to migrate more than 10 times the seam thickness" (it is further stated however that even this empirical rule is disputed). In accordance with the above guidance, there should be ten times the seam thickness of solid rock to provide adequate coverage from resulting void migration (i.e. roof collapse). For example, a 1m coal seam should have 10m of rock above the top of the seam to provide adequate cover. The assessment should also take into consideration the stresses imposed on the soil or rock from the base of any proposed foundations. It should

also be noted that for multiple worked seams, rock above any subsequent workings should not be counted as “competent”.

Based on the guidance provided by the Coal Authority and the anticipated sequence of strata, it is therefore concluded that if present, workings within the two shallow coal seams outcropping beneath the site could potentially result in surface instability.

To prove the presence or otherwise of coal workings beneath the site, it was recommended that rotary probing be conducted to investigate the presence of coal, workings or voids. The desk study information indicated a maximum seam thickness of 0.7m at shallow depth beneath the site. Previous investigations have shown rock to be encountered to ~10m bgl. To allow for investigating the presence of otherwise of shallow seams and proving sufficient thickness of cover in the absence of worked seams in consideration of the potential zone of influence of foundations, a nominal investigation depth of 25m was deemed adequate subject to the actual ground conditions encountered.

Further discussion of the findings of the intrusive investigation are included in Section 6.1.1,

4 OUTLINE CONCEPTUAL SITE MODEL

Based on the information presented in the previous desk studies and reports and the current review, an outline Conceptual Site Model (CSM) of the site has been prepared and illustrates the potentially active pollutant linkages. A pollutant linkage exists only when a source, pathway and receptor are linked together.

- A **source** is a substance that has potential to cause harm or adversely affect controlled waters.
- A **receptor** is something that could be adversely affected by a contaminant such as human health, an ecological system, animals or crops, buildings or controlled waters.
- A **pathway** is a route or means by which a receptor can be exposed to, or affected by, a contaminant.

The outline CSM is presented in Figure 3 and is summarised below:

4.1 Sources

The following potential pollutant sources are considered to be present:

- Made ground across the site, with contaminants of concern (CoC) including inorganics, heavy metals and PAHs;
- Other CoC related to former site uses (Glass, steel and iron works) including inorganics, heavy metals, PAH, TPH, PCB and asbestos.
- Asbestos from imported made ground on site;
- Ammoniacal nitrogen in groundwater; and
- Dissolved phase hydrocarbons and PCB in groundwater from adjacent site.

4.2 Pathways

The following pollutant pathways are considered to be potentially active;

- Dermal contact;
- Ingestion;
- Outdoor and indoor vapour inhalation;
- Accidental inhalation of wind blown dust of contaminated soil ;
- Sub-surface migration; soil leaching and lateral migration of groundwater;
- Migration of ground gases from soil and groundwater and accumulation in confined spaces leading to asphyxiation and/or explosion;
- Direct contact of soil and groundwater with building infrastructure including future foundations and services;
- Contact of the root zone of plants used in future landscaping with contaminated material and root uptake of contaminated shallow groundwater; and
- Migration of leachable contaminants along buried services.

4.3 Receptors

The following receptors are considered to be potentially at risk from the identified pollutants;

- Future site users (future residents);
- Construction workers and maintenance staff;
- Calder and Hebble Navigation adjacent to the north of the site;

- Surface water features on site (pond and drainage ditch);
- Shallow groundwater;
- Flora used in landscaping;
- Adjacent site residents and structures; and
- Future buildings structures and services.

5 ENVIRONMENTAL AND GEOTECHNICAL FIELD INVESTIGATIONS

5.1 Introduction

The intrusive phase of the investigation was undertaken between 14th and 25th February 2011. Subsequent groundwater and surface water monitoring was conducted between 2nd March and 7th March 2011. Ground gas monitoring is ongoing and will be reported separately.

The site layout plan, showing exploratory hole locations, is presented as Figure 2.

5.2 Health and Safety

Prior to commencing any works a site specific health & safety plan was developed for the site works. This was based on information obtained from the previous intrusive investigations and observation made during the site walkover conducted by ARCADIS on 18th October 2010.

5.3 Investigation Scope

The scope of the investigation work comprised the following main aspects:

- Advancement of up to 20 No. trial pits to an approximate maximum depth of 4.0m bgl;
- Advancement of up to 18 No. window sample boreholes;
- Advancement of up to 6 No. cable percussion boreholes to a nominal depth of 10m bgl;
- Soil, groundwater and surface water sampling
- Geotechnical and environmental laboratory testing;
- Advancement of up to 5 No. rotary probing boreholes to a nominal depth of 25m bgl in areas of potential historic mine workings;
- Conduct up to 6 No. in-situ California Bearing Ratio tests;
- Conduct up to 8 No. rising head tests in monitoring wells across the site;
- Ground gas monitoring of window sample boreholes;
- Surveying of newly installed monitoring wells, trial pits and sampling points to determine location and elevation relative to Ordnance Datum; and

The exploratory hole logs are presented in Appendix G.

5.3.1 Variations

Only four cable percussion boreholes were advanced during the site works. Two boreholes were not advanced due to access difficulties and because previous monitoring wells were identified in a usable condition in close proximity to the proposed locations.

Two additional window samples and five additional trial pits were conducted in areas considered necessary based on conditions encountered in adjacent exploratory locations and to improve the investigation site coverage.

Five dynamic probe holes were carried out to help delineate the extents of the former gravel pit.

5.4 Intrusive Investigation Strategy

5.4.1 Rationale

Window Sample Investigation

The window sample investigation was designed primarily to obtain a more detailed understanding of soil and groundwater conditions across the site and to provide information on the geological strata underlying the site. Monitoring wells were installed in all window sample locations to facilitate subsequent groundwater and ground gas monitoring.

Trial Pit Investigation, Further Characterisation of Shallow Soils

Trial pitting was deemed to provide an effective way of obtaining representative shallow soil samples across a wide area, in particular, the shallow made ground. In the vicinity of the former gravel pit, the trial pits were extended as trenches in order to delineate the extent of this feature.

Plate Bearing Tests

Plate bearing tests (PBT) were conducted to provide geotechnical data for the proposed development specifically for use on roadways. As such, locations of the PBT were positioned relative to proposed roadways.

Cable Percussion Boreholes

The primary purpose of these boreholes was to provide geotechnical information relevant to foundation design. The information obtained from these boreholes will be used to corroborate the information on ground conditions presented in the boreholes conducted as part of the previous site investigations. Monitoring wells were installed in each borehole to enable subsequent groundwater and ground gas monitoring.

Soil Sampling

The soil sampling was designed and conducted in general accordance with *EA document Secondary Model Procedures for the Development of Appropriate Soil Sampling Strategies for Land Contamination, R&D Technical Report P5-066/TR*, which indicates that an approximate 20m x 20m sampling grid is required over areas to be redeveloped for residential end use. The sample grid was designed to take into account the soil samples obtained from previous investigations and fill data gaps observed in previous works. One sample was taken from each exploratory hole location and a second sample was obtained from roughly 20% of locations. Samples were predominantly obtained from made ground material with a lesser number of samples considered sufficient to characterise natural soils.

Groundwater Assessment

Groundwater monitoring included the inspection of all 22 newly installed monitoring wells and pre-existing monitoring well BH5a. The monitoring allowed the measurement of groundwater elevations in order to determine a groundwater flow direction.

Rising Head Tests

Rising head tests were conducted to provide an estimation of the conductivity of the strata beneath the site. This data may be used as part of a potential future detailed quantitative risk assessment.

Pond Profiling and Pond Sediment Sampling

It is understood that the pond represents a man made feature and is retained as part of the proposed development. Pond profiling was intended to provide information on the depth and shape of the pond. The pond profiling was not intended to provide detail on the construction design of the pond. Sediment sampling was conducted to provide information on the sediment quality at the base of the pond.

Surface Water Assessment

Surface water samples were taken from the on site pond and ditch and also from the canal that borders the site in order to assess the water quality in these features.

Ground Gas Assessment

The strategy for installation of the monitoring wells was designed in general accordance with CIRIA C665, guidance document *Assessing risks posed by hazardous ground gases to buildings*, 2007.

Up to 27 monitoring wells were monitored during each visit, comprising a combination of monitoring wells installed during this and previous phases of investigation.

The gas monitoring results are to be compared with the above referenced CIRIA C665 document to identify the ground gas Characteristic Situation and the most suitable option to address potential ground gas issues pertaining to the proposed development. A separate document will be prepared to detail the ground gas assessment following completion of the six visits continued ground gas monitoring.

5.4.2 Methodology

Utility Clearance

Utility clearance was carried out prior to intrusive site investigation works. The utility clearance procedures were designed to enable the safe advancement of boreholes and trial pits. ARCADIS' provided a detailed non-invasive utility procedure which comprised a two step process:

- Review of available utility company drawings; and,
- The use of equipment such as Cable Avoidance Tool (CAT), Sonde and Ground Penetrating Radar (GPR) to assist in identifying sub-surface utilities and services in order that investigation points could be located away from known services.

Trial Pitting

Trial pitting was undertaken using a back hoe type excavator or a 360° tracked excavator. Each trial pit dimension was approximately 3m x 1m x 4.0m. Personnel are not permitted to enter the trial pits, and therefore samples were taken from the excavator bucket for field screening with PID and subsequent laboratory analysis. Photographs were taken of each trial pit and spoil to provide a visual record of the material excavated. Selected photographs are presented in Appendix H highlighting general site conditions.

Plate Bearing Tests

PBT were carried out in six locations across the site at specific locations relating to proposed roadways. An excavator removed any topsoil or the top layer of made ground where the test can be undertaken. The equipment is set up on the location and the tracked excavator used as kentledge.

Window Sampling

Window sample boreholes were drilled using a percussive Competitor rig which drives a steel 1m sampler into the ground by utilising a drop weight. The sampler had a plastic sleeve which collected the soil sample and enabled logging and sub-sampling.

One soil sample was taken from each of the investigation positions (generally from the upper made ground material) with an additional sample taken from selected locations to characterise the range of strata encountered at different depths.

Cable Percussion Drilling

Four deep boreholes were drilled using cable percussion drilling techniques. The percussive technique enables the borehole to be advanced through superficial and weathered bedrock. The boreholes were terminated at bedrock.

In-situ geotechnical testing, comprising Standard Penetration Tests (SPTs) were undertaken at approximate 1m centres up to 5m bgl and at 1.5m centres from 5m to the base of the borehole, where appropriate.

Dynamic Probing

Five dynamic probe holes were carried out using the window sample rig detailed above. In place of the sampler and drilling rods, a sacrificial cone with dynamic probe rods was used. The system used was for "super heavy dynamic probing" (SHDP), which comprises a 750mm drop height, a 63.5kg weight using a 50.5cm² diameter cone. This method of investigation does not provide samples for logging, but provides an indication of the relative density of soil strata.

Rotary Probing

Five rotary probe holes were carried out using a tracked 360° Krupp rotary drill rig. The Coal Authority were contacted prior to site works to grant permission to disturb Coal Authority interests, this permission required the use of gas monitoring equipment to monitor for the potential mobilisation of mine gases. Air flush was allowed to be used as the nearest residential properties to the borehole locations were greater than 75m away.

Material was logged by the driller based on flush returns at the surface. On completion of the borehole, a cement bentonite mix was used to backfill the hole.

Soil Sampling

Soil samples recovered were logged in general accordance with BS 5930:1999 Amendment 2 to provide information on the sequence of strata observed at each position. During the logging of the soil, particular attention was paid to physical evidence of impacts, such as soil staining, odour and the presence of separate-phase liquids.

Soil samples were generally collected at approximately 0.5m intervals. Samples were placed into two polythene bags. The first bag was sealed to enclose as much air as possible around the soil sample. The soil sample was gently broken up and left for approximately fifteen minutes. Following this, the polythene bag was pierced and a MiniRAE 2000 PID fitted with a 10.6eV UV lamp was inserted to test for ionisable volatile contaminants. PID readings are presented on the trial pit logs and the borehole logs in Appendix G. The second bag was sealed with minimal air space contained, in order to minimise volatilisation and provide a sample for submission to the laboratory if required.

Soil samples from the boreholes and trial pits were selected for laboratory analysis based on the following criteria:

- Exhibiting high PID headspace reading;
- Visible or olfactory evidence of impact; and
- To provide adequate coverage of different lithologies and depths.

Sediment Sampling

Sediment sampling of the pond was carried out. A single sample from the centre of the pond was obtained using a sampler from a boat which was moored to the bank (SEDIMENT 1). A second sample was obtained from TP104 (SEDIMENT 2) which was excavated in to western end of the pond and the third sample (SEDIMENT 3) was collected using a 'sediment grab' sampling device which was lowered in and sample collected from the eastern end of the pond.

Installation of Monitoring Wells

Following the completion of each borehole and appropriate soil sampling, permanent groundwater and/or bulk soil gas monitoring wells were installed at selected locations to enable groundwater and/or bulk soil gas sampling. The monitoring wells were constructed from 50mm diameter threaded High Density Polyethylene (HDPE) well screen and blank casing. The construction details are presented on the borehole logs in Appendix G

Washed filter sand was used to fill the annulus between the monitoring well casing and the borehole wall. A small bentonite granule 'plug' was placed above the filter sand, above which a bentonite/cement slurry was poured to the top of the blank casing. The slurry provides an effective upper seal and prevents infiltration of perched shallow groundwater into the well. In addition, a well cap and flush mounted security casing were installed flush with the ground surface.

In some cases, where a monitoring well was not required, the position was backfilled with granulated or pellet-form bentonite.

Monitoring Well Development

Well development was undertaken prior to groundwater monitoring with the aim of removing, as far as possible, fine sediments from within the monitoring well and filter pack along the screened section of the well. The development process assists with limiting the quantity of sediment entering the borehole during sampling events.

Monitoring well development involved the removal of approximately 10 times the calculated volume of water in the well. In cases where the monitoring well purged dry during development, the groundwater recharge was monitored to assess the viability of removing 10 times the calculated volume removal. Where this was not possible, all water present in the well was purged prior to subsequent low-flow monitoring. In some cases, where groundwater recharge was insufficient for low-flow monitoring to be completed, a grab sample was collected using a peristaltic pump.

The development procedure was achieved by pumping with an inertial pump.

Groundwater and Surface Water Sampling

A total of 22 groundwater samples were obtained from the boreholes across the site, comprising the window sample boreholes and the four cable percussion boreholes. Boreholes WS113 and WS118 were recorded as being dry. In addition a sample was collected from pre-existing borehole BH5a.

Three surface water samples were obtained from the canal (east, centre and west of site), two from the drainage ditch (one at the point the ditch enters the site and a second close to the culvert entrance) and one from the pond (western end). The locations of surface water sampling points are included on Figure 2.

Groundwater monitoring involved the inspection of monitoring wells for the presence of groundwater and Non-Aqueous Phased Liquids (NAPLs); the measurement of NAPL thickness (where present), depth to groundwater and groundwater sampling.

Groundwater monitoring wells were sampled using a low-flow technique, which is designed to produce samples which are representative of the aquifer conditions. A length of dedicated tubing was lowered into each well to approximately halfway down the water column and water was drawn up the tubing into a flow cell using a peristaltic pump. The continuous uptake of groundwater into the flow cell gives instantaneous measurements of changes in geochemical parameters (dissolved oxygen, pH, redox and conductivity). Once the parameters stabilised to within 10% of the previous readings, the groundwater was then sampled.

Collection, Preservation and Transport of Samples

Laboratory-supplied glass jars and vials were used for the collection and transport of soil, groundwater and surface water samples to be analysed for volatile and semi-volatile organic compounds (VOC and SVOC) and extractable petroleum hydrocarbons. Laboratory-supplied plastic containers were used to collect and transport soil, groundwater and surface water samples for metals, inorganic compounds and pH. Details of the chemical laboratory analysis conducted is presented in Section 5.5

Containers used to transport groundwater for VOC analysis were filled so that no air space remained prior to sealing the container. Jars used to transport soils for VOC analyses were filled with minimal air space prior to sealing. Sample containers were collected within cool boxes with cooling aids to minimise the loss of volatile contaminants and reduce microbial activity.

Groundwater sampled for metals analysis was filtered on site prior to being sent to the laboratory. The collected water was passed through a disposable 0.45µm nitrocellulose paper using a disposable plastic syringe directly into the plastic sample bottle provided by the laboratory which was pre-loaded with a preservative of nitric acid to fix the metals in solution to prevent oxidation/reduction of dissolved metal ions prior to analysis.

Groundwater to be analysed for nitrogenous compound analysis were preserved on site with H₂SO₄ to fix the NH₃ and convert it to NH₄ which is measured and expressed as ammoniacal nitrogen.

Surface water sampled to be analysed for phenolic compounds were preserved on site with NaOH.

Samples were collected from the site on the day of sampling, where possible, and transported to the laboratory by a courier in dedicated sample boxes containing cooling aids under full chain of custody. Where samples were not collected on the same day of sampling, the samples were stored in a fridge overnight prior to collection the following day.

Bulk Soil Gas Monitoring

Gas monitoring involved the measurement of flow of gas into or out of the monitoring well followed by measurement of concentrations of carbon dioxide, methane and oxygen using an infra-red gas analyser. Both the peak and steady state gas concentrations were recorded. The pressure difference between the monitoring well and surrounding atmosphere was also recorded along with the atmospheric pressure.

Investigation Point Survey

Investigation locations were surveyed in to Ordnance survey grid coordinated by Ellam Land Survey at the request of Kirklees Council. The survey was supervised by ARCADIS to ensure all exploratory holes were located.

Rising Head Tests

Rising head tests were conducted in selected monitoring wells across the site (CP101, CP103, CP104, WS103, WS105, WS109, WS112 and WS114). Tests were designed and conducted within monitoring wells to provide information on hydraulic conductivity of the various strata encountered beneath the site.

5.5 Chemical Laboratory Analysis

The extent of laboratory testing carried out during this phase of investigation is summarised below;

Analytes	Soil	Soil Leachate	Groundwater and surface water	Analytical Method
pH	60	20	29	pH probe
Cyanide (total and free)	60	20	29	SKALAR SANS + SYSTEM
Anions – Cl, F, SO ₄ , PO ₄ , NO ₂ /NO ₃	60	20	29	Kone Analyser
Boron	60	20	29	By ICP-OES
TPH CWG including BTEX	60	20 (DRO only)	29	By GC FID
Speciated PAHs	60	20	29	By GC-MS
Sulphide	30	20	29	
Sulphur	30	20	29	
Metals (As, Cu, Cd, Cr, Cr (VI), Fe, Pb, Ni, Hg, Ag, Sn, Zn, Be, V, Mo, Al, Mg)	60	20	29	By ICP-OES
Asbestos screen	60	-	-	Visual inspection
Total Organic Carbon	20	-	-	
Calorific Value	20	-	-	
Ammoniacal Nitrogen as N	30	20	29	Kone Analyser
Ammonium Nitrogen as NH ₄ (calculated)	30	20	29	Kone Analyser
Non-ionised (free) ammonia (calculated)	30	20	29	
VOCs	25	-	29	By GC-MS
SVOCs	25	-	29	By GC-MS
PCBs	25	-	15	By GC-MS
Phenolic compounds	25	15	15	
Hardness	-	-	15	
Waste Acceptance Criteria	4	-	-	

All soil, leachate, groundwater and surface water laboratory results are presented in Appendix I.

5.6 Quality Assurance and Quality Control

Samples were submitted by ARCADIS to ALcontrol an approved and United Kingdom accredited laboratory (UKAS accredited) under a completed chain of custody. In addition, the laboratory carried out its own QA/QC programme to ensure that the quality of the analytical data conformed to the appropriate test method protocols.

5.7 Geotechnical Laboratory Analysis

Representative soil samples from the trial pits and boreholes were submitted to an accredited laboratory for a combination of the following specified tests:

- Natural moisture content;
- Atterberg four point cone tests to determine plastic and liquid limits;
- Particle Size Distributions (PSDs) and sedimentation tests;
- 2.5kg compaction tests;
- CBR remoulded tests;
- Slag expansivity tests;
- Total organic content;
- Loss on ignition; and
- pH and water soluble sulphate content.

The results of the geotechnical testing are presented in Appendix J.

6 SITE INVESTIGATION FINDINGS

6.1 Ground Conditions

All exploratory logs are presented in Appendix G and photographs representative of material encountered during the intrusive works are presented as Appendix H. The exploratory hole location plan is presented as Figure 2.

The table below summarises the ground conditions encountered from this phase of site work, which was generally consistent with the ground conditions encountered during the previous investigations conducted by others.

Geology	Depth to base (m bgl)		Typical Description
	Min.	Max.	
Made Ground	0.3	3.5	Mix of clay, silt, sand and gravel with cobbles and boulders of mixed lithologies.
Made Ground (Backfilled gravel pit)	-	4.8	Very soft black clay and silt.
Alluvial Deposits	1.0	4.0	Soft to firm brown and green grey sand clay, silty clay, clay/silt with occasional plant matter and gravel.
River Terrace Deposits	7.0	10.7	Medium dense to dense brown sand, gravelly sand, sandy gravel, sand and gravel with frequent cobbles. Occasional clay layers.
Weathered Coal Measures (Cohesive)	8.0	9.5	Firm to stiff brown clay with occasional gravel and cobbles.
Lower Coal Measures	-	-	Mudstone with occasional sandstone units and coal seams.

A cross section of the site has been produced to highlight ground conditions. A line running approximately north-south across site is presented as Figure 5.

Descriptions of the strata encountered are presented in the following subsections.

Made Ground

General Made Ground

Made ground was encountered at all locations to varying depths, up to 3.50m, however, DP1 (located within the former gravel pit) encountered poorly consolidated material (believed to be made ground) to 4.80m bgl. The made ground varied across site with several different material types being encountered (clay, silt, sand, gravel, cobbles and boulders). Generally, the coarse soils consisted of brick, concrete and sandstone. Further details relevant to type of made ground encountered in certain areas/features on site are presented under the following subsections.

East of the drainage ditch and south of the embankment in the north-east corner of the site, made ground was not encountered, where topsoil overlay the natural strata. This area of the site was noted to be the lowest lying area.

Western Section of Site

The western third of the site was generally covered in concrete, reinforced in places, with occasional cut off steel stanchions (associated with former buildings) and railway lines still

present. Multiple mounds of made ground have been deposited on top of the concrete. Underlying the concrete, varying layers of made ground were encountered. However, confined to this western area of site, slag deposits were noted within the made ground (in particular TP111 and TP112).

Backfilled Gravel Pit/Pond

The existing pond represents part of the former gravel pit. The gravel pit was found to extend to the west of the current pond and was found to have been backfilled with a soft black silt/clay, (possibly canal silt dredged from the near by canal or tailings as discussed in Section 2.3.1). Trial pits and dynamic probing have been used to delineate the approximate extents of the backfilled gravel pit west of the pond, presented as Figure 4. Exploratory holes TP104, TP105, TP107, TP108, TP110, WS109, DP101, DP102 and DP104 are all considered to be located within the backfilled gravel pit. In the vicinity of the former gravel pit, poorly consolidated material was recorded to depths of up to 4.80m bgl (DP101).

As stated in Section 2.3 above, a mound of material immediately south of the pond was believed to consist of slurry pit dredgings which were left to dry out beside the pit. Exploratory holes in this area (WS119, WS120 and TP109) confirmed that between 1.50m bgl and 3.30m bgl a black silt, similar to that recovered from the infilled area of the former gravel pit was encountered.

Sediment Profiling and Sampling

Sediment sampling of the pond was carried out as described in Section 4.4.2 above. All three samples comprised soft or very soft black silt.

At the time of the profiling, sediment within the pond was recorded at approximately 1m below the water level. The pond was recorded to contain much vegetation. Of further note was the presence of a tank cradle in the north-western portion of the pond.

Made ground material encountered in TP4 (excavated in to the western end of the pond) included plastic bags, glass, plastic bottles, metal wire and sheeting, window frames and part of a brick wall.

Central-Eastern Section of Site

Made ground in the central-eastern portion of the site contained many boulders of concrete and sandstone. The findings from the intrusive locations in this area of the site appear to support the anecdotal evidence that, as described in Section 2.3, this material was from demolished cooling towers deposited in this area of site.

Eastern Section of Site (east of surface water ditch)

No substantial deposits of made ground were encountered in the eastern section of site (immediately west of the surface water ditch and east of the ditch). Thick layers of topsoil (up to 1.0m thick) and some possibly reworked material up to 1.0m bgl were encountered in these areas. These investigation findings again support the anecdotal evidence that this portion of the site represents natural ground level. It is also noted that this area of the site is the lowest at approximately 37.35 mAOD

Obstructions/Refusals/Not investigated

Some of the exploratory holes encountered refusals and obstructions within the made ground. TP124 encountered a concrete slab at 2.80m bgl. WS102 encountered either concrete or a sandstone cobble at 2.20m bgl.

Railway lines and large slabs of concrete were noted at the surface in areas in the western half of the site.

An area of raised ground, understood to be placed for an historic railway, was not investigated due to the presence of badger setts (as detailed in Section 2.5). No excavation or drilling took place on this or within 30m/20m respectively.

Alluvium

Alluvium was encountered generally across the site. It generally consisted of a soft to firm brown and green grey clay, silty clay and sandy clay. Plant matter, organic odour and sandstone gravel was occasionally encountered.

The cohesive deposits were encountered to a maximum depth of 4.0m bgl, with thicknesses between 0m and 2.0m.

River Terrace Deposits

Beneath the made ground or the cohesive deposits a brown granular unit was encountered. It generally consisted of medium dense to dense brown sand, gravelly sand, sandy gravel and sand and gravel with frequent cobbles. The gravel and cobbles consisted of subangular to rounded sandstone. Occasional clay layers were noted within the granular deposits.

The granular deposits were encountered to a maximum depth of 10.7m bgl, with thicknesses between 0m and 5.5m.

Comment [D1]: Density

Weathered Lower Coal Measures (Cohesive Deposits)

In three of the four cable percussion boreholes, a firm to stiff brown gravelly clay was encountered between 7.0m and 9.0m up to a metre thick. It is considered that this probably represents a weathered bedrock unit.

Lower Coal Measures

In the cable percussion and rotary probe holes only, the Lower Coal measures were encountered at between 7.0m and 10.7m bgl comprising mudstone with some sandstone units. Coal seams were also encountered beneath the site; with details presented in the following subsection.

6.1.1 Coal Measures and Presence of Coal

The rotary boreholes were carried out in order to provide information on the presence or otherwise of coal, coal workings or voids. The boreholes were advanced to between 32m and 40m bgl. It was initially anticipated to advance the boreholes to 25m bgl. On drilling the first borehole (RP101) located in the east of the site, a 0.2m thick seam of coal was identified at 18.7m bgl. Based on the desk study information, it was anticipated that a second seam of coal would be present at approximately 29m bgl. The borehole was progressed to 40m bgl to identify the presence or otherwise of this second seam which was encountered at 30.7m bgl (1.8m thick). The information obtained from this borehole was used to inform the strategy for the following boreholes with final depths were taken at least 3m beyond the depth of any coal encountered.

It was shown that a single main seam of coal was encountered between 18.80m bgl and 30.70m bgl dipping to the north-east. The thickness of this seam ranged between 1.10m and 1.80m. Due to the conflicting evidence from the BGS published maps, together with a much greater seam thickness, it is not clear if this seam is representative of the Green Line/Middleton Thin or the New Hards Coal.

Several other seams were encountered both above and below this seam between 0.2m and 0.4m in thickness. It is considered that these seams do not represent a named seam but smaller seams within the Coal Measures.

A cross section running approximately east-west is presented as Figure 6 highlighting the main coal seam across site.

No worked coal seams were identified beneath the site in the boreholes drilled.

6.2 Groundwater

6.2.1 Groundwater Occurrence

During the intrusive site works, water strikes were noted within most of the exploratory holes generally within the granular deposits, at depths between 1.20m and 4.00m bgl.

Post fieldwork, groundwater was encountered in all but three monitoring wells installed during this phase of works (WS104, WS118 and WS124) and the monitoring well installed during the previous investigation works (BH05a). Groundwater was encountered at depths of between 0.44m bgl and 4.87m bgl.

6.2.2 Groundwater Flow

Boreholes, monitoring wells and sampling points were surveyed relative to Ordnance Datum and National Grid Coordinate System to enable groundwater elevations to be calculated. It was shown that groundwater was relatively continuous across site and not confined to one stratum. Groundwater levels were recorded between 35.803m AOD and 37.031m AOD, however, excluding these two results, levels were recorded between 36.102m AOD and 36.841m AOD. No definitive groundwater flow direction can be deduced from these results, though a slight trend to the west or north-west can be inferred.

The groundwater elevation data is presented on Table 1.

It is also understood that the level of water within the pond on site varies considerably throughout the year and is influenced by periods of heavy rainfall etc.

6.2.3 Hydraulic Conductivity

Rising head tests were conducted to enable hydraulic conductivity values to be calculated. Details of hydraulic conductivity are summarised in the table below.

Borehole Reference	Stratum Boreholes Screened Within	Hydraulic Conductivity (m/day)
CP101	River Terrace Deposits	30.42
CP103		15.38
CP104		23.68
WS112	Alluvium / River Terrace Deposits	4.72
WS103	Made ground / Alluvium	1.05
WS105		0.31
WS109		1.11
WS114		0.001

The results summarised in the table above shows that the hydraulic conductivity values vary across the geological strata. Hydraulic conductivity within the River Terrace Deposits show high values, corresponding to the high rates of recharge seen in trial pits and cable percussion boreholes. Values from the made ground and Alluvium strata are generally low, with WS114 not showing signs of significant recharge during the rising head tests.

Rising head test calculations using the Bouwer-Rice Hydraulic Conductivity Spreadsheet are presented as Appendix H.

6.3 Soil Quality

6.3.1 Free Product

No free phase hydrocarbon product was encountered in the soils recovered during the investigations.

6.3.2 Visual and Olfactory Evidence

Field screening was carried out using a PID. The results are detailed on the borehole logs presented in Appendix G. No elevated readings were taken using the PID.

Olfactory evidence was noted in a number of exploratory holes. A hydrocarbon odour was noted in TP110 (within the backfilled gravel pit), TP109 and WS120 (within 'dredgings' south of the pond).

6.3.3 Laboratory Analysis

The results of the environmental laboratory analysis of the soil samples obtained during the investigation are presented in Tables 2 to 9. Full laboratory analysis results and certificates are presented as Appendix I. Discussion of the results is included under the following subsections.

Volatile organic Compounds (VOC)

Concentrations of VOC were detected in 19 of the 23 soil samples tested at concentrations ranging between 2.9270mg/kg in soil sampled from TP109 (2.60-2.70m bgl) and 0.0315mg/kg in soil sampled from TP114 (1m bgl).

The VOC comprised predominantly BTEX compounds (benzene, toluene, ethylbenzene, and xylene), and other alkyl benzenes. Eighteen of the nineteen samples where VOC were detected were found to contain xylenes. Concentrations of xylene ranged between 0.609mg/kg (TP109, 2.6-2.70m bgl) and 0.0164mg/kg (TP125, 0.50m bgl). Naphthalene was detected at a concentration above 1mg/kg in soil sampled from TP109 (2.6-2.7m bgl, 2.02mg/kg), and WS109 (2.5-2.8m bgl, 1.14mg/kg).

Twenty-two of the 23 samples tested comprised made ground and VOC were detected in 19 of these samples. No VOC were detected in the natural ground sampled from WS112 (0.60-1.00m bgl, sand).

Semi-Volatile Organic Compounds (SVOC)

Concentrations of SVOC were detected in 20 of the 23 soil samples tested at concentrations ranging between 78.777mg/kg in soil sampled from TP109 (0.20-0.30m bgl) and 0.176mg/kg in soil sampled from WS103 (0.6-0.8m bgl).

Twenty-two of the 23 samples tested comprised made ground and SVOC were detected in 20 of these samples. No SVOC were detected in the natural ground sampled from WS112 (0.60-1.00m bgl, sand).

Total Petroleum Hydrocarbons (TPH)

Concentrations of TPH were detected in 54 of the 55 soil samples tested at concentrations ranging between 5,560mg/kg in soil sampled from TP104 (2.00-2.50m bgl) and 15.00mg/kg in soil sampled from WS115 (1.60-1.90m bgl).

The TPH comprised predominantly hydrocarbons in the EPH or C₁₂-C₄₄ molecular weight range; aliphatic hydrocarbons were predominantly detected in higher concentrations than aromatic hydrocarbons.

Forty-five of the 58 samples tested comprised made ground with TPH being detected in 44 of these samples at concentrations ranging between 5,560 in soil sampled from TP104 (2.0-2.50m bgl) and 15.00mg/kg in soil sampled from WS115 (1.60-1.90m bgl).

Twelve of the 58 samples tested comprised natural ground with TPH being detected in all 12 of these samples at concentrations ranging between 1,995mg/kg in soil sampled from WS108 (1.00-1.30m bgl) and 18.15mg/kg in soil sampled from WS113 (3.5-4.00m bgl).

Concentrations of BTEX were detected in 51 of the 54 soil samples tested, with benzene, toluene, ethylbenzene, and xylene being detected, ethylbenzene and toluene were detected most frequently. Forty-four detections were in samples of made ground and ten detections were in natural ground. No MTBE was detected in any of the soil samples tested.

Polycyclic Aromatic Hydrocarbons (PAH)

Concentrations of PAH were detected in 55 of the 58 soil samples tested. Forty-five of the 58 samples tested comprised made ground and PAH were detected in 43 of these samples at concentrations ranging between 2,015mg/kg in soil sampled from TP104 (2.0-2.50m bgl) and 0.0700mg/kg in soil sampled from WS109 (1.00-2.00m bgl).

Thirteen of the 58 samples tested comprised natural ground and PAH were detected in 12 of these samples at concentrations ranging between 77.27mg/kg in soil sampled from WS108 (1.00-1.30m bgl) and 0.0202 mg/kg in soil sampled from WS112 (0.60-1.00m bgl).

The three highest concentrations of PAH were detected in samples thought to represent made ground from the backfilled gravel pit.

Phenols and PCBs

Concentrations of phenols were detected in four of the 23 soil samples tested at concentrations ranging between 0.4239mg/kg in soil sampled from TP119 (0.5m bgl) and 0.014mg/kg in soil sampled from TP109 (2.60-2.70m bgl). One sample of natural ground from WS112 (0.60-1.00m bgl) was tested with no phenols detected.

Concentrations of PCBs were detected in four of the 27 soil samples tested at concentrations ranging between 0.0271mg/kg in soil sampled from TP110 (0.5m bgl) and 0.00318mg/kg in soil sampled from WS111 (0.70-1.00m bgl). One sample of natural ground was tested with PCBs detected at a concentration of 0.00318 (WS111 (0.70-1.00m bgl)). Two of the made ground samples were taken from the backfilled gravel pit and one sample taken from made ground in the far east of the site.

The initial site strategy for testing of PCBs was based on the remediation validation report from the adjoining Miller Homes site to the east of the site where PCBs had impacted the site. Concentrations of PCB in natural soil (where no historical development is thought to have taken place) on site indicates that historical spillages from the adjacent site may have impacted the site.

Metals

Concentrations of metals measured in the soil samples are summarised in the tables below for made ground and natural deposits:

Made Ground				
Metal	No. of Analysis	No. of Detections	Maximum Concentration (mg/kg)	Location of Maximum Concentration
Aluminium	41	41	52,500	TP112 (0.50m bgl)

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Made Ground				
Metal	No. of Analysis	No. of Detections	Maximum Concentration (mg/kg)	Location of Maximum Concentration
Arsenic	41	41	196	TP119 (0.50m bgl)
Beryllium	41	41	8.86	TP112 (0.50m bgl)
Boron	41	6	1.61	TP110 (2.20m bgl)
Cadmium	41	8	2.41	WS103 (1.60-1.80m bgl)
Chromium	41	41	219	TP122 (0.30m bgl)
Chromium VI	41	2	5.26	CP103 (0.50-1.0m bgl)
Copper	41	40	1,490	TP117 (0.40m bgl)
Iron	41	41	373,000	WS107 (0.70-1.00m bgl)
Lead	41	40	7,660	TP125 (0.50m bgl)
Magnesium	41	41	14,600	TP113 (1.20m bgl)
Mercury	41	5	1.74	WS109 (2.5-2.8m bgl)
Molybdenum	41	36	23	TP112 (0.50m bgl)
Nickel	41	40	85.5	WS107 (0.7-1.0m bgl)
Tin	41	34	57.2	WS107 (0.7-1.0m bgl)
Silver	41	-	-	-
Vanadium	41	41	737	TP122 (0.30m bgl)
Zinc	41	40	352	TP117 (0.40m bgl)

Natural Deposit				
Metal	No. of Analysis	No. of Detections	Maximum Concentration (mg/kg)	Location of Maximum Concentration
Aluminium	15	15	19,700	WS114 (3.50-4.00m bgl)
Arsenic	15	14	133	WS109 (2.50-2.80m bgl)
Beryllium	15	15	199	WS109 (2.50-2.80m bgl)
Boron	15	0	-	-
Cadmium	15	7	0.92	WS106 (2.3-2.6m bgl)
Chromium	15	15	34.8	WS108 (1.00-1.30m bgl)
Chromium VI	15	0	-	-
Copper	15	15	103	WS109 (2.50-2.80m bgl)
Iron	15	15	71,700	WS106 (2.3-2.6m bgl)
Lead	15	15	154	WS108 (1.00-1.30m bgl)
Magnesium	15	15	3,540	WS114 (3.50-4.00m bgl)
Mercury	15	2	1.74	WS109 (2.50-2.80m bgl)
Molybdenum	15	7	6.62	WS108 (1.00-1.30m bgl)
Nickel	15	15	46	WS109 (2.50-2.80m bgl)
Tin	15	12	6.29	WS108 (1.00-1.30m bgl)
Silver	15	0	-	-
Vanadium	15	15	49.3	WS108 (1.00-1.30m bgl)
Zinc	15	15	148	WS108 (1.00-1.30m bgl)

Forty-four soil samples were taken from the made ground (including topsoil) and twelve samples from natural deposits. Soil samples from made ground material generally contained the highest concentrations of metal species. Of the made ground samples TP112 (1.40m bgl) and WS107 (0.70-1.00m bgl) both contained the maximum concentration of three metal species. Of the natural deposit samples WS108 (1.00-1.30m bgl) contained maximum concentrations of six metals

Anions and Sulphur

Concentrations of anions, sulphur and the acid neutralisation capacity measured in the soil samples are summarised in the table below for made ground and natural deposits:

Made Ground				
Species	No. of Analysis	No. of Detections	Maximum Concentration (mg/kg)	Location of Maximum Concentration
Chloride	41	38	156	TP110 (2.20m bgl)
Fluoride	41	30	7.71	TP120 (0.30m bgl)
Water soluble phosphate (PO ₄)	2	0	-	-

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Made Ground				
Species	No. of Analysis	No. of Detections	Maximum Concentration (mg/kg)	Location of Maximum Concentration
Phosphate (PO ₄)	39	1	1.52	WS108 (0.60-0.75m bgl)
Nitrite as NO ₂	41	38	3.98	TP117 (0.40m bgl)
Nitrate as NO ₃	41	32	57.9	TP115 (1.00m bgl)
Ammoniacal Nitrogen	32	2	460	TP113 (1.20m bgl)
Elemental Sulphur	25	17	1,140	TP110 (2.20m bgl)
Total Sulphur	20	17	1.55	TP109 (1.50-1.60m bgl)
Easily Liberated Sulphide	27	5	426	TP110 (2.20m bgl)
Water Soluble Sulphate	16	12	1.22	TP113 (1.20m bgl)
Total Sulphate	27	24	7,170	TP113 (1.20m bgl)
ANC at pH4	8	4	0.76	TP120 (0.50m bgl)
ANC at pH6	8	3	0.239	TP120 (0.50m bgl)

Natural Deposits				
Species	No. of Analysis	No. of Detections	Maximum Concentration (mg/kg)	Location of Maximum Concentration
Chloride	15	13	586	TP105 (3.50-4.00m bgl)
Fluoride	15	9	2.5	TP114 (2.50m bgl)
Phosphate (PO ₄)	15	0	-	-
Nitrite as NO ₂	15	14	2.86	TP120 (2.10m bgl)
Nitrate as NO ₃	15	9	7.57	WS108 (1.00-1.30m bgl)
Ammoniacal Nitrogen	2	1	79.5	WS109 (2.50-2.80m bgl)
Elemental Sulphur	1	1	200	WS109 (2.50-2.80m bgl)
Total Sulphur	2	2	1.2	WS109 (2.50-2.80m bgl)
Easily Liberated Sulphide	2	1	560	WS109 (2.50-2.80m bgl)
Water Soluble Sulphate	1	1	1.67	WS109 (2.50-2.80m bgl)
Total Sulphate	2	2	9,420	WS109 (2.50-2.80m bgl)

Soil pH, Asbestos, and Other Parameters

Forty-seven samples of made ground (including topsoil) and twelve samples of natural deposits were analysed for asbestos fibres. Possible asbestos fibres were identified in made ground sampled from WS117 (0.60-0.90m bgl).

Soil pH ranged between 4.69 considered acidic to 10.5 considered basic, the majority of the soil samples were within the range 6.5 to 8.5.

Forty-four samples of made ground (including topsoil) and twelve samples of natural deposits were analysed for total and free cyanide. Total cyanide was detected in 10 of the 41 made ground samples tested at concentrations ranging between 196 mg/kg in soil sampled from WS119 (0.30-0.50m bgl) and 2.38 mg/kg in soil sampled from (1.50-2.00m bgl). Total cyanide was not detected in natural deposit samples. No free cyanide was detected in any of the samples analysed.

Four samples of made ground were tested for loss on ignition results ranged between 41% (TP115, 1.00m bgl) and 7.04% (TP116, 1.00m bgl).

Twenty samples of made ground were analysed for calorific value, results ranged between 18,400 kJ/kg (TP109, 1.50-1.60m bgl), and 0 kJ/kg ((CP101, 0.50-1.00m bgl), (CP103, 0.50-1.00m bgl), (CP104, 0.50-1.00m bgl), and WS103 (0.60-0.80m bgl)). One sample of natural deposits was tested for calorific value, recorded as 0 kJ/kg (WS112, 0.60-1.00m bgl).

One sample of natural deposits was analysed for TOC results were recorded as 1.24%. Twenty samples of made ground were tested for TOC results ranged between 14.3% and 0.39%.

6.4 Sediment Quality

6.4.1 Free Product

No free phase hydrocarbon product was encountered in the soils recovered during the investigations.

6.4.2 Visual and Olfactory Evidence

No visual or olfactory evidence was noted on the samples recovered.

6.4.3 Laboratory Analysis

The results of the environmental laboratory analysis of the sediment samples obtained during the investigation are presented in Tables 2 to 9. Full laboratory analysis results and certificates are presented as Appendix I.

Volatile organic Compounds (VOC)

Concentrations of VOC were detected in both of the sediment samples tested at concentrations of 0.7543mg/kg in SEDIMENT 1 and 0.092mg/kg in SEDIMENT 3. Toluene and carbon disulphide were detected in both sediment samples with naphthalene, ethylbenzene, and m&p-xylene also detected in SEDIMENT 1

Semi-Volatile Organic Compounds (SVOC)

Concentrations of SVOC were detected in both of the sediment samples tested at concentrations of 6.814mg/kg in SEDIMENT 3 and 0.29mg/kg in SEDIMENT 1. Naphthalene was detected in both sediment samples with further PAH and phthalates detected in SEDIMENT 1.

Total Petroleum Hydrocarbons (TPH)

Concentrations of TPH were detected in all three of the sediment samples tested at concentrations of 1,495 mg/kg in SEDIMENT 3, 735.4mg/kg in SEDIMENT 2, and 190.7mg/kg in SEDIMENT 1.

The TPH comprised predominantly hydrocarbons in the EPH or C₁₂-C₄₄ molecular weight range; aliphatic hydrocarbons were predominantly detected in higher concentrations than aromatic hydrocarbons.

Concentrations of BTEX were detected in two of the three sediment samples tested. Toluene was detected in SEDIMENT 1 and SEDIMENT 2, and ethylbenzene was detected in SEDIMENT 2.

Polycyclic Aromatic Hydrocarbons (PAH)

Concentrations of PAH were detected in all three of the sediment samples tested at concentrations of 32.22mg/kg in SEDIMENT 2, 22.25mg/kg in SEDIMENT 3, and 5.371mg/kg in SEDIMENT 1. All sixteen PAH within the suite were detected in all samples.

Phenols and PCBs

Two sediment samples were tested for phenols and PCBs. Phenol and PCBs were detected in SEDIMENT 3 at a concentration of 0.039 mg/kg, and 0.03158mg/kg respectively.

Metals

Concentrations of metals measured in the sediment samples are summarised in the tables below:

Metal	No. of Analysis	No. of Detections	Maximum Concentration (mg/kg)	Location of Maximum Concentration
Aluminium	3	3	19,300	SEDIMENT 1
Arsenic	3	3	41.1	SEDIMENT 2
Beryllium	3	3	1.76	SEDIMENT 2
Boron	3	1	2.71	SEDIMENT 3
Cadmium	3	2	0.769	SEDIMENT 3
Chromium	3	3	68.2	SEDIMENT 2
Chromium VI	3	0	-	-
Copper	3	3	386	SEDIMENT 2
Iron	3	3	92,300	SEDIMENT 2
Lead	3	3	5,680	SEDIMENT 2
Magnesium	3	3	4,190	SEDIMENT 1
Mercury	3	0	-	-
Molybdenum	3	3	7.36	SEDIMENT 2
Nickel	3	3	70	SEDIMENT 2
Silver	3	0	-	-
Tin	3	3	22.4	SEDIMENT 2
Vanadium	3	3	45.6	SEDIMENT 2
Zinc	3	3	1,550	SEDIMENT 2

Sample SEDIMENT 2 generally contained the highest concentration of metals.

Anions and Sulphur

Concentrations of anions, sulphur and the acid neutralisation capacity measured in the sediment samples are summarised in the table below:

Species	No. of Analysis	No. of Detections	Maximum Concentration (mg/kg)	Location of Maximum Concentration
Chloride	2	2	71.8	SEDIMENT 1
Fluoride	2	0	-	-
Phosphate (PO ₄)	2	0	-	-
Nitrite as NO ₂	2	2	0.15	SEDIMENT 1
Nitrate as NO ₃	2	0	-	-
Ammoniacal Nitrogen	3	1	36.4	SEDIMENT 1
Elemental Sulphur	2	2	548	SEDIMENT 2
Total Sulphur	2	2	0.17	SEDIMENT 2
Easily Liberated Sulphide	3	1	76.1	SEDIMENT 1
Water Soluble Sulphate	2	1	0.128	SEDIMENT 2
Total Sulphate	3	2	1,540	SEDIMENT 3

Soil pH, Asbestos, and Other Parameters

The following additional parameters were recorded:

- No asbestos containing material was detected in the three sediment samples tested;
- Soil pH ranged between 6.59 and 7.17 considered neutral;
- Total cyanide was detected in one of the three sediment samples tested at a concentration of 1.77mg/kg in SEDIMENT 1. No free cyanide was detected in any of the samples analysed;
- Calorific values of 467kJ/kg and 2,070kJ/kg were recorded for SEDIMENT 1 and SEDIMENT 2 respectively; and
- Total organic carbon results were recorded as 9.8%, 5.91%, and 2.22% for SEDIMENT 3, SEDIMENT 2, and SEDIMENT 1 respectively.

6.5 Soil Leachate Quality

The results of the environmental laboratory analysis of soil leachate (using NRA leachate preparation 10:1) obtained from the soil samples are presented in Tables 18 to 22. Full laboratory analysis results and certificates are presented as Appendix I. Four samples were tested using a 2:1 leachate preparation. Results from these samples have been reported in tables 23 to 27 and are discussed in the following subsections.

Extractable Petroleum Hydrocarbons (EPH)

Concentrations of EPH were detected in 3 of the 18 soil samples tested at concentrations ranging between 394µg/l in natural soil sampled from TP104 (2.0-2.5m bgl) and 19.3µg/l in made ground sampled from TP124 (0.8m bgl).

The EPH comprised ranges from C₁₀ through to C₄₀ molecular weight range.

Polycyclic Aromatic Hydrocarbons (PAH)

Concentrations of PAH were detected in 16 of the 18 soil leachate samples tested. Concentrations of PAH were reported ranging between 40.3µg/l in soil sampled from TP104 (2.0 - 2.5m bgl) and 0.0111µg/l in soil sampled from WS102µg/l (1.40-1.6m bgl).

Phenols

All ten samples tested for phenols did not report concentrations above the limit of detection.

Metals

Concentrations of metals measured in the soil leachate samples are summarised in the tables below for made ground and natural deposits:

Made Ground				
Metal	No. of Analysis	No. of Detections	Maximum Concentration (µg/l)	Location of Maximum Concentration
Aluminium	16	16	2,140	WS119
Arsenic	16	16	111	TP112
Beryllium	16	2	2.26	WS119
Boron	23	2	17.4	TP113
Cadmium	16	3	9.73	WS119
Chromium	16	16	65.8	TP120
Copper	16	14	65.4	WS119
Lead	16	15	17.9	TP109
Molybdenum	16	15	16.8	TP112
Nickel	16	16	174	WS119
Silver	16	0	-	-
Tin	16	0	-	-
Vanadium	16	15	48.3	TP112
Zinc	16	12	586	WS119
Mercury	16	3	0.0271	TP124
Magnesium	16	14	11,400	CP104
Iron	16	0	-	-
Chromium VI	16	1	47	TP120

Natural Deposit				
Metal	No. of Analysis	No. of Detections	Maximum Concentration (µg/l)	Location of Maximum Concentration
Aluminium	2	2	354	WS105
Arsenic	2	2	47.6	TP104
Beryllium	2	0	-	-
Boron	3	2	12.5	TP104
Cadmium	2	0	-	-
Chromium	2	2	4.27	TP104
Copper	2	2	1.27	WS105
Lead	2	2	0.509	TP104
Molybdenum	2	2	5.27	TP104

Natural Deposit				
Metal	No. of Analysis	No. of Detections	Maximum Concentration (µg/l)	Location of Maximum Concentration
Nickel	2	2	1.05	TP104/WS105
Silver	2	0	-	-
Tin	2	0	-	-
Vanadium	2	2	1.6	TP104
Zinc	2	2	1.69	TP104
Mercury	2	1	0.0135	TP104
Magnesium	2	2	4120	WS105
Iron	2	1	553	WS105
Chromium VI	2	0	-	-

Inorganics

Concentrations of ammonia, anions, sulphur and the acid neutralisation capacity measured in the soil leachate samples are summarised in the table below for made ground and natural deposits:

Made Ground				
Species	No. of Analysis	No. of Detections	Maximum Concentration (µg/l)	Location of Maximum Concentration
Ammoniacal Nitrogen (N)	21	2	353	TP101
Ammoniacal Nitrogen (NH ₄)	21	2	454	TP101
Ammonia Free/unionised (N)	22	0	-	-
Sulphide	16	0	-	-
Fluoride	16	8	1,480	TP120
Sulphate	16	15	546,000	TP113
Chloride	16	1	2,000	TP119
Nitrite as NO ₂	16	0	-	-
Phosphate (ortho) as PO ₄	16	9	183	TP118
Nitrate as NO ₃	16	12	2,160	TP120
Cyanide, Total	16	0	-	-
Cyanide, Free	16	0	-	-
pH	22	22	9.32	TP124
Sulphur, Free	16	0	-	-

Natural Deposits				
Species	No. of Analysis	No. of Detections	Maximum Concentration (µg/l)	Location of Maximum Concentration
Ammoniacal Nitrogen (N)	3	3	10,100	TP104
Ammoniacal Nitrogen (NH ₄)	3	2	13,000	TP104
Ammonia Free/unionised (N)	2	1	819	TP104
Sulphide	2	0	-	-
Fluoride	2	0	-	-
Sulphate	2	1	10,100	WS105
Chloride	2	2	8,100	TP104
Nitrite as NO ₂	2	0	-	-
Phosphate (ortho) as PO ₄	2	1	244	TP104
Nitrate as NO ₃	2	0	-	-
Cyanide, Total	2	0	-	-
Cyanide, Free	2	0	-	-
pH	3	3	8.25	TP104
Sulphur, Free	2	0	-	-

6.6 Surface Water and Groundwater Quality

6.6.1 Free Product

No free phase hydrocarbon product was encountered on the water sampled from the monitoring wells during the groundwater monitoring visits.

6.6.2 Visual and Olfactory Evidence

No visual or olfactory evidence was noted in the water sampled from borehole wells or monitoring points during the monitoring.

6.6.3 Laboratory Analysis

The results of the environmental laboratory analysis of the groundwater and surface water samples obtained during the investigation are presented in Tables 10 to 17. Full laboratory analysis certificates and results are presented as Appendix I.

It is noted that groundwater samples were taken from wells screened in the superficial deposits. Although the four wells installed in the cable percussion boreholes penetrated into the Coal Measures, the groundwater within these well are also considered representative of groundwater within the superficial deposits rather than in the Coal Measures.

Volatile Organic Compounds (VOC)

Concentrations of VOC were reported below the limit of detection in all of the groundwater and surface water samples.

Semi-Volatile Organic Compounds (SVOC)

Concentrations of three specific SVOC compounds were detected in 2 of the 28 samples tested. Acenaphthene and dibenzofuran were detected in WS109 at concentrations of 1.07 and 1.1µg/l respectively. Bis(2-Ethylhexyl) phthalate was reported at a concentration of 3.3µg/l in WS105.

Total Petroleum Hydrocarbons (TPH)

In the sample taken from WS104, the concentration of total TPH was reported at 50µg/l. The individual carbon bands from the same sample were all reported below the limit of detection.

Polycyclic Aromatic Hydrocarbons (PAH)

Concentrations of PAH were detected in 12 of the 22 groundwater samples and all six of the surface water samples tested. Concentrations of PAH compounds ranged between 1.21µg/l in water sampled from WS102 and 0.0143µg/l in water sampled from WS105.

Phenols and PCB

Concentrations of phenols and PCB were reported below the limit of detection in all of the groundwater and surface water samples.

Metals

Concentrations of metals measured in the soil samples are summarised in the tables below for surface water and groundwater samples:

Surface Water				
Metal	No. of Analysis	No. of Detections	Maximum Concentration (µg/l)	Location of Maximum Concentration
Aluminium	6	5	35.3	Canal West
Arsenic	6	6	1.89	Canal Mid
Beryllium	6	0	-	-
Boron	6	6	42	Stream
Cadmium	6	0	-	-
Chromium	6	6	6.65	Stream
Chromium VI	6	0	-	-
Copper	6	6	2.62	Pond
Lead	6	6	0.517	Pond
Molybdenum	6	4	0.637	Canal West
Nickel	6	6	4.36	Stream
Silver	6	0	-	-

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Surface Water				
Metal	No. of Analysis	No. of Detections	Maximum Concentration (µg/l)	Location of Maximum Concentration
Tin	6	0	-	-
Vanadium	6	5	0.592	Canal Mid
Zinc	6	6	16.1	Canal East
Mercury	6	0	-	-
Magnesium	6	6	24,100	Stream
Iron	6	0	-	-
Hardness	3	3	223,000	Stream

Groundwater				
Metal	No. of Analysis	No. of Detections	Maximum Concentration (µg/l)	Location of Maximum Concentration
Aluminium	22	7	7,790	WS119
Arsenic	22	22	338	WS120
Beryllium	22	1	5.68	WS119
Boron	22	22	140	WS119
Cadmium	22	5	8.92	WS119
Chromium	22	22	19	WS105
Chromium VI	22	1	47	WS109
Copper	22	21	13.3	WS119
Lead	22	18	11.5	WS103
Molybdenum	22	16	7.68	WS102
Nickel	22	22	544	WS119
Silver	22	0	-	-
Tin	22	0	-	-
Vanadium	22	19	5.78	WS105
Zinc	22	21	1,390	WS119
Mercury	22	0	-	-
Magnesium	22	22	65,900	WS112
Iron	22	12	67,400	WS120
Hardness	12	12	1,570,000	WS120

Inorganics

Concentrations of ammoniacal nitrogen, anions, sulphur and the acid neutralisation capacity measured in the surface water and groundwater samples are summarised in the table below:

Surface Water				
Species	No. of Analysis	No. of Detections	Maximum Concentration (µg/l)	Location of Maximum Concentration
Ammoniacal Nitrogen (N)	6	3	435	Canal Mid
Ammoniacal Nitrogen (NH ₄)	6	3	559	Canal Mid
Ammonia Free/unionised (N)	6	0	-	-
Sulphide	6	1	18	Canal Mid
Fluoride	6	0	-	-
Sulphate	6	6	117,000	Stream
Chloride	6	6	57,400	Canal East
Nitrite as NO ₂	6	4	138	Canal West
Phosphate (ortho) as PO ₄	6	5	357	Canal West
Nitrate as NO ₃	6	6	18,100	Canal Mid
Cyanide, Total	6	0	-	-
Cyanide, Free	6	0	-	-
pH	6	6	8.05	Stream
Sulphur, Free	6	0	-	-

Groundwater				
Species	No. of Analysis	No. of Detections	Maximum Concentration (µg/l)	Location of Maximum Concentration
Ammoniacal Nitrogen (N)	22	13	7,090	WS114
Ammoniacal Nitrogen (NH ₄)	22	13	9,120	WS114
Ammonia Free/unionised (N)	22	3	780	WS114

Groundwater				
Species	No. of Analysis	No. of Detections	Maximum Concentration (µg/l)	Location of Maximum Concentration
Sulphide	22	9	71	WS109
Fluoride	22	6	2240	WS119
Sulphate	22	22	1,270,000	WS120
Chloride	22	22	126,000	WS112
Nitrite as NO ₂	22	5	521	CP104
Phosphate (ortho) as PO ₄	22	4	365	WS109
Nitrate as NO ₃	22	11	19,600	WS105
Cyanide, Total	22	0	-	-
Cyanide, Free	22	0	-	-
pH	22	22	8.74	WS102
Sulphur, Free	22	0	-	-

6.7 Ground Gas Monitoring Results

The results of the ground gas monitoring conducted to date are presented as Appendix P.

A subsequent ground gas assessment report will be produced when the full round of gas monitoring has been completed. No assessment of results has been carried out within this report.

6.8 Geotechnical testing

6.8.1 Plate Bearing Tests

Six in situ plate bearing tests (PBT) were carried out across site. The locations are shown on the site layout drawing with five of the tests carried out at the same location as a trial pit. The CBR values calculated from the PBT are summarised below.

PBT ID	Corresponding TP ID	Correlating CBR Value (%)
PB1	TP111	9.3
PB2	TP115	31.3
PB3	TP117	22.7
PB4	n/a	34.2
PB5	TP119	14.8
PB6	TP120	5.9

6.8.2 Laboratory Results

Geotechnical laboratory results are presented on Appendix J and are discussed in more detail in Section 11.

7 MOVEMENT/REUSE OF WASTE MATERIAL ASSOCIATED WITH PROPOSED DEVELOPMENT

It was detailed in the Stage 1B Assessment that Kirklees Council had conducted a ground modelling exercise with keyTERRAFIRMA using the latest base topographical survey supplied by Aecom and the finished floor level requirement in the outline planning application of 38.7m AOD. It is understood that the resulting output after calculating the required cut and fill volumes to make-up the levels identifies a fill requirement of 6,621 cubic metres which equates to a topping layer across the site which would be 118mm thick.

In accordance with the above, it is understood that it is intended to re-use material on site as far as possible and reduce the quantity of material that will be required to be imported to meet finished levels. As such, material will need to be cut from raised areas and moved to areas of lower elevation to produce a level building platform for the proposed residential development. The amount of cut will depend on a number of factors including the following:

- The final design of the proposed development and required cover systems;
- Whether retaining walls will be using along the site boundaries cut area or whether further cut is required to maintain a safe angle of repose;

The following subsections provide details of some of the aspects associated with movement of waste.

7.1 Environmental Permitting Regulations

7.1.1 Achieving Non-Waste Status

It is important that materials that moved around the site are not classified as a waste (as defined by revised Waste Framework Directive) on completion of the works. All materials that are excavated are deemed to be a waste unless it can be demonstrated (via appropriate permitting etc.) that:

- The materials are suitable for use (both chemically and geotechnically) without further processing;
- The use of the materials is certain; and
- Only the quantity required is used.

When the factors detailed above are fulfilled the material is then deemed to have achieved 'non waste' status and can be reused. It is proposed to reuse the materials within part of the site to create a level building platform. As detailed above the proposed final level of 38.7m AOD requires material to be moved to achieve this level.

In order to demonstrate that the materials are chemically suitable for reuse it is recommended that the Detailed Quantitative Risk Assessment (DQRA) is carried out. The DQRA will provide Site Specific Assessment Criteria (SSAC) for each of the contaminants, which can be used to demonstrate that the material is suitable for its particular end use. With respect to geotechnical suitability the material is proposed to be reused beneath the proposed building footprints. Due to the soft cohesive deposits located beneath the site a piled foundation solution is considered to be the most suitable option. Therefore, while the materials to be moved will not be required to support structural loads from the proposed buildings it will still be necessary for the material to be suitable for road and hardstanding construction. Therefore, the materials will need to be placed in accordance with a suitable engineering specification. Further details are give in Section 12.4.

There are several different permits/systems available, the suitability of which is dependant upon the complexity of the site. The main routes as permits/systems are as follows:

- Exemption from the need to hold an Environmental Permit;
- Standard Environmental Permit;
- Bespoke Environmental Permit;
- Application in accordance with the CL:AIRE document 'Definition of Waste: Development Industry Code of Practice'.

The complexity of the site and the volume of material to be moved will mean that the site will not be exempt from the need to hold an Environmental Permit. Reuse of material under a standard or bespoke Environmental Permit is limited to the reuse of material classified as inert or non-hazardous waste. As some of the waste is likely to be classified as hazardous waste (see Section 7.2.1) this is not considered to be the most appropriate permitting route for the site.

7.1.2 Definition of Waste: Construction Industry Approved Code of Practice (ACoP)

The Environment Agency (EA) has worked with industry through CL:AIRE to prepare the ACoP. The purpose of the ACoP is to allow industry to regulate itself with respect to determining whether excavated materials have achieved non-waste status. The EA states that *'When a signed Declaration is sent to us (the EA) by a Qualified Person showing that excavated materials are to be dealt with as set out in the CoP, we (the EA) will take the view that the materials on the site where they are to be used will not be waste.'*

In addition to the DQRA, a materials management plan will be required detailing where soils will be moved to and how they will be tracked, together with a signed declaration by a registered competent person. On completion of the work a verification report will need to be completed. This is comparable to the information that will need to be supplied to the Environment Agency as part of the Standard Rules Environmental Permit application but as the declaration can be made by ARCADIS costs would be lower.

At present only a generic quantitative risk assessment has been undertaken which has indicated that much of the soil had concentrations of CoC above the applicable SSAC. Without carrying out a DQRA it will not be possible to reuse the material as it will not be possible to demonstrate that the material is suitable for use.

7.2 Characterisation of Waste

7.2.1 Overall Classification

Hazardous waste calculations (presented in Appendix L) have shown that the highest concentrations taken from across the site would classify the material as hazardous. High levels of TPH, PAH, lead and copper have resulted in the hazards H7, H10 and H14 being identified.

However, the majority of the made ground material is classified as non-hazardous waste with only isolated areas in the made ground (due to the elevated metal, TPH and PAH concentrations) classified as hazardous waste.

It is intended that the majority of the materials will be reused on site. Criteria for reuse are based on suitability for reuse and not the waste classification. Therefore, waste classification will only be of use for materials that do not meet the suitability for reuse criteria or are needed to be removed as part of the development process.

7.2.2 Specific Waste Classification

Three separate areas of raised ground were identified as representative of large areas likely to be required to be cut and moved. The three areas comprised raised ground in the north-west of the site (TP115, TP116, TP124, WS103 and WS113), central-east of the site (TP119, TP120, WS117, WS118, WS119 and CP104) and the raised mound of sediment south of the pond (TP109, WS119 and WS120). The below table highlights the results:

Area of Raised Ground	Respective Exploratory Holes	Result From Hazardous Waste Calculations
North-western area	TP115	Non-hazardous / inert
	TP116	
	TP124	
	WS103	
	WS113	
Central-eastern area	TP119	Hazardous* (Likely non-hazardous/inert)
	TP120	
	WS117	
	WS118	
	WS119	
	CP104	
Former Gravel Pit sediment	TP109	Non-hazardous / inert
	WS119	
	WS120	

*Presence of asbestos from WS117 makes waste hazardous. Removal of asbestos would make material non-hazardous/inert

In reference to Section 7.1, should the waste movement be conducted under an Environmental Permit rather than CoP, it is recommended that further analysis is carried out during waste movements in order to minimise the amount of material classified as hazardous waste.

Waste characterisation methodology and the methodology for the classification of hazardous waste are presented as Appendices M and N respectively.

7.2.3 Waste Acceptance Criteria (WAC)

Four samples were tested for a WAC suite, all of the samples were representative of the made ground. The samples were chosen from three areas of raised ground across site as detailed in the above section.

Based on the results from these samples, it has been shown that the material would not be suitable for an inert waste landfill due to excessively high concentrations of TOC, loss on ignition, lead and fluoride. In addition, the high levels of TOC and loss on ignition placed two of the samples above the threshold to be accepted in a hazardous waste landfill (one from Slurry backfill, one from north-western raised). This indicates that the material classified as hazardous waste may not meet the requirements for disposal in a hazardous waste landfill without some form of pre-treatment. It is recommended that further WAC analysis is undertaken of the hazardous waste material to be removed from site during redevelopment.

Waste acceptance criteria results are presented within Appendix I.

8 QUANTITATIVE RISK ASSESSMENT

8.1 Non-statutory Regulatory Technical Guidance

The following documents, which have been consulted in undertaking this QRA, present guiding principles in assessing potentially contaminated land:

General

- Model Procedures for the Management of Land Contamination, DEFRA & Environment Agency (R&D Publication CLR 11).

Human Health

- Human health toxicological assessment of contaminants in soil. Environment Agency Science Report SC050021/SR2 (EA, 2009a);
- Updated technical background to the CLEA model. Environment Agency Science Report SC050021/SR3 (EA, 2009b); and
- Compilation of data for priority organic pollutants for derivation of Soil Guideline Values. Environment Agency Science Report SC050021/SR7 (EA, 2008).

Water Resources

- Remedial Targets Methodology (RTM): Hydrogeological Risk Assessment for Land Contamination, Environment Agency of England and Wales (2006); and
- Petroleum Hydrocarbons in Groundwater: Supplementary Guidance for Hydrogeological Risk Assessment, Environment Agency of England and Wales (2009).

8.2 Generic Quantitative Risk Assessment

As outlined in CLR 11, the purpose of generic quantitative risk assessment (GQRA) is to focus the assessment process on sites which may require more detailed approach and/or remediation although the United Kingdom has not adopted any sort of generic, risk based clean up criteria. GQRA uses generic assessment criteria (GAC) which have been derived in-house based on ARCADIS professional experience in the assessment of the contaminated land in England and Wales. GAC are criteria derived using largely generic assumptions about the characteristics and behaviour of sources, pathways and receptors. These assumptions are conservative in a defined range of conditions. As such, the first step in the GQRA is to ensure that the assumptions made during the development of the in-house ARCADIS GAC are appropriate, for this site.

A CSM (Figure 3) has been developed for the site and the potential pollutant linkages of concern have been outlined.

The data used in the derivation of the GAC for low density residential end use is presented in Appendix R. The GAC are presented in Appendix R.

8.2.1 Consideration of site-specific conditions

Ground Conditions

The lithology beneath the site has been found to comprise made ground (cobble gravels with variable sand and clay content), Alluvium and sands and gravels and Lower Coal Measures

as discussed in Section 6.1. The ARCADIS in-house GAC are derived for granular soils represented by sand. Given the presence of granular deposits beneath the site, ARCADIS considers that the assumptions made in the derivation of the GAC are suitable for the geology beneath the site.

Human Health

The site is proposed to be used for residential developments, as such, the human health receptors associated with the site are likely to be on-site residents and nearby neighbouring residents.

The ARCADIS in-house GAC derived for low density residential end-use are calculated considering a 0-6 year old female child where plants and vegetables could be planted on site.

Water Resources

The primary water resource receptors associated with the site are the Secondary 'A' Aquifer directly underlying the site, the Calder and Hebble Navigation located adjacent to the northern boundary of the site and the two surface water features on site (pond and surface water ditch). The site is not considered to be located in a high sensitivity setting given the absence of a groundwater SPZ within at least 2km of the site.

The ARCADIS GAC for water resources are derived based on consideration of partitioning from soil into soil leachate and dilution within the underlying groundwater. However, no consideration is given to potential attenuation during lateral migration; hence the point of compliance is the groundwater directly beneath the source. Therefore, in this case, the GAC are considered to provide suitably protective target levels for the identified water resource receptors.

8.3 Selected Approach

Given the suitability of the assumptions made in the ARCADIS GAC, it is considered appropriate to use these values as screening criteria in order to identify impacts beneath the site and hence determine the need for further assessment.

9 RISK ASSESSMENT EVALUATION

9.1 Derivation of GAC

The derivation of the ARCADIS GAC, to which the concentrations of the CoC have been compared, is presented as Appendix R. The ARCADIS GAC used within this assessment for soil and groundwater samples are included in Tables 2 to 27 and Appendix R.

9.2 Comparison of Soil and Sediment Analysis Results to GAC

The measured concentrations of CoC in soil have been compared to the ARCADIS in-house GAC in Tables 2 to 9. A summary of the results is presented below:

9.2.1 Human Health – Residential (With Gardens) End Use

The following compounds were identified at concentrations above the GAC protective of human health receptors based on residential end use (including gardens).

CoC which exceed GAC	Number of samples which exceeded GAC	Strata	Specific Pathways (oral/inhalation/combined)
Benzene	4	4 x Made ground	Inhalation only
Naphthalene	17	14 x Made ground 2 x Natural deposits 1 x Sediment	Inhalation only
Benzo(a)anthracene	19	17 x Made ground 1 x Natural deposits 1 x Sediment	Inhalation only
Benzo(b)fluoranthene	1	1 x Made ground	Combined only
Benzo(a)pyrene	22	19 x Made ground 1 x Natural deposits 2 x Sediment	Oral and inhalation (one sample inhalation only)
TPH Aliphatic C ₁₂ -C ₁₆	22	17 x Made ground 3 x Natural deposits 2 x Sediment	Inhalation only
TPH Aromatic EC ₁₂ -EC ₁₆	15	13 x Made ground 2 x Natural deposits	Inhalation only
Arsenic	37	35 x Made ground 1 x Natural deposits 1 x Sediment	Oral/Inhalation of dust
Lead	12	11 x Made ground 1 x Sediment	Oral/ Inhalation of dust

In addition to the above, it should be noted that GAC were not available for some of the analytes.

9.2.2 Water Resources – Set 1

The following CoC were measured at concentrations above the GAC protective of water resources.

CoC which exceed GAC	Number of samples which exceeded GAC	Strata
Benzene	3	3 x Made ground
Ethylbenzene	6	6 x Made ground
Xylene	1	1 x Made ground
Naphthalene	43	38 x Made ground 3 x Natural deposits 3 x Sediment

CoC which exceed GAC	Number of samples which exceeded GAC	Strata
Benzo(b)fluoranthene	51	40 x Made ground 8 x Natural deposits 3 x Sediment
Benzo(k)fluoranthene	39	33 x Made ground 3 x Natural deposits 3 x Sediment
Benzo(a)pyrene	22	19 x Made ground 1 x Natural deposits 2 x Sediment
Indeno(1,2,3-cd)pyrene	43	37 x Made ground 3 x Natural deposits 3 x Sediment
Benzo(g,h,i)perylene	39	33 x Made ground 3 x Natural deposits 3 x Sediment
TPH Aromatics EC ₁₂ -EC ₁₆	52	40 x Made ground 9 x Natural deposits 3 x Sediment
TPH Aromatics EC ₁₆ -EC ₂₁	38	31 x Made ground 4 x Natural deposits 3 x Sediment

9.3 Comparison of Groundwater Analysis Results to GAC

The measured concentrations of CoC in groundwater have been compared to the ARCADIS in-house GAC in Tables 10 to 17. A summary of the results is presented below:

Receptor	CoC which exceed GAC	Location
Residential End Use (with gardens)	None	N/A
Water Resources (Set 1)	Benzo[a]pyrene	WS102
	Benzo[b]fluoranthene	WS102, WS105, WS107, WS109
	Benzo[g,h,i]perylene	WS102, WS104, WS105, WS107, WS109
	Benzo[k]fluoranthene	WS102, WS105, WS107, WS109
	Indeno[1,2,3-cd]pyrene	WS102, WS105, WS109

In addition to the above, it should be noted that GAC were not available for some of the analytes.

9.3.1 Comparison of Groundwater Analysis Results to Environmental Quality Standards (EQS)

The measured concentrations of CoC in groundwater have been compared to EQS values and are presented in Tables 11. A summary of the results is presented below:

Receptor	CoC which exceed EQS	Location
Water Resources (Freshwater Fishlife)	Arsenic	WS120
	Nickel	WS119
	Iron	CP101, WS103, WS105, WS112, WS114, WS120
	Ammoniacal Nitrogen (NH ₄)	Canal mid, BH5A, CP101, WS103, WS109, WS111, WS114, WS115, WS119, WS120
	Ammoniacal Nitrogen (Free N)	WS114, WS115, WS120

In addition to the above, it should be noted that EQS values were not available for some of the analytes.

9.4 Comparison of Soil Leachate Analysis Results to GAC

The measured concentrations of CoC in leachate have been compared to the ARCADIS in-house GAC in Tables 18 to 22. A summary of the results is presented below:

Receptor	CoC which exceed GAC	Location
Residential End Use (with gardens)	None	n/a
Water Resources (Set 1)	Naphthalene	TP104
	Benzo[b]fluoranthene	TP120
	Benzo[k]fluoranthene	TP120
	Indeno[1,2,3-cd]pyrene	TP120

In addition to the above, it should be noted that GAC were not available for some of the analytes.

9.4.1 Comparison of Soil Leachate Analysis Results to Environmental Quality Standards (EQS)

The measured concentrations of CoC in groundwater have been compared to EQS values and are presented in Table 19. A summary of the results is presented below:

Receptor	CoC which exceed EQS	Location
Water Resources (Freshwater Fishlife)	Arsenic	TP112, TP113
	Copper	TP124, WS119
	Nickel	WS119 – awaiting hardness
	Vanadium	TP112
	Zinc	TP112, WS119 – awaiting hardness

In addition to the above, it should be noted that EQS values were not available for some of the analytes.

9.5 Discussion of Results

9.5.1 Exceedances of Generic Assessment Criteria

Human Health

The results of the risk assessment indicate exceedances of the GAC defined for the protection of human health receptors for a residential end use (with gardens).

Soil

Concentrations in soils have shown exceedances in several compounds, including TPH aromatic and aliphatic band C12-C16, benzene, PAH compounds (naphthalene, benzo(a)anthracene, benzo(b)fluoranthene and benzo(a)pyrene), arsenic and lead. Exceedances were not restricted to one specific soil type but encountered at a variety of depths in made ground, natural deposits and sediment sampled from the pond. It is however noted that a number of the exceedances were identified in soil sample from within the backfilled gravel pit, slurry pit dredging and pond sediment which are considered to represent a noted area at the site comprising elevated concentrations of the identified CoC. Also, the exceedances of benzene was restricted to the backfilled gravel pit and pond sediment.

As there is a high frequency of exceedances of several compounds across the site with a proposed sensitive end use, it is considered that the risk to site users is moderate to high.

For the analytes for which no GAC were available, only marginal detection of contaminants in isolated locations were identified. As such, the potential level of risk presented to human health receptors is considered to be low.

Groundwater

No exceedances of the Human Health GAC were identified in groundwater.

Surface Water

No exceedances of the Human Health GAC were identified in surface water.

Soil Leachate

No exceedances of the Human Health GAC were identified in soil leachate.

Water Resources

The results of the risk assessment indicate exceedances of the GAC defined for the protection of water resource receptors.

Soil

Concentrations of a variety of CoC have exceeded the respective GAC for water resource receptors including benzene, ethylbenzene, xylene, PAH (naphthalene, benzo(b)fluoranthene, benzo(k)fluoranthene, ideno(1,2,3-cd)pyrene, benzo(g,h,i)perylene and benzo(a)pyrene), and TPH aromatic bands C12-16 and C16-21. Exceedances were not restricted to one soil type and were encountered across site in made ground, natural deposits and sediment sampled from the pond.

In order for soil impacts to present a potential risk to water resource receptors, they must first partition into groundwater in order to migrate laterally to a receptor. Results from groundwater are discussed below.

Of those analytes for which no GAC were available, only marginal detections of contaminants in isolated locations were identified. As such, the potential level of risk presented by these to water resource receptors is considered to be low.

Groundwater

Concentrations of PAH (benzo(b)fluoranthene, benzo(k)fluoranthene, ideno(1,2,3-cd)pyrene, benzo(g,h,i)perylene and benzo(a)pyrene) were identified above the GAC in groundwater sampled from WS102, WS104, WS105, WS107 and WS109. These locations are restricted to the area in the west of site covered by hardstanding and immediately around this area (WS105 just south and WS109 just east).

The groundwater results indicate that several of the CoC encountered in the soil samples have not leached into the groundwater. The exceedances of the PAH results are relatively minor and encountered from compounds of low mobility. The groundwater receptor on site (the Secondary A aquifer), although having four abstractions within 1km, are all for industrial uses. As such, the potential level of risk presented by the CoC to water resource receptors is considered to be low.

Surface Water

No exceedances of the water resource (Set 1) GAC were identified in surface water.

Soil Leachate

Concentrations of PAH compounds benzo(b)fluoranthene, benzo(k)fluoranthene and ideno(1,2,3-cd)pyrene were in exceedance for the GAC protective of water resource receptors in one sample from TP120. The concentration of naphthalene in a sample from TP104 also exceeded the respective GAC.

Soil leachate testing highlights the compounds contained within soil which could potentially leach into the groundwater or surface water bodies. Exceedances in groundwater have shown that elevated levels of some of the PAH compounds are present. As discussed above, the mobility of these compounds in a water body is low and the levels of exceedance are relatively small. As such, it is considered that the potential level of risk presented by the CoC to water resource receptors is considered to be low.

9.5.2 Exceedances of Environmental Quality Standards

Groundwater

Concentrations of arsenic, iron, and nickel were measured above the EQS for water resources. Concentrations of ammoniacal nitrogen (NH_4 and free N) also showed exceedances, however, discussion of these is detailed below. It should be noted that EQS values are devised for the protection of the receiving water (the receptor) and some are dependant on water hardness. The EQS applied have been based on reported concentrations of water hardness..

Total ammoniacal nitrogen as N is the sum of all ammoniacal nitrogen species. The two important species are “free” ammonia (as N) and ammonium (ammoniacal nitrogen present as ionic NH_4^+). The ionisation of ammonia to ammonium is dependent in part on the pH of the groundwater. The laboratory has provided estimated splits between ammonia and ammonium on the basis of the pH recorded in each sample. Ammonia represents a higher toxicity to aquatic life, with an EQS of $15\mu\text{g/l}$, in comparison to the EQS of $500\mu\text{g/l}$ for ammonium. As such, both forms of ammoniacal nitrogen have been assessed as separate CoC.

- Ammonia

Detections of ammonia in excess of $200\mu\text{g/l}$ were reported in three groundwater samples, two located along the northern boundary (WS114 and WS115) and one south of the pond (WS120). The highest measured concentration of $780\mu\text{g/l}$ was recorded in groundwater sampled from monitoring well WS114.

- Ammonium

Detections of ammonium (ionised ammoniacal nitrogen as NH_4), in excess of $500\mu\text{g/l}$, were measured in groundwater across site. The highest measured concentration of $9,120\mu\text{g/l}$ was recorded in groundwater sampled from monitoring well WS114.

Soil Leachate

Concentrations of arsenic, copper, nickel, vanadium and zinc were measured above the EQS for water resources. It should be noted that EQS values are calculated for the concentration in the receiving water (the receptor) and are dependant on water hardness; the EQS values used in this report are the most conservative available. Soil leachate testing highlights the compounds contained within soil which could potentially leach into the groundwater or surface water bodies. The results indicate that arsenic, copper and nickel have leached from soil into groundwater.

Surface water

One sample from the canal (canal middle) showed an exceedance of the EQS for ammoniacal nitrogen (NH_4). The high levels of ammonia detected in WS114 and WS115 (which are located adjacent to the sampling point from the canal middle sample) could possibly indicate a link to the elevated level of ammonium detected in the canal.

Other than this single sample, no exceedances of EQS values were noted from the surface water samples obtained from the pond, the canal of the drainage ditch.

Based from the single groundwater and surface water monitoring visit, results potentially indicate that CoC exceeding the EQS in both groundwater and leachate results have not been encountered within the surface water bodies.

9.6 Additional Parameters Assessment

Calorific Value

In consideration of the site history and material encountered on site, analysis of calorific value was undertaken. This is in response to information contained within the *Interdepartmental Committee on the Redevelopment of Contaminated Land Notes on the fire hazards of contaminated land (ICRCL Guidance Note 61/84)* which states that *in a few materials, notably colliery waste...., self-heating caused by slow chemical oxidation can occur. If the rate at which such heat is generated exceeds that at which it is released to the surroundings, the temperature may rise sufficiently for combustion to start and propagate.*

The same document goes on to state that the most widely used criterion to assess whether a sample, and consequently a site, can ignite and smoulder is the Calorific Value (CV). Calorific value is the quantity of heat which can be released from a sample after complete combustion in excess oxygen under 30 atmospheres pressure. The measurement of CV is quick, and may be useful for the initial screening of potentially combustible materials. The guidance notes state that *it seems likely that materials whose CVs exceed 10 MJ/Kg are almost certainly combustible, while those with values below 2MJ/kg are unlikely to burn. Within this range of values, there is likely to be a large number of potentially combustible material*

Twenty soil samples and two sediment samples were analysed for calorific value, with concentrations recorded at between 0 MJ/kg and 18M/kg.

Four samples were reported at concentrations >10MJ/kg. Three of the samples were reported in the black silt located within the former gravel pit (WS109, TP105, TP110) and the fourth was from material considered representative of gravel pit dredgings (TP110) located immediately south of the pond.

Based on the concentrations recorded and the guidance notes presented above, the silt material and dredgings are considered combustible.

A further seven samples (six made ground soils and one sediment) were reported with concentrations in the range 2MJ/kg to 10 MJ/kg considered potentially combustible.

9.7 Refined Conceptual Site Model

Based on the findings of the site investigation the conceptual site model for the site was updated in light of the information obtained. The refined conceptual site model is presented as Figure 7.

10 REFINED CONCEPTUAL SITE MODEL

The model procedures for the management of contaminated land – CLR11 published by DEFRA and the EA – use a staged and tiered risk-based approach to assess land contamination. The first part of the risk assessment process requires the development of a conceptual site model, initially based on available desk study information. On completion of intrusive works the conceptual model is refined. The conceptual model provides details of potential sources and receptors associated with the site and the pathways which could potentially link them. In order for a risk to be realised all three components of the source, pathway and receptor linkage must be present.

Information obtained from this phase of works, has been assessed along with information obtained from previous phases of works (if considered relevant) to refine the initial outline CSM presented in Section 4. The refined sources, pathways and receptors are presented below and presented as Figure 7.

10.1 Sources

Based on the findings of intrusive works at the site the following potential sources have been identified at the site:

- Concentrations of heavy metals, metalloid, TPH and PAH compounds in soil (made ground and natural) across the site;
- Concentrations of PAH compounds in groundwater across the western section of the site; and
- Ammoniacal nitrogen in groundwater across the site.

10.2 Pathways

Based on the findings of the site investigation, the following potential pathways for the site have been identified for its future use for residential use:

- Dermal contact;
- Ingestion;
- Outdoor and indoor vapour inhalation;
- Inhalation of wind blown dust of contaminated soil;
- Sub-surface migration; soil leaching and lateral migration of groundwater;
- Direct contact of soil and groundwater with building infrastructure including future foundations and services;
- Contact of the root zone of plants used in future landscaping with contaminated material and root uptake of contaminated shallow groundwater; and
- Migration of leachable contaminants along buried services.

10.3 Receptors

Based on the current and possible future use of the site, the following potential receptors have been identified as:

- Future site users (future residents);
- Construction workers and maintenance staff;
- Surface water features on site (pond and drainage ditch);
- Calder and Hebble Navigation adjacent to the north of the site;
- Shallow groundwater;

- Flora used in landscaping;
- Adjacent site users and structures (residential properties); and
- Future buildings structures and services.

11 ENVIRONMENTAL CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

The conclusions presented below are based on the information gathered as part of both this and the previous investigations and reports.

Site Conditions

The majority of the site has been extensively developed historically since the 19th Century, with a glass works, iron and steel works and an associated gravel pit being developed in the western half of the site. The gravel pit was subsequently partially backfilled and used as pond to the present day. Other areas of the site have anecdotally been used to store dredgings from the pond and demolition waste from off site sources.

The site investigation comprised trial pitting, cable percussion boreholes, window sample boreholes and rotary boreholes.

Ground conditions generally comprise four main units, made ground, Alluvium, River Terrace Deposits and the Lower Coal Measures. The made ground is generally 1m to 3.5m thick (up to 4.8m in the backfilled gravel pit) with the Alluvium and Terrace Deposits being encountered below this. The cable percussion and rotary boreholes encountered bedrock at between 7.0m and 10.7m bgl.

Groundwater was encountered across site in made ground and soil deposits. Standing levels recorded from the monitoring wells have shown groundwater in made ground and natural soils to generally rest between 36.10m AOD and 36.84m AOD. A groundwater flow direction is inconclusive, however, a best indication is a flow to the west or north-west.

A limited sampling exercise was conducted to obtain preliminary details of the condition of the existing pond, with results detailed in Section 6.1. The sampling conducted identified elevated concentrations of a number of CoC within the sediment samples. Based on the reported laboratory analysis results it is indicated that the pond does not represent a significant contaminant source area impacting upon the surrounding groundwater and surface water quality. However, the presence of scrap metal, scrap materials/waste and a tank cradle were identified within/within the base of the base. It is understood that the existing pond it to be retained as part of the proposed development and although perhaps not an environmental necessity, it is recommended these waste/scrap materials are removed from the pond as part of the development. Assessment to determine whether the pond can be re-used in its entirety as part of the proposed development is beyond the remit of this report.

Risk to Human Health

The results of soil, groundwater, surface water and soil leachate analysis have been compared to ARCADIS GAC for residential with gardens end use where it was shown that a number of CoC exceed the GAC protective of human health.

It was noted that human health exceedances were restricted to samples from soil (both made ground and natural) and not from groundwater, surface water or soil leachate. The soil samples from across site have shown levels of TPH, PAH compounds, benzene, lead and arsenic in exceedance of the respective GAC. The backfilled gravel pit, pond sediment and slurry pit dredging on the southern bank to the pond was identified as a noted areas of elevated CoC at the site.

The pathways by which the compounds identified in exceedance of GAC affect the relative receptors (in this case based on 0-6yr old females) is via inhalation pathways and inhalation of dust pathways. As detailed in Section 2.7 and following results from previous

investigations, it was previously recognised that a capping layer would be required as part of the development. Although a suitable capping layer of clean material would prevent direct contact and inhalation of dust pathway, the inhalation of vapours would still pose a potential risk to human health and would not remove ongoing liability associated with contamination at the site.

Risk to Water Resource Receptors

The results of soil, groundwater, surface water and soil leachate analysis have been compared to ARCADIS GAC for residential with gardens end use where it was shown that a number of CoC exceed the GAC protective of water resource receptors. The results have also been compared to Environmental Quality Standards (EQS) (which are protective of fishlife) which have also highlighted a number of exceedances.

The exceedances of both GAC and EQS were encountered in soil, groundwater, surface water and soil leachate samples.

Soil Samples

Soil samples from across site have shown levels of benzene, ethylbenzene, xylene, TPH and PAH compounds in exceedance of the GAC. The results are from both made ground and natural deposits.

Soil Leachate

Two samples have shown levels of PAH compounds in exceedance of the GAC. The results are restricted to one sample taken from TP120 (located in the central-eastern portion of site) and one sample taken from TP104 (located at the western bank of the pond).

Two soil leachate results exceeded the EQS for arsenic (TP112, TP113) and one sample exceeded the EQS for nickel (WS119), vanadium (TP112), zinc (WS119) and copper (TP124 and WS119).

The results indicate that some of the CoC from the soil have a very limited potential to migrate into the groundwater.

Surface Water and Groundwater Samples

Groundwater samples from site have shown levels of PAH compounds in exceedance of the GAC. The results are restricted to samples taken in the western area of site. No surface water samples exceeded the GAC protective of water resource receptors.

Six samples of groundwater exceeded the EQS limits (freshwater) for iron. One sample exceeded the EQS for arsenic (WS120) and one sample exceeded the EQS for nickel (WS119). No samples of the surface water receptors on site and adjacent to site have shown any results above EQS values.

The EQS levels have been created for use at the receptor (e.g. a river) so any exceedances reported in groundwater samples are conservative with respect to the surface water receptor. As the surface water receptors on site and adjacent to site have shown no exceedances of EQS values it is considered that these compounds encountered in the groundwater are not impacting significantly upon the surface water quality.

Ammoniacal nitrogen as ammonium and ammonia has exceeded the respective EQS levels. It has shown that ammonium is encountered across site and within one section of the canal. The more toxic ammonia has been encountered above EQS levels in three locations, beside the canal and beside the pond. As levels of ammonia above EQS values have not been encountered within the surface water receptors (pond, stream or canal), it is considered that the concentrations encountered in groundwater beneath the site are not significantly impacting upon the surface waters. The lack of impacts identified in the surface water is not however justification that the pollutant pathway linking impacts in groundwater to the surface

water receptors is not active. The potential risk should be further assessed as part of a DQRA.

Potential Pollutant Linkage

The results indicate that some of the CoC highlighted within the soil samples have not been identified in the groundwater. It is possible that leaching of CoC from the made ground material, may have already taken place, with the soils providing only limited continued potential to impact upon the groundwater. A number of PAH compounds encountered in both soil and soil leachate samples have also been encountered in groundwater indicative of a pollutant linkage. The respective PAH compounds are of low mobility in water and show only minor exceedances. Due to the low sensitivity of water resource receptors (no abstractions within 250m, no drinking water abstractions within 1km) it is considered that these compounds are unlikely to pose a significant risk.

Previous Reports

This ARCADIS investigation has shown that results from the previous site investigations carried out concur with ground conditions on site. The previous Exploration Associates reports indicated a risk to human health posed from heavy metals and PAH compounds within the made ground, and that a capping layer should be installed to break the contamination pathway. The reports also highlighted the elevated levels of ammoniacal nitrogen, though they stated that it was likely to have been created from an off site source.

The CL Associates report made additional comments to the possibility of TPH and VOC contamination and the possible need for a DQRA to be carried out based on further site investigation.

11.2 Recommendations

A number of potential pollutant linkages have been identified as being present on site. It has been shown, based on the generic assessment conducted and the current site condition that the risk to water resource receptors is low and no further actions are deemed necessary to address this risk. It should be noted however, that there are a number of CoC for which a GAC has not been defined and the risk posed by concentrations of these CoC is therefore outside of the quantitative risk assessment conducted.

It is further noted that this assessment is based on one round of groundwater sample collection and monitoring. As detailed in Section 2.7, the EA have stated a requirement for three rounds of monitoring to be conducted. The final assessment should be conducted following completion of the additional two rounds of monitoring.

Although the refined conceptual model, based on current site conditions, indicates the site is not significantly impacting upon controlled water resources, the movement of material around the site has the potential to re-mobilise some contaminants of concern. Therefore, as detailed in Section 7.1, it is recommended that a DQRA is carried out to include a water resource risk assessment in order to demonstrate that the materials are chemically suitable for reuse. The DQRA will provide Site Specific Assessment Criteria (SSAC) for each of the contaminants, which can be used to demonstrate that the material is suitable for its particular end use. At present only a generic quantitative risk assessment has been undertaken which has indicated that much of the soil had concentrations of CoC above the applicable SSAC. Without carrying out a DQRA it will not be possible to reuse the material as it will not be possible to demonstrate that it is suitable for use.

Human health receptors for a residential end use with gardens have been shown to be at risk from CoC currently on site. It is recommended that a detailed quantitative risk assessment (DQRA) be carried out to create site specific assessment criteria (SSAC) for the CoC in exceedance of GAC to enable assessment of suitability of material with respect to the proposed development.

The result of the DQRA would be used to inform the requirements for and/or design of the Remediation Options Appraisal to determine the most appropriate remedial measures.

The investigation has highlighted soils in the vicinity of the former gravel pit which are potentially combustible due to high calorific value. The majority of these soils are currently located within the pond, and as such will be prevented from combusting due to the high water level in this area. A quantity of dredged sediment is also present in this area. This material is at a higher risk of combustion and may be re-used elsewhere in the development. In order to mitigate the potential for combustion of this material it is recommended that it be used in less sensitive areas of the site (i.e. outside of building plots), the material is placed and compacted in a controlled manner to minimise air entrainment, and the material is placed beneath a minimum 600mm layer of compacted cover. A number of potential combustible soils have also been identified elsewhere on site. It is recommended that a similar protocol be adopted to minimise the possibility of combustion in these materials.

12 GEOTECHNICAL APPRAISAL

12.1 Proposed Development

The site is to be developed with a number of two storey detached and semi detached properties. A smaller number of flats are also understood to be included in the scheme. (West and Machell Drg 2776(1) P007b Site Layout). Finished floor levels for the units are proposed at 38.70m AOD, details of how the site will link with Forge Lane (43.60m AOD) have not been finalised. The existing surface water features (pond and stream) are to be retained in the proposed development and a public footpath along the Calder and Hebble Navigation will be constructed. The proposed development is constrained by a number of existing underground utilities including culverted watercourses, sewers and at least one water main.

It is anticipated that in order to achieve the proposed site levels it will be necessary to conduct an earthworks reprofiling exercise. A preliminary cut and fill exercise carried out by Kirklees Council has indicated that on average the western areas of the site will be raised by 150mm, with the easternmost area of the site requiring uplift by approximately 1500mm. A detailed cut/fill balance is outside of the scope of this commission, however, as detailed in section 7, information provided by Kirklees Council detailed a nett deficit, with a fill requirement of 6,621 cubic metres which equates to a topping layer across the site which would be 118mm thick to achieve site levels.

12.2 Foundations

Ground conditions beneath the site generally comprise a layer of variable made ground overlying alluvial deposits and sands and gravels. Groundwater is present at approximately 36.60m AOD, but is anticipated to be subject to seasonal variations.

Given the ground conditions observed and the proposed site levels, three distinct areas of the site have been identified, namely:

- Central and western area of the site (covering approximately 2/3 of the site)
- Eastern area of the site (covering approximately 1/4 of the site area);and
- Vicinity of the infilled gravel pit (area to north west, west and south of current pond).

A brief summary of the foundation options for these areas is outlined below.

Central and Western Area

The made ground is highly variable in composition and consistency and is not considered suitable as a founding medium in its current condition. In the western most area of the site, it is anticipated that a number of relict footings, floor slabs etc. will be present associated with the former steel works buildings. In the area immediately north east of the current pond a quantity of demolition rubble (including a large proportion of oversize concrete etc.) has recently been deposited.

This area will require excavation in the western most section and uplift in the central and eastern areas to achieve proposed site levels.

The natural granular soils in this area are considered suitable bearing strata, however, due to their depth and the high water table, the use of strip or trench fill foundations are unlikely to be practicable. It is therefore recommended that improvement of the bearing characteristics of the made ground be carried out to provide a stratum suitable of supporting shallow pad or raft foundations. Prior to ground improvement it will be necessary to remove relict footings, slabs, oversize concrete etc. These materials should then be crushed suitable for re-use as secondary site won aggregate. Following removal of the hard spots it is considered likely that vibrocompaction or rolling dynamic compaction will be capable of improving the bearing

properties of the made ground sufficient to support loadings of up to 50 kN/m². It should, however, be noted that these techniques may not be suitable locally due to the presence of sewers/culverts etc which are to be retained. In addition, during a previous phase of investigation, Exploration Associates encountered an area of the site underlain by peat along the site's northern boundary. It is understood that this area is not currently proposed for development, however, should this change, or the peat be found to be more laterally extensive, ground improvement will not be suitable in this area. Alternatively consideration could be given to excavating all of the made ground in this area with replacement of the made ground to an engineering specification as detailed in Section 12.4.

It is recommended that specialist ground improvement contractors be contacted to discuss the suitability of their proprietary ground improvement solutions prior to finalising the foundation design.

Where ground improvement is not appropriate (due to protected structures, peat etc.) or where higher loadings are required (e.g. for flats), it will be necessary to transmit foundation loads to a more competent stratum at depth. It is therefore considered that piled foundations will be the most appropriate solution for these areas of the site.

It is considered that piles end bearing within the Lower Coal Measures deposits will be suitable with piles likely to be in the order of 8 to 10m in depth in order to fully penetrate the Alluvium.

Driven piles have the disadvantage of causing unacceptable amounts of vibration that could potentially damage to nearby above and underground structures. If driven piles are used then assurances will need to be sought from the piling contractor that damage will not be caused to nearby structures, including buried infrastructure on the site. Alternatively, consideration could be given to adopting continuous flight auger (CFA) piles.

Piles in rock are usually driven to refusal in order to obtain the maximum carrying capacity from the pile. It should be noted that the carrying capacity of the pile may therefore be dictated by the strength of the pile shaft. In addition, piles that are not driven a sufficient distance into the rock have the potential to buckle due to the lack of lateral support. This could be an issue on this particular site as the materials located above rock were generally soft and are unlikely to provide much lateral support. The pile solution will also need to take into account of the possibility of negative skin friction being imposed by settlement of the shallow fill and compressible peat and Alluvium.

It is recommended that a specialist piling contractor should be consulted prior to finalising the foundation design.

Eastern Area of Site

In the easternmost area of the site, it is anticipated that site levels will be raised by approximately 1.0 to 1.5m. Again due to the high water table, it is unlikely that construction of foundations within the natural granular deposits will be economical. It is therefore recommended that during uplifting of the site, material be placed and compacted in a controlled manner to facilitate the use of shallow raft foundations. An appropriate level of verification testing should be consulted to confirm the earthworks will achieve the required bearing and settlement criteria.

Raft footings will not be appropriate where higher loads, long terraces or flats are proposed. In these instances a piled foundation solution should be adopted as outlined previously.

Vicinity of Former Gravel Pit

In the vicinity of the former gravel pit, the made ground was found to consist of a soft or very soft clayey silt to a depth of 4.8m bgl. This material has very low shear strength and is likely to be highly compressible. Traditional ground improvement techniques are unlikely to be

suitable, however, the use of vibro concrete columns may be suitable for lightly loaded structures. It is recommended that a specialist ground improvement contractor is contacted to confirm the suitability for vibro concrete columns in this area of the site.

If vibro concrete columns are unsuitable, then a piled foundation option should be adopted. The precautions highlighted previously against buckling and negative skin friction should be adopted.

12.3 Floor Slabs

Where ground improvements are undertaken to improve the bearing capacity of the near surface soils, it is anticipated that ground bearing floor slabs will be appropriate, however, where a piled foundation solution is required, fully suspended floor slabs should be adopted.

It should be noted that the environmental assessment has indicated the presence of several VOCs in the soils beneath the site at concentrations above the laboratory method detection limit and in some cases above the GAC. VOCs can present a risk to the end users of the site via the inhalation pathway. A DQRA is recommended in order to assess the risk further. However, if VOCs are identified at concentrations in excess of the SSAC derived as part of the DQRA mitigation measures will need to be installed into the proposed buildings to prevent vapour intrusion from occurring.

Further comment on the need for gas protection measures within the floor slab will be included within the addendum ground gas assessment report.

12.4 Earthworks

It is understood that earthworks will be required in order to achieve the proposed finished levels.

In areas of fill, where future use comprises car parking, hardstanding or access roads, materials excavated from site may be reused provided they comply with the acceptability criteria for earthworks as defined by the Highways Agency Manual of Contract for Highways Work, Volume 1: Specification for Highway Works, Series 600, Earthworks (SHW) (available at www.standardsforhighways.co.uk/). The materials should be compacted using an appropriate method compaction as defined in the SHW.

In areas of fill beneath proposed structures, fills should be selected in accordance with the SHW and compacted using an appropriate end product compaction specification. An appropriate level of compaction and frequency and method of test will need to be selected depending upon floor loads etc. It is recommended that the fill does not support structural foundations but it could be suitable for ground bearing floor slabs.

The made ground was found to be variable and therefore is likely to include granular (Class 1 material for reuse) as well as cohesive materials (Class 2). It should be noted that granular materials with a high fines content may also be classified as Class 2. It is recommended that the made ground material available for reuse is assessed once the final levels are determined and available material is identified.

Soft cohesive materials will not suitable for reuse. Other unsuitable materials encountered (e.g. timber, plastic etc), should be removed from site.

It is important that materials that are moved around the site are not considered to be waste. Further details are provided in Section 7 of this report.

12.5 Excavations

Excavations for services and foundations should be well within the capability of conventional backhoe excavators. All excavations are likely to require close sided support in the form of trench sheets or sheet piles. Alternatively, the sides of the excavation could be battered back to a safe angle to allow man access.

Standing groundwater was encountered at approximately 36.60m AOD It will therefore be necessary to provide a system of groundwater control where excavations deeper than 36.60m AOD are required. Appropriate discharge consents will need to be obtained.

12.6 Hardstanding/roads

The results of in situ and laboratory CBR testing have identified a range of CBR values from approximately 4.5% to in excess of 30% across much of the site. It is recommended that a CBR value of 4.5% be adopted for preliminary pavement design. The formation should be considered to be frost susceptible. Following excavation, the formation should be proof rolled and any soft spots or deleterious materials should be removed and replaced with well compacted granular fill.

In the vicinity of the former gravel pit significant thicknesses of soft silts have been recorded. Laboratory CBR values within this material have recorded CBR values of <0.5%. It is likely that additional precautions will be required in this area to mitigate potential total differential settlements where roads cross this material. It is likely that pre-consolidation, via application of a surcharge load, will reduce the total settlements, however, given the depth of the material, long term consolidation is likely to occur. It is also anticipated that the Local Authority will require the use of a geotextile reinforced granular blanket in this area of the site to further minimise settlement.

The Local Authority Highways Department should be contacted to confirm that such a technique will be acceptable for any highways which are to be adopted.

12.7 Subsurface concrete

Concentrations of sulphate in groundwater were found to range up to 1,270 mg/l, with pH ranging from 6.9 to 8.7. Concentrations of water soluble sulphate in soil ranged up to 1,300 mg/l and pH values ranged from 4.7 to 7.6.

BRE Special Digest 1: 2005 Concrete in Aggressive Ground indicates that the design sulphate class is DS-2 and the corresponding ACEC Class is AC-2.

The earthworks could potentially oxidise sulphur compounds (i.e. pyrite) to form sulphates. It is therefore recommended that total potential sulphate testing is carried out to confirm the above classification.

12.8 Retaining Walls

At present details of the treatment to the western boundary have not been finalised. We would be happy to provide further advice on retaining wall design once further information is available.

13 STUDY LIMITATIONS

IMPORTANT. This section should be read before reliance is placed on any of the information, opinions, advice, recommendations or conclusions contained in this report.

1. This report has been prepared by Arcadis (UK) Ltd (ARCADIS), with all reasonable skill, care and diligence within the terms of the Appointment and with the resources and manpower agreed with Kirklees Council (the 'Client'). ARCADIS does not accept responsibility for any matters outside the agreed scope.
2. This report has been prepared for the sole benefit of the Client unless agreed otherwise in writing.
3. Unless stated otherwise, no consultations with authorities or funders or other interested third parties have been carried out. ARCADIS are unable to give categorical assurance that the findings will be accepted by these third parties as such bodies may have unpublished, more stringent objectives. Further work may be required by these parties.
4. All work carried out in preparing this report has used, and is based on, ARCADIS' professional knowledge and understanding of current relevant legislation. Changes in legislation or regulatory guidance may cause the opinion or advice contained in this report to become inappropriate or incorrect. In giving opinions and advice pending changes in legislation, of which ARCADIS is aware, have been considered. Following delivery of the report ARCADIS have no obligation to advise the Client or any other party of such changes or their repercussions.
5. This report is only valid when used in its entirety. Any information or advice included in the report should not be relied upon until considered in the context of the whole report.
6. Whilst this report and the opinions made are to the best of ARCADIS' belief, ARCADIS cannot guarantee the accuracy or completeness of any information provided by third parties.
7. This report has been prepared based on the information reasonably available during the project programme. All information relevant to the scope may not have received.
8. This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of changes in the condition of the site since the time of the investigation.
9. The content of this report represents the professional opinion of experienced environmental consultants. ARCADIS does not provide specialist legal or other professional advice. The advice of other professionals may be required.
10. Where intrusive investigation techniques have been employed they have been designed to provide a reasonable level of assurance on the conditions. Given the discrete nature of sampling, no investigation technique is capable of identifying all conditions present in all areas. In some cases the investigation is further limited by site operations, underground obstructions and above ground structures. Unless otherwise stated, areas beyond the boundary of the site have not been investigated.
11. If below ground intrusive investigations have been conducted as part of the scope, service tracing for safe location of exploratory holes has been carried out. The location of underground services shown on any drawing in this report has been determined by visual observations and electromagnetic techniques. No guarantee can be given that all services have been identified. Additional services, structures or other below ground obstructions, not indicated on the drawing, may be present on site.
12. Unless otherwise stated the report provides no comment on the nature of building materials, operational integrity of the facility or on any regulatory compliance issues.
13. Unless otherwise stated, samples from the site (soil, groundwater, building fabric or other samples) have NOT been analysed or assessed for waste classification purpose.

TABLES

Table 1

Borehole and Groundwater Elevation Data

BH ID	BH Level (m AOD)	GW Level (m bgl)	GW Level (m AOD)
WS101	38.280	1.654	36.626
WS102	38.734	1.97	36.764
WS103	38.650	2.847	35.803
WS104	38.000	1.662	36.338
WS105	38.412	2.128	36.284
WS106	38.346	1.815	36.531
WS107	38.526	2.424	36.102
WS108	37.857	1.207	36.650
WS109	37.844	1.152	36.692
WS110	37.768	0.942	36.826
WS111	37.581	0.789	36.792
WS112	37.283	0.442	36.841
WS113	40.956	DRY	-
WS114	38.612	2.123	36.489
WS115	39.517	3.133	36.384
WS116	38.099	1.428	36.671
WS117	38.869	2.455	36.414
WS118	38.391	DRY	-
WS119	38.638	2.293	36.345
WS120	39.758	2.727	37.031
CP101	38.118	1.678	36.440
CP102	38.151	1.876	36.275
CP103	38.026	1.539	36.487
CP104	38.848	2.256	36.592

Results taken on 24th March 2011

**Table 2
Inorganic Compound Concentrations in Soil**

Sample Identity	CP101	CP102	CP103	CP104	TP101	TP102	TP103	TP104	TP105	TP105	TP108	TP109	TP109	TP109	TP110	TP110	TP111	TP112	TP112		
Stratum	Made Ground	Made Ground	Made Ground	Made Ground	Topsoil	Topsoil	Topsoil	Made Ground	Made Ground	Made Ground	Topsoil	Made Ground									
Sample Depth	0.50-1.00	0.20-1.00	0.50-1.00	0.50-1.00	0.20-0.30	0.20-0.30	0.50-0.60	2.00-2.50	3.50-4.00	1.00-1.50	0.20-0.30	0.20-0.30	1.50-1.60	2.60-2.70	2.20-	3.00-	0.30-	0.50-	1.40-		
Date of Sampling	14/02/2011	16/02/2011	17/02/2011	18/02/2011	16/02/2011	16/02/2011	16/02/2011	18/02/2011	18/02/2011	18/02/2011	18/02/2011	18/02/2011	18/02/2011	18/02/2011	23/02/2011	23/02/2011	21/02/2011	21/02/2011	21/02/2011		
Test	Units	LOD																			
Chloride (soluble)	mg/kg	<5	11.3	19.6	5.73	5.81	7.68	10.7	8.81	268	586	8.4	15.7	7.73		48.8	156		6.89	19.6	21.4
Fluoride, 2:1 water soluble	mg/kg	<1	2.09	1.1	3.61	1.5	1.26	-	-	1.31	1.35	2.99	2.06	-		1.36	1.84		2.05	-	1.13
Phosphate (ortho) as PO4, 2:1 water soluble	mg/kg	<3	-	-	-	-	-	-	-	-	-	-	-	-		-	-		-	-	-
Phosphate (ortho) as PO4	mg/kg	<1	-	-	-	-	-	-	-	-	-	-	-	-		-	-		-	-	-
Nitrite as NO2, 2:1 water soluble	mg/kg	<0.1	0.93	1.03	0.64	0.61	0.12	0.12	0.15	0.34	0.25	2.87	0.86	-		0.21	0.29		0.81	-	1.84
Nitrate as NO3, 2:1 water soluble	mg/kg	<1	11.4	18.7	-	8.9	10.8	13.6	9.2	3.15	-	4.36	16.5	4.47		-	-		5.94	3.81	21.1
Ammoniacal Nitrogen as N	mg/kg	<15	-	-	-	-	-	-	-	-	-	-	-	-		-	56.6		-	-	-
Sulphur, Elemental	mg/kg	<5	-	-	-	-	11.9	-	-	-	-	-	-	-		114	1140		15.4	-	-
Sulphur, Total	%	<0.02	-	0.4	-	-	0.09	-	-	-	-	-	-	-		1.55	-		0.26	-	-
Sulphide, Easily liberated	mg/kg	<15	-	-	-	-	-	-	-	-	-	-	-	-		27.1	426		-	-	-
Water Soluble Sulphate as SO4 2:1 Extract	g/l	<0.008	-	-	-	-	0.0314	-	-	-	-	-	-	-		1.12	-		0.36	-	-
Sulphate, Total	mg/kg	<48	-	2,780	-	-	497	-	-	-	-	-	-	-		4,010	865		2,520	-	-
ANC @ pH 4	mol/kg	<0.03	-	-	-	-	-	-	-	-	-	-	-	-		0.0345	-		-	-	-
ANC @ pH 6	mol/kg	<0.03	-	-	-	-	-	-	-	-	-	-	-	-		-	-		-	-	-
Cyanide, Total	mg/kg	<1	-	-	-	-	-	-	72.3	65.8	-	15.4	157	-		45.1	-		-	-	-
Cyanide, Free	mg/kg	<1	-	-	-	-	-	-	-	-	-	-	-	-		-	-		-	-	-
Calorific value*	kJ/kg		-	2320	-	-	-	-	-	-	13400	-	-	-		18400	-	15600	967	-	-
pH	pH Units	<1	8.06	9.38	8.15	8.12	7.31	6.97	6.44	8.43	8.11	8.3	8.11	4.85		7.44	7.39		9.89	9.15	10.5
Loss on ignition	%	<0.7	-	-	-	-	-	-	-	-	-	-	-	-		32.3	-		-	-	-
Organic Carbon, Total	%	<0.2	-	-	-	-	-	-	-	-	-	-	-	-		10.4	9.32		2.49	-	-
Asbestos Containing Material Screen	na	na	No ACM	No ACM	No ACM	No ACM	No ACM	No ACM	No ACM	No ACM	No ACM	No ACM	No ACM	No ACM		No ACM	No ACM		No ACM	No ACM	No ACM

Notes:

- m bgl : Meters below ground level
- na : Not applicable
- ACM : Asbestos containing material
- No ACM : No Asbestos containing material detected
- Poss ACM : Possible Asbestos containing material detected
- LOD : Limit of detection
- : Below LOD
- : Not analysed

1.23 Calorific value greater than 10 MJ/Kg representing material this is are almost certainly combustible (ICRCL Guidance Note 61/84)

**Table 2
Inorganic Compound Concentrations in Soil**

Sample Identity	TP113	TP113	TP114	TP115	TP116	TP117	TP118	TP119	TP120	TP120	TP122	TP124	TP124	TP125	WS101	WS102	WS102	WS103
Stratum	Made Ground																	
Sample Depth	0.60-	1.20-	1.00-	1.00-	1.00-	0.40-	0.30-	0.50-	0.30-	0.50-	0.30-	0.40-	0.80-	0.50-	0.50-0.70	0.80-1.00	1.40-1.60	0.60-0.80
Date of Sampling	21/02/2011	21/02/2011	21/02/2011	21/02/2011	21/02/2011	23/02/2011	23/02/2011	23/02/2011	23/02/2011	23/02/2011	23/02/2011	25/02/2011	25/02/2011	25/02/2011	14/02/2011	14/02/2011	14/02/2011	14/02/2011
Test	Units	LOD																
Chloride (soluble)	mg/kg	<5	11.5	16.9	14	65.8	5.89	20	15.1	34.2	17.3	17.2	10.4	20	13.7	-		
Fluoride, 2:1 water soluble	mg/kg	<1	-	1.05	3.09	1.83	1.73	4.14	5.1	2.54	7.71	1.78	2.38	2.81	1.79	-		
Phosphate (ortho) as PO4, 2:1 water soluble	mg/kg	<3																
Phosphate (ortho) as PO4	mg/kg	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite as NO2, 2:1 water soluble	mg/kg	<0.1	0.68	0.73	0.95	1.3	1.13	3.98	2.74	3.26	2.51	1.64	0.88	1.26	0.56	0.63		
Nitrate as NO3, 2:1 water soluble	mg/kg	<1	23	7.98	5.83	57.9	-	7.23	5.16	-	7.64	3.67	5.65	4.25	1.77	3.13		
Ammoniacal Nitrogen as N	mg/kg	<15		460	-													
Sulphur, Elemental	mg/kg	<5		13.8	<25			17	189	143		57.7	226	<25	181		19.9	111
Sulphur, Total	%	<0.02		0.3	0.24										0.38		0.45	0.29
Sulphide, Easily liberated	mg/kg	<15		-	-			26	-	-		-	-	-	18.1		-	-
Water Soluble Sulphate as SO4 2:1 Extract	g/l	<0.008		1.22	0.318										0.147		0.0252	0.159
Sulphate, Total	mg/kg	<48		7,170	3,980			1,610	2,480	1,710		1,150	2,110		1,130	2,940	3,630	2,910
ANC @ pH 4	mol/kg	<0.03				0.237	0.0812				0.76							
ANC @ pH 6	mol/kg	<0.03				0.077	0.0346				0.239							
Cyanide, Total	mg/kg	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide, Free	mg/kg	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calorific value*	kJ/kg			738			1820	6960	5620			8210			1,760		1,720	-
pH	pH Units	<1	8.39	8.09	8.42	7.97	8.49	8.54	8.51	8.3	8.5	8.44	7.62	8.47	8.44	8.5	7.35	
Loss on ignition	%	<0.7				41	7.04					7.2						
Organic Carbon, Total	%	<0.2			5.59	14.3	4.3	0.39	7.39	6.92		4.29	9.14		6.45		7.89	7.98
Asbestos Containing Material Screen	na	na	No ACM															

- Notes:**
- m bgl : Meters below ground level
 - na : Not applicable
 - ACM : Asbestos containing material
 - No ACM : No Asbestos containing material detected
 - Poss ACM : Possible Asbestos containing material detected
 - LOD : Limit of detection
 - : Below LOD
 - : Not analysed
 - 1.23** : Calorific value greater than 10 MJ/Kg ref

**Table 2
Inorganic Compound Concentrations in Soil**

Sample Identity	WS103	WS105	WS107	WS108	WS109	WS109	WS110	WS113	WS114	WS115	WS116	WS117	WS118	WS119	TP114	TP120	TP121		
Stratum	Made Ground	Sand	Clay	Clay															
Sample Depth	1.60-1.80	0.80-1.00	0.70-1.00	0.60-0.75	1.00-2.00	2.50-2.80	0.50-1.00	1.50-2.00	0.50-1.00	1.60-1.90	0.30-0.60	0.60-0.90	0.50-0.70	0.30-0.50	2.50-	2.10-	1.00-		
Date of Sampling	14/02/2011	15/02/2011	15/02/2011	16/02/2011	16/02/2011	16/02/2011	16/02/2011	17/02/2011	17/02/2011	17/02/2011	17/02/2011	17/02/2011	18/02/2011	18/02/2011	21/02/2011	23/02/2011	23/02/2011		
Test	Units	LOD																	
Chloride (soluble)	mg/kg	<5	7.46	7.28	13.9	22.3	7.11	282	58.2	13.8	-	-	12.2	-	6.95	18	7.56	16.9	5.13
Fluoride, 2:1 water soluble	mg/kg	<1	1.35	2.35	2.3	1.65	1.46	-	-	-	-	-	1.13	-	3.85	-	2.5	1.95	-
Phosphate (ortho) as PO4, 2:1 water soluble	mg/kg	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphate (ortho) as PO4	mg/kg	<1	-	-	-	1.52	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite as NO2, 2:1 water soluble	mg/kg	<0.1	0.48	0.15	0.32	0.1	0.94	0.29	0.18	1.74	0.45	0.29	0.46	-	2.26	-	0.7	2.86	1.36
Nitrate as NO3, 2:1 water soluble	mg/kg	<1	20.7	13	9.94	-	1.51	-	8.43	28.1	-	-	-	-	6.75	6.61	3.27	5.56	2.24
Ammoniacal Nitrogen as N	mg/kg	<15	-	-	-	-	-	79.5	-	-	-	-	-	-	-	-	-	-	-
Sulphur, Elemental	mg/kg	<5	-	-	16.3	67.9	-	200	-	-	-	-	60.2	-	41.9	-	-	-	-
Sulphur, Total	%	<0.02	-	-	0.2	0.16	-	1.3	0.22	0.22	0.03	0.02	0.21	-	0.24	-	-	-	-
Sulphide, Easily liberated	mg/kg	<15	-	-	-	-	-	560	-	-	-	-	-	-	20.4	-	-	-	-
Water Soluble Sulphate as SO4 2:1 Extract	g/l	<0.008	-	-	0.19	0.0536	-	1.67	-	-	-	-	0.041	-	0.0325	-	-	-	-
Sulphate, Total	mg/kg	<48	-	-	1,520	734	-	9,420	4,660	2,990	81	103	3,350	-	1,380	-	-	-	-
ANC @ pH 4	mol/kg	<0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANC @ pH 6	mol/kg	<0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide, Total	mg/kg	<1	-	-	-	2.93	-	145	4.56	2.38	-	-	-	-	196	-	-	-	-
Cyanide, Free	mg/kg	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calorific value*	kJ/kg		-	-	2430	1980	-	11500	1080	2760	-	-	1630	-	-	-	-	-	-
pH	pH Units	<1	7.41	7.81	6.93	7.12	7.22	7.56	5.52	8.11	7.36	6.06	7.71	-	8.27	4.69	8.4	8.03	7.42
Loss on ignition	%	<0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Organic Carbon, Total	%	<0.2	-	-	4.35	4.79	-	12.4	4.66	4.29	-	-	-	-	6.92	-	-	-	-
Asbestos Containing Material Screen	na	na	No ACM	Poss ACM	No ACM	No ACM	No ACM	No ACM	No ACM										

Notes:

- m bgl : Meters below ground level
- na : Not applicable
- ACM : Asbestos containing material
- No ACM : No Asbestos containing material detected
- Poss ACM : Possible Asbestos containing material detected
- LOD : Limit of detection
- : Below LOD
- : Not analysed
- 1.23** : Calorific value greater than 10 MJ/Kg ref

**Table 2
Inorganic Compound Concentrations in Soil**

Sample Identity			TP122	WS104	WS106	WS108	WS111	WS112	WS113	WS114	WS118	SEDIMENT 1	SEDIMENT 2	SEDIMENT 3
Stratum			Clay	Gravel	Sand	Clay	Clay	Sand	Sand	Clay	Clay			
Sample Depth			1.00-	1.50-1.70	2.30-2.60	1.00-1.30	0.70-1.00	0.60-1.00	3.50-4.00	3.50-4.00	1.50-1.70	1.00-1.00	0.20-0.30	-
Date of Sampling			23/02/2011	15/02/2011	15/02/2011	16/02/2011	16/02/2011	16/02/2011	17/02/2011	17/02/2011	18/02/2011	16/02/2011	18/02/2011	23/02/2011
Test	Units	LOD												
Chloride (soluble)	mg/kg	<5	10.6	20.8	8.55	33.2	-	51.5	-	44.3	8.48	71.8	29.7	
Fluoride, 2:1 water soluble	mg/kg	<1	1.41	1.34	-	1.03	-	-	-	1.17	1.39	-	-	
Phosphate (ortho) as PO4, 2:1 water soluble	mg/kg	<3												
Phosphate (ortho) as PO4	mg/kg	<1	-	-	-	-	-	-	-	-	-	-	-	
Nitrite as NO2, 2:1 water soluble	mg/kg	<0.1	3.2	0.36	0.29	0.17	0.17	0.4	-	0.1	1	0.15	0.14	
Nitrate as NO3, 2:1 water soluble	mg/kg	<1	-	-	-	7.57	1.88	-	1.22	1.01	4.79	-	-	
Ammoniacal Nitrogen as N	mg/kg	<15						-				36.4	-	-
Sulphur, Elemental	mg/kg	<5										336	548	
Sulphur, Total	%	<0.02						0.05				0.06	0.17	
Sulphide, Easily liberated	mg/kg	<15						-				-	76.1	-
Water Soluble Sulphate as SO4 2:1 Extract	g/l	<0.008										<0.008	0.128	
Sulphate, Total	mg/kg	<48						421				512	-	1,540
ANC @ pH 4	mol/kg	<0.03												
ANC @ pH 6	mol/kg	<0.03												
Cyanide, Total	mg/kg	<1	-	-	-	-	-	-	-	-	-	1.77	-	-
Cyanide, Free	mg/kg	<1	-	-	-	-	-	-	-	-	-	-	-	-
Calorific value*	kJ/kg							0				467	2,070	
pH	pH Units	<1	8.14	7.62	7.3	7.41	7.14	7.73	5.96	6.57	7.79	6.59	7.17	7.07
Loss on ignition	%	<0.7												
Organic Carbon, Total	%	<0.2						1.24				2.22	5.91	9.8
Asbestos Containing Material Screen	na	na	No ACM											

Notes:

- m bgl : Meters below ground level
- na : Not applicable
- ACM : Asbestos containing material
- No ACM : No Asbestos containing material detected
- Poss ACM : Possible Asbestos containing material detected
- LOD : Limit of detection
- : Below LOD
- : Not analysed
- 1.23** : Calorific value greater than 10 MJ/Kg req

Table 3

Metals and Metalloid Compound Concentrations in Soil (mg/kg)

Sample Identity			GAC Human Health - Residential (mg/kg)	CP101	CP102	CP103	CP104	TP101	TP102	TP103	TP104	TP105	TP105	TP108	TP109	TP109	TP110	TP111	TP112	
Stratum	Sample Depth (m bgl)	Date of Sampling		Made Ground	Made Ground	Made Ground	Made Ground	Topsoil	Topsoil	Topsoil	Made Ground									
Units	LOD			0.50-1.00	0.20-1.00	0.50-1.00	0.50-1.00	0.20-0.30	0.20-0.30	0.50-0.60	2.00-2.50	3.50-4.00	1.00-1.50	0.20-0.30	0.20-0.30	2.60-2.70	2.20-	0.30-	0.50-	
Test				14/02/2011	16/02/2011	17/02/2011	18/02/2011	16/02/2011	16/02/2011	16/02/2011	18/02/2011	18/02/2011	18/02/2011	18/02/2011	18/02/2011	18/02/2011	18/02/2011	23/02/2011	21/02/2011	21/02/2011
Aluminium	mg/kg	<11	ND	15,700	8,360	11,800	8,870	11,000	11,900	17,600	7,530	9,990	9,270	13,400	7,420	10,500	10,700	9,080	52,500	
Arsenic	mg/kg	<0.6	32	29.7	29.5	134	23.8	38.7	43.2	123	78.9	63.7	48.1	63	59.1	60	58.6	95.8	71.1	
Beryllium	mg/kg	<0.01	ND	2.61	0.767	1.6	1.38	1.41	1.52	2.39	1.18	1.34	1.11	1.51	0.974	1.09	1.58	0.835	8.86	
Boron, water soluble	mg/kg	<1	234	-	-	-	-	-	-	1.02	-	-	-	-	-	-	1.61	-	-	
Cadmium	mg/kg	<0.02	10	-	-	-	-	-	-	-	0.579	0.272	-	-	-	-	0.404	-	-	
Chromium	mg/kg	<0.9	1.59E+05	24.9	32.8	39.1	19.4	24	25.9	30.2	28.2	28.8	35.1	39.8	20.5	16.8	57.8	11.3	20.1	
Chromium, Hexavalent	mg/kg	<0.6	36	-	<1.2	5.26	-	-	-	<1.2	-	-	-	<1.2	<1.2	-	-	-	-	
Copper	mg/kg	<1.4	3363	67.5	68.9	114	38.7	40.7	53.1	141	54.8	58.7	80.1	77.2	47.2	58	96.4	29.7	139	
Iron	mg/kg	<2	ND	74,300	64,800	74,400	78,700	39,800	39,800	56,800	31,300	27,700	58,700	39,400	19,800	29,300	78,100	29,100	113,000	
Lead	mg/kg	<0.7	400	132	244	524	108	81.9	113	141	54.3	55.4	193	497	47.1	758	596	2,270	6.66	
Magnesium	mg/kg	<8	ND	1,820	2,180	4,350	2,190	1,950	2,160	2,070	2,380	2,980	2,750	3,090	1,520	1,610	1,970	1,760	10,600	
Mercury	mg/kg	<0.14	0.012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Molybdenum	mg/kg	<0.1	107	7	2.95	8.41	0.874	3.57	3.26	6.53	3.68	2.99	5.14	3.56	3.06	6.8	-	3.21	23	
Nickel	mg/kg	<0.2	130	35.6	30.3	50	35.1	30.2	41.3	61.5	34.4	35.2	31.1	38	15.6	39.4	32.8	17.2	58.5	
Silver	mg/kg	<10	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Tin	mg/kg	<0.24	ND	4.36	5.04	12	3.66	6.09	5.36	6.66	1.93	2.13	5.35	17.7	1.81	6.11	9.7	1.31	<0.24	
Vanadium	mg/kg	<0.2	ND	45.3	52.1	61	31.1	32.6	34.4	43.4	20	25.8	79	37.8	25	28	154	23.6	133	
Zinc	mg/kg	<1.9	10,500	141	107	225	102	102	143	253	147	125	82	273	65	81	179	34	5	

Notes:

- m bgl : Meters below ground level
- 1.23 : Concentration exceeds Human Health GAC
- ND : GAC not derived
- GAC : Generic Assessment Criteria
- LOD : Limit of detection
- : Not analysed

Table 3

Metals and Metalloid Compound Concentrations in Soil (mg/kg)

Sample Identity			GAC Human Health - Residential (mg/kg)	TP112	TP113	TP113	TP114	TP115	TP116	TP117	TP118	TP119	TP120	TP122	TP124	TP125	WS101	WS102	WS103	
Stratum	Sample Depth (m bgl)	Date of Sampling		Made Ground																
Units	LOD			1.40-	0.60-	1.20-	1.00-	1.00-	1.00-	1.00-	0.40-	0.30-	0.50-	0.30-	0.30-	0.40-	0.50-	0.50-0.70	0.80-1.00	1.60-1.80
Test				21/02/2011	21/02/2011	21/02/2011	21/02/2011	21/02/2011	21/02/2011	21/02/2011	23/02/2011	23/02/2011	23/02/2011	23/02/2011	23/02/2011	25/02/2011	25/02/2011	14/02/2011	14/02/2011	14/02/2011
Aluminium	mg/kg	<11	ND	32,600	25,500	52,300	8,150	6,370	11,600	6,990	16,300	14,300	16,300	9,390	10,100	8,930	34,900	16,000	5,060	
Arsenic	mg/kg	<0.6	32	54.6	140	48.3	80.9	70	24.1	128	176	196	27	49.9	86.9	62.4	84.6	52.7	16.9	
Beryllium	mg/kg	<0.01	ND	4.97	4.44	3.97	0.905	0.825	1.19	0.331	2.49	1.75	1.68	0.331	1.57	1.17	5.81	2.3	1.25	
Boron, water soluble	mg/kg	<1	234	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cadmium	mg/kg	<0.02	10	-	-	-	0.941	-	-	<0.2	0.358	<0.2	0.761	<0.2	<0.2	<0.2	1.13	-	2.41	
Chromium	mg/kg	<0.9	1.59E+05	20.7	38.8	31.1	48.8	22.2	23.3	174	29.4	66.8	170	219	61.5	181	30.4	21.5	29.6	
Chromium, Hexavalent	mg/kg	<0.6	36	-	-	-	-	-	-	-	-	-	0.755	-	-	-	-	-	-	
Copper	mg/kg	<1.4	3363	118	114	45.5	230	90	47.3	1,490	123	180	97.1	83.7	122	609	144	64	142	
Iron	mg/kg	<2	ND	73,400	102,000	51,600	234,000	58,900	45,500	203,000	66,300	137,000	44,500	216,000	92,500	236,000	87,000	79,300	242,000	
Lead	mg/kg	<0.7	400	34.7	66.9	<0.7	444	212	47.3	181	504	364	690	324	7,660	25.6	24.3	208		
Magnesium	mg/kg	<8	ND	5,860	11,000	14,600	1,410	1,100	4,240	1,620	5,490	4,540	3,140	1,590	6,250	2,830	7,150	2,710	606	
Mercury	mg/kg	<0.14	0.012	-	-	-	0.244	0.296	-	-	-	-	-	-	0.539	-	<1.4	-	<1.4	
Molybdenum	mg/kg	<0.1	107	14.3	11.9	2.68	3.99	10.2	0.783	-	10.3	-	3.99	-	4.9	1.5	18.3	11.2	4.15	
Nickel	mg/kg	<0.2	130	52.4	56.2	31.8	65	17.5	42.3	52.5	46.2	85.2	31.3	25.2	34.4	40.3	77.4	42.2	51.8	
Silver	mg/kg	<10	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Tin	mg/kg	<0.24	ND	<0.24	5.31	<0.24	24.5	6.28	5.14	28.7	17.3	13.2	11.4	45.2	16.9	47.7	<2.4	0.309	12.8	
Vanadium	mg/kg	<0.2	ND	95.4	163	102	121	65.5	26.4	534	64.6	131	58.1	737	167	514	134	53.4	59.5	
Zinc	mg/kg	<1.9	10,500	17	30	5	140	131	116	352	290	127	320	101	159	245	<19	26	22	

Notes:

- m bgl : Meters below ground level
- 1.23 : Concentration exceeds Human Health GAC
- ND : GAC not derived
- GAC : Generic Assessment Criteria
- LOD : Limit of detection
- : Not analysed

Table 3

Metals and Metalloid Compound Concentrations in Soil (mg/kg)

Sample Identity			GAC Human Health - Residential (mg/kg)	WS105	WS107	WS108	WS109	WS109	WS110	WS113	WS114	WS115	WS116	WS118	WS119	TP114	TP120	TP121	TP122
Stratum	Sample Depth (m bgl)	Date of Sampling		Made Ground	Sand	Clay	Clay	Clay											
				0.80-1.00	0.70-1.00	0.60-0.75	1.00-2.00	2.50-2.80	0.50-1.00	1.50-2.00	0.50-1.00	1.60-1.90	0.30-0.60	0.50-0.70	0.30-0.50	2.50-	2.10-	1.00-	1.00-
Test	Units	LOD		15/02/2011	15/02/2011	16/02/2011	16/02/2011	16/02/2011	16/02/2011	16/02/2011	17/02/2011	17/02/2011	17/02/2011	17/02/2011	18/02/2011	18/02/2011	21/02/2011	23/02/2011	23/02/2011
Aluminium	mg/kg	<11	ND	29,100	6,440	14,500	10,000	9,460	22,000	7,170	10,100	9,300	41,300	11,500	7,830	5,590	10,600	9,350	9,330
Arsenic	mg/kg	<0.6	32	45.5	77.9	58.7	5.1	133	123	44	8.35	10.9	39.1	84.3	81	9.73	5.12	5.87	4
Beryllium	mg/kg	<0.01	ND	4.44	0.656	2.07	0.927	1.99	2.98	0.477	0.922	1.15	3.38	1.37	1	0.695	0.717	0.689	0.667
Boron, water soluble	mg/kg	<1	234	-	-	1.72	-	-	1.39	1.02	-	-	-	-	-	-	-	-	-
Cadmium	mg/kg	<0.02	10	0.749	<0.2	0.624	0.457	0.678	-	-	-	-	-	-	-	-	0.154	0.386	0.353
Chromium	mg/kg	<0.9	1.59E+05	47.4	201	33.1	19.1	32.3	26.3	84.8	17.6	17	35.7	137	26.3	14.5	19.5	17.3	16.7
Chromium, Hexavalent	mg/kg	<0.6	36	-	-	-	-	-	<3	-	-	<3	-	<1.2	<1.2	-	-	-	-
Copper	mg/kg	<1.4	3363	105	501	71.9	14.7	103	96.4	160	25.4	21.1	55.5	203	56.8	24.8	14.4	13.3	11.8
Iron	mg/kg	<2	ND	96,100	373,000	48,700	27,200	42,200	56,400	161,000	37,700	67,100	38,900	177,000	21,800	35,800	33,300	27,200	26,500
Lead	mg/kg	<0.7	400	139	682	163	14	109	106	235	25.7	11.2	11.2	708	81.4	80.6	15.7	15.5	12.1
Magnesium	mg/kg	<8	ND	5,910	1,030	2,140	2,060	2,220	2,610	1,910	2,780	2,120	4,390	3,070	1,470	2,090	2,120	1,710	1,570
Mercury	mg/kg	<0.14	0.012	-	-	-	-	1.74	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/kg	<0.1	107	11.1	-	4.04	0.263	5.55	7.44	2.59	<0.1	<0.1	5.93	10.6	3.51	-	-	-	-
Nickel	mg/kg	<0.2	130	48.8	85.5	56.7	29.3	46	62.1	37.1	33.1	30.5	43.1	73.8	17.7	22.6	20.1	23.6	19
Silver	mg/kg	<10	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin	mg/kg	<0.24	ND	8.93	57.2	9.86	0.367	5.18	3.46	31.1	<0.24	<0.24	<0.24	20.5	2.93	2.75	0.317	0.412	-
Vanadium	mg/kg	<0.2	ND	168	550	52.5	18.4	43	32.7	214	20.2	25.2	90.8	75.7	27.7	16.9	19.5	17.8	17.6
Zinc	mg/kg	<1.9	10,500	93	81	220	99	137	261	198	76	74	26	279	73	51	64	87	54

Notes:

- m bgl : Meters below ground level
- 1.23 : Concentration exceeds Human Health GAC
- ND : GAC not derived
- GAC : Generic Assessment Criteria
- LOD : Limit of detection
- : Not analysed

Table 3

Metals and Metalloid Compound Concentrations in Soil (mg/kg)

Sample Identity			GAC Human Health - Residential (mg/kg)	WS104	WS106	WS108	WS111	WS112	WS113	WS114	WS118	SEDIMENT 1	SEDIMENT 2	SEDIMENT 3
Stratum				Gravel	Sand	Clay	Clay	Sand	Sand	Clay	Clay			
Sample Depth (m bgl)				1.50-1.70	2.30-2.60	1.00-1.30	0.70-1.00	0.60-1.00	3.50-4.00	3.50-4.00	1.50-1.70	1.00-1.00	0.20-0.30	-
Date of Sampling				15/02/2011	15/02/2011	16/02/2011	16/02/2011	16/02/2011	17/02/2011	17/02/2011	18/02/2011	16/02/2011	18/02/2011	23/02/2011
Test	Units	LOD												
Aluminium	mg/kg	<11	ND	5,230	5,260	9,330	7,680	12,400	5,110	19,700	12,900	19,300	13,000	11,900
Arsenic	mg/kg	<0.6	32	3.63	<6	125	6.84	5.63	14.3	5.31	13.5	19.6	41.1	16.5
Beryllium	mg/kg	<0.01	ND	0.564	0.992	1.65	0.73	0.89	0.348	1.17	0.995	1.47	1.76	1.07
Boron, water soluble	mg/kg	<1	234	-	-	-	-	-	-	-	-	-	-	2.71
Cadmium	mg/kg	<0.02	10	-	0.92	-	-	-	-	-	-	0.597	-	0.769
Chromium	mg/kg	<0.9	1.59E+05	10.6	14.6	34.8	15.3	22.7	13.2	32.7	24.1	32.7	68.2	33
Chromium, Hexavalent	mg/kg	<0.6	36	-	-	-	<1.2	<3	-	-	-	<3	<1.2	<1.2
Copper	mg/kg	<1.4	3363	6.91	<14	88.2	13.6	16.1	17.3	23.9	23.7	41.3	387	80.3
Iron	mg/kg	<2	ND	33,800	71,700	52,800	32,700	31,400	49,100	44,900	33,400	41,400	92,300	21,300
Lead	mg/kg	<0.7	400	8.53	7.03	154	29.9	15.5	18.2	32.1	43.8	40.8	5,680	98
Magnesium	mg/kg	<8	ND	1,650	1,260	1,590	1,630	2,360	1,150	3,540	2,440	4,190	2,810	3,240
Mercury	mg/kg	<0.14	0.012	-	<1.4	0.143	-	-	-	-	-	-	-	-
Molybdenum	mg/kg	<0.1	107	-	0.91	6.62	-	0.578	-	-	1.43	0.709	7.36	1.76
Nickel	mg/kg	<0.2	130	16.5	18.2	41.8	27.1	25.9	15.8	37.9	27	49.2	70	35
Silver	mg/kg	<10	ND	-	-	-	-	-	-	-	-	-	-	-
Tin	mg/kg	<0.24	ND	0.276	<2.4	6.29	0.288	0.274	-	0.496	1.29	1.35	22.4	5.32
Vanadium	mg/kg	<0.2	ND	12	33.7	49.3	17.4	22.3	17.4	31.5	26.4	33.7	45.6	30.8
Zinc	mg/kg	<1.9	10,500	67	58	148	73	64	45	98	81	159	1,550	246

Notes:

- m bgl : Meters below ground level
1.23 : Concentration exceeds Human Health GAC
 ND : GAC not derived
 GAC : Generic Assessment Criteria
 LOD : Limit of detection
 - : Not analysed

Table 4

Total Petroleum Hydrocarbon, BTEX and MTBE Concentrations in Soil (mg/kg)

Sample Identity			GAC Human Health - Residential (mg/kg)			GAC Water Resources Set 1 (mg/kg)	TP113	TP113	TP114	TP115	TP116	TP117	TP118	TP119	TP120	TP120	TP122	TP124	TP125	WS101	WS102	WS103	WS105
Stratum	Sample Depth (m bgl)	Date of Sampling	Oral	Inhalation	Combined		Made Ground																
Test	Units	LOD																					
Mineral oil >C10-C40	mg/kg	-			ND	ND			286	131					34.9								
Methyl tertiary butyl ether	mg/kg	<0.005	534	8	8	0.018																	
Benzene	mg/kg	<0.01	0.48	0.034	0.032	0.056																0.0222	
Toluene	mg/kg	<0.002	755	60	55.6	0.16																	0.0132
Ethylbenzene	mg/kg	<0.003	568	14	14	0.11																	0.036
m,p-Xylene	mg/kg	<0.006																					
o-Xylene	mg/kg	<0.003	1,040	4.6	4.6	0.17																	
Aliphatics >C5-C6	mg/kg	<0.01	2.38E+04	6.0	6.0	2.6																	0.0564
Aliphatics >C6-C8	mg/kg	<0.01	6.75E+04	8	8	5.3																	0.024
Aliphatics >C8-C10	mg/kg	<0.01	3,363	1.0	1.0	22																	0.0192
Aliphatics >C10-C12	mg/kg	<0.01	4,246	4.1	4.1	ND																	0.018
Aliphatics >C12-C16	mg/kg	<0.1	4,411	19	19	ND																	7.91
Aliphatics >C16-C21	mg/kg	<0.1				ND																	10.8
Aliphatics >C21-C35	mg/kg	<0.1	8.84E+04	NR	8.84E+04	ND																	27.7
Aliphatics >C35-C44	mg/kg	<0.1	ND	ND	ND	ND																	3.97
Total Aliphatics >C12-C44	mg/kg	<0.1	ND	ND	ND	ND																	50.4
Aromatics >EC5-EC7	mg/kg	<0.01	0.48	0.034	0.032	0.056																	0.0222
Aromatics >EC7-EC8	mg/kg	<0.01	755	60.0	55.6	0.16																	0.0132
Aromatics >EC8-EC10	mg/kg	<0.01	352	1.4	1.4	0.9																	0.0516
Aromatics >EC10-EC12	mg/kg	<0.01	435	8	7.5	1.3																	0.012
Aromatics >EC12-EC16	mg/kg	<0.1	638	38	36	2.6																	8.14
Aromatics >EC16-EC21	mg/kg	<0.1	808	NR	808	8.1																	14
Aromatics >EC21-EC35	mg/kg	<0.1	1,228	NR	1,228	ND																	42.7
Aromatics >EC35-EC44	mg/kg	<0.1	ND	ND	ND	ND																	10.7
Aromatics >EC40-EC44	mg/kg	<0.1	ND	ND	ND	ND																	3.11
GRO >C5-C12	mg/kg	na	ND	ND	ND	ND																	0.1644
EPH >C12-C44	mg/kg	na	ND	ND	ND	ND																	125.92
TPH	mg/kg		ND	ND	ND	ND																	126.1

- Notes:
- m bgl : Meters below ground level
 - LOD : Limit of detection
 - : Below LOD
 - 1.23 : Concentration exceeds Human Health GAC
 - 1.23 : Concentration exceeds Water Resources GAC
 - ND : GAC not derived
 - GAC : Generic Assessment Criteria
 - GRO : Gasoline range organics
 - EPH : Extractable petroleum hydrocarbons
 - : Not analysed

Table 4

Total Petroleum Hydrocarbon, BTEX and MTBE Concentrations in Soil (mg/kg)

Sample Identity			GAC Human Health - Residential (mg/kg)			GAC Water Resources Set 1 (mg/kg)	WS107	WS108	WS109	WS109	WS110	WS113	WS114	WS115	WS116	WS118	WS119	TP114	TP120	TP121	TP122	WS104	WS106		
Stratum	Sample Depth (m bgl)	Date of Sampling	Oral	Inhalation	Combined		Made Ground	Sand	Clay	Clay	Clay	Gravel	Sand												
Units	LOD					0.70-1.00	0.60-0.75	1.00-2.00	2.50-2.80	0.50-1.00	1.50-2.00	0.50-1.00	1.60-1.90	0.30-0.60	0.50-0.70	0.30-0.50	2.50-	2.10-	1.00-	1.00-	1.50-1.70	2.30-2.60			
Test						15/02/2011	16/02/2011	16/02/2011	16/02/2011	16/02/2011	17/02/2011	17/02/2011	17/02/2011	17/02/2011	18/02/2011	18/02/2011	21/02/2011	23/02/2011	23/02/2011	23/02/2011	15/02/2011	15/02/2011			
Mineral oil >C10-C40	mg/kg	-			ND																				
Methyl tertiary butyl ether	mg/kg	<0.005	534	8	8																				
Benzene	mg/kg	<0.01	0.48	0.034	0.032				0.0634																
Toluene	mg/kg	<0.002	755	60	55.6				0.0136	0.0135		0.00604	0.0109	0.0123	0.00456	0.00348	0.0161	0.0061	0.00548		0.048	0.0075	0.0276	0.0022	0.00224
Ethylbenzene	mg/kg	<0.003	568	14	14				0.0407	0.0197		0.00453	0.0296	0.0302	0.0125	0.00812	0.0288	0.00854		0.00456	0.016		0.0096	0.0044	0.0056
m,p-Xylene	mg/kg	<0.006								0.00861		0.0151	<0.012				<0.012		<0.012		0.0443	0.0075	0.0276		
o-Xylene	mg/kg	<0.003	1,040	4.6	4.6							0.0121									0.016		0.0096		
Aliphatics >C5-C6	mg/kg	<0.01	2.38E+04	6.0	6.0					0.0197		0.0498							0.037					0.077	0.102
Aliphatics >C6-C8	mg/kg	<0.01	6.75E+04	8	8					0.0455		0.162	0.0421	0.0168					0.155		0.0406		0.0132	0.0176	0.0246
Aliphatics >C8-C10	mg/kg	<0.01	3,363	1.0	1.0				0.0102	0.0258		0.0815	0.0312	0.0112					0.0452		0.0185			0.0726	0.0582
Aliphatics >C10-C12	mg/kg	<0.01	4,246	4.1	4.1					0.0197		0.0544	0.0452						0.0507					0.219	0.208
Aliphatics >C12-C16	mg/kg	<0.1	4,411	19	19				6.36	7.63	10.4	130	48	16.9	5.18	3.62	9.01	17.5	93.2	7.27	11.8	39.1	11.5	5.38	9
Aliphatics >C16-C21	mg/kg	<0.1							5.58	7.83	5.86	134	89.9	28.2	5.09	2.91	5.53	23.3	79.2	7.31	8.68	12.5	6.15	9.18	16.3
Aliphatics >C21-C35	mg/kg	<0.1	8.84E+04	NR	8.84E+04				20.2	26.1	11.2	530	705	95.5	11.4	7.64	10.9	176	241	13.9	9.62	9.79	7.07	17.5	13.5
Aliphatics >C35-C44	mg/kg	<0.1	ND	ND	ND				3.9	4.16	2.25	273	342	36.1	1.7	0.657	4.83	65.7	116	1.48		0.743	1.31	2.3	0.949
Total Aliphatics >C12-C44	mg/kg	<0.1	ND	ND	ND				36.1	45.7	29.7	1070	1190	177	23.4	14.8	30.3	283	529	30	30.1	62.1	26	34.4	39.8
Aromatics >EC5-EC7	mg/kg	<0.01	0.48	0.034	0.032							0.0634													
Aromatics >EC7-EC8	mg/kg	<0.01	755	60.0	55.6				0.0136	0.0135			0.0123								0.048		0.0276		
Aromatics >EC8-EC10	mg/kg	<0.01	352	1.4	1.4				0.052	0.0492		0.0861	0.0608	0.0437	0.0148	0.0104	0.038	0.0122	0.0384		0.0886	0.0125	0.0528	0.0528	0.0482
Aromatics >EC10-EC12	mg/kg	<0.01	435	8	7.5					0.0135		0.0362	0.0296						0.0343					0.146	0.139
Aromatics >EC12-EC16	mg/kg	<0.1	638	38	36				12.3	14.3	8.3	386	41.3	16.8	2.4	0.159	47	29.3	129	4.34	5.57	4.57	6.2	83.1	15.2
Aromatics >EC16-EC21	mg/kg	<0.1	808	NR	808				15.5	23.8	6.68	312	80.5	44.8	3.41		11.8	42.3	125	5.79	5.53	7.2	3.67	131	11.1
Aromatics >EC21-EC35	mg/kg	<0.1	1,228	NR	1,228				33	84.4	12.8	508	347	153	8.33		16.9	164	241	14.8	8.81	8.15	2.31	188	7.49
Aromatics >EC35-EC44	mg/kg	<0.1	ND	ND	ND				15.8	19.7	3.02	193	208	76.3	2.97		8.22	92.1	90.6	2.24		0.288	0.447	62.2	0.854
Aromatics >EC40-EC44	mg/kg	<0.1	ND	ND	ND				5.25	5.53	0.599	80.5	94.2	32.8	1.22		3.09	36.3	35.6				0.106	23.8	0.118
GRO >C5-C12	mg/kg	na	ND	ND	ND				0.0758	0.1537	0	0.4428	0.1341	0.084	0.0148	0.0104	0.038	0.0122	0.2756		0.1957	0.0125	0.0936	0.22	0.233
EPH >C12-C44	mg/kg	na	ND	ND	ND				112.64	187.92	60.51	2466	1861.7	467.6	40.48	14.986	114.19	610.2	1115	57.13	50.01	82.341	38.657	498.66	74.393
TPH	mg/kg		ND	ND	ND				112.7	188.1	60.51	2,466	1,862	467.7	40.49	15.00	114.2	610.2	1,115	57.13	50.21	82.35	38.75	498.9	74.63

- Notes:
- m bgl : Meters below ground level
 - LOD : Limit of detection
 - : Below LOD
 - 1.23 : Concentration exceeds Human Health GAC
 - 1.23 : Concentration exceeds Water Resources GAC
 - ND : GAC not derived
 - GAC : Generic Assessment Criteria
 - GRO : Gasoline range organics
 - EPH : Extractable petroleum hydrocarbons
 - : Not analysed

Table 5

Polycyclic Aromatic Hydrocarbon Compound Concentrations in Soil (mg/kg)

Sample Identity			GAC Human Health - Residential (mg/kg)			GAC Water Resources Set 1 (mg/kg)	CP101	CP102	CP103	CP104	TP101	TP102	TP103	TP104	TP105	TP105	TP108	TP109	TP109	TP110	TP111	TP112	TP112	TP113
Stratum	Sample Depth (m bgl)	Date of Sampling	Oral	Inhalation	Combined		Made Ground	Made Ground	Made Ground	Made Ground	Topsoil	Topsoil	Topsoil	Made Ground										
Test	Units	LOD																						
Naphthalene	mg/kg	<0.009	142.9	1.3	1.3	0.076	0.168	0.872	0.338	0.145	0.0905	0.136	2.34	562	85.3	0.518	26.1	32.8	18.3	9.58	0.394	0.012	0.0292	0.0341
Acenaphthylene	mg/kg	<0.012	146.0	89.4	55	-	0.0293	-	0.0135	0.0183	0.0153	0.0514	0.282	4.5	4.18	0.027	1.15	0.736	0.822	0.62	0.0148	-	-	-
Acenaphthene	mg/kg	<0.008	824.5	325.7	233	-	0.0326	0.0174	0.0177	0.207	0.0131	0.0272	0.378	939	328	0.0387	3.63	3.07	33.9	41.4	0.0284	-	-	-
Fluorene	mg/kg	<0.01	2296	3074	1,314	-	0.0416	0.0288	0.0218	0.161	0.0137	0.0366	0.267	322	189	0.0465	1.84	1.3	15.8	20	0.0251	-	-	-
Phenanthrene	mg/kg	<0.015	2302	1.E+04	1,874	-	0.629	1.46	0.753	1.98	0.186	0.469	2.86	97.9	111	1.17	15.6	20	14.2	14	1.14	0.0259	0.0679	0.13
Anthracene	mg/kg	<0.016	2620	2.E+04	2,360	-	0.161	0.0369	0.0602	0.318	0.0211	0.0647	0.584	22.8	28.9	0.0841	2.76	2.33	4.34	4.32	0.0539	-	-	0.0348
Fluoranthene	mg/kg	<0.017	270	2223	241	-	0.776	0.293	0.503	2.15	0.227	0.754	3.81	13.7	18.5	0.768	9.85	9.53	8	7.78	0.183	0.0364	0.0541	0.323
Pyrene	mg/kg	<0.015	1563	13110	1,397	-	0.668	0.31	0.453	1.73	0.197	0.637	3.22	10.3	13.1	0.704	7.88	6.94	6.25	5.93	0.202	0.0306	0.0464	0.277
Benzo(a)anthracene	mg/kg	<0.014	14.6	2.3	2.0	-	0.352	0.231	0.348	0.896	0.128	0.395	2.18	5.02	6.35	0.437	4.81	4.12	2.75	4.11	0.19	0.0202	0.0446	0.227
Chrysene	mg/kg	<0.01	140.6	95.9	57	-	0.282	0.268	0.332	0.87	0.139	0.47	1.84	4.5	4.86	0.503	4.18	4.36	2.3	3.17	0.246	0.0207	0.0449	0.186
Benzo(b)fluoranthene	mg/kg	<0.015	15.0	17.2	8.0	0.026	0.501	0.35	0.495	0.968	0.233	0.715	2.69	4.47	4.35	0.667	4.51	3.67	2.21	4.18	0.189	0.0309	0.0535	0.225
Benzo(k)fluoranthene	mg/kg	<0.014	15.3	20.6	8.8	0.037	0.175	0.0921	0.143	0.47	0.0752	0.265	1.29	1.55	2.06	0.208	2.16	1.65	1.07	1.6	0.0671	-	0.0303	0.0911
Benzo(a)pyrene	mg/kg	<0.015	1.5	2.0	0.86	0.91	0.356	0.183	0.314	0.836	0.131	0.421	2.05	3.72	4.71	0.391	3.66	2.12	2.17	3.18	0.129	0.0217	0.0423	0.191
Indeno(1,2,3-cd)pyrene	mg/kg	<0.018	14.8	15.9	7.7	0.022	0.183	0.101	0.191	0.434	0.087	0.257	1.35	1.42	1.81	0.224	2.03	1.31	1	1.4	0.0559	-	0.0367	0.122
Dibenzo(a,h)anthracene	mg/kg	<0.023	1.5	1.5	0.76	-	0.0539	0.0487	0.066	0.135	-	0.0603	0.414	<0.575	0.659	0.0852	0.7	0.549	0.352	0.519	0.0454	-	-	0.0347
Benzo(g,h,i)perylene	mg/kg	<0.024	2370	1.E+06	2,365	0.11	0.234	0.22	0.265	0.546	0.104	0.273	1.48	2.05	2.3	0.319	2.28	1.49	1.22	1.64	0.139	-	0.0452	0.152
Total PAH	mg/kg	na			ND	ND	4.642	4.512	4.314	11.86	1.661	5.032	27.04	2,015	805.1	6.191	93.14	95.98	114.7	123.4	3.103	0.1984	0.4951	2.028

- Notes:
- m bgl : Meters below ground level
 - LOD : Limit of detection
 - : Below LOD
 - 1.23 : Concentration exceeds Human Health GAC
 - 1.23 : Concentration exceeds Water Resources GAC
 - ND : GAC not derived
 - GAC : Generic Assessment Criteria

Table 5

Polycyclic Aromatic Hydrocarbon Compound Concentrations in Soil (mg/kg)

Sample Identity			GAC Human Health - Residential (mg/kg)			GAC Water Resources Set 1 (mg/kg)	TP113	TP114	TP115	TP116	TP117	TP118	TP119	TP120	TP120	TP122	TP124	TP125	WS101	WS102	WS103	WS105	WS107	WS108
Stratum	Sample Depth (m bgl)	Date of Sampling	Oral	Inhalation	Combined		Made Ground																	
Test	Units	LOD				1.20-	1.00-	1.00-	1.00-	0.40-	0.30-	0.50-	0.30-	0.50-	0.30-	0.40-	0.50-	0.50-0.70	0.80-1.00	1.60-1.80	0.80-1.00	0.70-1.00	0.60-0.75	
						21/02/2011	21/02/2011	21/02/2011	21/02/2011	23/02/2011	23/02/2011	23/02/2011	23/02/2011	23/02/2011	23/02/2011	25/02/2011	25/02/2011	14/02/2011	14/02/2011	14/02/2011	15/02/2011	15/02/2011	16/02/2011	
Naphthalene	mg/kg	<0.009	142.9	1.3	1.3	0.076	-	0.319	0.821	0.285	0.314	0.831	1.07	0.624	-	1.79	0.867	0.403	1.62	0.795	0.0885	0.401	0.0871	0.284
Acenaphthylene	mg/kg	<0.012	146.0	89.4	55	-	-	0.142	0.0906	0.0627	0.172	0.0696	0.0558	0.0976	-	0.287	0.145	0.568	0.303	-	-	0.0658	-	0.0457
Acenaphthene	mg/kg	<0.008	824.5	325.7	233	-	-	0.193	0.04	0.0263	0.131	0.0179	0.0393	0.79	-	0.0529	0.165	0.11	0.019	-	-	0.12	-	0.0739
Fluorene	mg/kg	<0.01	2296	3074	1,314	-	-	0.143	0.0514	0.0459	0.12	0.0278	0.0507	0.465	-	0.132	0.133	0.229	0.0598	0.0225	-	0.087	-	0.0567
Phenanthrene	mg/kg	<0.015	2302	1.E+04	1,874	-	-	2.4	2.8	0.688	2.7	1.13	1.3	5.14	-	3.24	2.58	4.33	0.677	0.917	0.0839	0.985	0.263	0.521
Anthracene	mg/kg	<0.016	2620	2.E+04	2,360	-	-	0.621	0.235	0.103	0.661	0.0831	0.136	1.04	-	0.561	0.454	0.901	0.0442	0.0247	-	0.155	-	0.0978
Fluoranthene	mg/kg	<0.017	270	2223	241	-	-	6.53	2.22	1.07	6.83	0.591	1.15	8.56	-	2.4	3.83	8.75	0.126	0.118	0.0201	0.944	0.0746	0.817
Pyrene	mg/kg	<0.015	1563	13110	1,397	-	-	6.57	2.16	0.872	5.37	0.532	0.886	7.15	-	2.21	3.25	7.13	0.18	0.141	-	0.863	0.0708	0.693
Benzo(a)anthracene	mg/kg	<0.014	14.6	2.3	2.0	-	-	4.86	1.99	0.594	3.76	0.407	0.78	4.29	-	1.63	2.51	4.86	0.078	0.11	0.0197	0.538	0.0379	0.469
Chrysene	mg/kg	<0.01	140.6	95.9	57	-	-	3.78	1.5	0.564	2.85	0.371	0.732	3.28	-	1.38	2	3.6	0.102	0.104	0.0128	0.528	0.0683	0.437
Benzo(b)fluoranthene	mg/kg	<0.015	15.0	17.2	8.0	0.026	-	5.49	2.47	0.821	4.7	0.58	1.2	4.68	-	1.75	3.12	4.96	0.114	0.139	0.0209	0.86	0.129	0.661
Benzo(k)fluoranthene	mg/kg	<0.014	15.3	20.6	8.8	0.037	-	2.05	0.869	0.291	1.78	0.218	0.49	2.21	-	0.707	1.13	2.37	0.0313	0.0305	-	0.293	0.0302	0.237
Benzo(a)pyrene	mg/kg	<0.015	1.5	2.0	0.86	0.91	-	5	2.18	0.571	3.83	0.421	0.79	4.68	-	1.27	2.51	4.94	0.0845	0.0883	-	0.567	0.0445	0.455
Indeno(1,2,3-cd)pyrene	mg/kg	<0.018	14.8	15.9	7.7	0.022	-	2.43	1.07	0.36	2.15	0.238	0.565	2.37	-	0.633	1.29	2.42	0.037	0.0365	-	0.373	0.0495	0.236
Dibenzo(a,h)anthracene	mg/kg	<0.023	1.5	1.5	0.76	-	-	0.706	0.381	0.107	0.608	0.0869	0.191	0.69	-	0.269	0.415	0.767	-	-	-	0.132	-	0.0685
Benzo(g,h,i)perylene	mg/kg	<0.024	2370	1.E+06	2,365	0.11	-	2.79	1.24	0.434	2.48	0.323	0.714	2.8	-	0.856	1.52	2.64	0.0905	0.107	-	0.458	0.0851	0.286
Total PAH	mg/kg	na			ND	ND	0	44.02	20.12	6.895	38.46	5.927	10.15	48.87	-	19.17	25.92	48.98	3.566	2.634	0.2459	7.370	0.9400	5.439

Notes:
 m bgl : Meters below ground level
 LOD : Limit of detection
 - : Below LOD
1.23 : Concentration exceeds Human Health GAC
1.23 : Concentration exceeds Water Resources GAC
 ND : GAC not derived
 GAC : Generic Assessment Criteria

Table 5

Polycyclic Aromatic Hydrocarbon Compound Concentrations in Soil (mg/kg)

Sample Identity			GAC Human Health - Residential (mg/kg)			GAC Water Resources Set 1 (mg/kg)	WS109	WS109	WS110	WS113	WS114	WS115	WS116	WS118	WS119	TP114	TP120	TP121	TP122	WS104	WS106	WS108	WS110	WS111	
Stratum	Sample Depth (m bgl)	Date of Sampling	Oral	Inhalation	Combined		Made Ground	Sand	Clay	Clay	Clay	Gravel	Sand	Clay	Clay	Clay									
Test	Units	LOD					16/02/2011	16/02/2011	16/02/2011	17/02/2011	17/02/2011	17/02/2011	17/02/2011	18/02/2011	18/02/2011	21/02/2011	23/02/2011	23/02/2011	23/02/2011	15/02/2011	15/02/2011	16/02/2011	16/02/2011	16/02/2011	
Naphthalene	mg/kg	<0.009	142.9	1.3	1.3	0.076	0.0162	32.2	1.34	0.696	-	-	0.218	0.65	38.7	1.7	0.0335	0.0302	0.0432	0.0386	0.0167	18.4	-	-	0.0114
Acenaphthylene	mg/kg	<0.012	146.0	89.4	55	-	-	2.92	0.23	0.764	-	-	-	0.205	0.888	0.0564	-	-	0.0135	-	-	1.1	-	-	-
Acenaphthene	mg/kg	<0.008	824.5	325.7	233	-	-	85.4	0.238	0.439	-	-	-	0.25	2.99	0.108	0.0161	-	-	0.101	-	6.63	-	-	-
Fluorene	mg/kg	<0.01	2296	3074	1,314	-	-	40.1	0.178	0.519	-	-	-	0.171	1.43	0.099	-	-	-	0.0791	-	6.07	-	-	-
Phenanthrene	mg/kg	<0.015	2302	1.E+04	1,874	-	0.0352	40.1	2.09	7.27	0.0426	-	0.14	3.11	20	0.507	0.0864	0.0534	0.0914	0.212	0.0211	16.6	-	-	0.0255
Anthracene	mg/kg	<0.016	2620	2.E+04	2,360	-	-	13.7	0.508	1.54	-	-	-	0.597	2.39	0.122	-	-	-	0.0669	-	4.71	-	-	-
Fluoranthene	mg/kg	<0.017	270	2223	241	-	-	14.4	3.22	12.5	-	-	0.0316	5.91	8.4	0.679	0.0554	0.0326	-	0.0898	-	7.27	-	-	0.0233
Pyrene	mg/kg	<0.015	1563	13110	1,397	-	-	9.99	2.79	10.4	0.0265	-	0.0319	5.02	6.23	0.594	0.0496	0.0284	-	0.0657	-	5.02	-	-	0.0231
Benzo(a)anthracene	mg/kg	<0.014	14.6	2.3	2.0	-	0.0186	4.32	2.2	7.82	0.0198	-	0.0355	3.29	4.1	0.423	-	0.0181	-	0.0253	-	2.5	-	-	0.0218
Chrysene	mg/kg	<0.01	140.6	95.9	57	-	-	3.59	1.9	6.08	0.0271	-	0.0343	2.76	4.1	0.382	0.0207	0.0211	0.02	0.0391	-	1.99	-	-	0.019
Benzo(b)fluoranthene	mg/kg	<0.015	15.0	17.2	8.0	0.026	-	3.92	3.34	9.22	0.039	-	0.0279	3.83	3.83	0.535	0.0357	0.0364	0.0208	0.0379	-	2.51	-	-	0.0342
Benzo(k)fluoranthene	mg/kg	<0.014	15.3	20.6	8.8	0.037	-	1.38	1.25	3.68	-	-	-	1.78	1.78	0.193	-	-	-	0.0182	-	0.841	-	-	-
Benzo(a)pyrene	mg/kg	<0.015	1.5	2.0	0.86	0.91	-	2.68	2.09	7.43	0.0187	-	0.0209	3.55	2.39	0.443	0.0193	-	-	0.0263	-	1.63	-	-	0.0245
Indeno(1,2,3-cd)pyrene	mg/kg	<0.018	14.8	15.9	7.7	0.022	-	1.26	1.29	4	-	-	-	2.19	1.51	0.236	-	-	-	-	-	0.832	-	-	-
Dibenzo(a,h)anthracene	mg/kg	<0.023	1.5	1.5	0.76	-	-	0.473	0.369	1.23	-	-	-	0.603	0.647	0.076	-	-	-	-	-	0.243	-	-	-
Benzo(g,h,i)perylene	mg/kg	<0.024	2370	1.E+06	2,365	0.11	-	1.54	1.47	4.52	-	-	-	2.7	1.81	0.291	-	-	-	-	-	0.927	-	-	-
Total PAH	mg/kg	na			ND	ND	0.07	258.0	24.50	78.11	0.1737	-	0.5401	36.62	101.2	6.444	0.3167	0.2202	0.1889	0.7999	0.0378	77.27	0	-	0.1828

Notes:

- m bgl : Meters below ground level
- LOD : Limit of detection
- : Below LOD
- 1.23 : Concentration exceeds Human Health GAC
- 1.23 : Concentration exceeds Water Resources GAC
- ND : GAC not derived
- GAC : Generic Assessment Criteria

Table 7
Semi-Volatile Organic Compound Concentrations in Soil (mg/kg)

Sample Identity	Stratum	GAC Human Health - Residential (mg/kg)	GAC Water Resources Set 1 (mg/kg)	TP109	TP109	TP110	TP111	TP112	TP114	TP117	TP118	TP119	TP122	TP124	TP125	WS101	WS102	WS103	WS105	WS107	WS108	WS109	WS110	WS113	WS118	WS112	SEDIMENT 1	SEDIMENT 3			
				Made Ground	Sand	1.00-1.00	-																								
				0.20-0.30	2.60-2.70	2.20-	0.30-	0.50-	1.00-	0.40-	0.30-	0.50-	0.30-	0.40-	0.50-	0.30-	0.40-	0.50-	0.50-0.70	1.40-1.60	0.60-0.80	0.80-1.00	0.70-1.00	0.60-0.75	2.50-2.80	0.50-1.00	1.50-2.00	0.50-0.70	0.60-1.00	1.00-1.00	-
Date of Sampling																															
Test	Units	LOD																													
Phenol	mg/kg	<0.1	192	ND	0.372	0.177	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Pentachlorophenol	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.446	-	-	-	-	-	-			
n-Nitroso-n-dipropylamine	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Nitrobenzene	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Isophorone	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Hexachloroethane	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Hexachlorocyclopentadiene	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Hexachlorobutadiene	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Hexachlorobenzene	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
n-Dioctyl phthalate	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Dimethyl phthalate	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Diethyl phthalate	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
n-Dibutyl phthalate	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Dibenzofuran	mg/kg	<0.1	ND	ND	18.2	4.07	3.02	0.137	-	0.287	0.212	0.307	0.259	0.61	0.296	0.424	0.168	-	-	0.224	-	0.842	8.58	0.612	0.454	0.678	-	0.752			
Carbazole	mg/kg	<0.1	ND	ND	1.33	0.433	0.156	-	-	0.358	0.187	-	-	0.124	0.177	0.61	-	-	-	-	0.129	0.895	-	0.298	0.427	-	-	-			
Butylbenzyl phthalate	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
bis(2-Ethylhexyl) phthalate	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	0.164	-	-	-	-	-	-	0.209	-	-	-	-	0.509			
bis(2-Chloroethoxy)methane	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
bis(2-Chloroethyl)ether	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
Azobenzene	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
4-Nitrophenol	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
4-Nitroaniline	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
4-Methylphenol	mg/kg	<0.1	ND	ND	0.568	0.401	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.04	-	-	-	-	-	-			
4-Chlorophenylphenylether	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
4-Chloroaniline	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
4-Chloro-3-methylphenol	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
4-Bromophenylphenylether	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
3-Nitroaniline	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
2-Nitrophenol	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
2-Nitroaniline	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
2-Methylphenol	mg/kg	<0.1	ND	ND	0.235	0.142	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.878	-	-	-	-	-	-			
1,2,4-Trichlorobenzene	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
2-Chlorophenol	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
2,6-Dinitrotoluene	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
2,4-Dinitrotoluene	mg/kg	<0.1	ND	ND	0.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
2,4-Dimethylphenol	mg/kg	<0.1	ND	ND	0.302	0.185	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.22	-	-	-	-	-	-			
2,4-Dichlorophenol	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
2,4,6-Trichlorophenol	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
2,4,5-Trichlorophenol	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
1,4-Dichlorobenzene	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
1,3-Dichlorobenzene	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
1,2-Dichlorobenzene	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
2-Chloronaphthalene	mg/kg	<0.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
2-Methylnaphthalene	mg/kg	<0.1	ND	ND	17.4	3.62	1.19	0.392	-	0.372	0.434	0.809	0.508	1.94	0.8	0.507	0.601	-	-	0.757	0.151	1.67	6.39	1.51	1.04	1.44	-	1.42			
Benzo(a)anthracene	mg/kg	<0.1	2.0	-	7.97	0.547	0.477	0.621	-	3.15	1.8	1.01	0.658	0.706	1.26	4.85	-	-	-	0.683	-	0.738	0.655	0.722	2.4	3.34	-	0.746			
Chrysene	mg/kg	<0.1	96	57	8.13	0.662	0.557	0.573	-	3.27	2.07	1.1	0.765	0.888	1.38	5.18	-	-	-	0.876	0.722	0.902	2.7	4.01	-	-	-	0.837			
Naphthalene	mg/kg	<0.1	1.3	0.076	24	4.49	1.32	0.188	-	0.341	0.286	0.509	0.46	1.15	0.581	0.355	0.347	-	0.176	0.474	0.119	2.06	7.86	1.41	0.726	1.37	-	2.55			
Total SVOC	mg/kg	n/a	ND	ND	78.777	14.727	6.72	1.911	-	7.778	4.989	3.735	2.65	5.418	4.494	11.926	1.28	-	0.176	2.899	0.27	6.315	28.686	5.365	7.618	11.265	-	6.814			

Notes:
m bgl : Meters below ground level
LOD : Limit of detection
- : Below LOD
1.23 : Concentration exceeds Human Health GAC
1.23 : Concentration exceeds Water Resources GAC
ND : GAC not derived
GAC : Generic Assessment Criteria
WS118 LOD raised by factor of 2

Table 8

Polychlorinated Biphenyl Compound Concentrations in Soil (mg/kg)

Sample Identity			TP101	TP102	TP103	TP109	TP110	TP112	TP114	TP115	TP116	TP117	TP118	TP119	TP120	TP122	TP124	TP125
Stratum			Topsoil	Topsoil	Topsoil	Made Ground												
Sample Depth (m bgl)			0.20-0.30	0.20-0.30	0.50-0.60	2.60-2.70	2.20-	0.50-	1.00-	1.00-	1.00-	0.40-	0.30-	0.50-	0.50-	0.30-	0.40-	0.50-
Date of Sampling			16/02/2011	16/02/2011	16/02/2011	18/02/2011	23/02/2011	21/02/2011	21/02/2011	21/02/2011	21/02/2011	23/02/2011	23/02/2011	23/02/2011	23/02/2011	23/02/2011	25/02/2011	25/02/2011
Test	Units	LOD																
PCB congener 28	mg/kg	<0.003	-	-	-	-	0.0197	-	-	-	-	-	-	-	-	-	-	-
PCB congener 52	mg/kg	<0.003	-	-	-	-	0.00392	-	-	-	-	-	-	-	-	-	-	-
PCB congener 101	mg/kg	<0.003	-	-	-	-	0.00344	-	-	-	-	-	-	-	-	-	-	-
PCB congener 118	mg/kg	<0.003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB congener 138	mg/kg	<0.003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB congener 153	mg/kg	<0.003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB congener 180	mg/kg	<0.003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs, Total ICES 7	mg/kg	<0.003	-	-	-	-	0.0271	-	-	-	-	-	-	-	-	-	-	-

Notes:

- m bgl : Meters below ground level
- LOD : Limit of detection
- : Below LOD
- 1.23** : Concentration exceeds Human Health GAC
- ND : GAC not derived
- GAC : Generic Assessment Criteria

Table 8

Polychlorinated Biphenyl Compound Concentrations in Soil (mg/kg)

Sample Identity			WS101	WS102	WS103	WS107	WS108	WS109	WS110	WS113	WS118	WS111	WS112	SEDIMENT 1	SEDIMENT 3
Stratum			Made Ground	Clay	Sand										
Sample Depth (m bgl)			0.50-0.70	1.40-1.60	0.60-0.80	0.70-1.00	0.60-0.75	2.50-2.80	0.50-1.00	1.50-2.00	0.50-0.70	0.70-1.00	0.60-1.00	1.00-1.00	-
Date of Sampling			14/02/2011	14/02/2011	14/02/2011	15/02/2011	16/02/2011	16/02/2011	16/02/2011	17/02/2011	18/02/2011	16/02/2011	16/02/2011	16/02/2011	23/02/2011
Test	Units	LOD													
PCB congener 28	mg/kg	<0.003	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB congener 52	mg/kg	<0.003	-	-	-	-	-	-	-	-	-	-	-	-	0.00669
PCB congener 101	mg/kg	<0.003	-	-	-	-	-	-	-	-	-	-	-	-	0.0041
PCB congener 118	mg/kg	<0.003	-	-	-	-	-	-	-	-	-	-	-	-	0.00422
PCB congener 138	mg/kg	<0.003	-	-	-	-	-	0.00368	0.00543	-	-	-	-	-	0.00618
PCB congener 153	mg/kg	<0.003	-	-	-	-	-	-	0.00331	-	-	0.00318	-	-	0.00644
PCB congener 180	mg/kg	<0.003	-	-	-	-	-	-	0.00502	-	-	-	-	-	0.00395
PCBs, Total ICES 7	mg/kg	<0.003	-	-	-	-	-	0.00368	0.01376	-	-	0.00318	-	-	0.03158

Notes:

- m bgl : Meters below ground level
- LOD : Limit of detection
- : Below LOD
- 1.23** : Concentration exceeds Human
- ND : GAC not derived
- GAC : Generic Assessment Criteria

Table 9

Phenol Compound Concentrations in Soil (mg/kg)

Sample Identity			GAC Human Health - Residential (mg/kg)	TP101	TP109	TP110	TP111	TP112	TP114	TP117	TP118	TP119	TP122	TP124	TP125	WS101	WS102	
Stratum				Topsoil	Made Ground													
Sample Depth (m bgl)				0.20-0.30	2.60-2.70	2.20-	0.30-	0.50-	1.00-	0.40-	0.30-	0.50-	0.30-	0.40-	0.50-	0.50-0.70	1.40-1.60	
Date of Sampling				16/02/2011	18/02/2011	23/02/2011	21/02/2011	21/02/2011	21/02/2011	23/02/2011	23/02/2011	23/02/2011	23/02/2011	25/02/2011	25/02/2011	14/02/2011	14/02/2011	
Test	Units	LOD																
Catechol	mg/kg	<0.01	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Phenol	mg/kg	<0.01	192	-	-	-	-	-	-	-	-	-	-	-	-	0.128	-	
Cresols	mg/kg	<0.01	ND	-	0.014	-	-	-	-	-	-	0.0968	-	-	-	0.104	-	
Resorcinol	mg/kg	<0.05	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Xylenols	mg/kg	<0.015	ND	-	-	-	-	-	-	-	-	-	-	-	-	0.0348	-	
1-Naphthol	mg/kg	<0.01	ND	-	-	-	-	-	-	-	-	0.0121	-	-	-	-	-	
2,3,5-Trimethylphenol	mg/kg	<0.01	ND	-	-	-	-	-	-	-	-	0.315	-	-	-	-	-	
2-Isopropylphenol	mg/kg	<0.015	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Phenols, Total 8 Speciated	mg/kg	<0.15	ND	-	0.014	-	-	-	-	-	-	0.4239	-	-	-	0.2668	-	

Notes:

- m bgl : Meters below ground level
- LOD : Limit of detection
- : Below LOD
- 1.23** : Concentration exceeds Human Health GAC
- ND : GAC not derived
- GAC : Generic Assessment Criteria

Table 9

Phenol Compound Concentrations in Soil (mg/kg)

Sample Identity			WS103	WS105	WS107	WS108	WS109	WS110	WS113	WS118	WS112	SEDIMENT 1	SEDIMENT 3
Stratum			Made Ground	Sand									
Sample Depth (m bgl)			0.60-0.80	0.80-1.00	0.70-1.00	0.60-0.75	2.50-2.80	0.50-1.00	1.50-2.00	0.50-0.70	0.60-1.00	1.00-1.00	-
Date of Sampling			14/02/2011	15/02/2011	15/02/2011	16/02/2011	16/02/2011	16/02/2011	17/02/2011	18/02/2011	16/02/2011	16/02/2011	23/02/2011
Test	Units	LOD											
Catechol	mg/kg	<0.01	-	-	-	-	-	-	-	-	-	-	-
Phenol	mg/kg	<0.01	-	-	-	-	0.0151	-	-	-	-	-	-
Cresols	mg/kg	<0.01	-	-	-	-	0.181	-	-	-	-	-	0.039
Resorcinol	mg/kg	<0.05	-	-	-	-	-	-	-	-	-	-	-
Xylenols	mg/kg	<0.015	-	-	-	-	0.151	-	-	-	-	-	-
1-Naphthol	mg/kg	<0.01	-	-	-	-	0.0151	-	-	-	-	-	-
2,3,5-Trimethylphenol	mg/kg	<0.01	-	-	-	-	-	-	-	-	-	-	-
2-Isopropylphenol	mg/kg	<0.015	-	-	-	-	-	-	-	-	-	-	-
Phenols, Total 8 Speciated	mg/kg	<0.15	-	-	-	-	0.3622	-	-	-	-	-	0.039

Notes:

- m bgl : Meters below ground level
- LOD : Limit of detection
- : Below LOD
- 1.23** : Concentration exceeds Humar
- ND : GAC not derived
- GAC : Generic Assessment Criteria

Table 10
Inorganic Compound Concentrations in Groundwater and Surface Water

Test	Sample Identification		EQS Values (µg/l)	Surface Water						Groundwater										
	Date of Sampling			CANAL EAST	CANAL MIDDLE	CANAL WEST	POND	STREAM	UPSTREAM	BH5A	CP101	CP102	CP103	CP104	WS101	WS102	WS103	WS104	WS105	WS106
	Units	LOD		02/03/2011	02/03/2011	02/03/2011	02/03/2011	02/03/2011	02/03/2011	07/03/2011	02/03/2011	03/03/2011	04/03/2011	03/03/2011	07/03/2011	07/03/2011	07/03/2011	04/03/2011	07/03/2011	03/03/2011
Inorganics																				
Ammoniacal Nitrogen as N	µg/l	<200	ND	275	435	341	-	-	-	1010	417	333	-	-	-	-	1770	-	379	-
Ammoniacal Nitrogen as NH4	µg/l	<300	500	354	559	438	-	-	-	1300	536	428	-	-	-	-	2280	-	487	-
Ammonia, Free / unionised as N	µg/l	<200	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphide	µg/l	<10	ND	-	18	-	-	-	-	-	-	-	22	-	-	-	36	-	14	-
Fluoride	µg/l	<500	ND	-	-	-	-	-	-	-	512	-	-	-	-	-	-	-	-	-
Sulphate	µg/l	<2000	ND	50700	53100	51600	96100	117000	103000	179000	137000	169000	137000	162000	101000	30400	148000	70200	55800	114000
Chloride	µg/l	<2000	ND	57400	57300	57000	23500	31200	27700	35600	36300	29200	32900	33000	20900	11100	27300	26200	9200	20900
Nitrite as NO2	µg/l	<50	ND	118	135	138	-	65	-	-	-	-	454	521	-	75	-	-	119	-
Phosphate (ortho) as PO4	µg/l	<50	ND	301	344	357	-	54	101	64	-	-	-	-	117	70	-	-	-	-
Nitrate as NO3	µg/l	<300	ND	16600	18100	16800	2740	9310	11300	-	2960	-	2560	3010	1020	-	-	-	19600	1740
Cyanide, Total	µg/l	<50	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide, Free	µg/l	<50	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	pH Units	<1	ND	7.57	7.89	7.63	8.01	8.05	8.01	7.42	7.89	8.3	8.37	8.54	8.01	8.74	8.04	8.62	7.58	8.42
Sulphur, Free	µg/l	<50	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

- LOD : Limit of detection
- : Below LOD
- ND : GAC/EQS not derived
- 1.23 : Result exceeds EQS value

**Table 10
Inorganic Compound Concentrations in Groundwater and Surface Water**

Groundwater														
Test	Sample Identification		EQS Values (µg/l)	WS107	WS109	WS110	WS111	WS112	WS114	WS115	WS116	WS117	WS119	WS120
	Date of Sampling			03/03/2011	04/03/2011	02/03/2011	02/03/2011	02/03/2011	03/03/2011	02/03/2011	03/03/2011	03/03/2011	03/03/2011	04/03/2011
	Units	LOD												
Inorganics														
Ammoniacal Nitrogen as N	µg/l	<200	ND	253	1450	-	519	332	7090	5540	-	-	485	2990
Ammoniacal Nitrogen as NH4	µg/l	<300	500	325	1860	-	667	427	9120	7120	-	-	624	3840
Ammonia, Free / unionised as N	µg/l	<200	15	-	-	-	-	-	780	367	-	-	-	285
Sulphide	µg/l	<10	ND	-	71	-	-	-	-	18	25	18	50	30
Fluoride	µg/l	<500	ND	826	533	-	-	-	502	-	-	-	2240	1400
Sulphate	µg/l	<2000	ND	127000	117000	118000	87500	189000	81900	28700	150000	261000	1060000	1270000
Chloride	µg/l	<2000	ND	9000	29800	15200	13900	126000	50300	49700	32900	28600	10900	10400
Nitrite as NO2	µg/l	<50	ND	100	-	-	-	-	-	-	-	-	-	-
Phosphate (ortho) as PO4	µg/l	<50	ND	-	365	-	-	-	-	-	-	-	-	-
Nitrate as NO3	µg/l	<300	ND	2490	-	390	-	-	-	-	663	14200	1560	-
Cyanide, Total	µg/l	<50	ND	-	-	-	-	-	-	-	-	-	-	-
Cyanide, Free	µg/l	<50	ND	-	-	-	-	-	-	-	-	-	-	-
pH	pH Units	<1	ND	8.54	8.44	7.69	8.01	7.86	8.46	8.15	8.59	8.23	6.9	8.4
Sulphur, Free	µg/l	<50	ND	-	-	-	-	-	-	-	-	-	-	-

Notes:

- LOD : Limit of detection
- : Below LOD
- ND : GAC/EQS not derived
- 1.23 : Result exceeds EQS value

Table 11

Metals and Metalloid Compound Concentrations in Groundwater and Surface Water (µg/l)

Test	Sample Identification		GAC Human Health - Residential (µg/l)	GAC Water Resources - Set 1 (µg/l)	EQS Values (µg/l)	Surface Water														
						Date of Sampling		CANAL EAST	CANAL MIDDLE	CANAL WEST	POND	STREAM	UPSTREAM	BH5A	CP101	CP102	CP103	CP104	WS101	WS102
	Units	LOD				02/03/2011	02/03/2011	02/03/2011	02/03/2011	02/03/2011	02/03/2011	02/03/2011	07/03/2011	02/03/2011	03/03/2011	04/03/2011	03/03/2011	07/03/2011	07/03/2011	07/03/2011
Metals																				
Aluminium	µg/l	<2.9	ND	ND	ND	23.9	22.6	35.3	20.6	-	4.31	-	-	-	30	-	12.7	3.69		
Arsenic	µg/l	<0.12	ND	ND	50	1.86	1.89	1.85	0.862	0.683	0.517	0.378	0.515	0.306	0.424	1.63	0.43	1.69	1.65	
Beryllium	µg/l	<0.07	ND	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Boron	µg/l	<9.4	ND	ND	2000	37.3	29.2	39.7	27	42	30	98.3	63.2	55	72	81.2	57.8	43.7	67.8	
Cadmium	µg/l	<0.1	ND	ND	ND	-	-	-	-	-	-	0.203	-	0.178	0.118	-	-	-	-	
Chromium	µg/l	<0.22	ND	ND	150 to 250†	1.09	1.74	6.55	0.625	6.65	1.18	12.9	1.68	9.14	5.75	10.3	14.4	4.98	9.9	
Copper	µg/l	<0.85	ND	ND	1 to 28*	2.46	1.97	2.01	2.62	2.33	2	1.04	0.861	1.55	1.76	2.96	1.29	1.71	0.871	
Lead	µg/l	<0.02	ND	ND	20 to 250†	0.349	0.412	0.268	0.517	0.028	0.024	0.037	0.045	0.042	0.031	0.056	0.044	0.122	11.5	
Molybdenum	µg/l	<0.24	ND	ND	ND	0.534	0.621	0.637	0.526	-	-	-	-	0.243	0.29	6.16	3	7.68	-	
Nickel	µg/l	<0.15	ND	ND	50 to 200*	3.56	2.88	3.16	3.98	4.36	3.62	7.79	2.96	5.99	4.65	3.13	3.71	1.12	3.85	
Silver	µg/l	<1.5	ND	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Tin	µg/l	<0.36	ND	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Vanadium	µg/l	<0.24	ND	ND	20 to 60*	0.286	0.592	-	0.313	0.401	0.355	2.28	-	0.974	1.6	4.24	2.38	1.47	2.12	
Zinc	µg/l	<0.41	ND	ND	75 to 500†	16.1	9.55	9.03	4.99	4.06	4.71	3.86	3.27	7.1	10.1	8.43	2.69	-	5.33	
Mercury	µg/l	<0.01	7	ND	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Magnesium	µg/l	<36	ND	ND	ND	6580	6130	6360	16900	24100	20900	31600	27600	21600	25100	25100	28800	4460	21300	
Iron	µg/l	<19	ND	ND	1000	-	-	-	-	-	-	-	1410	-	-	-	-	-	1970	
Hardness, Total as CaCO3	µg/l	<1000	ND	ND	ND	86,100			167,000	223,000					246,000			97,600		
Chromium, Hexavalent	µg/l	<30	ND	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Notes:

- LOD : Limit of detection
- ND : GAC/EQS not derived
- : Below LOD
- EQS Value : Suitable for freshwater, unless otherwise stated
- * : Hardness Related
- † : Suitable for coarse fish
- Not analysed
- 1.23 : Concentration exceeds Human Health GAC
- 1.23 : Concentration exceeds Water Resources GAC
- 1.23 : Result exceeds EQS value

Table 11

Metals and Metalloid Compound Concentrations in Groundwater and Surface Water (µg/l)

Test	Sample Identification		GAC Human Health - Residential (µg/l)	GAC Water Resources - Set 1 (µg/l)	EQS Values (µg/l)	Groundwater													
	Date of Sampling					WS104	WS105	WS106	WS107	WS109	WS110	WS111	WS112	WS114	WS115	WS116	WS117	WS119	WS120
	Units	LOD				04/03/2011	07/03/2011	03/03/2011	03/03/2011	04/03/2011	02/03/2011	02/03/2011	02/03/2011	03/03/2011	02/03/2011	03/03/2011	03/03/2011	04/03/2011	04/03/2011
Metals																			
Aluminium	µg/l	<2.9	ND	ND	ND	-	-	-	-	-	8.49	-	-	7.76	18.1	-	-	7790	-
Arsenic	µg/l	<0.12	ND	ND	50	0.536	2.17	0.828	1.41	13.9	0.332	0.506	3.14	2.6	0.913	2.49	0.667	0.504	338
Beryllium	µg/l	<0.07	ND	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	5.68	-
Boron	µg/l	<9.4	ND	ND	2000	90.5	119	71.4	72	85.8	140	68.2	64	71.6	113	82.1	98.3	95	121
Cadmium	µg/l	<0.1	ND	ND	ND	-	-	-	-	-	0.105	-	-	-	-	-	-	8.92	-
Chromium	µg/l	<0.22	ND	ND	150 to 250†	10.1	19	12.8	5.79	11	4.51	5.86	4.96	9.61	2.94	8.22	9.88	9.45	14.3
Copper	µg/l	<0.85	ND	ND	1 to 28*	2.88	1.99	3.38	1.69	1.77	1.71	0.865	1.95	6.76	-	1.73	6.87	13.3	5.75
Lead	µg/l	<0.02	ND	ND	20 to 250†	-	0.103	0.073	0.035	0.043	-	-	0.1	0.253	0.029	0.057	0.053	1.36	-
Molybdenum	µg/l	<0.24	ND	ND	ND	1.97	2.58	0.703	1.98	3.38	-	0.265	0.695	6.12	-	1.11	1.03	-	1.31
Nickel	µg/l	<0.15	ND	ND	50 to 200*	7.09	7.09	8.17	2.01	8.5	8.86	10.3	9.8	6.68	4.89	3.37	2.8	544	14.4
Silver	µg/l	<1.5	ND	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin	µg/l	<0.36	ND	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	µg/l	<0.24	ND	ND	20 to 60*	2.69	5.78	3.21	1.97	2.61	-	-	1.43	2.17	0.364	1.43	1.37	1.31	4.38
Zinc	µg/l	<0.41	ND	ND	75 to 500†	41	6.45	19.6	2.7	6.85	99.6	24.7	23.9	4.02	4.73	19.4	15.4	1390	6.79
Mercury	µg/l	<0.01	7	ND	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	µg/l	<36	ND	ND	ND	8620	15700	13200	15900	18200	19900	14000	65900	18500	16700	32300	20600	43100	45700
Iron	µg/l	<19	ND	ND	1000	-	1910	182	986	806	-	117	9120	1400	748	-	-	45.3	67400
Hardness, Total as CaCO3	µg/l	<1000	ND	ND	ND	-	471,000	-	285,000	330,000	167,000	-	536,000	168,000	163,000	308,000	535,000	-	1,570,000
Chromium, Hexavalent	µg/l	<30	ND	ND	ND	-	-	-	-	47	-	-	-	-	-	-	-	-	-

Notes:

LOD	: Limit of detection
ND	: GAC/EQS not derived
-	: Below LOD
EQS Value	: Suitable for freshwater, unless otherwise stated
*	: Hardness Related
†	: Suitable for coarse fish
	: Not analysed
1.23	: Concentration exceeds Human Health GAC
1.23	: Concentration exceeds Water Resources GAC
1.23	: Result exceeds EQS value

Table 12

Total Petroleum Hydrocarbon, BTEX and MTBE Concentrations in Groundwater and Surface Water (µg/l)

Land off Forge Lane, Dewsbury
962340101_01 / June 2011

Test	Sample Identification		GAC Human Health - Residential (µg/l)	GAC Water Resources - Set 1 (µg/l)	Surface Water													
	Units	LOD			CANAL EAST	CANAL MIDDLE	CANAL WEST	POND	STREAM	UPSTREAM	BH5A	CP101	CP102	CP103	CP104	WS101	WS102	WS103
					02/03/2011	02/03/2011	02/03/2011	02/03/2011	02/03/2011	02/03/2011	07/03/2011	02/03/2011	03/03/2011	04/03/2011	03/03/2011	07/03/2011	07/03/2011	07/03/2011
TPH																		
Aliphatics >C5-C6	µg/l	<10	>SOL	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aliphatics >C6-C8	µg/l	<10	>SOL	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aliphatics >C8-C10	µg/l	<10	>SOL	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aliphatics >C10-C12	µg/l	<10	>SOL	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aliphatics >C12-C16	µg/l	<10	>SOL	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aliphatics >C16-C21	µg/l	<10			-	-	-	-	-	-	-	-	-	-	-	-	-	
Aliphatics >C21-C35	µg/l	<10	NR	50	-	-	<10	-	-	-	-	-	-	-	-	-	-	
Total Aliphatics >C12-C35	µg/l	<10	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aromatics >EC5-EC7	µg/l	<10	669	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aromatics >EC7-EC8	µg/l	<10	>SOL	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aromatics >EC8-EC10	µg/l	<10	6,600	50	-	-	<10	6,600	-	-	-	-	-	-	-	-	-	
Aromatics >EC10-EC12	µg/l	<10	9,200	50	-	-	<10	-	-	-	-	-	-	-	-	-	-	
Aromatics >EC12-EC16	µg/l	<10	>SOL	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aromatics >EC16-EC21	µg/l	<10	NR	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aromatics >EC21-EC35	µg/l	<10	NR	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total Aromatics >EC12-EC35	µg/l	<10	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total Aliphatics & Aromatics >C5-35	µg/l	<10	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
GRO >C5-C12	µg/l	<50	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Methyl tertiary butyl ether (MTBE)	µg/l	<3	290,000	15	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzene	µg/l	<7	669	30	-	-	-	-	-	-	-	-	-	-	-	-	-	
Toluene	µg/l	<4	>SOL	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ethylbenzene	µg/l	<5	120,000	20	-	-	-	-	-	-	-	-	-	-	-	-	-	
m,p-Xylene	µg/l	<8			-	-	-	-	-	-	-	-	-	-	-	-	-	
o-Xylene	µg/l	<3	32,000	30	-	-	-	-	-	-	-	-	-	-	-	-	-	
m,p,o-Xylene	µg/l	<10			-	-	-	-	-	-	-	-	-	-	-	-	-	
BTEX, Total	µg/l	<10	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	

Notes:

- LOD : Limit of detection
- : Below LOD
- 1.23 : Concentration exceeds Human Health GAC
- 1.23 : Concentration exceeds Water Resources GAC
- ND : GAC not derived
- GAC : Generic Assessment Criteria
- >SOL : Target acceptable risk not exceeded at theoretical solubility concentration
- NR : No appropriate inhalation reference dose identified during review of toxicological data

Table 12

Total Petroleum Hydrocarbon, BTEX and MTBE Concentrations in Groundwater and Surface Water (µg/l)

Land off Forge Lane, Dewsbury
962340101_01 / June 2011

Test	Sample Identification		GAC Human Health - Residential (µg/l)	GAC Water Resources - Set 1 (µg/l)	Groundwater													
	Units	LOD			WS104	WS105	WS106	WS107	WS109	WS110	WS111	WS112	WS114	WS115	WS116	WS117	WS119	WS120
					04/03/2011	07/03/2011	03/03/2011	03/03/2011	04/03/2011	02/03/2011	02/03/2011	02/03/2011	03/03/2011	02/03/2011	03/03/2011	03/03/2011	04/03/2011	04/03/2011
TPH																		
Aliphatics >C5-C6	µg/l	<10	>SOL	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aliphatics >C6-C8	µg/l	<10	>SOL	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aliphatics >C8-C10	µg/l	<10	>SOL	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aliphatics >C10-C12	µg/l	<10	>SOL	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aliphatics >C12-C16	µg/l	<10	>SOL	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aliphatics >C16-C21	µg/l	<10		50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aliphatics >C21-C35	µg/l	<10	NR	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total Aliphatics >C12-C35	µg/l	<10	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aromatics >EC5-EC7	µg/l	<10	669	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aromatics >EC7-EC8	µg/l	<10	>SOL	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aromatics >EC8-EC10	µg/l	<10	6,600	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aromatics >EC10-EC12	µg/l	<10	9,200	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aromatics >EC12-EC16	µg/l	<10	>SOL	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aromatics >EC16-EC21	µg/l	<10	NR	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aromatics >EC21-EC35	µg/l	<10	NR	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total Aromatics >EC12-EC35	µg/l	<10	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total Aliphatics & Aromatics >C5-35	µg/l	<10	ND	ND	50	-	-	-	-	-	-	-	-	-	-	-	-	
GRO >C5-C12	µg/l	<50	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Methyl tertiary butyl ether (MTBE)	µg/l	<3	290,000	15	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzene	µg/l	<7	669	30	-	-	-	-	-	-	-	-	-	-	-	-	-	
Toluene	µg/l	<4	>SOL	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ethylbenzene	µg/l	<5	120,000	20	-	-	-	-	-	-	-	-	-	-	-	-	-	
m,p-Xylene	µg/l	<8			-	-	-	-	-	-	-	-	-	-	-	-	-	
o-Xylene	µg/l	<3	32,000	30	-	-	-	-	-	-	-	-	-	-	-	-	-	
m,p,o-Xylene	µg/l	<10			-	-	-	-	-	-	-	-	-	-	-	-	-	
BTEX, Total	µg/l	<10	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	

Notes:

- LOD : Limit of detection
- : Below LOD
- 1.23 : Concentration exceeds Human Health GAC
- 1.23 : Concentration exceeds Water Resources GAC
- ND : GAC not derived
- GAC : Generic Assessment Criteria
- >SOL : Target acceptable risk not exceeded at theoretical solubility α
- NR : No appropriate inhalation reference dose identified during rev

Table 13

Polycyclic Aromatic Hydrocarbon Compound Concentrations in Groundwater and Surface Water (µg/l)

Test	Sample Identification		GAC Human Health - Residential (µg/l)	GAC Water Resources - Set 1 (µg/l)	Surface Water												
	Date of Sampling				CANAL EAST	CANAL MIDDLE	CANAL WEST	POND	STREAM	UPSTREAM	BH5A	CP101	CP102	CP103	CP104	WS101	WS102
	Units	LOD			02/03/2011	02/03/2011	02/03/2011	02/03/2011	02/03/2011	02/03/2011	07/03/2011	02/03/2011	03/03/2011	04/03/2011	03/03/2011	07/03/2011	07/03/2011
PAHs																	
Naphthalene	µg/l	<0.1	2,900	10	0.12	0.101	0.106	0.296	-	-							
Acenaphthylene	µg/l	<0.011	>SOL	-	-	-	-	0.0157	-	-					0.108		
Acenaphthene	µg/l	<0.015	>SOL	-	0.017	-	-	1.36	-	-					0.034		
Fluorene	µg/l	<0.014	>SOL	-	-	-	-	0.378	-	-					0.0265		
Phenanthrene	µg/l	<0.022	>SOL	-	0.0383	-	-	0.247	-	0.0465					0.018		
Anthracene	µg/l	<0.015	>SOL	-	-	-	-	0.0342	-	-					0.32		
Fluoranthene	µg/l	<0.017	>SOL	-	0.0218	-	0.0214	0.0238	-	0.0451					0.0671		
Pyrene	µg/l	<0.015	>SOL	-	0.0177	-	0.0189	0.0164	-	0.0394					1.21		
Benzo(a)anthracene	µg/l	<0.017	>SOL	-	0.0238	-	0.0252	0.0236	0.0218	0.0318					1.41		
Chrysene	µg/l	<0.013	>SOL	-	0.0213	-	0.0282	0.017	0.0166	0.0539					0.428		
Benzo(b)fluoranthene	µg/l	<0.023	>SOL	0.025	-	-	-	-	-	-					0.987		
Benzo(k)fluoranthene	µg/l	<0.027	>SOL	0.025	-	-	-	-	-	-					0.399		
Benzo(a)pyrene	µg/l	<0.009	>SOL	0.7	-	-	-	-	-	-					0.636		
Indeno(1,2,3-cd)pyrene	µg/l	<0.014	>SOL	0.025	-	-	-	-	-	0.0145					0.812		
Dibenzo(a,h)anthracene	µg/l	<0.016	>SOL	-	-	-	-	-	-	-					0.464		
Benzo(g,h,i)perylene	µg/l	<0.016	>SOL	0.025	-	-	-	-	-	-					0.121		
PAH, Total Detected USEPA 16	µg/l	<0.1	ND	ND	0.26	0.101	0.199	2.42	-	0.231					0.639		
															7.68		

Notes:

LOD	: Limit of detection
-	: Below LOD
1.23	: Concentration exceeds Human Health GAC
1.23	: Concentration exceeds Water Resources GAC
ND	: GAC not derived
GAC	: Generic Assessment Criteria
>SOL	: Target acceptable risk not exceeded at theoretical solubility concentration
NR	: No appropriate inhalation reference dose identified during review of toxicological data

Table 13

Polycyclic Aromatic Hydrocarbon Compound Concentrations in Groundwater and Surface Water (µg/l)

Test	Sample Identification		GAC Human Health - Residential (µg/l)	GAC Water Resources - Set 1 (µg/l)	Groundwater														
					WS103	WS104	WS105	WS106	WS107	WS109	WS110	WS111	WS112	WS114	WS115	WS116	WS117	WS119	WS120
	Units	LOD			Date of Sampling	07/03/2011	04/03/2011	07/03/2011	03/03/2011	03/03/2011	04/03/2011	02/03/2011	02/03/2011	02/03/2011	03/03/2011	02/03/2011	03/03/2011	03/03/2011	04/03/2011
PAHs																			
Naphthalene	µg/l	<0.1	2,900	10	0.115	0.901	0.145	-	-	0.193	0.109	-	-	-	-	-	-	0.263	0.315
Acenaphthylene	µg/l	<0.011	>SOL	-	-	0.0301	0.0143	-	-	0.0318	-	-	-	-	-	-	-	-	-
Acenaphthene	µg/l	<0.015	>SOL	-	-	0.269	0.0347	-	-	0.7	-	0.0225	-	-	-	-	-	0.115	0.12
Fluorene	µg/l	<0.014	>SOL	-	-	0.0777	0.0266	-	-	0.277	-	-	-	-	-	-	-	0.0508	0.0363
Phenanthrene	µg/l	<0.022	>SOL	-	-	0.0773	0.179	-	-	0.375	0.0293	0.0233	-	-	-	-	-	0.083	0.0417
Anthracene	µg/l	<0.015	>SOL	-	-	0.0208	0.057	-	-	0.106	-	-	-	-	-	-	-	0.0152	-
Fluoranthene	µg/l	<0.017	>SOL	-	-	0.0439	0.407	-	0.0597	0.282	-	-	-	-	-	-	-	0.0177	0.0199
Pyrene	µg/l	<0.015	>SOL	-	-	0.0515	0.437	-	0.0592	0.229	-	-	-	-	-	-	-	0.0184	0.0209
Benzo(a)anthracene	µg/l	<0.017	>SOL	-	-	0.0375	0.181	-	0.0495	0.0947	0.0234	-	-	-	-	-	-	-	-
Chrysene	µg/l	<0.013	>SOL	-	-	0.0377	0.435	-	0.0278	0.0919	0.0145	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	µg/l	<0.023	>SOL	0.025	-	0.0237	0.132	-	0.034	0.0614	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	µg/l	<0.027	>SOL	0.025	-	-	0.184	-	0.0367	0.0512	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	µg/l	<0.009	>SOL	0.7	-	0.024	0.2	-	0.0437	0.0671	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/l	<0.014	>SOL	0.025	-	0.0207	0.138	-	0.0217	0.0363	-	-	-	-	-	-	-	-	-
Dibenzo(a,h)anthracene	µg/l	<0.016	>SOL	-	-	-	0.0403	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	µg/l	<0.016	>SOL	0.025	-	0.0285	0.17	-	0.0258	0.0393	-	-	-	-	-	-	-	-	-
PAH, Total Detected USEPA 16	µg/l	<0.1	ND	ND	0.115	1.64	2.78	-	0.358	2.64	0.176	-	-	-	-	-	-	0.563	0.554

Notes:

LOD	: Limit of detection
-	: Below LOD
1.23	: Concentration exceeds Human Health GAC
1.23	: Concentration exceeds Water Resources GAC
ND	: GAC not derived
GAC	: Generic Assessment Criteria
>SOL	: Target acceptable risk not exceeded at theoretical solubility cc
NR	: No appropriate inhalation reference dose identified during rev

Table 14

Volatile Organic Compound Concentrations in Groundwater and Surface Water (µg/l)

Test	Sample Identification		GAC Human Health - Residential (µg/l)	GAC Water Resources - Set 1 (µg/l)	Surface Water													
					Date of Sampling		CANAL EAST	CANAL MIDDLE	CANAL WEST	POND	STREAM	UPSTREAM	BH5A	CP101	CP102	CP103	CP104	WS101
	Units	LOD			02/03/2011	02/03/2011	02/03/2011	02/03/2011	02/03/2011	02/03/2011	07/03/2011	02/03/2011	03/03/2011	04/03/2011	03/03/2011	07/03/2011	07/03/2011	07/03/2011
VOCs																		
Dichlorodifluoromethane	µg/l	<7	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chloromethane	µg/l	<9	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Vinyl chloride	µg/l	<1.2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bromomethane	µg/l	<2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chloroethane	µg/l	<2.5	72	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	
Trichlorofluoromethane	µg/l	<1.3	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,1-Dichloroethene	µg/l	<1.2	30,900	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	
Carbon disulphide	µg/l	<1.3	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dichloromethane	µg/l	<3.7	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Methyl tertiary butyl ether (MTBE)	µg/l	<1.6	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,1-Dichloroethane	µg/l	<1.2	12,00	30	-	-	-	-	-	-	-	-	-	-	-	-	-	
cis-1,2-Dichloroethene	µg/l	<2.3	2396	50	-	-	-	-	-	-	-	-	-	-	-	-	-	
trans-1,2-Dichloroethene	µg/l	<1.9	4891		-	-	-	-	-	-	-	-	-	-	-	-	-	
2,2-Dichloropropane	µg/l	<3.8	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bromochloromethane	µg/l	<1.9	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chloroform	µg/l	<1.8	8,186	12	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,1,1-Trichloroethane	µg/l	<1.3	200,000	100	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,1-Dichloropropene	µg/l	<1.3	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Carbontetrachloride	µg/l	<1.4	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,2-Dichloroethane	µg/l	<3.3	46	10	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzene	µg/l	<1.3	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Trichloroethene	µg/l	<2.5	1,697	10	-	-	-	-	-	-	-	-	-	-	-	-	-	
Tetrachloroethene	µg/l	<1.5	22,000		-	-	-	-	-	-	-	-	-	-	-	-	-	
1,2-Dichloropropane	µg/l	<3	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dibromomethane	µg/l	<2.7	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bromodichloromethane	µg/l	<0.9	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
cis-1,3-Dichloropropene	µg/l	<1.9	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Toluene	µg/l	<1.4	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
trans-1,3-Dichloropropene	µg/l	<3.5	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,1,2-Trichloroethane	µg/l	<2.2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,3-Dichloropropane	µg/l	<2.2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dibromochloromethane	µg/l	<1.7	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,2-Dibromoethane	µg/l	<2.3	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chlorobenzene	µg/l	<3.5	50,000	90	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,1,1,2-Tetrachloroethane	µg/l	<1.3	2,400	20	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ethylbenzene	µg/l	<2.5	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
m,p-Xylene	µg/l	<2.5	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
o-Xylene	µg/l	<1.7	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Styrene	µg/l	<1.2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bromoform	µg/l	<3	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Isopropylbenzene	µg/l	<1.4	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,1,2,2-Tetrachloroethane	µg/l	<5.2	2,400	20	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,2,3-Trichloropropane	µg/l	<7.8	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bromobenzene	µg/l	<2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Propylbenzene	µg/l	<2.6	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
2-Chlorotoluene	µg/l	<1.9	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,3,5-Trimethylbenzene	µg/l	<1.8	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
4-Chlorotoluene	µg/l	<1.9	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
tert-Butylbenzene	µg/l	<2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,2,4-Trimethylbenzene	µg/l	<1.7	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
sec-Butylbenzene	µg/l	<1.7	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
4-iso-Propyltoluene	µg/l	<2.6	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,3-Dichlorobenzene	µg/l	<2.2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,4-Dichlorobenzene	µg/l	<2.7	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
n-Butylbenzene	µg/l	<2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,2-Dichlorobenzene	µg/l	<3.7	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,2-Dibromo-3-chloropropane	µg/l	<9.8	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,2,4-Trichlorobenzene	µg/l	<2.3	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Hexachlorobutadiene	µg/l	<2.5	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
tert-Amyl methyl ether (TAME)	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
Naphthalene	µg/l	<3.5	2,900	10	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,2,3-Trichlorobenzene	µg/l	<3.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	
1,3,5-Trichlorobenzene	µg/l	<10	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	

Notes:

- LOD : Limit of detection
- : Below LOD
- 1.23 : Concentration exceeds Human Health GAC
- 1.23 : Concentration exceeds Water Resources GAC
- ND : GAC not derived
- GAC : Generic Assessment Criteria
- >SOL : Target acceptable risk not exceeded at theoretical solubility concentration
- NR : No appropriate inhalation reference dose identified during review of toxicological data

Table 14

Volatile Organic Compound Concentrations in Groundwater and Surface Water (µg/l)

Test	Sample Identification		GAC Human Health - Residential (µg/l)	GAC Water Resources - Set 1 (µg/l)	Groundwater													
					WS104	WS105	WS106	WS107	WS109	WS110	WS111	WS112	WS114	WS115	WS116	WS117	WS119	WS120
	Units	LOD			Date of Sampling	04/03/2011	07/03/2011	03/03/2011	03/03/2011	04/03/2011	02/03/2011	02/03/2011	02/03/2011	03/03/2011	02/03/2011	03/03/2011	03/03/2011	04/03/2011
VOCs																		
Dichlorodifluoromethane	µg/l	<7	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloromethane	µg/l	<9	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl chloride	µg/l	<1.2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromomethane	µg/l	<2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroethane	µg/l	<2.5	72	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	µg/l	<1.3	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	µg/l	<1.2	30,900	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon disulphide	µg/l	<1.3	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloromethane	µg/l	<3.7	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl tertiary butyl ether (MTBE)	µg/l	<1.6	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	µg/l	<1.2	12,00	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	µg/l	<2.3	2396	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
trans-1,2-Dichloroethene	µg/l	<1.9	4891	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,2-Dichloropropane	µg/l	<3.8	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	µg/l	<1.9	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	µg/l	<1.8	8,186	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	µg/l	<1.3	200,000	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	µg/l	<1.3	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbontetrachloride	µg/l	<1.4	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	µg/l	<3.3	46	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	µg/l	<1.3	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethene	µg/l	<2.5	1,697	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethene	µg/l	<1.5	22,000	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloropropane	µg/l	<3	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibromomethane	µg/l	<2.7	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	µg/l	<0.9	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cis-1,3-Dichloropropene	µg/l	<1.9	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	µg/l	<1.4	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
trans-1,3-Dichloropropene	µg/l	<3.5	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	µg/l	<2.2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichloropropane	µg/l	<2.2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	µg/l	<1.7	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	µg/l	<2.3	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	µg/l	<3.5	50,000	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/l	<1.3	2,400	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	µg/l	<2.5	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m,p-Xylene	µg/l	<2.5	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylene	µg/l	<1.7	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	µg/l	<1.2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromoform	µg/l	<3	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	µg/l	<1.4	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/l	<5.2	2,400	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichloropropane	µg/l	<7.8	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromobenzene	µg/l	<2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Propylbenzene	µg/l	<2.6	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	µg/l	<1.9	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	µg/l	<1.8	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	µg/l	<1.9	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	µg/l	<2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	µg/l	<1.7	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	µg/l	<1.7	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-iso-Propyltoluene	µg/l	<2.6	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/l	<2.2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/l	<2.7	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	µg/l	<2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/l	<3.7	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	µg/l	<9.8	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/l	<2.3	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	µg/l	<2.5	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tert-Amyl methyl ether (TAME)	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	µg/l	<3.5	2,900	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	µg/l	<3.1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trichlorobenzene	µg/l	<10	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

- LOD : Limit of detection
- : Below LOD
- 1.23 : Concentration exceeds Human Health GAC
- 1.23 : Concentration exceeds Water Resources GAC
- ND : GAC not derived
- GAC : Generic Assessment Criteria
- >SOL : Target acceptable risk not exceeded at theoretical solubility cc
- NR : No appropriate inhalation reference dose identified during rev

Table 15

Semi Volatile Organic Compound Concentrations in Groundwater and Surface Water (µg/l)

Test	Sample Identification		GAC Human Health - Residential (µg/l)	GAC Water Resources - Set 1 (µg/l)	Surface Water													
	Date of Sampling				CANAL EAST	CANAL MIDDLE	CANAL WEST	POND	STREAM	UPSTREAM	BH5A	CP101	CP102	CP103	CP104	WS101	WS102	WS103
	Units	LOD			02/03/2011	02/03/2011	02/03/2011	02/03/2011	02/03/2011	02/03/2011	07/03/2011	02/03/2011	03/03/2011	04/03/2011	03/03/2011	07/03/2011	07/03/2011	07/03/2011
SVOCs																		
1,2,4-Trichlorobenzene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
1,2-Dichlorobenzene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
1,3-Dichlorobenzene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
1,4-Dichlorobenzene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
2,4,5-Trichlorophenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
2,4,6-Trichlorophenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
2,4-Dichlorophenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
2,4-Dimethylphenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
2,4-Dinitrotoluene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
2,6-Dinitrotoluene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
2-Chloronaphthalene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
2-Chlorophenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
2-Methylnaphthalene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
2-Methylphenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
2-Nitroaniline	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
2-Nitrophenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
3-Nitroaniline	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
4-Bromophenylphenylether	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
4-Chloro-3-methylphenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
4-Chloroaniline	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
4-Chlorophenylphenylether	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
4-Methylphenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
4-Nitrophenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
4-Nitroaniline	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Azobenzene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Acenaphthylene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Acenaphthene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Anthracene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
bis(2-Chloroethyl)ether	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
bis(2-Chloroethoxy)methane	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
bis(2-Ethylhexyl) phthalate	µg/l	<2	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Benzo(a)anthracene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Butylbenzyl phthalate	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Benzo(b)fluoranthene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Benzo(k)fluoranthene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Benzo(a)pyrene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Benzo(g,h,i)perylene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Carbazole	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Chrysene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Dibenzofuran	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
n-Dibutyl phthalate	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Diethyl phthalate	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Dibenzo(a,h)anthracene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Dimethyl phthalate	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
n-Dioctyl phthalate	µg/l	<5	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Fluoranthene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Fluorene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Hexachlorobenzene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Hexachlorobutadiene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Pentachlorophenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Phenol	µg/l	<1	912,000	ND	-	-	-	-	-	-	-	-	-	-	-	-		
n-Nitroso-n-dipropylamine	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Hexachloroethane	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Nitrobenzene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Naphthalene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Isophorone	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Hexachlorocyclopentadiene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Phenanthrene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Indeno(1,2,3-cd)pyrene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		
Pyrene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-		

Notes:

- LOD : Limit of detection
- : Below LOD
- 1.23 : Concentration exceeds Human Health GAC
- 1.23 : Concentration exceeds Water Resources GAC
- ND : GAC not derived
- GAC : Generic Assessment Criteria
- >SOL : Target acceptable risk not exceeded at theoretical solubility concentration
- NR : No appropriate inhalation reference dose identified during review of toxicological data

Table 15

Semi Volatile Organic Compound Concentrations in Groundwater and Surface Water (µg/l)

Test	Sample Identification		GAC Human Health - Residential (µg/l)	GAC Water Resources - Set 1 (µg/l)	Groundwater													
					WS104	WS105	WS106	WS107	WS109	WS110	WS111	WS112	WS114	WS115	WS116	WS117	WS119	WS120
	Units	LOD			Date of Sampling	04/03/2011	07/03/2011	03/03/2011	03/03/2011	04/03/2011	02/03/2011	02/03/2011	02/03/2011	03/03/2011	02/03/2011	03/03/2011	03/03/2011	04/03/2011
SVOCs																		
1,2,4-Trichlorobenzene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4,5-Trichlorophenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4,6-Trichlorophenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dichlorophenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dimethylphenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dinitrotoluene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,6-Dinitrotoluene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chloronaphthalene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorophenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylphenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Nitroaniline	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Nitrophenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3-Nitroaniline	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Bromophenylphenylether	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chloro-3-methylphenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chloroaniline	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorophenylphenylether	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Methylphenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Nitrophenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Nitroaniline	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Azobenzene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	µg/l	<1	ND	ND	-	-	-	-	1.07	-	-	-	-	-	-	-	-	-
Anthracene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
bis(2-Chloroethyl)ether	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
bis(2-Chloroethoxy)methane	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
bis(2-Ethylhexyl) phthalate	µg/l	<2	ND	ND	-	3.3	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Butylbenzyl phthalate	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbazole	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	µg/l	<1	ND	ND	-	-	-	-	1.1	-	-	-	-	-	-	-	-	-
n-Dibutyl phthalate	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diethyl phthalate	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzo(a,h)anthracene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dimethyl phthalate	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Dioctyl phthalate	µg/l	<5	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobenzene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pentachlorophenol	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	µg/l	<1	912,000	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Nitroso-n-dipropylamine	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachloroethane	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrobenzene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Isophorone	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorocyclopentadiene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	µg/l	<1	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

- LOD : Limit of detection
- : Below LOD
- 1.23 : Concentration exceeds Human Health GAC
- 1.23 : Concentration exceeds Water Resources GAC
- ND : GAC not derived
- GAC : Generic Assessment Criteria
- >SOL : Target acceptable risk not exceeded at theoretical solubility co
- NR : No appropriate inhalation reference dose identified during rev

Table 16

Polychlorinated Biphenol Compound Concentrations in Groundwater and Surface Water (µg/l)

Sample Identification			Surface Water														
			CANAL EAST	CANAL MIDDLE	CANAL WEST	POND	STREAM	UPSTREAM	BH5A	CP101	CP102	CP103	CP104	WS101	WS102	WS103	WS104
Date of Sampling			02/03/2011	02/03/2011	02/03/2011	02/03/2011	02/03/2011	02/03/2011	07/03/2011	02/03/2011	03/03/2011	04/03/2011	03/03/2011	07/03/2011	07/03/2011	07/03/2011	04/03/2011
Test	Units	LOD															
PCBs																	
PCB congener 28	µg/l	<0.015	-					-	-				-	-			
PCB congener 52	µg/l	<0.015	-					-	-				-	-			
PCB congener 101	µg/l	<0.015	-					-	-				-	-			
PCB congener 118	µg/l	<0.015	-					-	-				-	-			
PCB congener 138	µg/l	<0.015	-					-	-				-	-			
PCB congener 153	µg/l	<0.015	-					-	-				-	-			
PCB congener 180	µg/l	<0.015	-					-	-				-	-			
PCBs, Total ICES 7	µg/l	<0.015	-					-	-				-	-			

Notes:

- LOD : Limit of detection
- : Below LOD
- █ : Not analysed

Table 16

Polychlorinated Biphenol Compound Concentrations in Groundwater and Surface Water (µg/l)

			Groundwater												
Sample Identification			WS105	WS106	WS107	WS109	WS110	WS111	WS112	WS114	WS115	WS116	WS117	WS119	WS120
Date of Sampling			07/03/2011	03/03/2011	03/03/2011	04/03/2011	02/03/2011	02/03/2011	02/03/2011	03/03/2011	02/03/2011	03/03/2011	03/03/2011	04/03/2011	04/03/2011
Test	Units	LOD													
PCBs															
PCB congener 28	µg/l	<0.015			-	-	-	-	-		-		-		-
PCB congener 52	µg/l	<0.015			-	-	-	-	-		-		-		-
PCB congener 101	µg/l	<0.015			-	-	-	-	-		-		-		-
PCB congener 118	µg/l	<0.015			-	-	-	-	-		-		-		-
PCB congener 138	µg/l	<0.015			-	-	-	-	-		-		-		-
PCB congener 153	µg/l	<0.015			-	-	-	-	-		-		-		-
PCB congener 180	µg/l	<0.015			-	-	-	-	-		-		-		-
PCBs, Total ICES 7	µg/l	<0.015			-	-	-	-	-		-		-		-

Notes:

- LOD : Limit of detection
- : Below LOD
- : Not analysed

**Table 17
Speciated Phenol Compound Concentrations in Groundwater and Surface Water**

Test	Sample Identification		GAC Human Health - Residential (µg/l)	GAC Water Resources - Set 1 (µg/l)	Surface Water													
	Date of Sampling				CANAL EAST	CANAL MIDDLE	CANAL WEST	POND	STREAM	UPSTREAM	BH5A	CP101	CP102	CP103	CP104	WS101	WS102	WS103
	Units	LOD			02/03/2011	02/03/2011	02/03/2011	02/03/2011	02/03/2011	02/03/2011	07/03/2011	02/03/2011	03/03/2011	04/03/2011	03/03/2011	07/03/2011	07/03/2011	07/03/2011
Phenols																		
Resorcinol	µg/l	<10	ND	ND	-													
Catechol	µg/l	<10	ND	ND	-													
Phenol	µg/l	<2	912,000	ND	-													
Cresols	µg/l	<6	ND	ND	-													
Xylenols	µg/l	<8	ND	ND	-													
1-Naphthol	µg/l	<10	ND	ND	-													
2,3,5-Trimethylphenol	µg/l	<3	ND	ND	-													
2-Isopropylphenol	µg/l	<6	ND	ND	-													

Notes:

- LOD : Limit of detection
- : Below LOD
- 1.23 : Concentration exceeds Human Health GAC
- 1.23 : Concentration exceeds Water Resources GAC
- ND : GAC not derived
- GAC : Generic Assessment Criteria
- >SOL : Target acceptable risk not exceeded at theoretical solubility concentration
- NR : No appropriate inhalation reference dose identified during review of toxicological data
- Not analysed

**Table 17
Speciated Phenol Compound Concentrations in Groundwater and Surface Water**

					Groundwater													
Test	Sample Identification		GAC Human Health - Residential (µg/l)	GAC Water Resources - Set 1 (µg/l)	WS104	WS105	WS106	WS107	WS109	WS110	WS111	WS112	WS114	WS115	WS116	WS117	WS119	WS120
	Units	Date of Sampling			LOD	04/03/2011	07/03/2011	03/03/2011	03/03/2011	04/03/2011	02/03/2011	02/03/2011	02/03/2011	03/03/2011	02/03/2011	03/03/2011	03/03/2011	04/03/2011
Phenols																		
Resorcinol	µg/l	<10	ND	ND				-	-	-	-	-		-		-		-
Catechol	µg/l	<10	ND	ND				-	-	-	-	-		-		-		-
Phenol	µg/l	<2	912,000	ND				-	-	-	-	-		-		-		-
Cresols	µg/l	<6	ND	ND				-	-	-	-	-		-		-		-
Xylenols	µg/l	<8	ND	ND				-	-	-	-	-		-		-		-
1-Naphthol	µg/l	<10	ND	ND				-	-	-	-	-		-		-		-
2,3,5-Trimethylphenol	µg/l	<3	ND	ND				-	-	-	-	-		-		-		-
2-Isopropylphenol	µg/l	<6	ND	ND				-	-	-	-	-		-		-		-

Notes:

- LOD : Limit of detection
- : Below LOD
- 1.23 : Concentration exceeds Human Health GAC
- 1.23 : Concentration exceeds Water Resources GAC
- ND : GAC not derived
- GAC : Generic Assessment Criteria
- >SOL : Target acceptable risk not exceeded at theoretical solubility α
- NR : No appropriate inhalation reference dose identified during rev
- : Not analysed

Table 18
Inorganic Compound Concentrations in Soil Leachate

Customer Sample ID				CP103	CP104	TP101	TP104	TP109	TP109	TP112	TP113	TP115	TP116	TP116	TP118
Stratum				Made Ground											
Depth				0.50-1.00	0.50-1.00	0.20-0.30	2.00-2.50	0.20-0.30	2.60-2.70	1.40-	0.60-	1.00-	1.00-	1.50-	0.80-
Sampled Date				17/02/2011	18/02/2011	16/02/2011	18/02/2011	18/02/2011	18/02/2011	21/02/2011	21/02/2011	21/02/2011	21/02/2011	21/02/2011	23/02/2011
Test	Method	Units	LOD												
NRA - Ammoniacal Nitrogen as N	TM099	µg/l	<200		-	353	10100	-	-	-	-	-	-	-	-
NRA - Ammoniacal Nitrogen as NH4	TM099	µg/l	<300		-	454	13000	-	-	-	-	-	-	-	-
NRA - Ammonia, Free / unionised as N	TM099	µg/l	<200	-	-	-	819	-	-	-	-	-	-	-	-
NRA - Sulphide	TM101	µg/l	<10		-		-	-		-	-			-	-
NRA - Fluoride	TM104	µg/l	<500		666		-	-		-	-			-	1380
NRA - Sulphate	TM184	µg/l	<2000		225000		-	13300		7300	546000			8300	8200
NRA - Chloride	TM184	µg/l	<2000		-		8100	-		-	-			-	-
NRA - Nitrite as NO2	TM184	µg/l	<50		-		-	-		-	-			-	-
NRA - Phosphate (ortho) as PO4	TM184	µg/l	<50		86		244	-		93	-			-	183
NRA - Nitrate as NO3	TM184	µg/l	<300		649		-	-		585	1640			324	511
NRA - Cyanide, Total	TM227	µg/l	<50		-		-	-		-	-			-	-
NRA - Cyanide, Free	TM227	µg/l	<50		-		-	-		-	-			-	-
NRA - pH	TM256	pH Units	<1	8.02	7.96	7.35	8.25	5.4	7.36	8.07	7.35	7.24	7.99	8.22	7.68
NRA - Sulphur, Free	TM294	µg/l	<50		-		-	<50		-	-			-	-

Notes:

- m bgl : Meters below ground level
- LOD : Limit of detection
- : Below LOD
- ND : GAC not derived
- GAC : Generic Assessment Criteria
- : Not tested for

Table 18
Inorganic Compound Concentrations in Soil Leachate

Customer Sample ID				TP119	TP120	TP121	TP123	TP124	TP125	WS101	WS102	WS103	WS105	WS108	WS114
Stratum				Made Ground	Alluvium	Alluvium	Made Ground								
Depth				1.50-	1.00-	0.25-	1.00-	0.80-	0.75-	0.50-0.70	1.40-1.60	0.60-0.80	2.30-2.50	1.00-1.30	0.50-1.00
Sampled Date				23/02/2011	23/02/2011	23/02/2011	25/02/2011	25/02/2011	25/02/2011	14/02/2011	14/02/2011	14/02/2011	15/02/2011	16/02/2011	17/02/2011
Test	Method	Units	LOD												
NRA - Ammoniacal Nitrogen as N	TM099	µg/l	<200	-	-	-	-	-	-	-	-	-	872	207	-
NRA - Ammoniacal Nitrogen as NH4	TM099	µg/l	<300	-	-	-	-	-	-	-	-	-	1120	-	-
NRA - Ammonia, Free / unionised as N	TM099	µg/l	<200	-	-	-	-	-	-	-	-	-	-	-	-
NRA - Sulphide	TM101	µg/l	<10	-	-	-	-	-	-	-	-	-	-	-	-
NRA - Fluoride	TM104	µg/l	<500	664	1480	-	649	714	-	708	-	591	-	-	-
NRA - Sulphate	TM184	µg/l	<2000	46000	6100	2000	7800	22400	10300	25300	-	7800	10100	-	-
NRA - Chloride	TM184	µg/l	<2000	2000	-	-	-	-	-	-	-	-	5900	-	-
NRA - Nitrite as NO2	TM184	µg/l	<50	-	-	-	-	-	-	-	-	-	-	-	-
NRA - Phosphate (ortho) as PO4	TM184	µg/l	<50	108	128	-	144	106	117	-	-	143	-	-	-
NRA - Nitrate as NO3	TM184	µg/l	<300	-	2160	988	871	1050	618	421	330	-	-	-	-
NRA - Cyanide, Total	TM227	µg/l	<50	-	-	-	-	-	-	-	-	-	-	-	-
NRA - Cyanide, Free	TM227	µg/l	<50	-	-	-	-	-	-	-	-	-	-	-	-
NRA - pH	TM256	pH Units	<1	7.12	6.98	7.17	8.07	9.32	8.06	7.67	7.08	7.36	7.63	7.82	6.92
NRA - Sulphur, Free	TM294	µg/l	<50	-	-	<88.2	-	-	-	-	-	-	-	-	-

Notes:

- m bgl : Meters below ground level
- LOD : Limit of detection
- : Below LOD
- ND : GAC not derived
- GAC : Generic Assessment Criteria
- Not tested for : Not tested for

Table 18
Inorganic Compound Concentrations in Soil Leachate

Customer Sample ID				WS119
Stratum				Made Ground
Depth				0.80-1.00
Sampled Date				18/02/2011
Test	Method	Units	LOD	
NRA - Ammoniacal Nitrogen as N	TM099	µg/l	<200	240
NRA - Ammoniacal Nitrogen as NH4	TM099	µg/l	<300	309
NRA - Ammonia, Free / unionised as N	TM099	µg/l	<200	-
NRA - Sulphide	TM101	µg/l	<10	-
NRA - Fluoride	TM104	µg/l	<500	-
NRA - Sulphate	TM184	µg/l	<2000	65000
NRA - Chloride	TM184	µg/l	<2000	-
NRA - Nitrite as NO2	TM184	µg/l	<50	-
NRA - Phosphate (ortho) as PO4	TM184	µg/l	<50	-
NRA - Nitrate as NO3	TM184	µg/l	<300	-
NRA - Cyanide, Total	TM227	µg/l	<50	-
NRA - Cyanide, Free	TM227	µg/l	<50	-
NRA - pH	TM256	pH Units	<1	6.01
NRA - Sulphur, Free	TM294	µg/l	<50	-

Notes:

- m bgl : Meters below ground level
- LOD : Limit of detection
- : Below LOD
- ND : GAC not derived
- GAC : Generic Assessment Criteria
- █ : Not tested for

**Table 19
Metals Metalloid Compound Concentrations in Soil Leachate**

Phase II Environmental Geotechnical Site Assessment
and Generic Risk Assessment
Land off Forge Lane, Dewsbury
962340101_01 / June 2011

Customer Sample ID				GAC Human Health - Residential	GAC Water Resources - Set 1	EQS Values	CP103	CP104	TP101	TP109	TP109	TP112	TP113	TP115	TP116	TP116		
Stratum							Made Ground											
Depth							0.50-1.00	0.50-1.00	0.20-0.30	0.20-0.30	2.60-2.70	1.40-	0.60-	1.00-	1.00-	1.50-		
Sampled Date							17/02/2011	18/02/2011	16/02/2011	18/02/2011	18/02/2011	21/02/2011	21/02/2011	21/02/2011	21/02/2011	21/02/2011		
Test	Method	Units	LOD	µg/l	µg/l	µg/l												
NRA - Aluminium (diss.filt)	TM152	µg/l	<2.9	ND	ND	ND		21.6	47		603	13.4				77.6		
NRA - Arsenic (diss.filt)	TM152	µg/l	<0.12	ND	ND	50		1.29	0.146		111	70.7				0.826		
NRA - Beryllium (diss.filt)	TM152	µg/l	<0.07	ND	ND	ND		-	0.144		-	-				-		
NRA - Boron (diss.filt)	TM152	µg/l	<9.4	ND	ND	2000		-	-		-	17.4		-		-		
NRA - Cadmium (diss.filt)	TM152	µg/l	<0.1	ND	ND	ND		-	0.104		-	-				-		
NRA - Chromium (diss.filt)	TM152	µg/l	<0.22	ND	ND	150 to 250*†		2.16	0.406		3.26	4.28				3.08		
NRA - Copper (diss.filt)	TM152	µg/l	<0.85	ND	ND	1 to 28*		2.31	1.92		1.94	1.86				0.875		
NRA - Lead (diss.filt)	TM152	µg/l	<0.02	ND	ND	20 to 250*†		-	17.9		0.184	0.037				0.842		
NRA - Molybdenum (diss.filt)	TM152	µg/l	<0.24	ND	ND	ND		3.78	2.47		16.8	12.1				3.8		
NRA - Nickel (diss.filt)	TM152	µg/l	<0.15	ND	ND	50 to 200*		1.45	6.22		0.565	5.58				0.227		
NRA - Silver (diss.filt)	TM152	µg/l	<1.5	ND	ND	ND		-	-		-	-				-		
NRA - Tin (diss.filt)	TM152	µg/l	<0.36	ND	ND	ND		-	-		-	-				-		
NRA - Vanadium (diss.filt)	TM152	µg/l	<0.24	ND	ND	20 to 60*		0.71	-		48.3	16.1				0.539		
NRA - Zinc (diss.filt)	TM152	µg/l	<0.41	ND	ND	75 to 500*†		0.806	14.2		-	2.16				0.633		
NRA - Mercury (diss.filt)	TM183	µg/l	<0.01	7	ND	1		-	-		-	-				-		
NRA - Magnesium (diss.filt)	TM228	µg/l	<36	ND	ND	ND		11400	-		117	7660				2790		
NRA - Iron (diss.filt)	TM228	µg/l	<19	ND	ND	1000		-	-		-	-				-		
NRA - Chromium, Hexavalent	TM241	µg/l	<30	ND	ND	ND		-	-		-	-				-		

Notes:

- m bgl : Meters below ground level
- LOD : Limit of detection
- : Below LOD
- 1.23** : Concentration exceeds Human Health GAC
- 1.23** : Concentration exceeds Water Resources GAC
- 1.23** : Concentration exceeds EQS
- ND : GAC/EQS not derived
- GAC : Generic Assessment Criteria
- Not tested for
- EQS Value : Suitable for freshwater, unless otherwise stated
- * : Hardness Related - based on hardness of receptor
- † : Suitable for coarse fish

Table 19
Metals Metalloid Compound Concentrations in Soil Leachate

Customer Sample ID				GAC Human Health - Residential	GAC Water Resources - Set 1	EQS Values	TP118	TP119	TP120	TP121	TP123	TP124	TP125	WS101	WS102	WS103		
Stratum							Made Ground											
Depth							0.80-	1.50-	1.00-	0.25-	1.00-	0.80-	0.75-	0.50-0.70	1.40-1.60	0.60-0.80		
Sampled Date							23/02/2011	23/02/2011	23/02/2011	23/02/2011	25/02/2011	25/02/2011	25/02/2011	14/02/2011	14/02/2011	14/02/2011		
Test	Method	Units	LOD	µg/l	µg/l	µg/l												
NRA - Aluminium (diss.filt)	TM152	µg/l	<2.9	ND	ND	ND	68.5	88.1	123	168	53.6	54.1	68.5	32.9	134	97.3		
NRA - Arsenic (diss.filt)	TM152	µg/l	<0.12	ND	ND	50	41.4	1.12	9.05	0.603	2.67	25.1	4.3	41.7	0.346	3.54		
NRA - Beryllium (diss.filt)	TM152	µg/l	<0.07	ND	ND	ND	-	-	-	-	-	-	-	-	-	-		
NRA - Boron (diss.filt)	TM152	µg/l	<9.4	ND	ND	2000	-	-	-	14.6	-	-	-	-	-	-		
NRA - Cadmium (diss.filt)	TM152	µg/l	<0.1	ND	ND	ND	-	-	0.172	-	-	-	-	-	-	-		
NRA - Chromium (diss.filt)	TM152	µg/l	<0.22	ND	ND	150 to 250*†	2.65	3.74	65.8	0.512	2.52	3.5	2.78	1.91	0.448	1.58		
NRA - Copper (diss.filt)	TM152	µg/l	<0.85	ND	ND	1 to 28*	2.55	1.85	4.88	2.47	1.65	7.47	2.36	-	-	1.29		
NRA - Lead (diss.filt)	TM152	µg/l	<0.02	ND	ND	20 to 250*†	5.54	0.624	2.47	0.581	0.195	0.768	0.521	0.187	0.289	0.691		
NRA - Molybdenum (diss.filt)	TM152	µg/l	<0.24	ND	ND	ND	3.01	2.71	6.2	0.293	5.7	9.96	2.39	4.98	1.17	6.28		
NRA - Nickel (diss.filt)	TM152	µg/l	<0.15	ND	ND	50 to 200*	0.247	0.446	0.936	0.776	0.872	0.709	0.555	0.679	0.152	0.487		
NRA - Silver (diss.filt)	TM152	µg/l	<1.5	ND	ND	ND	-	-	-	-	-	-	-	-	-	-		
NRA - Tin (diss.filt)	TM152	µg/l	<0.36	ND	ND	ND	-	-	-	-	-	-	-	-	-	-		
NRA - Vanadium (diss.filt)	TM152	µg/l	<0.24	ND	ND	20 to 60*	2.59	0.981	6.69	0.31	1.44	5.43	1.06	2.5	0.47	1.67		
NRA - Zinc (diss.filt)	TM152	µg/l	<0.41	ND	ND	75 to 500*†	2.8	0.697	6.22	2.5	0.796	-	-	0.996	-	0.586		
NRA - Mercury (diss.filt)	TM183	µg/l	<0.01	7	ND	1	-	-	0.0125	0.0143	-	0.0271	-	-	-	-		
NRA - Magnesium (diss.filt)	TM228	µg/l	<36	ND	ND	ND	1510	2790	778	743	2370	2380	1310	2180	-	336		
NRA - Iron (diss.filt)	TM228	µg/l	<19	ND	ND	1000	-	-	-	-	-	-	-	-	-	-		
NRA - Chromium, Hexavalent	TM241	µg/l	<30	ND	ND	ND	-	-	47	-	-	-	-	-	-	-		

Notes:

- m bgl : Meters below ground level
- LOD : Limit of detection
- : Below LOD
- 1.23** : Concentration exceeds Human Health GAC
- 1.23** : Concentration exceeds Water Resources GAC
- 1.23** : Concentration exceeds EQS
- ND : GAC/EQS not derived
- GAC : Generic Assessment Criteria
- : Not tested for
- EQS Value : Suitable for freshwater, unless otherwise stated
- * : Hardness Related - based on hardness of receptor
- † : Suitable for coarse fish

Table 20
Extractable Petroleum Hydrocarbon Concentrations in Soil Leachate

Phase II Environmental Geotechnical Site Assessment
and Generic Risk Assessment
Land off Forge Lane, Dewsbury
962340101_01 / June 2011

Customer Sample ID				GAC Human Health - Residential	GAC Water Resources - Set 1	CP104	TP104	TP109	TP112	TP113	TP116	TP118	TP119	TP120	TP121	
Stratum						Made Ground										
Depth						0.50-1.00	2.00-2.50	0.20-0.30	1.40-	0.60-	1.50-	0.80-	1.50-	1.00-	0.25-	
Sampled Date						18/02/2011	18/02/2011	18/02/2011	21/02/2011	21/02/2011	21/02/2011	23/02/2011	23/02/2011	23/02/2011	23/02/2011	
Test	Method	Units	LOD	µg/l	µg/l											
NRA - EPH Range >C10 - C40 (aq)	TM172	µg/l	<46	ND	ND	-	394	-	-	-	-	-	-	-	-	
NRA - EPH Band >C10-C12 (aq)	TM172	µg/l	<10	ND	ND	-	60.8	-	-	-	-	-	-	-	-	
NRA - EPH Band >C12-C16 (aq)	TM172	µg/l	<10	ND	ND	-	254	-	-	-	-	-	-	-	-	
NRA - EPH Band >C16-C21 (aq)	TM172	µg/l	<10	ND	ND	-	-	-	-	-	-	-	-	-	-	
NRA - EPH Band >C21-C40 (aq)	TM172	µg/l	<10	ND	ND	-	79.3	-	-	-	-	-	-	-	-	

Notes:

- m bgl : Meters below ground level
- LOD : Limit of detection
- : Below LOD
- ND : GAC not derived
- GAC : Generic Assessment Criteria

Table 20
Extractable Petroleum Hydrocarbon Concentrations in Soil Leachate

Phase II Environmental Geotechnical Site Assessment
 and Generic Risk Assessment
 Land off Forge Lane, Dewsbury
 962340101_01 / June 2011

Customer Sample ID				GAC Human Health - Residential	GAC Water Resources - Set 1	TP123	TP124	TP125	WS101	WS102	WS103	WS105	WS119
Stratum						Made Ground	Alluvium	Made Ground					
Depth						1.00-	0.80-	0.75-	0.50-0.70	1.40-1.60	0.60-0.80	2.30-2.50	0.80-1.00
Sampled Date						25/02/2011	25/02/2011	25/02/2011	14/02/2011	14/02/2011	14/02/2011	15/02/2011	18/02/2011
Test	Method	Units	LOD	µg/l	µg/l								
NRA - EPH Range >C10 - C40 (aq)	TM172	µg/l	<46	ND	ND	-	75.9	103	-	-	-	-	-
NRA - EPH Band >C10-C12 (aq)	TM172	µg/l	<10	ND	ND	-	-	-	-	-	-	-	-
NRA - EPH Band >C12-C16 (aq)	TM172	µg/l	<10	ND	ND	-	-	-	-	-	-	-	-
NRA - EPH Band >C16-C21 (aq)	TM172	µg/l	<10	ND	ND	-	19.3	20.3	-	-	-	-	-
NRA - EPH Band >C21-C40 (aq)	TM172	µg/l	<10	ND	ND	-	56.6	82.7	-	-	-	-	-

Notes:

- m bgl : Meters below ground level
- LOD : Limit of detection
- : Below LOD
- ND : GAC not derived
- GAC : Generic Assessment Criteria

Table 21
Polycyclic Aromatic Hydrocarbon Compound Concentrations in Soil Leachate

Phase II Environmental Geotechnical Site Assessment
and Generic Risk Assessment
Land off Forge Lane, Dewsbury
962340101_01 / June 2011

Customer Sample ID				GAC Human Health - Residential	GAC Water Resources - Set 1	CP104	TP104	TP109	TP112	TP113	TP116	TP118	TP119	TP120	
Stratum						Made Ground	Made Ground								
Depth						0.50-1.00	2.00-2.50	0.20-0.30	1.40-	0.60-	1.50-	0.80-	1.50-	1.00-	
Sampled Date						18/02/2011	18/02/2011	18/02/2011	21/02/2011	21/02/2011	21/02/2011	23/02/2011	23/02/2011	23/02/2011	
Test	Method	Units	LOD	µg/l	µg/l										
NRA - Naphthalene (aq)	TM178	µg/l	<0.1	2900	10	0.293	33.9	-	0.221	0.221	-	-	-	0.192	
NRA - Acenaphthene (aq)	TM178	µg/l	<0.015	>SOL	-	0.15	40.3	-	0.0155	-	0.0168	-	-	0.0527	
NRA - Acenaphthylene (aq)	TM178	µg/l	<0.011	>SOL	-	-	0.389	-	-	-	-	-	-	-	
NRA - Fluoranthene (aq)	TM178	µg/l	<0.017	>SOL	-	0.0213	0.0529	-	-	-	0.0183	-	0.0393	0.0813	
NRA - Anthracene (aq)	TM178	µg/l	<0.015	>SOL	-	-	0.16	-	-	-	-	-	-	0.0172	
NRA - Phenanthrene (aq)	TM178	µg/l	<0.022	>SOL	-	0.0825	1.08	-	-	-	0.033	-	-	0.0798	
NRA - Fluorene (aq)	TM178	µg/l	<0.014	>SOL	-	0.0401	7.18	-	-	-	-	-	-	0.0183	
NRA - Chrysene (aq)	TM178	µg/l	<0.013	>SOL	-	-	-	-	-	-	-	-	-	0.029	
NRA - Pyrene (aq)	TM178	µg/l	<0.015	>SOL	-	0.0156	0.0403	-	-	-	0.0156	-	0.0372	0.0793	
NRA - Benzo(a)anthracene (aq)	TM178	µg/l	<0.017	>SOL	-	-	0.0206	-	-	-	-	-	-	0.0349	
NRA - Benzo(b)fluoranthene (aq)	TM178	µg/l	<0.023	>SOL	0.025	-	-	-	-	-	-	-	-	0.0367	
NRA - Benzo(k)fluoranthene (aq)	TM178	µg/l	<0.027	>SOL	0.025	-	-	-	-	-	-	-	-	0.0436	
NRA - Benzo(a)pyrene (aq)	TM178	µg/l	<0.009	>SOL	0.7	-	-	-	-	-	-	-	-	0.0423	
NRA - Dibenzo(a,h)anthracene (aq)	TM178	µg/l	<0.016	>SOL	0.025	-	-	-	-	-	-	-	-	-	
NRA - Benzo(g,h,i)perylene (aq)	TM178	µg/l	<0.016	>SOL	-	-	-	-	-	-	-	-	-	0.0409	
NRA - Indeno(1,2,3-cd)pyrene (aq)	TM178	µg/l	<0.014	>SOL	0.025	-	-	-	-	-	-	-	-	0.028	
NRA - Polyaromatic hydrocarbons, Total USEPA 16 (aq)	TM178	µg/l	<0.1	ND	ND	0.602	83.1	-	0.236	0.221	-	-	-	0.776	

Notes:

- m bgl : Meters below ground level
- LOD : Limit of detection
- : Below LOD
- 1.23** : Concentration exceeds Human Health GAC
- 1.23** : Concentration exceeds Water Resources GAC
- ND : GAC not derived
- GAC : Generic Assessment Criteria

Table 21
Polycyclic Aromatic Hydrocarbon Compound Concentrations in Soil Leachate

Phase II Environmental Geotechnical Site Assessment
and Generic Risk Assessment
Land off Forge Lane, Dewsbury
962340101_01 / June 2011

Customer Sample ID				GAC Human Health - Residential	GAC Water Resources - Set 1	TP121	TP123	TP124	TP125	WS101	WS102	WS103	WS105	WS119	
Stratum						Made Ground	Alluvium	Made Ground							
Depth						0.25-	1.00-	0.80-	0.75-	0.50-0.70	1.40-1.60	0.60-0.80	2.30-2.50	0.80-1.00	
Sampled Date						23/02/2011	25/02/2011	25/02/2011	25/02/2011	14/02/2011	14/02/2011	14/02/2011	15/02/2011	18/02/2011	
Test	Method	Units	LOD	µg/l	µg/l										
NRA - Naphthalene (aq)	TM178	µg/l	<0.1	2900	10	0.108	0.115	0.133	0.208	0.174	0.142	1.28	0.131	-	
NRA - Acenaphthene (aq)	TM178	µg/l	<0.015	>SOL	-	-	-	-	-	-	-	-	-	0.0204	
NRA - Acenaphthylene (aq)	TM178	µg/l	<0.011	>SOL	-	-	-	-	-	-	-	-	-	-	
NRA - Fluoranthene (aq)	TM178	µg/l	<0.017	>SOL	-	-	-	-	0.041	-	-	-	-	-	
NRA - Anthracene (aq)	TM178	µg/l	<0.015	>SOL	-	-	-	-	-	-	-	-	-	-	
NRA - Phenanthrene (aq)	TM178	µg/l	<0.022	>SOL	-	0.0247	-	-	0.0422	-	-	-	-	-	
NRA - Fluorene (aq)	TM178	µg/l	<0.014	>SOL	-	-	-	-	-	-	-	-	-	-	
NRA - Chrysene (aq)	TM178	µg/l	<0.013	>SOL	-	-	-	0.0172	0.0366	-	-	-	-	-	
NRA - Pyrene (aq)	TM178	µg/l	<0.015	>SOL	-	-	-	-	0.0324	-	-	-	-	-	
NRA - Benzo(a)anthracene (aq)	TM178	µg/l	<0.017	>SOL	-	-	-	0.0224	0.0297	-	-	-	-	-	
NRA - Benzo(b)fluoranthene (aq)	TM178	µg/l	<0.023	>SOL	0.025	-	-	-	-	-	-	-	-	-	
NRA - Benzo(k)fluoranthene (aq)	TM178	µg/l	<0.027	>SOL	0.025	-	-	-	-	-	-	-	-	-	
NRA - Benzo(a)pyrene (aq)	TM178	µg/l	<0.009	>SOL	0.7	-	-	-	0.0124	-	0.0111	-	-	-	
NRA - Dibenzo(a,h)anthracene (aq)	TM178	µg/l	<0.016	>SOL	0.025	-	-	-	-	-	-	-	-	-	
NRA - Benzo(g,h,i)perylene (aq)	TM178	µg/l	<0.016	>SOL	-	-	-	-	-	-	-	-	-	-	
NRA - Indeno(1,2,3-cd)pyrene (aq)	TM178	µg/l	<0.014	>SOL	0.025	-	-	-	-	-	-	-	-	-	
NRA - Polyaromatic hydrocarbons, Total USEPA 16 (aq)	TM178	µg/l	<0.1	ND	ND	0.132	0.115	0.172	0.402	0.174	0.153	1.28	0.131	-	

Notes:

- m bgl : Meters below ground level
- LOD : Limit of detection
- : Below LOD
- 1.23** : Concentration exceeds Human Health GAC
- 1.23** : Concentration exceeds Water Resources GAC
- ND : GAC not derived
- GAC : Generic Assessment Criteria

Table 22
Phenol Compound Concentrations in Soil Leachate (2:1 Concentration)

Customer Sample ID				GAC Human Health - Residential	GAC Water Resources - Set 1	TP104	TP116	TP118	TP119	TP120	TP123	TP124	TP125	WS101	WS119	
Stratum						Made Ground										
Depth						2.00-2.50	1.50-	0.80-	1.50-	1.00-	1.00-	0.80-	0.75-	0.50-0.70	0.80-1.00	
Sampled Date						18/02/2011	21/02/2011	23/02/2011	23/02/2011	23/02/2011	25/02/2011	25/02/2011	25/02/2011	25/02/2011	14/02/2011	18/02/2011
Test	Method	Units	LOD	µg/l	µg/l											
NRA - Resorcinol	TM259	µg/l	<10	ND	ND	-	-	-	-	-	-	-	-	-	-	
NRA - Catechol	TM259	µg/l	<10	ND	ND	-	-	-	-	-	-	-	-	-	-	
NRA - Phenol	TM259	µg/l	<2	912,000	ND	-	-	-	-	-	-	-	-	-	-	
NRA - Cresols	TM259	µg/l	<6	ND	ND	-	-	-	-	-	-	-	-	-	-	
NRA - Xylenols	TM259	µg/l	<8	ND	ND	-	-	-	-	-	-	-	-	-	-	
NRA - 1-Naphthol	TM259	µg/l	<10	ND	ND	-	-	-	-	-	-	-	-	-	-	
NRA - 2,3,5-Trimethylphenol	TM259	µg/l	<3	ND	ND	-	-	-	-	-	-	-	-	-	-	
NRA - 2-Isopropylphenol	TM259	µg/l	<6	ND	ND	-	-	-	-	-	-	-	-	-	-	

Notes:

- m bgl : Meters below ground level
- LOD : Limit of detection
- : Below LOD
- 1.23** : Concentration exceeds Human Health GAC
- 1.23** : Concentration exceeds Water Resources GAC
- ND : GAC not derived
- GAC : Generic Assessment Criteria

Table 23
Inorganic Compound Concentrations in Soil Leachate (2:1 Concentration)

Customer Sample ID				CP103	EQS Values	WS108	WS114
Stratum				Made Ground	Topsoil	Alluvium	Made Ground
Depth				0.50-1.00	0.20-0.30	1.00-1.30	0.50-1.00
Sampled Date				18/02/2011	17/02/2011	17/02/2011	18/02/2011
Test	Method	Units	LOD				
CEN 2:1 - Sulphide	TM101	mg/l	<0.01	-	-	-	-
CEN 2:1 - Sulphide	TM101	mg/kg	<0.02	-	-	-	-
CEN 2:1 - Fluoride	TM104	mg/kg	<1	2.08	1.02	1.79	-
CEN 2:1 - Fluoride	TM104	mg/l	<0.5	1.04	0.512	0.895	-
CEN 2:1 - Sulphate	TM184	mg/l	<3	49.4	-	116	23.2
CEN 2:1 - Sulphate	TM184	mg/kg	<6	98.8	-	232	46.4
CEN 2:1 - Chloride	TM184	mg/kg	<4	6.6	-	-	-
CEN 2:1 - Chloride	TM184	mg/l	<2	3.3	-	-	-
CEN 2:1 - Nitrite as NO2	TM184	mg/l	<0.05	-	-	-	-
CEN 2:1 - Nitrite as NO2	TM184	mg/kg	<0.1	-	-	-	-
CEN 2:1 - Phosphate (ortho) as PO4	TM184	mg/kg	<0.1	-	0.514	-	-
CEN 2:1 - Phosphate (ortho) as PO4	TM184	mg/l	<0.05	-	0.257	-	-
CEN 2:1 - Nitrate as NO3	TM184	mg/l	<0.3	-	9.91	1.61	-
CEN 2:1 - Nitrate as NO3	TM184	mg/kg	<0.6	-	19.8	3.22	-
CEN 2:1 - Cyanide, Total	TM227	mg/l	<0.05	-	-	-	-
CEN 2:1 - Cyanide, Total	TM227	mg/kg	<0.1	-	-	-	-
CEN 2:1 - Cyanide, Free	TM227	mg/kg	<0.1	-	-	-	-
CEN 2:1 - Cyanide, Free	TM227	mg/l	<0.05	-	-	-	-
CEN 2:1 - pH	TM256	mg/kg	<1	17	14	15	14
CEN 2:1 - pH	TM256	mg/l	<1	8.4	7.2	7.6	7.1
CEN 2:1 - Sulphur, Free	TM294	mg/l	<0.05	-	-	-	-
CEN 2:1 - Sulphur, Free	TM294	mg/kg	<0.1	-	-	-	-

Notes:

m bgl : Meters below ground level
LOD : Limit of detection
- : Below LOD
ND : GAC not derived
GAC : Generic Assessment Criteria

Table 24
Metals Metalloid Compound Concentrations in Soil Lechate (2:1 Concentration)

Customer Sample ID				CP103	TP101	WS108	WS114
Stratum				Made Ground	Topsoil	Alluvium	Made Ground
Depth				0.50-1.00	0.20-0.30	1.00-1.30	0.50-1.00
Sampled Date				18/02/2011	17/02/2011	17/02/2011	18/02/2011
Test	Method	Units	LOD				
CEN 2:1 - Aluminium (diss.filt)	TM152	mg/kg	<0.0058	0.0846	1.94	0.045	1.68
CEN 2:1 - Aluminium (diss.filt)	TM152	mg/l	<0.0029	0.0423	0.972	0.0225	0.842
CEN 2:1 - Arsenic (diss.filt)	TM152	mg/l	<0.00012	0.00602	0.00294	0.000177	0.000136
CEN 2:1 - Arsenic (diss.filt)	TM152	mg/kg	<0.00024	0.012	0.00588	0.000354	0.000272
CEN 2:1 - Beryllium (diss.filt)	TM152	mg/kg	<0.00014	-	-	-	-
CEN 2:1 - Beryllium (diss.filt)	TM152	mg/l	<0.00007	-	-	-	-
CEN 2:1 - Cadmium (diss.filt)	TM152	mg/l	<0.0001	-	-	-	-
CEN 2:1 - Cadmium (diss.filt)	TM152	mg/kg	<0.0002	-	-	-	-
CEN 2:1 - Chromium (diss.filt)	TM152	mg/kg	<0.00044	0.514	0.00524	0.00296	0.0028
CEN 2:1 - Chromium (diss.filt)	TM152	mg/l	<0.00022	0.257	0.00262	0.00148	0.0014
CEN 2:1 - Copper (diss.filt)	TM152	mg/l	<0.00085	0.00628	0.00932	0.00143	0.00319
CEN 2:1 - Copper (diss.filt)	TM152	mg/kg	<0.0017	0.0126	0.0186	0.00286	0.00638
CEN 2:1 - Lead (diss.filt)	TM152	mg/kg	<0.00004	0.00197	0.0155	0.000414	0.000666
CEN 2:1 - Lead (diss.filt)	TM152	mg/l	<0.00002	0.000986	0.00774	0.000207	0.000333
CEN 2:1 - Molybdenum (diss.filt)	TM152	mg/l	<0.00024	0.0139	0.0015	0.000308	-
CEN 2:1 - Molybdenum (diss.filt)	TM152	mg/kg	<0.00048	0.0278	0.003	0.000616	-
CEN 2:1 - Nickel (diss.filt)	TM152	mg/kg	<0.0003	0.00864	0.0127	0.00112	0.00196
CEN 2:1 - Nickel (diss.filt)	TM152	mg/l	<0.00015	0.00432	0.00634	0.000558	0.000979
CEN 2:1 - Silver (diss.filt)	TM152	mg/l	<0.0015	-	-	-	-
CEN 2:1 - Silver (diss.filt)	TM152	mg/kg	<0.003	-	-	-	-
CEN 2:1 - Tin (diss.filt)	TM152	mg/kg	<0.00072	-	-	-	-
CEN 2:1 - Tin (diss.filt)	TM152	mg/l	<0.00036	-	-	-	-
CEN 2:1 - Vanadium (diss.filt)	TM152	mg/l	<0.00024	-	0.00235	0.000479	0.00126
CEN 2:1 - Vanadium (diss.filt)	TM152	mg/kg	<0.00048	-	0.0047	0.000958	0.00252
CEN 2:1 - Zinc (diss.filt)	TM152	mg/kg	<0.00082	0.00452	0.0536	0.00582	0.0069
CEN 2:1 - Zinc (diss.filt)	TM152	mg/l	<0.00041	0.00226	0.0268	0.00291	0.00345
CEN 2:1 - Mercury (diss.filt)	TM183	mg/l	<0.00001	-	0.0000407	-	-
CEN 2:1 - Mercury (diss.filt)	TM183	mg/kg	<0.00002	-	0.0000814	-	-
CEN 2:1 - Magnesium (diss.filt)	TM228	mg/kg	<0.072	9.76	3.78	33.6	3.46
CEN 2:1 - Magnesium (diss.filt)	TM228	mg/l	<0.036	4.88	1.89	16.8	1.73
CEN 2:1 - Iron (diss.filt)	TM228	mg/l	<0.019	-	0.729	-	0.233
CEN 2:1 - Iron (diss.filt)	TM228	mg/kg	<0.038	-	1.46	-	0.466
CEN 2:1 - Chromium, Hexavalent	TM241	mg/kg	<0.06	0.6	-	-	-
CEN 2:1 - Chromium, Hexavalent	TM241	mg/l	<0.03	0.3	-	-	-

Notes:

- m bgl : Meters below ground level
- LOD : Limit of detection
- : Below LOD
- ND : GAC not derived
- GAC : Generic Assessment Criteria

Table 25
Extractable Petroleum Hydrocarbon Concentrations in Soil Leachate (2:1 Concentration)

Customer Sample ID				CP103	TP101	WS108	WS114
Stratum				Made Ground	Topsoil	Alluvium	Made Ground
Depth				0.50-1.00	0.20-0.30	1.00-1.30	0.50-1.00
Sampled Date				18/02/2011	17/02/2011	17/02/2011	18/02/2011
Test	Method	Units	LOD				
CEN 2:1 - EPH Range >C10 - C40 (aq)	TM172	mg/l	<0.046	0.163	-	-	-
CEN 2:1 - EPH Range >C10 - C40 (aq)	TM172	mg/kg	<0.092	0.326	-	-	-
CEN 2:1 - EPH Band >C10-C12 (aq)	TM172	mg/kg	<0.02	-	-	-	-
CEN 2:1 - EPH Band >C10-C12 (aq)	TM172	mg/l	<0.01	-	-	-	-
CEN 2:1 - EPH Band >C12-C16 (aq)	TM172	mg/l	<0.01	0.0288	-	-	-
CEN 2:1 - EPH Band >C12-C16 (aq)	TM172	mg/kg	<0.02	0.0576	-	-	-
CEN 2:1 - EPH Band >C16-C21 (aq)	TM172	mg/kg	<0.02	0.186	-	-	-
CEN 2:1 - EPH Band >C16-C21 (aq)	TM172	mg/l	<0.01	0.0928	-	-	-
CEN 2:1 - EPH Band >C21-C40 (aq)	TM172	mg/l	<0.01	0.0375	-	-	-
CEN 2:1 - EPH Band >C21-C40 (aq)	TM172	mg/kg	<0.02	0.075	-	-	-

Notes:

m bgl : Meters below ground level
LOD : Limit of detection
- : Below LOD
ND : GAC not derived
GAC : Generic Assessment Criteria

Table 26
Polycyclic Aromatic Hydrocarbon Compound Concentrations in Soil Leachate (2:1 Concentration)

Customer Sample ID				CP103	TP101	WS108	WS114
Stratum				Made Ground	Topsoil	Alluvium	Made Ground
Depth				0.50-1.00	0.20-0.30	1.00-1.30	0.50-1.00
Sampled Date				18/02/2011	17/02/2011	17/02/2011	18/02/2011
Test	Method	Units	LOD				
CEN 2:1 - Naphthalene (aq)	TM178	mg/kg	<0.0002	-	-	-	-
CEN 2:1 - Naphthalene (aq)	TM178	mg/l	<0.0001	-	-	-	-
CEN 2:1 - Acenaphthene (aq)	TM178	mg/l	<0.000015	-	-	-	-
CEN 2:1 - Acenaphthene (aq)	TM178	mg/kg	<0.00003	-	-	-	-
CEN 2:1 - Acenaphthylene (aq)	TM178	mg/kg	<0.000022	-	-	-	-
CEN 2:1 - Acenaphthylene (aq)	TM178	mg/l	<0.000011	-	-	-	-
CEN 2:1 - Fluoranthene (aq)	TM178	mg/l	<0.000017	-	0.0000266	0.0000199	-
CEN 2:1 - Fluoranthene (aq)	TM178	mg/kg	<0.000034	-	0.0000532	0.0000398	-
CEN 2:1 - Anthracene (aq)	TM178	mg/kg	<0.00003	-	-	-	-
CEN 2:1 - Anthracene (aq)	TM178	mg/l	<0.000015	-	-	-	-
CEN 2:1 - Phenanthrene (aq)	TM178	mg/l	<0.000022	-	-	-	-
CEN 2:1 - Phenanthrene (aq)	TM178	mg/kg	<0.000044	-	-	-	-
CEN 2:1 - Fluorene (aq)	TM178	mg/kg	<0.000028	-	-	-	-
CEN 2:1 - Fluorene (aq)	TM178	mg/l	<0.000014	-	-	-	-
CEN 2:1 - Chrysene (aq)	TM178	mg/l	<0.000013	-	-	-	-
CEN 2:1 - Chrysene (aq)	TM178	mg/kg	<0.000026	-	-	-	-
CEN 2:1 - Pyrene (aq)	TM178	mg/kg	<0.00003	-	0.0000464	0.0000334	-
CEN 2:1 - Pyrene (aq)	TM178	mg/l	<0.000015	-	0.0000232	0.0000167	-
CEN 2:1 - Benzo(a)anthracene (aq)	TM178	mg/l	<0.000017	-	-	-	-
CEN 2:1 - Benzo(a)anthracene (aq)	TM178	mg/kg	<0.000034	-	-	-	-
CEN 2:1 - Benzo(b)fluoranthene (aq)	TM178	mg/kg	<0.000046	-	-	-	-
CEN 2:1 - Benzo(b)fluoranthene (aq)	TM178	mg/l	<0.000023	-	-	-	-
CEN 2:1 - Benzo(k)fluoranthene (aq)	TM178	mg/l	<0.000027	-	-	-	-
CEN 2:1 - Benzo(k)fluoranthene (aq)	TM178	mg/kg	<0.000054	-	-	-	-
CEN 2:1 - Benzo(a)pyrene (aq)	TM178	mg/kg	<0.000018	-	0.0000256	-	-
CEN 2:1 - Benzo(a)pyrene (aq)	TM178	mg/l	<0.000009	-	0.0000128	-	-
CEN 2:1 - Dibenzo(a,h)anthracene (aq)	TM178	mg/l	<0.000016	-	-	-	-
CEN 2:1 - Dibenzo(a,h)anthracene (aq)	TM178	mg/kg	<0.000032	-	-	-	-
CEN 2:1 - Benzo(g,h,i)perylene (aq)	TM178	mg/kg	<0.000032	-	-	-	-
CEN 2:1 - Benzo(g,h,i)perylene (aq)	TM178	mg/l	<0.000016	-	-	-	-
CEN 2:1 - Indeno(1,2,3-cd)pyrene (aq)	TM178	mg/l	<0.000014	-	-	-	-
CEN 2:1 - Indeno(1,2,3-cd)pyrene (aq)	TM178	mg/kg	<0.000028	-	-	-	-
CEN 2:1 - Polyaromatic hydrocarbons, Total U	TM178	mg/kg	<0.0002	-	-	-	-
CEN 2:1 - Polyaromatic hydrocarbons, Total L	TM178	mg/l	<0.0001	-	-	-	-

Notes:

- m bgl : Meters below ground level
- LOD : Limit of detection
- : Below LOD
- ND : GAC not derived
- GAC : Generic Assessment Criteria

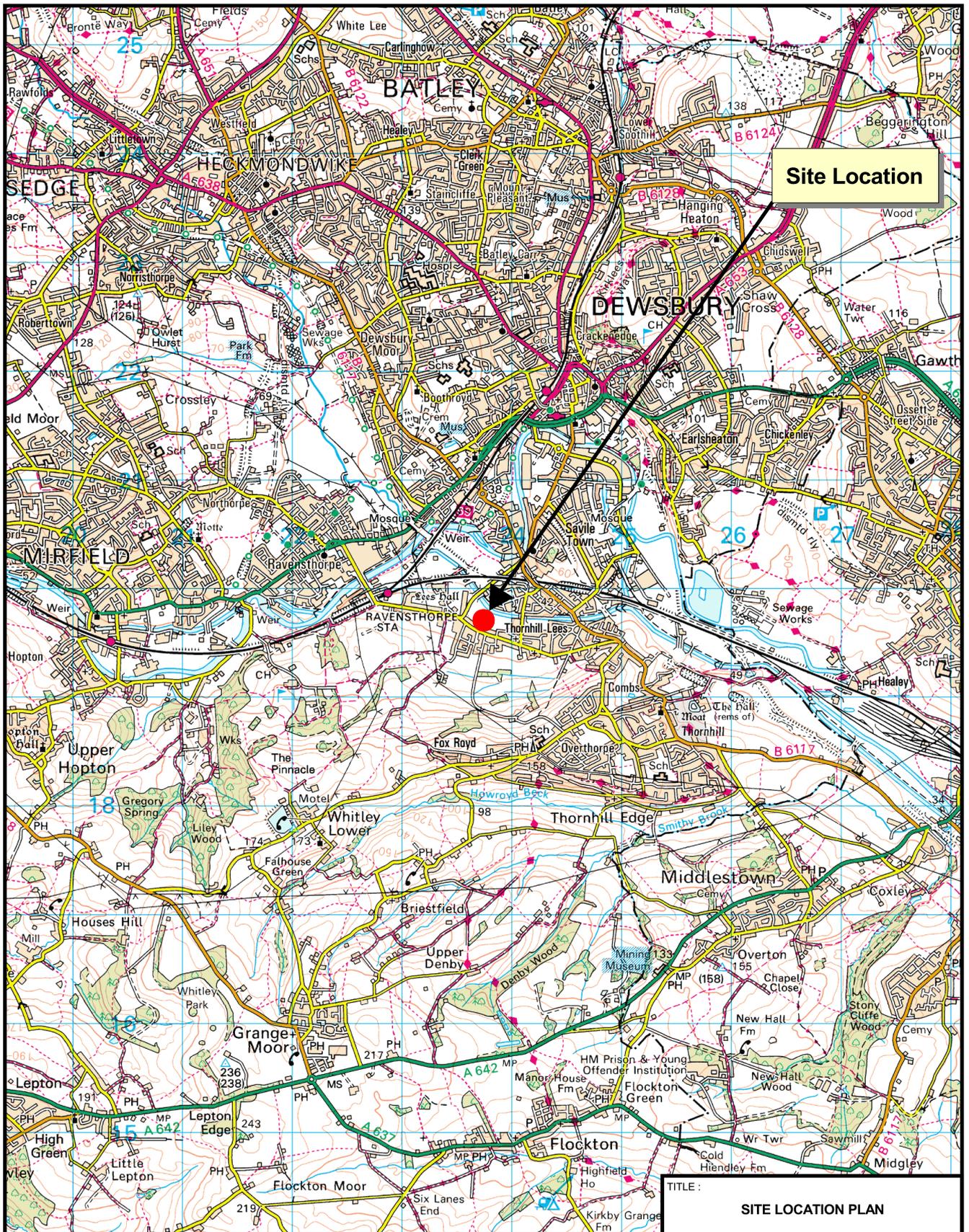
Table 27
Phenol Compound Concentrations in Soil Leachate (2:1 Concentration)

Customer Sample ID				CP103	TP101	WS108	WS114
Stratum				Made Ground	Topsoil	Alluvium	Made Ground
Depth				0.50-1.00	0.20-0.30	1.00-1.30	0.50-1.00
Sampled Date				18/02/2011	17/02/2011	17/02/2011	18/02/2011
Test	Method	Units	LOD				
CEN 2:1 - Resorcinol	TM259	mg/kg	<0.02	-	-	-	-
CEN 2:1 - Resorcinol	TM259	mg/l	<0.01	-	-	-	-
CEN 2:1 - Catechol	TM259	mg/l	<0.01	-	-	-	-
CEN 2:1 - Catechol	TM259	mg/kg	<0.02	-	-	-	-
CEN 2:1 - Phenol	TM259	mg/kg	<0.004	-	-	-	-
CEN 2:1 - Phenol	TM259	mg/l	<0.002	-	-	-	-
CEN 2:1 - Cresols	TM259	mg/l	<0.006	-	-	-	-
CEN 2:1 - Cresols	TM259	mg/kg	<0.012	-	-	-	-
CEN 2:1 - Xylenols	TM259	mg/kg	<0.016	-	-	-	-
CEN 2:1 - Xylenols	TM259	mg/l	<0.008	-	-	-	-
CEN 2:1 - 1-Naphthol	TM259	mg/l	<0.01	-	-	-	-
CEN 2:1 - 1-Naphthol	TM259	mg/kg	<0.02	-	-	-	-
CEN 2:1 - 2,3,5-Trimethylphenol	TM259	mg/kg	<0.006	-	-	-	-
CEN 2:1 - 2,3,5-Trimethylphenol	TM259	mg/l	<0.003	-	-	-	-
CEN 2:1 - 2-Isopropylphenol	TM259	mg/l	<0.006	-	-	-	-
CEN 2:1 - 2-Isopropylphenol	TM259	mg/kg	<0.012	-	-	-	-

Notes:

m bgl : Meters below ground level
LOD : Limit of detection
- : Below LOD
ND : GAC not derived
GAC : Generic Assessment Criteria

FIGURES

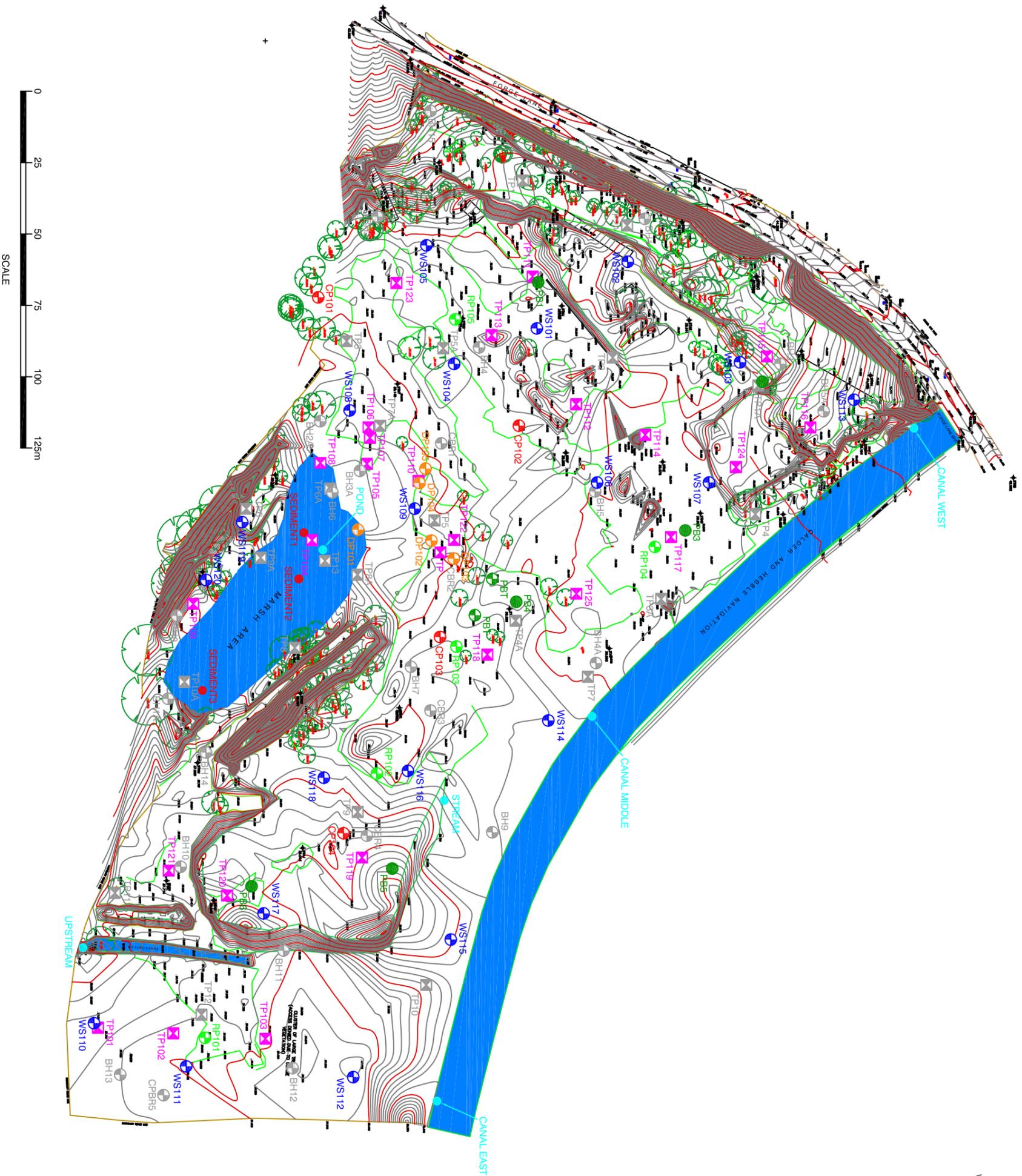


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LEGEND	NOTES
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SITE LOCATION	
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TITLE :	
SITE LOCATION PLAN	
SITE :	
FORGE LANE, THORNHILL LEES	
CLIENT :	
KIRKLEES COUNCIL	
PROJECT :	FIGURE 1
DATE :	DRAWN BY :
DRG No. :	RV
SCALE :	PRINT :
1 : 50,000	A4



KEY

- ⊕ BOREHOLE LOCATION - WINDOW SAMPLE
- ⊕ BOREHOLE LOCATION - CABLE PERCUSSION
- ⊕ BOREHOLE LOCATION - DYNAMIC PROBE
- ⊕ BOREHOLE LOCATION - ROTARY PROBE
- ⊕ TRIAL PIT LOCATION
- ⊕ HISTORICAL BOREHOLE - APPROX. LOCATION
- ⊕ HISTORICAL TRIAL PIT - APPROX. LOCATION
- SURFACE WATER SAMPLE LOCATION
- SEDIMENT SAMPLE LOCATION
- APPROXIMATE LOCATION OF PLATE BEARING TEST

NOTES

BASED ON DRAWING BY AECOM,
DRAWING No: 60140787_LS013D REV. -
DATE: 25/11/2009

REV	DATE	COMMENT	CAD
A	03.06.11	PLATE BEARING TEST LOCATIONS - RJW ADDED TO PLAN	

TITLE:
EXISTING SITE LAYOUT, EXPLORATORY
HOLE AND SAMPLING LOCATION PLAN

SITE:
FORGE LANE

CLIENT:
KIRKLEES COUNCIL

PROJECT: 96234.01 **FIGURE 2**

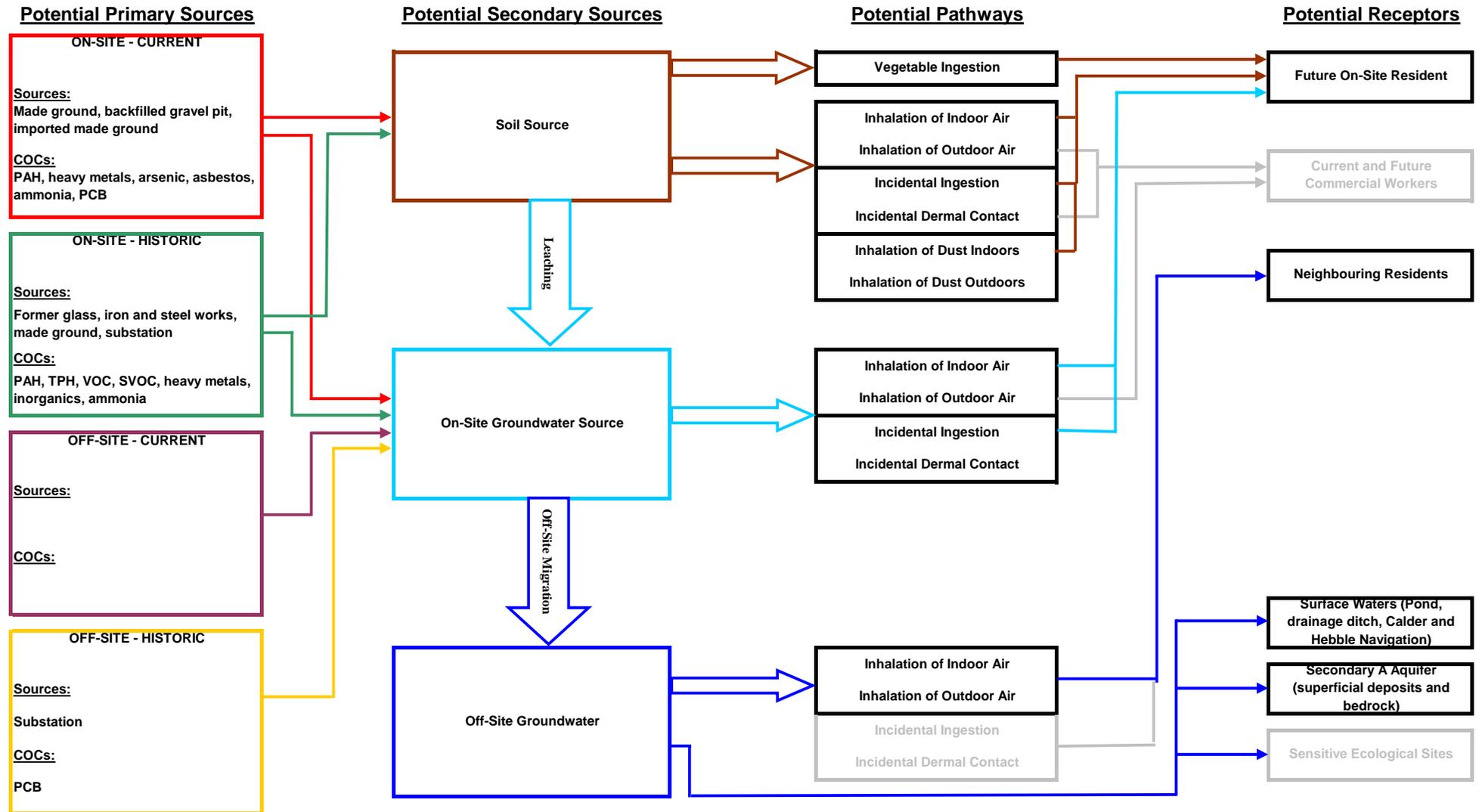
DATE: 28/03/11 **DRAWN:** BNB **REV:** A
DRG.No.: 962340117-CAD **PRINT:** A3

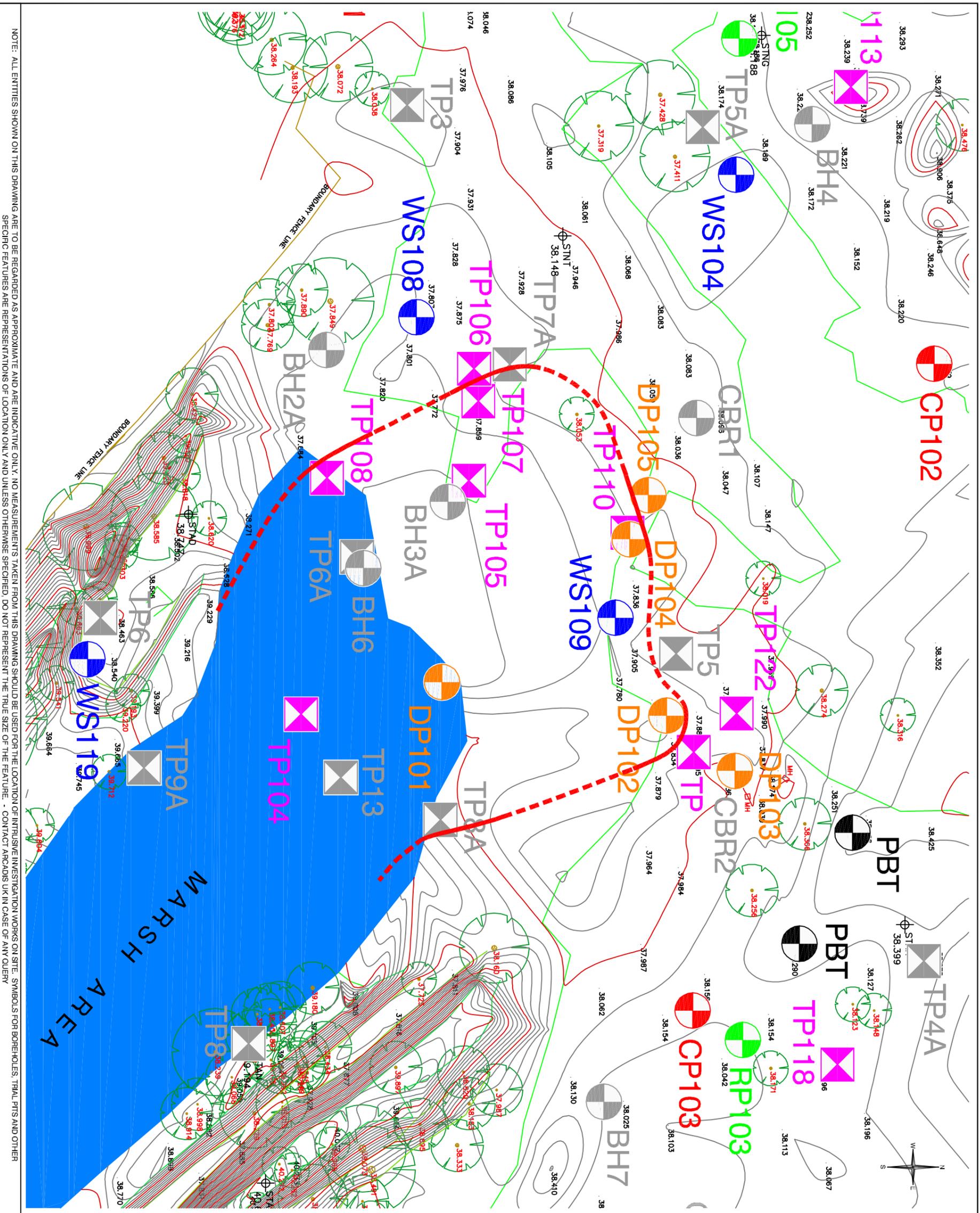
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Figure 3

Outline of Conceptual Site Model - Low Density Residential End-use





NOTE: ALL ENTITIES SHOWN ON THIS DRAWING ARE TO BE REGARDED AS APPROXIMATE AND ARE INDICATIVE ONLY. NO MEASUREMENTS TAKEN FROM THIS DRAWING SHOULD BE USED FOR THE LOCATION OF INTRUSIVE INVESTIGATION WORKS ON SITE. SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE. - CONTRACT ARCADIS UK IN CASE OF ANY QUERY

KEY

- BOREHOLE LOCATION - WINDOW SAMPLE
- BOREHOLE LOCATION - CABLE PERCUSSION
- BOREHOLE LOCATION - DYNAMIC PROBE
- BOREHOLE LOCATION - ROTARY PROBE
- TRIAL PIT LOCATION
- HISTORICAL BOREHOLE - APPROX. LOCATION
- HISTORICAL TRIAL PIT - APPROX. LOCATION
- KNOWN BOUNDARY OF FORMER GRAVEL PIT
- - - ASSUMED BOUNDARY OF FORMER GRAVEL PIT

NOTES

BASED ON DRAWING BY AECOM.
 DRAWING No: 60140787_L5013D REV. -
 DATE: 25/11/2009
 BOUNDARIES OF FORMER GRAVEL PIT TAKEN FROM PREVIOUS EXPLORATION ASSOCIATES LTD REPORTS. HISTORICAL PLANS TOGETHER WITH INFORMATION OBTAINED DURING THIS SITE INVESTIGATION.

REV	DATE	COMMENT	CAD

TITLE:
 EXTENT OF BACKFILLED GRAVEL PIT

SITE:
 FORGE LANE

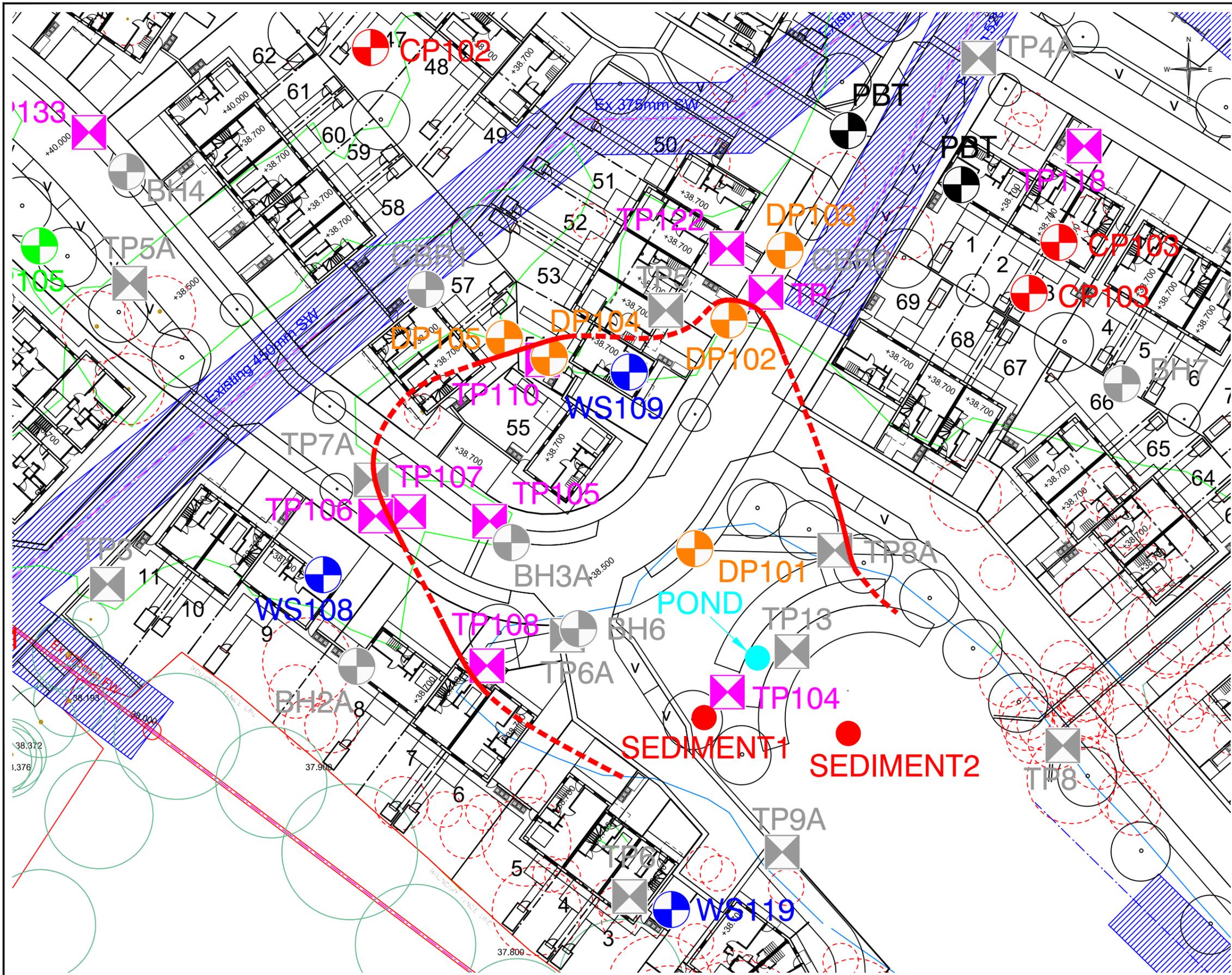
CLIENT:
 KIRKLEES COUNCIL

PROJECT:
 96234.01

DATE: 05/04/11 | DRAWN: ASZ | REV: -
 DRG.No.: 962340121-CAD | PRINT: A3

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FIGURE 4



KEY

- BOREHOLE LOCATION - WINDOW SAMPLE
- BOREHOLE LOCATION - CABLE PERCUSSION
- BOREHOLE LOCATION - DYNAMIC PROBE
- BOREHOLE LOCATION - ROTARY PROBE
- TRIAL PIT LOCATION
- HISTORICAL BOREHOLE - APPROX. LOCATION
- HISTORICAL TRIAL PIT - APPROX. LOCATION
- SURFACE WATER SAMPLE LOCATION
- SEDIMENT SAMPLE LOCATION
- KNOWN BOUNDARY OF FORMER GRAVEL PIT
- ASSUMED BOUNDARY OF FORMER GRAVEL PIT

NOTES

BASED ON DRAWING BY WEST & MACHELL ARCHITECTS.
DRAWING No: 2776(1)P008b
DATE: 06/02/2009

REV	DATE	COMMENT	CAD

TITLE:
PROPOSED SITE LAYOUT, EXPLORATORY HOLE AND SAMPLING LOCATION PLAN BACKFILLED GRAVEL PIT AREA

SITE: FORGE LANE

CLIENT: KIRKLEES COUNCIL

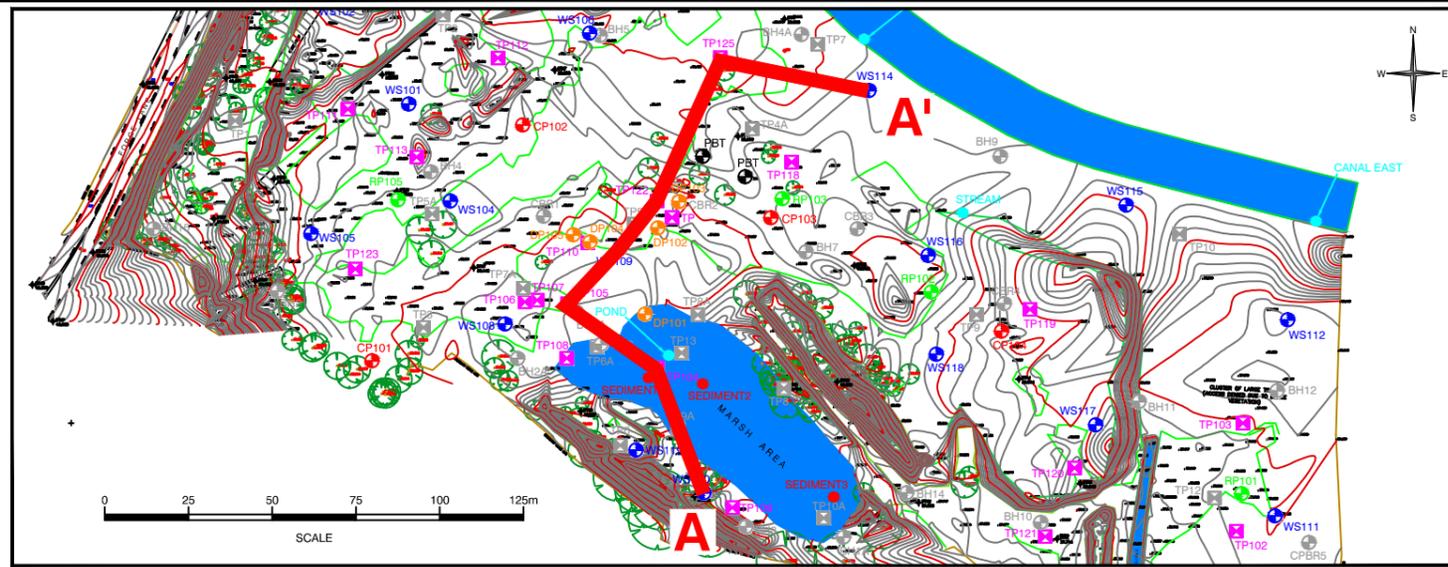
PROJECT: 96234.01 **FIGURE 3**

DATE: 14/04/11 **DRAWN:** BNB **REV:** -

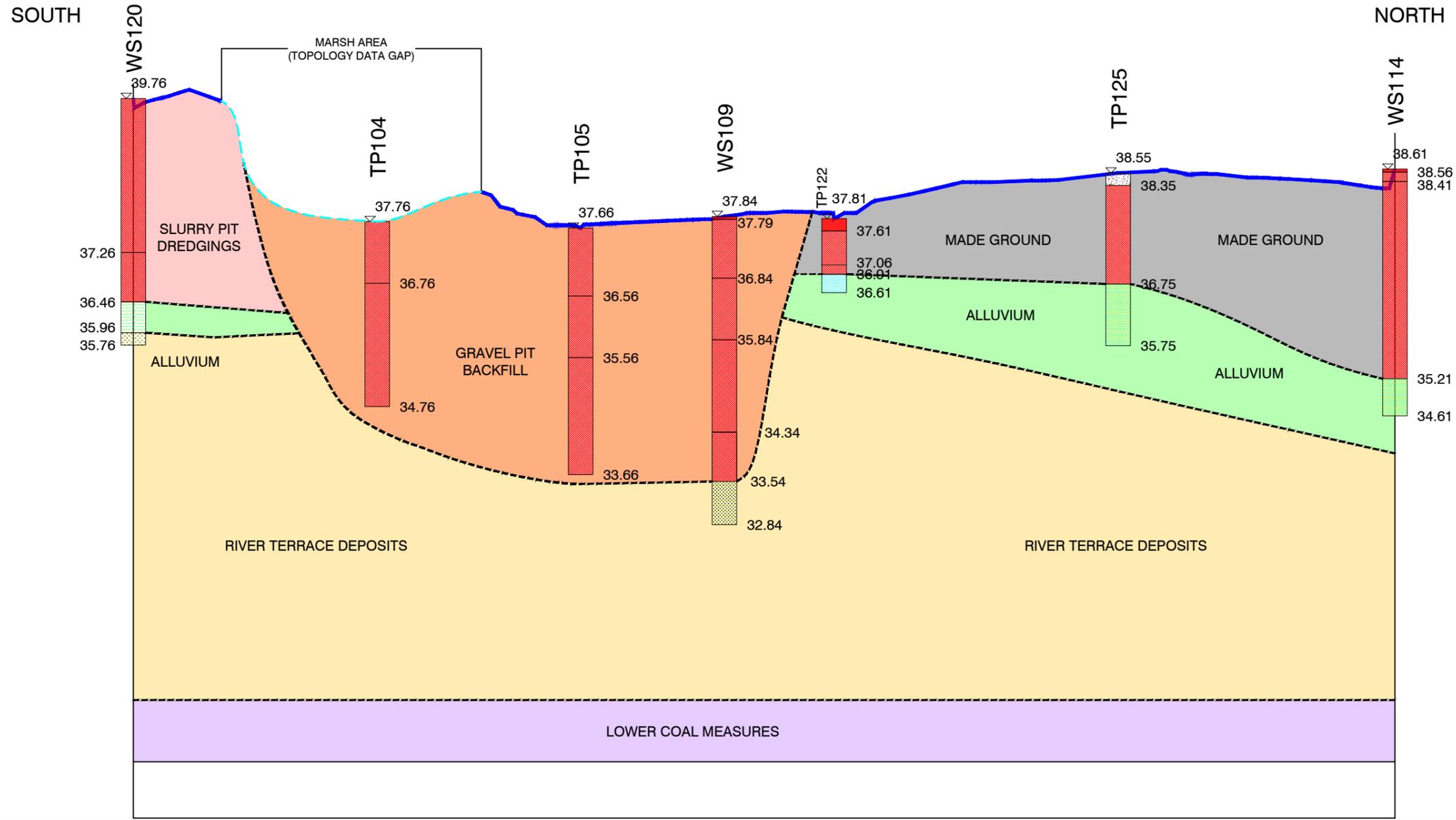
DRG.No.: 962340124-CAD **PRINT:** A3



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KEY	
	GRAVEL PIT BACKFILL
	MADE GROUND
	SLURRY PIT DREDGINGS
	ALLUVIUM
	RIVER TERRACE DEPOSITS
	LOWER COAL MEASURES
	APPROXIMATE / INFERRED GEOLOGY DEPTH



NOTES

BASED ON DRAWING BY AECOM.
DRAWING No: 60140787_LS013D REV. -
DATE: 25/11/2009

10X VERTICAL EXAGGERATION APPLIED TO CROSS SECTION

REV	DATE	COMMENT	CAD

TITLE: **GEOLOGICAL CROSS SECTION A-A'**

SITE: **FORGE LANE**

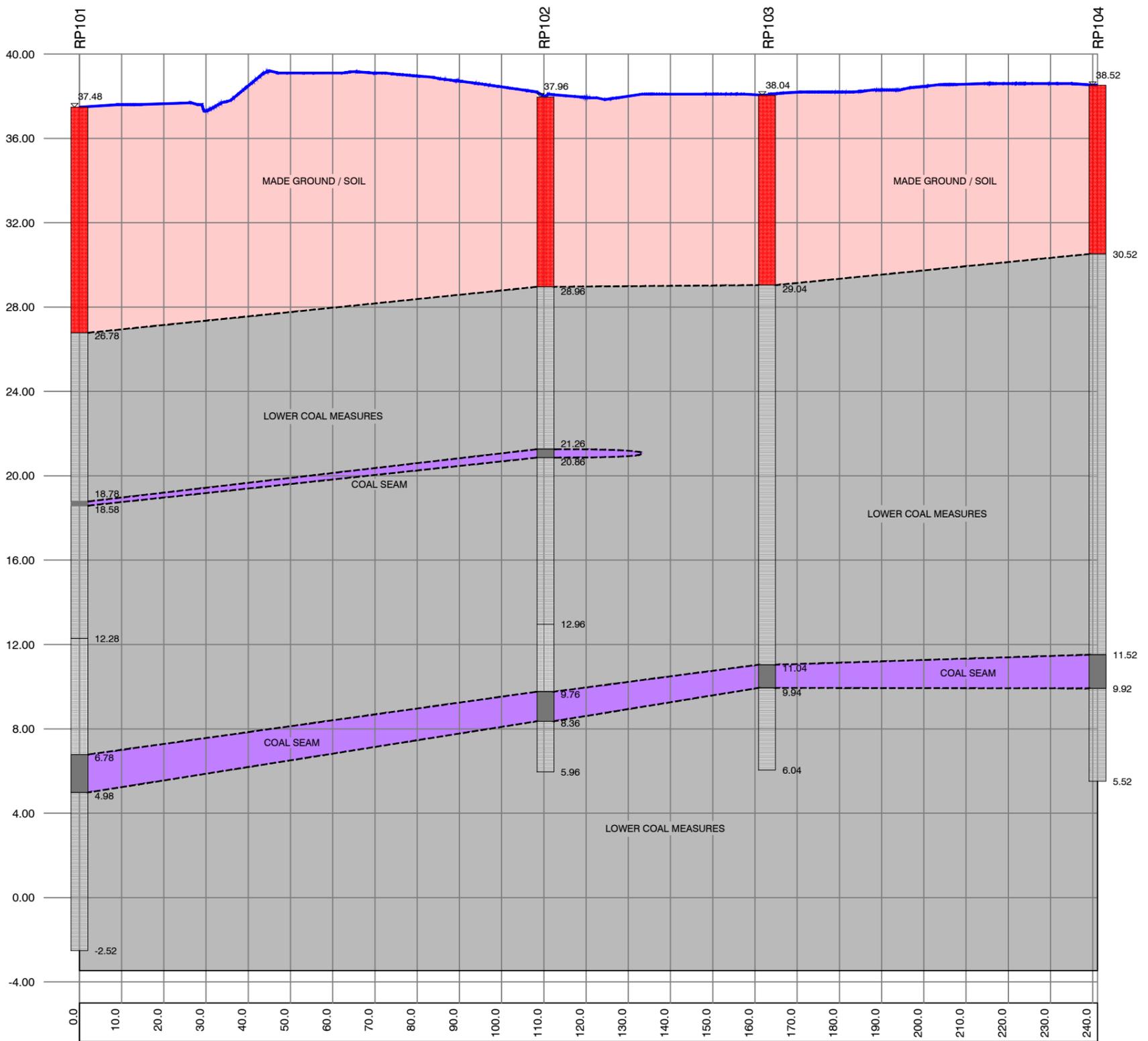
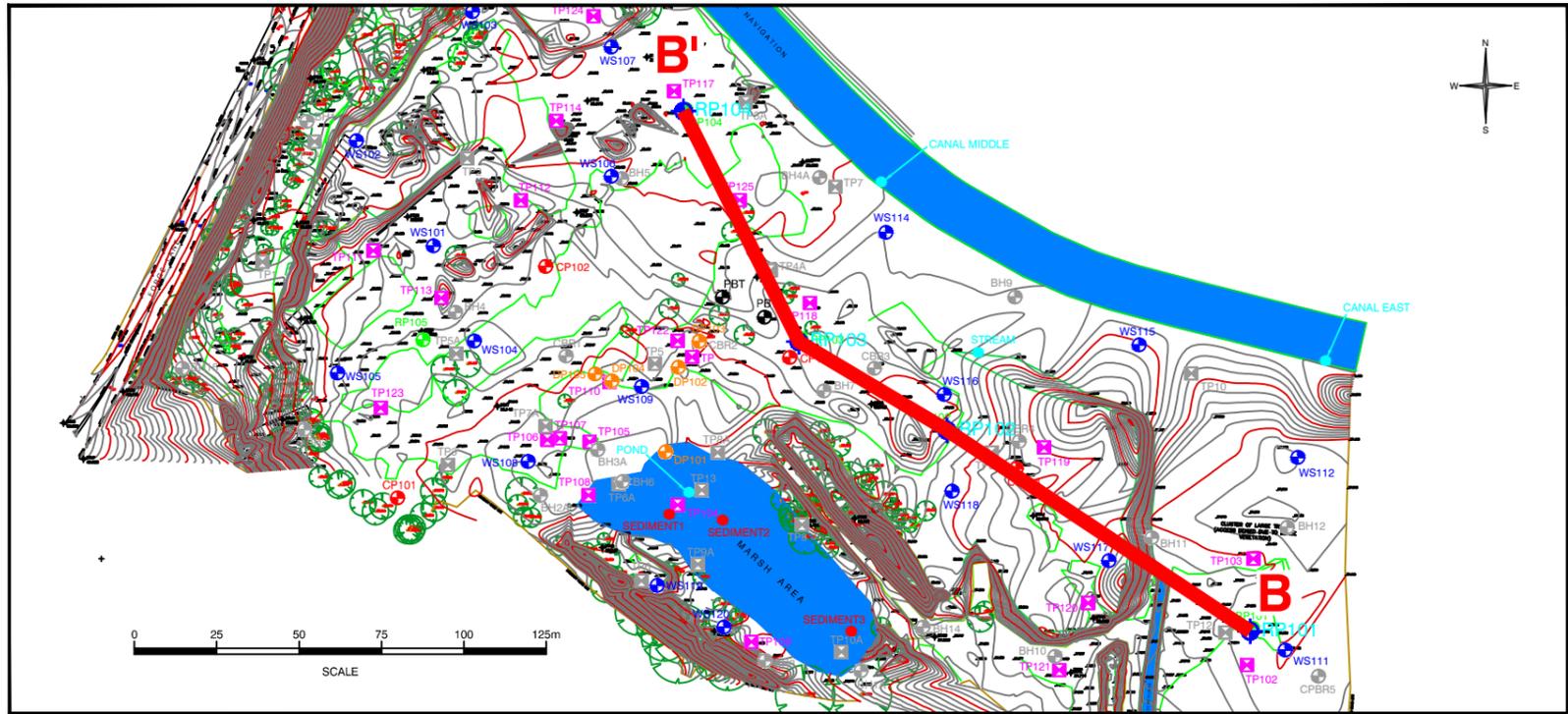
CLIENT: **KIRKLEES COUNCIL**

PROJECT: **96234.01** **FIGURE 5**

DATE: 11/04/11 DRAWN: BNB REV: -

DRG.No.: 962340122-CAD PRINT: A3

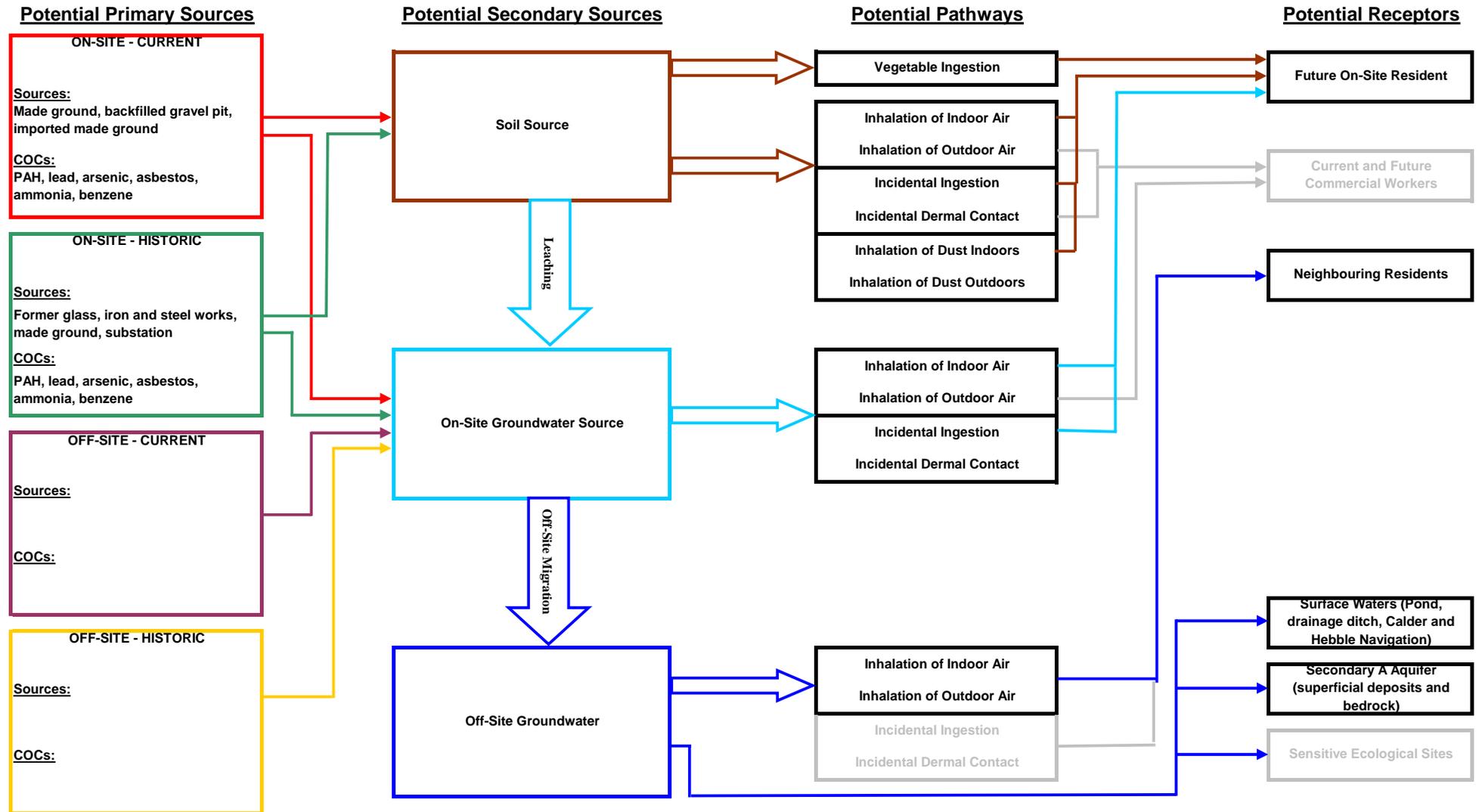




DISCLAIMER NOTE: ALL ENTITIES SHOWN ON THIS DRAWING ARE TO BE REGARDED AS APPROXIMATE AND ARE INDICATIVE ONLY. NO MEASUREMENTS TAKEN FROM THIS DRAWING SHOULD BE USED FOR THE LOCATION OF INTRUSIVE INVESTIGATION WORKS ON SITE. SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE. - CONTACT ARCADIS UK IN CASE OF ANY QUERY	NOTES BASED ON DRAWING BY AECOM. DRAWING No: 60140787_LS013D REV. - DATE: 25/11/2009 5X VERTICAL EXAGGERATION APPLIED TO CROSS SECTION	KEY MADE GROUND / SOIL LOWER COAL MEASURES COAL APPROXIMATE / INFERRED GEOLOGY DEPTH	TITLE: GEOLOGICAL CROSS SECTION B-B' SITE: FORGE LANE																															
	<table border="1"> <thead> <tr> <th>REV</th> <th>DATE</th> <th>COMMENT</th> <th>CAD</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>	REV	DATE	COMMENT	CAD																	<table border="1"> <tr> <td>PROJECT: 96234.01</td> <td>CLIENT: KIRKLEES COUNCIL</td> <td>FIGURE 6</td> </tr> <tr> <td>DATE: 11/04/11</td> <td>PRINT: A3</td> <td> </td> </tr> <tr> <td>DRAWN BY: BNB</td> <td>REV: -</td> <td> </td> </tr> <tr> <td>DRG.No.: 962340123-CAD</td> <td> </td> <td> </td> </tr> </table>	PROJECT: 96234.01	CLIENT: KIRKLEES COUNCIL	FIGURE 6	DATE: 11/04/11	PRINT: A3		DRAWN BY: BNB	REV: -		DRG.No.: 962340123-CAD		
REV	DATE	COMMENT	CAD																															
PROJECT: 96234.01	CLIENT: KIRKLEES COUNCIL	FIGURE 6																																
DATE: 11/04/11	PRINT: A3																																	
DRAWN BY: BNB	REV: -																																	
DRG.No.: 962340123-CAD																																		

Figure 7

Refinement of Conceptual Site Model - Low Density Residential End-use



APPENDICES

APPENDICES

Appendix A
Outline Planning Permission



Kirklees
METROPOLITAN COUNCIL

DECISION
13 DEC 2006
ISSUED

Town and Country Planning Act 1990

Town and Country Planning (General Development Procedure) Order 1995

OUTLINE PLANNING PERMISSION

Application Number: 2004/60/94709/E2

To: THE PLAN SHOP
(MR I HARRISON)
THE ASSEMBLY ROOMS
29 MARKET PLACE
BEDALE DL8 1ED



For: J PATEL & B RUSSELL

In pursuance of its powers under the above-mentioned Act and Order the KIRKLEES METROPOLITAN COUNCIL (hereinafter called "The Council") as Local Planning Authority hereby permits:-

OUTLINE APPLICATION FOR RESIDENTIAL DEVELOPMENT

At: FORGE LANE, THORNHILL, DEWSBURY.

In accordance with the plan(s) and applications submitted to the Council on 21 December 2005, subject to the condition(s) specified hereunder:-

- (1) Approval of the details of the siting, design and external appearance of the building(s), the means of access thereto and the landscaping of the site (hereinafter called 'the reserved matters ') shall be obtained from the local planning authority in writing before any development is commenced.
- (2) Plans and particulars of the reserved matters referred to in condition 1 above, relating to the siting, design and external appearance of any buildings to be erected, the means of access to the site and the landscaping of the site, shall be submitted in writing to the local planning authority and shall be carried out in full accordance with the approved plans.
- (3) Application for approval of reserved matters shall be made to the local planning authority before the expiration of three years from the date of this permission.

- (4) The development hereby permitted shall be begun either before the expiration of three years from the date of this permission, or before the expiration of two years from the date of approval of the last of the reserved matters approved, whichever is the latter.
- (5) Any planting, seeding or tree management works forming part of the landscaping scheme referred to in Condition 1 shall be carried out during the first planting, seeding or management season following the commencement of development, or as otherwise may be agreed in writing by the Local Planning Authority, and shall be maintained for a period of five years from the completion of planting works. All specimens which die within this period shall be replaced on a like for like basis.
- (6) The landscaping scheme referred to in Condition 1 shall include the retention and creation of small areas woodland or copses.
- (7) No development shall take place until a scheme for the integration of the canalside environment with the development, to include the provision of landscaping, access, public footpaths and opportunities for recreation, has been submitted to and approved in writing by the Local Planning Authority. The approved scheme shall be implemented in accordance with the approved scheme before the development hereby approved is first occupied and shall thereafter be retained.
- (8) No development shall take place until a scheme for ecological protection and improvements in accordance with the recommendations contained within the submitted Ecological Surveys dated August 2004 by Bullen Consultants has been submitted to and approved in writing by the Local Planning Authority. Unless otherwise agreed in writing by the Local Planning Authority, the approved scheme shall be implemented in accordance with the approved scheme before the development hereby approved is first occupied and shall thereafter be retained.
- (9) No development shall take place until a scheme which indicates the measures to be taken for the control of any glare or stray light affecting the canal arising from the operation of artificial lighting, has been submitted to and approved in writing by the Local Planning Authority. The development shall be implemented in accordance with the approved scheme before the development hereby approved is first occupied and shall thereafter be maintained.
- (10) No development shall take place until a scheme to facilitate, encourage and improve opportunities for walking, cycling and public transport use has been submitted to and approved in writing by the Local Planning Authority. The approved scheme shall be implemented before the development is first occupied and shall thereafter be retained.

NOTE The scheme shall include the integration of cycle ways and footways within the development which are segregated from traffic; provide links between key areas of the site and with Forge Lane and the 'Empire Works' site to the east; and are designed and constructed to recognised standards.

- (11) No development shall take place until details of the siting, design and materials to be used in the construction of walls or fences for boundaries, screens or retaining walls have been approved in writing by the Local Planning Authority. The approved walls/fences shall be erected before the development hereby approved is occupied/brought into use and shall thereafter be retained.

- (12) Trees within or on the boundary of the site shall be neither felled, topped or lopped except with the prior written approval of the Local Planning Authority, nor shall they be damaged or killed by fire or by the application of toxic or injurious substances.
- (13) No development shall take place until details of the location extent and depth of all excavations for drainage and other services in relation to and in proximity to trees which are to be retained on the site have been submitted to and approved in writing by the Local Planning Authority.
- (14) Before any materials are brought onto site or development commences the developer shall erect protective chestnut paling or similar fencing around all trees, shrubs or hedges to be retained, to the branch spread of individual trees or groups of trees/shrubs. The applicant shall obtain the Local Planning Authority written confirmation that the fence is satisfactory and shall maintain such fencing unaltered until the development is complete. No work shall be carried out within the protected area except in accordance with the Local Planning Authority code of practice Note 1.
- (15) Unless otherwise agreed in writing by the Local Planning Authority no material operation as defined in Section 56(4)(a)-(d) of the Town and Country Planning Act 1990 shall be carried out to commence the development pursuant to this planning permission until a planning obligation pursuant to Section 106 of the said Act relating to the land has been submitted to the Local Planning Authority and the Local Planning Authority has notified the person(s) submitting the same that it is acceptable. The said planning obligation will provide for facilitating an increase in the capacity of local schools commensurate with the demands of the development.
- (16) No material operation as defined in section 56(4)(a)-(d) of the Town & Country Planning Act 1990 shall be carried out to commence the development pursuant to this planning permission until arrangements for the provision of public open space to serve the development in accordance with the requirements of Policy H18 of the Council's Unitary Development Plan have been submitted to and agreed in writing by the Local Planning Authority. The arrangements shall cover the following matters:-
 - a) the layout and disposition of the public open space.
 - b) the timescale for the implementation and completion of the works to provide the public open space;
 - c) the mechanism for ensuring that the public open space will be available for public within perpetuity.
 - d) maintenance of the public open space in perpetuity.
- (17) No material operation as defined in Section 56(4)(a)-(d) of the Town & Country Planning Act 1990 shall be carried out to commence the development pursuant to this planning permission until arrangements for the provision of affordable housing within the development in accordance with the requirements of Policy H10 of the Council's Unitary Development Plan and the Council's Supplementary Planning Guidance (The Provision of Affordable Housing in New Housing Developments) have been submitted to and agreed in writing by the Local Planning Authority. The arrangements shall cover the following matters:-

- a) the number and type of affordable housing units to be provided.
 - b) the layout and disposition of the units affordable housing to be provided.
 - c) the timescale for the implementation and completion of the affordable housing units;
 - d) the mechanism for ensuring that the affordable housing units remain affordable for both the initial and subsequent occupiers.
- (18) No development shall take place until a scheme of noise attenuation measures in accordance with the recommendations contained within the submitted noise report by S&D Garritt Ltd dated June 2005 relating to dwellings adjoining or facing the commercial premises to the west of Forge Lane has been submitted to and approved in writing by the Local Planning Authority. The development shall be implemented in accordance with the approved scheme before the development hereby approved is first occupied and shall thereafter be retained.
- (19) Development shall not commence until a Remediation Strategy has been submitted to and approved in writing by the local planning authority. The Remediation Strategy shall include a timetable for the implementation and completion of the approved remediation measures.
- (20) Remediation of the site shall be carried out and completed in accordance with the Remediation Strategy approved pursuant to condition. In the event that remediation is unable to proceed in accordance with the approved Remediation Strategy or contamination not previously considered [in either the Preliminary Risk Assessment or the Phase II Intrusive Site Investigation Report] is identified or encountered on site, all works on site (save for site investigation works) shall cease immediately and the local planning authority shall be notified in writing within 2 working days. Unless otherwise agreed in writing with the local planning authority, works shall not recommence until proposed revisions to the Remediation Strategy have been submitted to and approved in writing by the local planning authority. Remediation of the site shall thereafter be carried out in accordance with the approved revised Remediation Strategy.
- (21) Following completion of any measures identified in the approved Remediation Strategy or any approved revised Remediation Strategy a Validation Report shall be submitted to the local planning authority. Unless otherwise agreed in writing with the local planning authority, no part of the site shall be brought into use until such time as the remediation measures for the whole site have been completed in accordance with the approved Remediation Strategy or the approved revised Remediation Strategy and a Validation Report in respect of those remediation measures has been approved in writing by the local planning authority.
- (22) In the event that contamination not previously identified by the developer prior to the grant of this planning permission is encountered during the development, all works on site (save for site investigation works) shall cease immediately and the local planning authority shall be notified in writing within 2 working days. Unless otherwise agreed in writing with the local planning authority, works on site shall not recommence until either (a) a Remediation Strategy has been submitted to and approved in writing by the local planning authority or (b) the local planning authority has confirmed in writing that remediation measures are not required.

The Remediation Strategy shall include a timetable for the implementation and completion of the approved remediation measures. Thereafter remediation of the site shall be carried out and completed in accordance with the approved Remediation Strategy.

- (23) Following completion of any measures identified in the approved Remediation Strategy a Validation Report shall be submitted to the local planning authority. Unless otherwise agreed in writing with the local planning authority, no part of the site shall be brought into use until such time as the whole site has been remediated in accordance with the approved Remediation Strategy and a Validation Report in respect of those works has been approved in writing by the local planning authority.
- (24) The finished floor level of new buildings shall be no lower than 38.7 metres AOD.
- (25) No development shall take place until a hydraulic assessment of the watercourses passing through this site to determine the 1 in 100 year flood level, and any further mitigation works to ensure that the proposed development would not be affected by flooding, has been submitted to and approved in writing by the Local Planning Authority. The development shall be implemented in accordance with the approved assessment before the development hereby approved is first occupied and shall thereafter be maintained.
- (26) All access road levels to dwellings shall be no lower than 38.5 metres AOD.
- (27) No development shall take place until a scheme for the provision and implementation of a surface water run-off limitation has been submitted to and approved in writing by of the Local Planning Authority. The scheme shall be implemented in accordance with the approved programme and details.
- (28) Unless otherwise agreed in writing by the Local Planning Authority and before development is first occupied an 8 metre, or as agreed, vegetated buffer zone shall be provided of locally native plant species, of UK genetic provenance, alongside the Calder and Hebble Canal. This buffer zone shall be measured from the top of the bank and shall be free of structures, hard standing and fences.
- (29) No development shall take place until a scheme for surface water drainage through trapped gullies has been submitted to and approved in writing by the Local Planning Authority. The development shall be implemented in accordance with the approved scheme before the development hereby approved is first occupied and shall thereafter be maintained.
- (30) No development shall take place until a scheme for the provision and implementation of the method of working and restoration of drainage has been submitted to and approved in writing by the Local Planning Authority. The development shall be implemented in accordance with the approved scheme before the development hereby approved is first occupied and shall thereafter be maintained.
- (31) The site shall be developed by means of a separate system of drainage for foul and surface water, details of which, including details of any balancing works and off-site works, shall be submitted to and approved in writing by the Local Planning Authority prior to development commencing. The drainage works shall be completed in accordance with the details prior to any dwellings first being occupied.

- (32) Unless otherwise agreed in writing by the Local Planning Authority, no building or other obstruction shall be located within six metres either side of the centre line of the raw water main which crosses the site, and within four metres either side of the centre line of the sewers which cross the site.
- (33) The site access off Forge Lane shall have 6.0m radius kerbs, 5.5m wide carriageway with 2.0m footways on either side.
- (34) No development shall take place until a scheme for the improvement of the function of Station Road, Forge Lane, Thornhill Road and Savile Road has been submitted to and approved in writing by the Local Planning Authority.

Unless otherwise agreed in writing by the Local Planning Authority, no dwelling shall be occupied until the works to provide the junction improvements have been completed in accordance with the approved scheme.

NOTE The scheme shall include the full section, details of speed reducing measures, construction specifications, drainage works, lighting, signing, white lining, surface finishes and treatment of sightlines together with an independent safety audit covering all aspects of the work.

- (35) Other than the works to construct the access, no development shall take place until works to construct the access have been completed and sightlines of 4.5m x 90m have been cleared of all obstructions to visibility exceeding 1m in height above the adjacent carriageway. The access sightlines shall thereafter be retained, free from such obstruction.
- (36) The areas to be used by vehicles including parking, loading and unloading areas shall be surfaced, sealed and drained before the development is occupied/brought into use and thereafter retained.

NOTE All contamination reports shall be prepared in accordance with CLR11, PPS23 and the Council's Advice for Development documents, or any subsequent revisions of those documents.

NOTE The layout and design of the development shall have regard to UDP and Government policy advice, crime prevention measures, and community safety issues.

NOTE The scheme for public open space will be expected to cater for the needs of a range of prospective residents

NOTE The Applicant should be reminded that the Planning Policy Guidance Note 25 (PPG25) 'Development and Flood Risk' states that it is clearly his own responsibility to ensure that this site can be developed and occupied safely. It is also the Applicants responsibility to ensure the validity of his flood risk assessment upon the commencement of the development. The Applicant should also be aware that there will always be a residual risk of flooding in the area if flood defences, where they exist, are breached or overtopped.

NOTE It is recommended that a strip of land 3 metres wide adjacent to the top of the watercourse bank is left clear of all buildings, structures, fences and trees to facilitate access, essential maintenance and possible future improvements. Ground levels should not be raised within this area.

NOTE Any culverting of a watercourse requires the prior written approval of the Agency under the terms of the Land Drainage Act 1991 or Water Resources Act 1991. The Agency resists culverting on conservation and other grounds, and consent for such works will not normally be granted except for access crossings.

NOTE Under the terms of the Land Drainage Act 1991, the prior written consent of this Agency is required for any proposal to divert, culvert or otherwise obstruct the flow in any watercourse (including the provision of a connection to a culvert).

NOTE No building or other obstruction should be placed within 3 metres of culverted watercourses that cross the site, to avoid damage to the culvert, and allow access for maintenance.

NOTE Under the Wildlife and Countryside Act 1981 it is an offence to disturb breeding birds and their habitat. Section 5.6.1 of the submitted Ecological Report states that the site supports a large bird population and a wide range of species for its size. If it will be necessary to undertake any vegetation disturbance during the breeding bird season (March 31st to late August) a survey of the vegetation to be disturbed should be undertaken to determine whether any nesting birds are present. If nesting birds are found during the survey no disturbance shall take place until the fledging birds have left the nest and the nest is abandoned (i.e. no further birds are produced).

NOTE Japanese knotweed is known to occur on this site. Care must be taken to prevent further dispersal of this plant during the works as it is an offence under the Wildlife and Countryside Act (1981) to plant or otherwise cause the species to grow in the wild.

NOTE As this is a large development in a high flood risk zone, parking areas and pavements should be made from permeable materials to minimise surface water on the site. Where possible soakaways should be used, but this will be dependant upon the results of the site investigation.

NOTE The development should incorporate Sustainable Urban Drainage (SUDs) including making use of permeable surfaces and other similar measures to reduce the risk of non-point source pollution or excessive surface water run-off adversely affecting adjacent watercourses. This might include the use of gravel surfaces in paths, parking spaces and driveways. The potential for this will again be dependant upon the results of the site investigation.

The reasons for the Council's decision to grant permission for the development subject to compliance with the conditions specified are:-

- (1/2) No details of the matter referred to having been submitted they are reserved for the subsequent approval in writing of the Local Planning Authority.
- (3/4) Pursuant to section 92 of the Town and Country Planning Act 1990, as amended by the Planning and Compulsory Purchase Act 2004.
- (5) In the interests of visual amenity and to accord with Policies D2 and BE3 of the Unitary Development Plan.

- (6) In order to enhance tree cover in the interests of protecting and enhancing visual amenity and biodiversity and to accord with Policies EP11 and NE10 of the Unitary Development Plan.
- (7) In the interests of public enjoyment of the canalside environment; in order to enhance the character and visual amenity of the waterside environment and to accord with Policy R18 of the Unitary Development Plan.
- (8) In the interests of protecting and enhancing the biodiversity of habitats within the site and adjoining canal and to accord with Policies NE9, EP11 and EP3a of the Unitary Development Plan.
- (9) In order to protect wildlife from excessive glare or stray light and to accord with Policies EP3a and EP11 of the Unitary Development Plan.
- (10) In order to reduce dependence on the car in the interests of sustainability in order to ensure the development is accessible by a range of non-car modes of transport and to accord with Policy D2 of the Unitary Development Plan and the advice contained within PPS 1, PPS 3 and PPG 13.
- (11) In the interests of visual amenity and to accord with Policies D2 and BE2 of the Unitary Development Plan.
- (12) In the interests of visual amenity and to accord with Policies D3 and BE2 of the Unitary Development Plan.
- (13/14) In order to safeguard the health and long term viability of those trees to be retained and to accord with Policies D3 and BE2 of the Unitary Development Plan.
- (15) To ensure that the proposed development does not put undue pressure on the existing educational facilities within the local area.
- (16) To ensure the satisfactory provision of public open space in accordance with Policy H18 of the Council's Unitary Development Plan.
- (17) To ensure the satisfactory provision of affordable housing in accordance with Policy H10 of the Council's Unitary Development Plan.
- (18) In order to protect future occupiers from excessive noise levels and to accord with Policy EP4 of the Unitary Development Plan.
- (19/23) In order that proper account is taken of any contamination on the site in the interests of future occupiers of the site and the surrounding environment and to accord with Policy G6 of the Unitary Development Plan.
- (24) In order to reduce flood risk.
- (25/26) In order to maintain access in flood conditions.
- (27) In order to reduce flood risk.
- (28) In order to maintain the character of the watercourse and provide wildlife habitats using the canal corridor.

(29/30) In order to prevent pollution of the water environment and to accord with Policy D2 of the Unitary Development Plan.

(31) In the interests of the proper drainage of the site and to accord with Policy D2 of the Unitary Development Plan.

(32) In order to allow sufficient access for maintenance and repair works at all times and to accord with Policy D2 of the Unitary Development Plan.

(33/36) In the interests of the free and safe use of the highway and to accord with Policies D2 and T10 of the Unitary Development Plan.

The decision to grant planning permission has been taken having regard to the policies and proposals in the Kirklees Unitary Development Plan set out below, and to all other relevant material considerations:

D2 - Unallocated land
D3 - Urban Greenspace
BE2 - Quality of design
H10 - Affordable housing
H18 - Provision of open space
NE9 - Retention of mature trees
NE10 - Landscaping schemes
T10 - Highway safety
EP11 - Ecological landscaping
EP3A - Culverting of watercourses
EP4 - Noise sensitive development
G6 - Land contamination
R18 - Development adjacent to canals and rivers
PPS1 – Delivering sustainable development
PPG13 - Transport (2001) - A Guide to Better Practice

Dated: 13 December 2006

Signed:

Jonathan Barrett 
Head of Service

Address to which all communications should be sent:

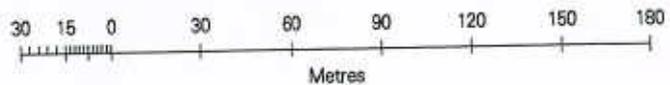
Planning Services, PO Box B93, Civic Centre, Off Market Street, Huddersfield, HD1 2JR

IMPORTANT – YOUR ATTENTION IS DRAWN TO THE NOTES ATTACHED

NOTES: TO BE READ IN CONJUNCTION WITH A DECISION NOTICE

- 1. If the development is not begun within the period specified in Condition 1, this permission will lapse. If the development is begun within that period but the period elapses without it having been completed the Local Planning Authority may, subject to confirmation by the Secretary of State, serve under Section 94 of the Town and Country Planning Act 1990 a notice requiring it to be completed within a specified period.**
- 2. If the applicant is aggrieved by the decision of the Local Planning Authority to refused permission or approval for the proposed development, or to grant permission or approval subject to conditions, he/she may appeal to the Secretary of State for the Environment in accordance with Section 78 of the Town and Country Planning Act 1990 within six months of the date of issue of this notice. Appeals must be made on a form which is obtainable from The Planning Inspectorate, Temple Quay House, 2 The Square, Temple Quay, Bristol BS1 6PN. The Secretary of State has power to allow a longer period for the giving of a notice of appeal but he will not normally be prepared to exercise this power unless there are special circumstances which excuse the delay in giving notice of appeal. The Secretary of State is not required to entertain an appeal if it appears to him that permission for the proposed development could not have been granted by the Local Planning Authority, or could not have been so granted otherwise than subject to the conditions imposed on them, having regard to the statutory requirements* to the provisions of the development order, and to any directions given under that order.**
- 3. If permission to develop land is refused or granted subject to conditions, whether by the Local Planning Authority or by the Secretary of State, and the owner of the land claims that the land has become incapable of reasonably beneficial use in its existing state and cannot be rendered capable of reasonably beneficial use by the carrying out of any development which has been or would be permitted, he may serve on the Council of the Metropolitan Borough a purchase notice requiring that Council to purchase his interest in the land in accordance with the provisions of Part VI of the Town and Country Planning Act 1990.**
- 4. In certain circumstances, a claim may be made against the Local Planning Authority for compensation, where permission is refused or granted subject to conditions. See Part V and Section 114 of the Town and Country Planning Act 1990.**
- 5. If at a later date an extension of the period of this permission is desired, an application for the purpose should be made to the Council before the expiration of the period.**
- 6. Further correspondence regarding this application should bear the application number quoted on the decision notice.**
- 7. This is a planning consent only, and it may be necessary to obtain permission under the Building Regulations or under any other legislation before the particular development is carried out.**
- 8. The applicant is reminded that the grant of planning permission does not entitle him to obstruct a right of way. If it is necessary to stop up or divert a footpath or bridleway in order to enable the development to be carried out, he should on receipt of planning permission, apply without delay to the Local Planning Authority for an order under Section 257 of the Town and Country Planning Act 1990. In the case of any right of way, application should be made to the Secretary of State for an order under Section 247 of the Act. In either case development should not be started until a decision has been taken on that application.**
- 9. Attention is drawn to the fact that any failure to adhere to the details of approved plans and specifications or to comply with conditions attached to the permission constitutes a contravention of the Town and Country Planning Act 1990, in respect of which enforcement action may be taken.**

*** The statutory requirements are those set out in Section 78 of the Town and Country Planning Act 1990, namely sections 70 and 72 of the Act.**



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Centre Coordinates: 423740 419738

National Grid sheet reference at centre of this Siteplan: SE2319NE

Supplied by: Blackwells
Serial Number: 01743500

KIRKLEES METROPOLITAN COUNCIL

APPROVED

13 DEC 2006

TO BE READ IN CONJUNCTION WITH THE APPLICATION AND DECISION DOCUMENTS

PLANNING SERVICES

REVISED DATE

21 Nov 2006

OF PL...

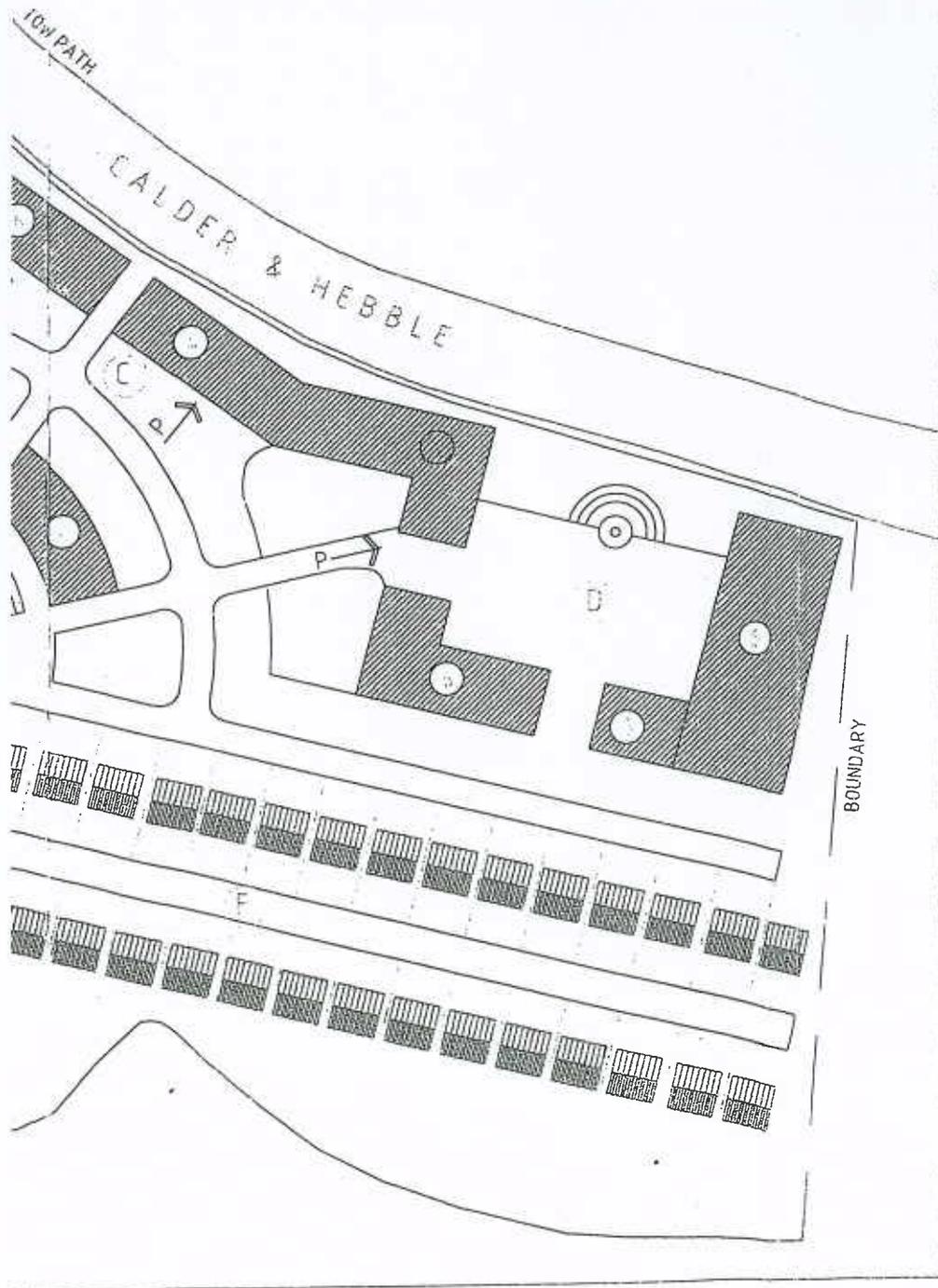
ACCOMMODATION SCHEDULE

1 Bed Apartment	16
2 Bed Apartment	139
3 Bed Apartment	21
4 Bed Apartment	15
4 Bed Town House	10
5 Bed Town House	2
3 Bed Detached	40
4 Bed Detached	24
TOTAL	267



30/94709/E2

KIRKLEES METROPOLITAN COUNCIL
APPROVED
 13 DEC 2006
 TO BE READ IN CONJUNCTION WITH THE
 APPLICATION AND DECISION DOCUMENTS
 PLANNING SERVICES



The Assembly Rooms, 29 Market Place
 Bedale, North Yorkshire, DL8 1ED
 Tel:01677 426616 Fax 01677 426226
 www.theplanshop.net

CLIENT

J & Y PATEL

REVISED DATE
 21 DEC 2005
OF RECEIPT

JOB

FORGE LANE, DEWSBURY

DRAWING TITLE

ACCOMMODATION LAYOUT 1

SCALE
 1:1250

DRAWN
 MW

DATE
 JULY 04

CHECKED

DRAWING NO
 1

REVISION
 19 OCT 2004

KIRKLEES METROPOLITAN COUNCIL
 RECEIVED



PLANNING SERVICES

Town and Country Planning (General Development Procedure) Order 1995

CERTIFICATES UNDER ARTICLE 7

YOU MUST COMPLETE and sign one of Certificates A, B, C or D and the Agricultural Holding Certificate

- (a) Certificates A, B, C and D are for use with applications and appeals for planning permission. One of the Certificates (or the appropriate certificate in the case of certain minerals applications) must be completed, together with the Agricultural Holdings Certificate.
- (b) "owner" means a person having a freehold interest or a leasehold interest the unexpired term of which is not less than 7 years, or in the case of development consisting of the winning and working of minerals, a person entitled to an interest in a mineral in the land (other than oil, gas, coal, gold or silver).

Insert:

- (c) description of steps taken
- (d) name of newspaper circulating in the area where the land is situated
- (e) date of publication (which must be not earlier than the day 21 days before the date of the application or appeal)
delete where appropriate

Agricultural Holdings Certificate(a)

Whichever is appropriate of the following alternatives must form part of Certificates A, B, C or D. If the applicant is the sole agricultural tenant he or she must delete the first alternative and insert "not applicable" as the information required by the second alternative.

- ❖ None of the land to which the application/appeal* relates is, or is part of, an agricultural holding
- OR
- ~~❖ I have/The applicant has/The appellant has* given the requisite notice to every person other than my/him/her* self who, on the day 21 days before the date of the application/appeal* was a tenant of an agricultural holding on all or part of the land to which the application/appeal* relates, as follows~~

Tenant's Name

Address at which notice was served

Date on which notice was served

Signed

On behalf of

J & B Patel / B. Russell

Date

8 Oct 04

Certificate A (a)

I certify that:

on the day 21 days before the date of the accompanying application/appeal* nobody, except the applicant/appellant*, was the owner(b) of any part of the land to which the application/appeal* relates.

Signed

On behalf of

J & B Patel / B. Russell

Date

8 Oct 04

Certificate B(a)

I certify that:

I have/The applicant has/The appellant has* given the requisite notice to everyone else who on the day 21 days before the date of the accompanying application/appeal*, was the owner(b) of any part of the land to which the application/appeal* relates, as listed below:

Owner's(b) name

Address at which notice was served

Date on which notice was served

Signed

On behalf of

Date

Certificate C(a)

I certify that:

- ❖ I/The applicant/The appellant* cannot issue a Certificate A or B in respect of the accompanying application/appeal*
- ❖ I have/The applicant has/The appellant has* given the requisite notice to the persons specified below, being persons who on the day 21 days before the date of the applicant/appeal*, were owners(b) of any part of the land to which the application/appeal* relates.

Owner's(b) name

Address at which notice was served

Date on which notice was served

- ❖ I/The applicant/The appellant* have/has* taken all reasonable steps open to me/him/her* to find out the names and addresses of the other owners of the land, or of part of it, but have/has* been unable to do so. These steps were as follows:

(c)

- ❖ Notice of the application/appeal*, as attached to this Certificate, has been published

- ❖ In the (d) on (e)

Signed

On behalf of

Date

Certificate D(a)

I certify that:

- ❖ I/The applicant/The appellant* cannot issue a Certificate A in respect of the accompanying application/appeal*
- ❖ I/The applicant/The appellant* have/has* taken all reasonable steps open to me/him/her* to find out the names and addresses of everyone else who on the day 21 days before the date of the application/appeal*, was the owner(b) of any part of the land to which the application/appeal* relates, but have/has* been unable to do so. These steps are as follows

(c)

- ❖ Notice of the application/appeal*, as attached to this Certificate, has been published

- ❖ In the (d) on (e)

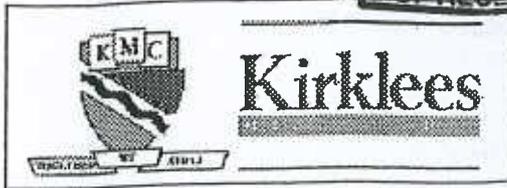
Signed

On behalf of

Date

REVISED
21 DEC 2005
OF RECEIPT

Town and Country Planning Act 1990



PLAN NO.	04/60/94709/E2	
DATE OF RECEIPT	19 OCT 2004	
RECEIPT NO.	2376	
FEE RECEIVED	£9265	
FEE REQUIRED	Exempt Fee £265	
CASH		CHEQUE 160044

PLANNING SERVICES

Please complete 5 copies of this form in black ink with block capitals. Please refer to the guidance notes provided (if you have any difficulty please ask for advice at the Planning Office). This form is available from the Council's website www.kirklees.gov.uk or direct from Kirklees Planning Services, PO Box B93, Civic Centre III, Huddersfield HD1 2JR. Please return all completed application forms to this address.

1. Brief Description of the proposal: RESIDENTIAL DEVELOPMENT	2. Full Postal Address/Site Location FORGE LANE THORNHILL LEES DENSBUURY Postcode:
3. Full Name, Address and Postcode: Applicant: J. PATEL & B. RUSSELL	Agent: (if used, all correspondence will be sent to this address) THE PLAN SHOP THE ASSEMBLY ROOMS 29 MARKET PLACE BEDALE N. YORKS Postcode: DL8 1ED Tel No. 01677 426616 E-mail: hellow@theplanshop.net Personal Contact: I. HARRISON
Postcode: Tel No. (Daytime): E-mail:	

4. Type of Application

- A. Full Application
- B. Change of Use
- C. Outline Application
- D. Reserved Matters Application

- E. Renewal of a previous permission
- F. Resubmission of previous application
- G. Application for Removal or Variation of Conditions

If box D, E, F or G has been ticked please give previous application number:

2002/60/94192/E2

5. Matters to be Considered

If your application is for C or D above, please tick one or more boxes to show those matters for which you are seeking approval.

- Siting of Buildings Access Design External appearance Landscaping

Please ensure that the above details, where seeking approval, are shown on the plans

6. Pre-Application Discussions

Have you had any pre-application talks with a planning officer about this proposal? Yes No

Officer: MS TERESA HARLOW Date:

7. Appointment

Is there any reason why an appointment should be made before a planning officer visits the site? **NO**
(eg security or guard dogs)

Contact name: _____ Tel: _____

8. Have you submitted a Building Regulations Application?

Yes No

9. Does the application involve the extension/alteration of a building where extensions have previously been built or permitted?

Yes No

If yes, please give details _____

SITE DETAILS

Site Area
(Hectares)

6.1

New External
Gross Floorspace
(sq.m.)

Proposed number of
dwellings

~~2/7~~

10. Existing Use

Please state the existing or last known use of this site/building:
If not currently used when was the last date of occupancy?

VACANT BRONNFIELD
FORMER STEELWORKS

11. Contaminated Land

To your knowledge has the site **EVER** been used for any of the following:

Manufacturing/Industrial Activity

Yes No

Chemical or Fuel Storage

Yes No

Treatment or Disposal of Waste Materials

Yes No

Do you have reason to suspect that the land may be contaminated due to its use(s) now or in the past? Why?

Yes No

If you have answered yes to any of the above questions, please see guidance notes

12. Trees and Hedgerows

Will the proposal involve lopping or felling any trees or hedges within the site or within 12 metres of the boundary?

Yes No

Will the proposal involve any excavation work within 12 metres of a tree or 5 metres of a hedgerow (including any paths, drainage works or changes in ground level)? If yes, to either question, you must show the affected trees or hedgerows on your plans (see guidance notes)

Yes No

13. Access, Roads and Right of Way

Is a new or altered vehicular access proposed to or from the public highway?

Yes No

Is a new or altered pedestrian access proposed to or from the public highway?

Yes No

Are there any new public roads to be provided within the sites?

Yes No

Are there any public rights of way within or adjacent to the site?

Yes No

If you have answered yes to any of the above questions, details must be shown on your plans, including how existing public rights of way will be affected

14. Parking – Car and Cycle

How many existing car parking spaces are there?
 How many car parking spaces are proposed including retained existing spaces?
 How many spaces are to be provided for disabled persons?
 How many spaces are to be provided for cycle parking?

400

Please indicate these spaces on your plans

15. Materials (please be specific e.g. type, colour, manufacturer and indicate on plans)

Roofs:	
External Walls:	
Boundaries:	
Surface materials for vehicular access/ hardstandings:	
Lighting (if applicable):	

16. Levels

Are there any proposed changes to the ground levels on site? **NOT KNOWN** Yes No
If yes, please indicate on the plans and include cross sections and long sections (see notes)

17. Drainage/Water Supply (please tick the appropriate boxes and show details on the plans)

Please state means of water supply: Mains Private piped Spring
 Will surface water be discharged into an existing sewer? Yes No
 If not, where will surface water be discharged to?
 What is the proposed means of foul water disposal? **FOUL SEWER**
 Does connection to any of the above involve crossing land, other than a public highway, which is not in the applicant's ownership? Yes No

18. Demolition

Does the proposal include any demolition works? Yes No
If yes, please give details and show works on the plans

COMMERCIAL, INDUSTRIAL AND RESIDENTIAL INSTITUTION APPLICATIONS

19. Type of Business

Describe the nature of the business, industrial process or other activity to be carried out in the building/on the site:

20. Floorspace

Existing floorspace: m²
 Proposed floorspace, including existing floorspace: m²
 What floor areas are to be used for the following? (m²)
 Retail Warehousing Industrial
 Office Leisure Other (specify)

21. Employees

How many existing employees are there? Full Time Part Time
 How many extra employees are anticipated as a direct result of your proposal? Full Time Part Time

22. Traffic Movements

Please state the number of commercial vehicle movements to and from the site:

Maximum Vehicle Weight Daily Weekly

Vehicle Type Is provision to be made for vehicular movements within the site, including turning, loading and unloading? Yes No

If yes, please indicate on the plans

23. Hours of Operation	Existing days and hours of use	Proposed days and hours of use
Working Hours		
Opening Hours		
Deliveries		

24. Waste and Hazardous Materials

Is there provision for bin storage within the site? Yes No

Please state the nature, volume and means of disposal of any trade effluent or trade waste:

Please give details (with quantities) of any hazardous materials to be used or stored on this site:

25. Disabled Persons

Does S29 of the National Assistance Act 1948(a) apply. (see notes)

Yes No

26. Access

Does the proposal include access facilities for people with disabilities?
Does the proposal involve a public building?

Yes No
Yes No

By signing this form, you have certified that all information contained in this application is accurate and acknowledge that any subsequent identification of factual discrepancies may invalidate the submission or any decision made. Any work carried out in advance of obtaining planning permission is at the applicant's own risk. PLEASE NOTE - THIS IS NOT AN APPLICATION FOR BUILDING REGULATIONS APPROVAL.

SIGNATURE

DATE

Are you an employee, Councillor or related to a Councillor of this Council?
If yes, please give details

Yes No

27. CHECKLIST (please tick the box)

- a. Have you answered all the relevant questions on this form?
- b. Have you enclosed 5 sets of plans (plus 5 location plans) and 5 sets of forms?
- c. Have you enclosed the correct application fee?
- d. Have you signed, dated and enclosed the separate ownership certificates?
- e. Now please print 5 times and sign and date the forms

TOWN AND COUNTRY PLANNING ACT 1990: Information provided on the application forms and submitted plans is required to make a decision on whether to grant planning permission. In accordance with the Town and Country Planning Act 1990 this information is available for members of the public to view and may be publicised in various ways and sent out on lists when requested. Any additional information sent in support of the application will also be available for the public to view.

Appendix B
Legislative Context and Regulatory Guidance

APPENDIX B Regulatory and Legislative Context

Land contamination is generally dealt with by the following types of regulation:

- Acts of Parliament to investigate and remedy harm caused by land contamination;
- Conditions placed upon Planning Permissions for the redevelopment of land; and,
- Acts of Parliament and Regulations for the control of waste.

In England land contamination is identified and dealt with through Acts / Regulations including:

- [The Contaminated Land \(England\) Regulations \(2006\)](#);
- [Part IIA of the Environmental Protection Act \(1990\)](#);
- [The Environment Act 1995](#);
- [The Town and Country Planning Act \(1990\)](#);
- [The Environmental Permitting \(England and Wales\) Regulations \(2007\)](#);
- [The Water Resources Act \(1991\)](#);
- [The Water Act \(2003\)](#);
- [The Environmental Damage \(Prevention and Remediation\) Regulations 2009](#); and,
- [The Groundwater \(England and Wales\) Regulations \(2009\)](#).

Part IIA of the Environmental Protection Act 1990

Part IIA of the Environmental Protection Act 1990 (which was inserted by Section 57 of the Environment Act 1995) created a regime for the identification and remediation of contaminated land. Section 78A(2) of the Environmental Protection Act 1990 defines contaminated land for the purposes of Part IIA as:

‘any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that;
(a) significant harm is being caused or there is a significant possibility of such harm being caused; or
(b) pollution of controlled waters is being, or is likely to be caused.’¹

Harm is defined under section 78A of the Environmental Protection Act as meaning ‘harm to the health of living organisms or other interference with the ecological systems of which they form part and, in the case of man, includes harm to his property’. Types of harm are related to specific receptors in order to determine whether they can be regarded as “significant”, as defined in Table A of Annex 3 of the DEFRA (2006)² statutory guidance.

Part IIA sets the definition of contaminated land within the context of the ‘suitable for use’ approach. The legal definition of contaminated land is also discussed within Statutory Guidance released by DEFRA (2008)³.

The government has recognised the following objectives with regard to contaminated land for England (DEFRA, 2006):

- *to identify and remove unacceptable risks to human health and the environment from contaminated land,*
- *to reduce the pressure on green field land and to encourage the reuse of land that may*

¹ Definition to be amended to “significant pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused” under the Water Act 2003

² [Environmental Protection Act 1990: Part 2A. Contaminated Land. DEFRA Circular 01/2006](#)

³ [Guidance on the legal definition of contaminated land. DEFRA July 2008](#)

- have been subject to potentially contaminative uses, and*
- *to seek to ensure a proportionate, manageable and economically sustainable approach to the cost burdens faced by individuals, companies and society as a whole.'*

The 'suitable for use' approach underlies these objectives, and is based on the principles of risk assessment, including the concept of the 'pollutant linkage'.

In the event that there are unacceptable levels of risk posed by a site, a remediation notice can be served under the contaminated land regime introduced under Part IIA of the Environmental Protection Act 1990.

Regulation of Development on Land Affected by Contamination

Management of risks from contamination in development of land is also regulated in the England under the Town and Country Planning Act 1990. Land contamination is a material planning consideration within this planning regime. The Local Planning Authority may impose conditions on the development during planning that include preliminary risk assessment, site investigation, risk assessment and remediation. The Environment Agency may use its role as a statutory consultee to provide the Local Planning Authority with advice.

Assessment of risk is again based on the pollutant linkage concept. The aim of risk management in the development should be to render the land suitable for the proposed use and, therefore, to prevent consideration of the site under Part IIA.

ODPM Planning Policy Statement 23 (PPS23): Planning and Pollution Control and its Annex 2: Development on Land Affected by Contamination provides guidance on the relationship between development and the management of risks from land contamination caused by historical use. The Building Regulations 2000, made under the Building Act 1984, also require measures to be taken to protect new buildings and their occupants from the effects of contamination. Guidance on the requirements is provided in Approved Document C - Site preparation and resistance to contaminants and moisture, published by ODPM in 2004.

Voluntary Remediation Action

Voluntary remediation action on contamination resulting from historical activities can often anticipate future remediation requirements, such as through the Planning regime, and is encouraged (DEFRA, 2006), especially where the site is not being assessed under Part IIA.

Environmental Damage

The Environmental Damage (Prevention and Remediation) Regulations 2009 came into force on 1st March 2009 to implement EC Directive 2004/35 on environmental liability with regard to the prevention and remedying of environmental damage.

These Regulations do not apply retrospectively; environmental damage that took place before the Regulations came into force (1st March 2009), or damage that takes place (or is likely to take place) after that date but is caused by an incident, event or emission that occurred before that date are exempt from the requirements of the Regulations.

The Regulation is concerned with preventing environmental damage. It requires that all operators of activities that cause an imminent threat of environmental damage to take all reasonably practical steps to prevent the damage. Where damage has already been caused, the operator must take all reasonably practical steps to prevent further damage from occurring.

Non-statutory regulatory technical guidance documents

The non-statutory regulatory technical guidance for England on the assessment of land contamination, primarily released as part of the Contaminated Land Exposure Assessment (CLEA) methodology (DEFRA and EA) has recently been updated. The following documents currently present guiding principles in investigating and assessing potentially contaminated land, which are generally adopted in considering sites within any of the legal frameworks discussed above, or when considering voluntary remediation action:

- *Investigation of potentially contaminated sites – Code of Practice* (British Standard 10175: 2001).
- *Contaminated Land Report CLR11 Model Procedures for the Management of Land Contamination.* (DEFRA and EA, 2004).
- *Human health toxicological assessment of contaminants in soil* Environment Agency Science Report SC050021/SR2 (EA, 2009)
- *Updated technical background to the CLEA model* Environment Agency Science Report SC050021/SR3 (EA, 2009)
- *Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values* Environment Agency Science Report SC050021/SR7 (EA, 2008)
- *An ecological risk assessment framework for contaminants in soil.* Environment Agency Science Report SC070009/SR1 and related reports S2a-e
- *Groundwater Protection: Policy and Practice*, Environment Agency GP3 Parts 1-4
- *Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination* (EA of England and Wales, 2006) developed in consultation with the Scottish Environment Protection Agency (SEPA) and the Northern Ireland Heritage and Environment Service.
- *Assessing risks posed by hazardous ground gases to buildings* Report C665 (CIRIA, 2007)
- *BS 8485:2007 Code of practice for the characterization and remediation from ground gas in affected developments*(British Standards Institution, 2007)
- *Risk Based Corrective Action (RBCA) Methodology* (ASTM designation E1739-95, E2081-00).
- *DoE Industry Profiles*

Appendix C
Environment Agency Correspondence – Review of Stage 1B Assessment

Mr Andrew Smith
Arcadis
1 Whitehall Riverside
Leeds
West Yorkshire
LS1 4BN

Our ref: RA/2011/117459/01-L02
Your ref: None
Date: 02 February 2011

For the attention of Andrew Smith

**SITE INVESTIGATION, PROPOSED SCOPE OF WORKS
FORMER THORNHILL IRON AND STEELWORKS, FORGE LANE, DEWSBURY**

Thank you for the above enquiry, which was received via email on 14 January 2011.

Without having seen the previous reports and history of the site we are limited in the detail of our response. However, the recommendations seem reasonable.

In addition to what has been proposed we recommend you:

- 1) Survey the monitoring locations to get accurate ground and groundwater level information.
- 2) Include a quantitative risk assessment
- 3) Carry out at least three rounds of groundwater monitoring
- 4) Follow the risk management framework provided in CLR11, Model Procedures for the Management of Land Contamination, when dealing with land affected by contamination.
- 5) Refer to the Environment Agency Guiding Principles for Land Contamination Reports for the type of information that we require in order to assess risks to controlled waters from the site. The Local Authority can advise on risk to other receptors, e.g. human health.
- 6) Refer to our website at www.environment-agency.gov.uk for more information.

Should you require any additional information, or wish to discuss these matters further, please contact me on the number below.

Yours sincerely

Environment Agency
Phoenix House, Global Avenue, Leeds, LS11 8PG.
Customer services line: 08708 506 506
Email: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk
Cont/d..

Ms Sally Armstrong

Planning Liaison Officer

Direct dial 0113 213 4923 Direct fax 0113 213 4609

Direct e-mail sally.armstrong@environment-agency.gov.uk

Appendix D
Proposed Redevelopment Plans



Recreation Ground

Recreation Ground

- 1000mm high metal railings
- 300mm high metal railings
- 1800mm high timber fence
- 1200mm high timber fence



West + Machell architects

1 Northwest Business Park, Service Hill, Leeds, LS2 2QH. Tel: 0113 2461746. Fax: 0113 2432399. email: architects@westmarchell.co.uk. www.westmarchell.co.uk

Bizmaker Limited
Forge Lane, Dewsbury
Site layout sheet 2 of 2

2776(1)P008b

1:500 CS 06/02/2009

West + Machell architects

1 Northwest Business Park, Service Hill, Leeds, LS2 2QH. Tel: 0113 2461746. Fax: 0113 2432399. email: architects@westmarchell.co.uk. www.westmarchell.co.uk

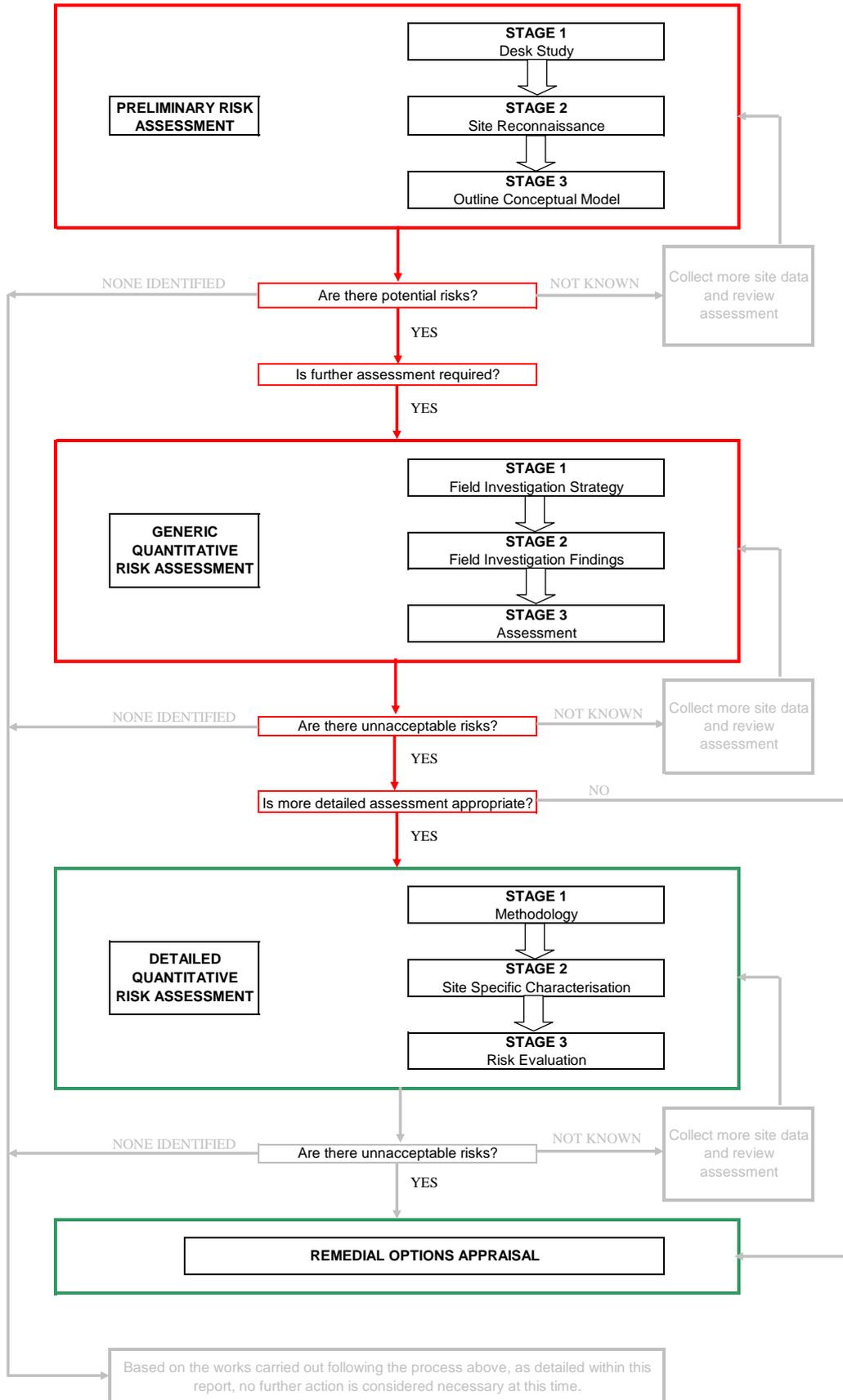
Bizmaker Limited
Forge Lane, Dewsbury
Site layout sheet 1 of 2

2776(1)P007b

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Appendix E
Overview of Model Procedures for Management of Land Contamination CLR 11

Overview of the Environment Assessment Process



Parts of the process outlined in red represent those stages which have been undertaken. Part of the process outlined in green represent the proposed next stage of works.

Appendix F
Coal Mining Report

Issued by:

The Coal Authority, Mining Reports Office, 200 Lichfield Lane, Berry Hill, Mansfield, Nottinghamshire NG18 4RG
 ON-Line Service: www.groundstability.com - Phone: 0845 762 6848 - DX 716176 MANSFIELD 5

KAY MIDDLETON,
 DESIGN & PROPERTY SERVICE,
 KIRKGATE BUILDINGS,
 BYRAM STREET,
 HUDDERSFIELD,
 WEST YORKSHIRE,
 HD1 1BY

Person dealing with this matter:	Darren Moody
Our reference:	00040697-10
Your reference:	
Electronic Ref:	EME_00014549030001_005
RRUID:	005.00014549030001
Date of your enquiry:	14 September 2010
Date we received your enquiry:	14 September 2010
Date of issue:	15 September 2010

This report is for the property described in the address below and the attached plan.

Non-Residential Coal and Brine Report

Forge Lane, Thornhill Lees, Dewsbury, West Yorkshire

This report is based on and limited to the records held by, the Coal Authority, and the Cheshire Brine Subsidence Compensation Board's records, at the time we answer the search.

Coal mining	Yes
Brine Compensation District	No

Information from the Coal Authority

Underground Coal Mining

Past

The property is in the likely zone of influence from workings in 2 seams of coal at 120m to 240m depth, and last worked in 1931.

Any ground movement from these coal workings should have stopped by now.

In addition the property is in an area where the Coal Authority believe there is coal at or close to the surface. This coal may have been worked at some time in the past.

Present

The property is not in the likely zone of influence of any present underground coal workings.

Future

The property is not in an area for which the Coal Authority is determining whether to grant a licence to remove coal using underground methods.

The property is not in an area for which a licence has been granted to remove coal using underground methods.

The property is not in an area that is likely to be affected at the surface from any planned future workings.

However reserves of coal exist in the local area which could be worked at some time in the future.

No notice of the risk of the land being affected by subsidence has been given under section 46 of the Coal Mining Subsidence Act 1991.

Mine entries

There are no known coal mine entries within, or within 20 metres of, the boundary of the property.

Records may be incomplete. Consequently, there may exist in the local area mine entries of which the Coal Authority has no knowledge.

Coal-mining geology

The Authority is not aware of any evidence of damage arising due to geological faults or other lines of weakness that have been affected by coal mining.

Opencast Coal Mining

Past

The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.

Present

The property does not lie within 200 metres of the boundary of an opencast site from which coal is being removed by opencast methods.

Future

The property is not within 800 metres of the boundary of an opencast site for which the Coal Authority is determining whether to grant a licence to remove coal by opencast methods.

The property is not within 800 metres of the boundary of an opencast site for which a licence to remove coal by opencast methods has been granted.

Coal-mining subsidence

The Coal Authority has not received a damage notice or claim for the property since 1 January 1984. There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

Mine gas

There is no record of a mine gas emission requiring action by the Coal Authority within the boundary of the property.

Hazards related to coal mining

The property has not been subject to remedial works, by or on behalf of the Authority, under its Emergency Surface Hazard Call Out procedures.

Withdrawal of Support

The property is not in an area for which a notice of entitlement to withdraw support has been published.