South Industrial Zone

Environmental Statement
July 2020

Volume 3 - Technical Appendices

Appendices to Chapter H (Ground Conditions and Remediation)

Appendix H1: Former Steelworks Land, South Tees Outline Remedial Strategy Flood Risk Assessment

South Tees Development Corporation

Former Steelworks Land, South Tees

Outline Remediation Strategy

Wood Environment & Infrastructure Solutions UK Limited – July 2019

Report for

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Document revisions

No.	Details	Date
SO -PO1	Outline Remediation Strategy	25 June 2019
A-P01	Outline Remediation Strategy	27 June 2019
A-P02	Final following consultation with Redcar & Cleveland BC	19 July 2019

Contents

1. Introduction

1.1 Terms of Reference

Wood Environment & Infrastructure Solutions UK Ltd (Wood) was commissioned by **Tees Valley Combined Authority** (TVCA) on behalf of **South Tees Development Corporation** (STDC) to prepare an outline contaminated land remediation strategy, inclusive of a remediation options appraisal, for a proportion of STDC's current land holdings (referred to herein as 'the site') available to be brought forward for redevelopment. The commission was undertaken in accordance with Wood's proposal ref: 41825-WOD-XX-XX-proposal-OC-0001_S0_P01 dated 31 May 2019.

The outline remediation strategy has been developed based on information available for the site at the time of writing, as contained within the document.

The conclusions reached, and advice given in this report are based in part upon information and/or documents that have been prepared by third parties. In view of this, we accept no responsibility or liability of any kind in relation to such third party information and no representation, warranty or undertaking of any kind, express or implied, is made with respect to the completeness, accuracy or adequacy of such third party information. In preparing this report we have assumed that all information provided by STDC is complete, accurate and not misleading.

1.2 Background

TVCA was formed in April 2016 to drive economic growth and job creation in the area. STDC was launched in August 2017 as a Mayoral Development Corporation.

STDC are responsible for the former TATA Steel (TATA) / Sahaviriya Steel Industries UK (SSI) Redcar Steelworks site as well as other industrial assets within its constitutional boundary. The South Tees Regeneration Master Plan was published in March 2019, setting out the vision for transforming the STDC area into a world-class example of a modern, large-scale industrial business park by providing a flexible development framework where land plots can be established in a variety of sizes to meet different occupier needs in the most efficient manner possible.

The site comprises a series of land parcels comprising approximately 285ha of the overall 618ha acquired from TATA by STDC. The condition of the land varies across the site and mostly consists of previously heavy industrial land uses.

This document comprises the outline remediation strategy and defines the proposed remediation required to render the site suitable for its proposed commercial and industrial end use. The current Regeneration Master Plan for the site defines the intended form of development. The Regeneration Master Plan should be read in conjunction with this remediation strategy. The document has been prepared in support of a detailed planning application for the site.

The outline remediation strategy will be further developed aligned to the form of development in each phase, this will be managed through the planning process with the use of a site-specific design statement.

1.3 Objectives & Scope of Work

The purpose of the outline remediation strategy is to assess and define an overarching approach to render the site suitable for use.

The outline remediation strategy comprises the following key components:

- Review of the environmental context (Section 2);
- Conceptual Model and Environmental Risk Evaluation (Section 3);
- Remediation Options Appraisal (Section 4); and
- Proposed Remediation Strategy (Section 5).

1.4 Regulatory Context

Development of the STDC area will be controlled under the Planning Regime.

Planning

Planning approval will be required for the remediation and redevelopment of the STDC land, including initial enabling activities such as demolition of structures and engineering operations associated with the ground preparation and the temporary storage of soils.

Redcar and Cleveland Borough Council (RCBC) are the local planning authority and their general requirements are set out on the RCBC planning portal, which also advises applicants to refer to the National Planning Policy Framework (NPPF) 2019.

RCBC have also prepared a Supplementary Planning Document (SPD) to support and guide future planning applications to assist the economic and physical regeneration of the South Tees Area. The SPD sets out how NPPF and adopted planning polices will be interpreted.

The NPPF sets out the Government's planning policies for England and how these should be applied. Planning guidance relating to the development of land potentially affected by contamination is detailed in the NPPF and states that:

- The natural environment should be conserved and enhanced by remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land;
- In preparing to meet development needs, the aim should be to minimise pollution and other adverse effects on the local and natural environment. Plans should allocate land with the least environmental or amenity value; and
- Planning policies and decisions should encourage the effective use of land by re-using land that has previously been developed (Brownfield land), provided that it is not of high environmental value.

Therefore, planning policies and decision should ensure that:

- A site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation;
- After remediation, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990; and
- Adequate site investigation information, prepared by a competent person, is presented.

The statutory definition of contaminated land is given under Part 2A of the Environmental Protection Act (EPA) 1990 (Part 2A). This generally does not include land that is already regulated through other means, such as Waste Management Legislation or the Environmental Permitting Regulations 2010.

In addition, the NPPF states that the planning system should contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affect by, unacceptable levels of soil, air, water or noise pollution or land instability.

Summary of Meeting Redcar and Cleveland Borough Council

A meeting was held with Mick Gent the Environmental Health Officer for RCBC on 24th May 2019 and it was agreed that a hybrid form of outline remediation strategy would be developed. This is subject to, as necessary, detailed ground investigation to back up/refine the requirements of the outline remediation strategy as areas of the site come forward for detailed development.

Contaminated Land Assessment Framework

There are a range of technical approaches to risk assessment of chemical contaminants, all of which broadly fit within a tiered approach. The tiered approach to assessing risks from land contamination is set out in the Department for Environment, Food and Rural Affairs (Defra) and Environment Agency (EA) publication 'Model Procedures for the Management of Land Contamination' (CLR11). CLR11 was archived from GOV.UK in 2016 and is currently scheduled to be withdrawn in November 2019, replaced by new guidance called Land Contamination Risk Management (LCRM), which builds upon the established CLR11 approach.

On the basis that LCRM was only released 5th June 2019 and the EA is looking for feedback on the technical content and structure for a period of 6 months, for the purposes of the remediation strategy where we refer to CLR11, guidance in LCRM have also been taken into consideration.

1.5 Information Sources

Guidance

- Contaminated Land: Applications in Real Environments (CL:AIRE) SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. 20th December 2013 APPENDIX E PROVISIONAL C4SLs FOR BENZO(A)PYRENE AS A SURROGATE MARKER FOR PAHS.
- CULP, S.J., GAYLOR, D.W., SHELDON, W.G. GOLDSTEIN, L.W., BELAND, F.A., 1998. A comparison of the tumours induced by coal tar and benzo(a)pyrene in a 2-year bioassay. Carcinogenesis, 19, 117-124.
- Defra, December 2014, SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, Policy Companion Document.
- Department for Communities and Local Government, National Planning Policy Framework, February 2019.
- Environment Agency, online guidance, Land Contamination: Risk Management (LCRM), June 2019. https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks
- Environment Agency and Defra, Contaminated Land Report 11, Model Procedures for the Management of Land Contamination (CLR 11), September 2004.
- Environment Agency, Updated Technical Background to the CLEA Model, Science Report SC050021/SR3, 2009.

- Environmental Industries Commission/Association of Geotechnical and Geoenvironmental Specialists/Contaminated Land: Applications in Real Environments (EIC/AGS/CL:AIRE, 2009). Soil Generic Assessment Criteria for Human Health Risk Assessment. December 2009.
- Health Protection Agency, 2010, HPA Contaminated Land Information Sheet, Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs), Version 5.
- Land Quality Management/Chartered Institute of Environmental Health (LQM/CIEH), 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment. Copyright Land Quality Management Limited reproduced with permission. Publication No. S4UL3076.
- Redcar & Cleveland Borough Council, South Tees Area Supplementary Planning Document, Adopted May 2018.
- Peter Bret Associates, South Tees Area Supplementary Planning Document: Environmental Report, March 2018.
- South Tees Development Corporation, South Tees Regeneration Master Plan, March 2019.

Previous Site Investigations / information

- Allied Exploration & Geotechnics Limited, South Tees Industrial Area- Site C- Ground Investiga1ion, 12/07/99. AEG Contract No. l7JSH.
- Arcadis, The Former SSI Steelworks, Redcar: Replacement Cle3/8 Landfill Boreholes CQA Validation Report South Tees Site Company Limited.
- CH2M Hill, TS3 Grangetown Prairie – Phase 1 Geoenvironmental Desk Study, August 2017.
- CH2M Hill, TS2 Tear Drop Site – Phase 1 Geoenvironmental Desk Study, August 2017.
- CH2M Hill, Data Review TS1 Steel House and Surrounding Area – Phase 1 Geoenvironmental Desk Study, August 2017.
- Cleveland County Council, Waste Disposal Licence, CLE 31/2. 1980.
- CORUS UK LTD. Design of a Site Protection and Monitoring Programme for Cleveland Works, Teesside, October 2004.
- CORUS UK LTD. First Phase Reporting of the Site Protection and Monitoring Programme. 31 January 2008.
- Enviros, Soil and Groundwater Baseline Characterisation Study Teesside Works, Summary Report and appendices. June 2004.
- Enviros, Corus Cleveland Prairie Teesside Site, Phase 1 Environmental Review for Graphite Resources, 2007.
- Enviros, Corus Cleveland Prairie Teesside Site, Phase II Geoenvironmental Assessment for Graphite Resources, 2007.
- MD2, Former Corus Cleveland Prairie Site, Land off Clay Lane – Ground Investigation Report, July 2011.
- Shadbolt Environmental, Prairie Site, Ground Investigation Factual Report, July 2011.
- South Teesside Waste Disposal Sites, Currently Licenced Tips, Drawing No. X-108701 (undated). Groundsure reports, June 2019 (see Appendix A to D).
- Stantec, Warrenby Landfill HRA Review, 2018.

- Summary of Geoenvironmental Information, Cleveland Prairie, Teesside, July 2014.
- TATA Steel, Landfill Closure Report for CLE31, Teesside, June 2015.

2. Site Details and Environmental Context

2.1 Site Location

The site is located on the southern bank of the River Tees, covering an area of approximately 286 ha. Extending from National Grid Reference NZ 52965 22005 in the west to NZ 58083 24716 in the east.

The site location is shown in Figure 1, with Figure 2 defining the site boundary, which is irregular in shape and based on land ownership rather than current use.

2.2 Site Appraisal

The site comprises a series of land parcels, which have recently been acquired by STDC from TATA, and which total around 285ha of the overall 618ha acquired. The condition of the land varies across the site and mostly consists of previously developed land formerly in heavy industrial use. Most of the land surrounding the site is within the STDC area and planned for future regeneration.

The site and surrounding areas have a long and layered industrial history. The main land uses are dominated by extensive iron and steel works together with auxiliary industries, infrastructure, power generation and distribution, together with waste management.

The history of the site and surrounding area has been established through review of historical mapping (Appendix A to D) and review of available site investigation information. To assist review of site conditions, for the sole purpose of this report, the site was allocated into four distinct zones, as shown on Figure 2 and summarised below:

- South Bank Works
- Grangetown Prairie
- Lackenby Coil Plate Mill
- Coatham Marsh (including Warrenby Landfill)

These zones were defined solely for historical site review and environmental context appraisal. For each of the four appraisal zones the environmental context summarises the geology, hydrogeology and environmental sensitivity of the sites.

2.3 South Bank Works

Site Description

The South Bank Works is part of the former Redcar Iron Works site located on the south bank of the River Tees. The "area" as it will be known throughout this Section, refers exclusively to areas within the redline boundary shown in Figure 2 as Zone 1: Former South Bank Works (extract below showing area location). The area centred approximately on National Grid Reference (NGR) NZ 53818, 22134.

The area is approximately 119.5 ha and is irregular in shape. The area is bound to the north by the River Tees (albeit, the boundary of the site is set back from the river by 20 metres). To the south is the Darlington to Saltburn Railway line, which runs along the periphery of the area on an approximate east-west axis. To the east of the area is Tees Dock, where PD Ports operate, and to the west the boundary is demarcated by internal roads beyond which is the Teesport Commerce Park which contains commercial uses associated with the port. To the south of the area is the Grangetown Prairie area (See Section 2.4), the South Tees Freight Park and an area used for landfill and waste management activities.

The area is largely free of active use and built development, however, it is interspersed by some active industrial uses, notably Hanson Concrete and Tarmac Teesside (part of the Tarmac Group) are currently operational in the central northern region of the South Bank area, however these commercial sites are excluded from the planning application site area. The Tarmac land is largely occupied by storage facilities in addition to large stockpiles of material. Land to the east and west of the former South Bank works is currently occupied by PD Ports.

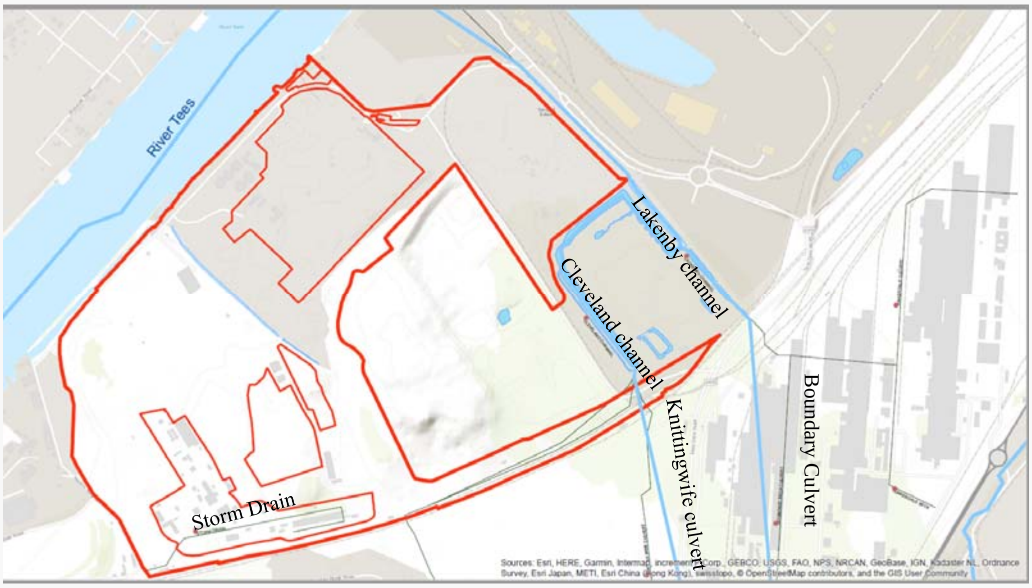
Generally, the area is predominantly flat following historic reclamation and development. Much of the area is in a derelict state with several permanent roads and tracks intersecting various parts of the site. Land in the north-west of the area is primarily constituted of unoccupied low-lying shrub and grassland. Large areas of land to the north-east are currently used for material storage and stockpiling in addition to an operational fuel oil depot.

The former Metals Recovery area is located to the east of the area. It is bound to the east by the Main Lackenby outfall, to the south by the Cleveland Channel and to the north and east by internal roads. It has previously been used for heavy industrial uses relating to the recovery of metals and the topography is more variable than the rest of the area, ranging from a platform approximately 19.0m AOD to existing ground level at approximately 7.0m AOD at its lowest point.

Environmental context

Geology & Hydrogeology	Information taken from British Geological Survey's (BGS) mapping website (http://mapapps.bgs.ac.uk/geologyofbritain/home.html), previous site reports, the Groundsure report (Appendix A, which includes extracts of the geological mapping) and the following publicly available exploratory records from the BGS GeoIndex web portal: - NZ52SW15054/AS2, AS4, AS6, AS8 & AS10 – Main Works Site - NZ52SW181/M – Eastern edge of Metal Recovery Plant - NZ52SW315 – Southern Edge of Metal Recovery Plant

Strata	Brief Description of typical constituents	Average thickness (m)	Aquifer and approximate water level if known*	Notable features
Made Ground	Light grey to dark grey slag with occasional ash and clinker	3.3 – 10.2	1.0 – 9.0m bgl (2.2 to -1.3m AOD)	Not present in Borehole 181/M.
Tidal Flat Sand	Medium dense predominantly laminate black, dark grey, greyish brown or brown silty SAND with occasional shells and gravel	1.2 – 5.6	Tidal Flat-Undifferentiated Aquifer Not Recorded	Not present in Borehole AS10
Tidal Flat Clay	Firm laminated brown silty CLAY	0.6 – 2.0	Tidal Flat-Undifferentiated Aquifer Not Recorded	Only present in Boreholes AS8 and AS10
Glaciolacustrine Deposits	Firm brown or grey mottled silty CLAY	1.20 – 2.25	Not classified Not recorded	Only present around metal recovery plant area
Glacial Till	Firm or stiff, locally soft to firm, locally hard, reddish brown, locally dark brown locally fissured silty sandy gravelly CLAY with rare sand layers.	1.8 – 11.2	Not classified 15.8 – 20.2m bgl (-9.3 to -14.05m AOD)	Groundwater only recorded at 3 locations

Mercia Mudstone	Reddish brown occasionally green weathered MUDSTONE	Not Proved	Not Recorded
Hydrogeological sensitivity[1]	The superficial deposits are classified as an undifferentiated secondary aquifer. There are no abstraction or source protection zones (SPZ) within 1km of the area.		
Groundwater Sensitivity	The superficial deposits in the vicinity of the area are classified as an undifferentiated Secondary Aquifer. There are no licensed abstractions within 1km of the site and Groundwater Sensitivity is assessed as being Low.		
Hydrology	 Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community The south bank of the River Tees runs parallel to within 20m of the northern boundary of the area and is classified by the EA as a Main River. The Tees is part of the Teesmouth and Cleveland Coast SSSI. There are several culverts within the wider site entering from the south flowing into the River Tees.		
Hydrological sensitivity	The principal surface water feature is the adjacent River Tees. There are no culverts known to cross the area and no named surface watercourses within the area boundary, however a storm drain/linear water feature is shown within the site to the west of the tank farm. A soakaway and a discharge to the River Tees at Cleveland Oil Farm are both regulated under PPC consent. Overall surface water sensitivity is assessed as being Moderate/high.		
Ecology	The area is adjacent to the Teesmouth and Cleveland Coast SSSI, the Teesmouth and Cleveland Coast SPA and Ramsar site.		
Ecological sensitivity	The area is close to this ecologically sensitive area the ecological sensitivity is assessed as being Moderate. An Ecological Assessment has been undertaken by the Industry Nature Conservation Association (INCA) in respect of Remediation Strategy area. Except for nesting birds, no protected species were observed in the surveys carried out as part of the assessment.		

Other Regulatory Database Information

Only regulatory data within 250m of the area with the potential to impact the area has been detailed below, please refer to Appendix A for the complete regulatory data set.

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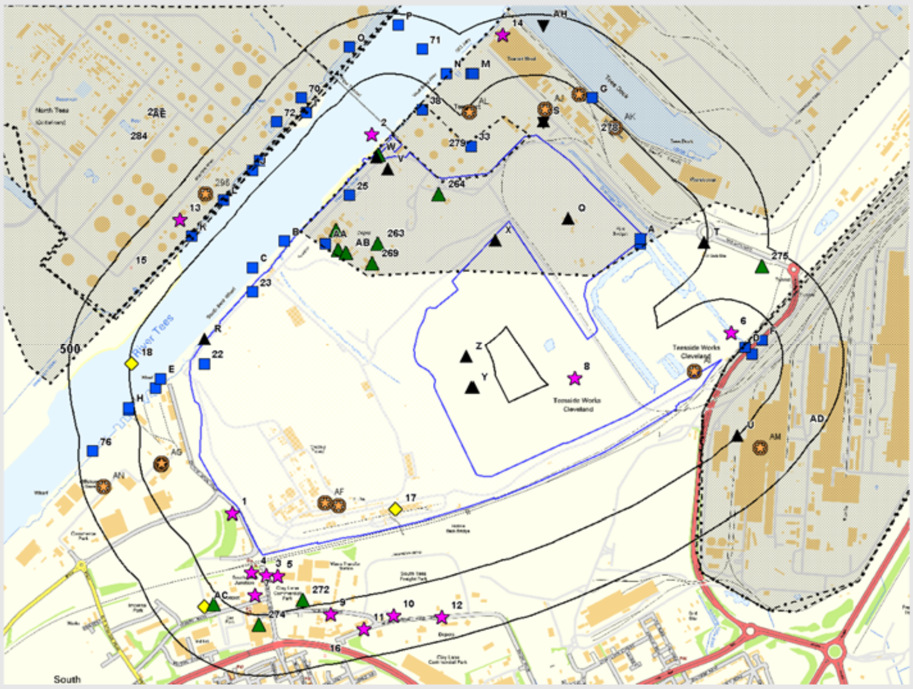
[1] Private water supplies are not included in the database and as such are not considered within the risk assessment, however, there remains the potential for risks to private water supplies however this is considered unlikely in the context of the site and its locality.

Activity	On-Site	0-250m	Details
Current Ground Works	3	3	Presence of South Bank Iron Works Clay pit, a surface mineral works on the southern area boundary, as well as small scale underground localised Brine wells situated in the centre. Grangetown Slag Works located in the south-west area of the site. Adjacent land is occupied by a number of brick works and yards and clay pits.
Potentially Contaminative Land Uses	248	356	Since the mid-19th century much of the area has undergone significant industrialisation. Within the area 248 potentially contaminative land uses have been identified inclusive of unspecified depots, warehouse, tanks and pits in addition to pumping stations, refuse heaps and railway infrastructure. Within the site area a number of iron, steel, concrete, brick and tile works have been operational largely up until the mid-twentieth century. Land adjacent to the area has undergone similar historical development.
Historic Landfill Sites	1	2	A small proportion of a single historic landfill appears to be within the area boundary with the main landfill body situated to the east. An additional two historic landfill sites associated with the Cargo Fleet Wharf Area and Clay Lane Steel Works are situated to the south-west and south of the area, respectively, in close proximity to the boundary.
Registered Landfill Sites and waste management sites	4	0	Three landfills are currently operational within the area. Principally the landfills are situated outside of the area site boundary however small areas of demarcated landfill boundary extent appear to be within the area boundary on the central eastern boundary line. • SSI High Tip: a licensed facility (CLE 3 and CLE 8) utilised for disposal of bi-products from iron and steel making operations. • SSI SLEMS: a waste handling and treatment facility (CLE 9) for BOS oxide waste that is marketed for re-use in the cement industry. • Highfield Environmental Facilities: Highfield operates various licenced landfill facilities (CLE 119 and CLE 170) along the central zone of this area, for both hazardous and non-hazardous wastes, that were previously designated as ICI landfills.  A Metals Recovery Area: an area leased by SSI from Tata Steel, that has previously been leased to Harsco who have been engaged in recycling materials from iron and steelmaking for recovery of metals (PP3338MT).
IPC	4	43	Four historical IPC permits are recorded within the area but appear to relate to one permit that has been transferred three times. The permit relates to the process of Iron and Steel.

Activity	On-Site	0-250m	Details
			Three historical IPC permits 5m northwest of the area, which appear to be one permit transferred three times. The permit relates to the process of Coating Processes and Printing. 
IPPC	3	131	Three IPPC Authorised Activities are recorded within the area, which appear to be the same permit transferred twice. The permit relates to the process of waste landfilling >10 tonnes per day with a capacity of >25,000 tonnes excluding inert waste. Five further IPPC Authorised Activities are recorded in close proximity to the area boundary, but again appear to be the same permit transferred four times. The permit relates to the process of waste landfilling >10 tonnes per day with a capacity of >25,000 tonnes excluding inert waste. A further twenty-seven IPPC Authorised Activities are recorded within 20m of the area, but these also appear to be the same permit transferred multiple times. The permit also relates to disposal or recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving physico-chemical treatment.
Red Discharge Consents	0	0	No consents within 500m of the area.
Petrol and Fuel Sites	0	0	No sites within 500m of the area.
Tank database	314	356	Largely unspecified tanks within the area. Oil tanks listed within the area in 1968.

Site History

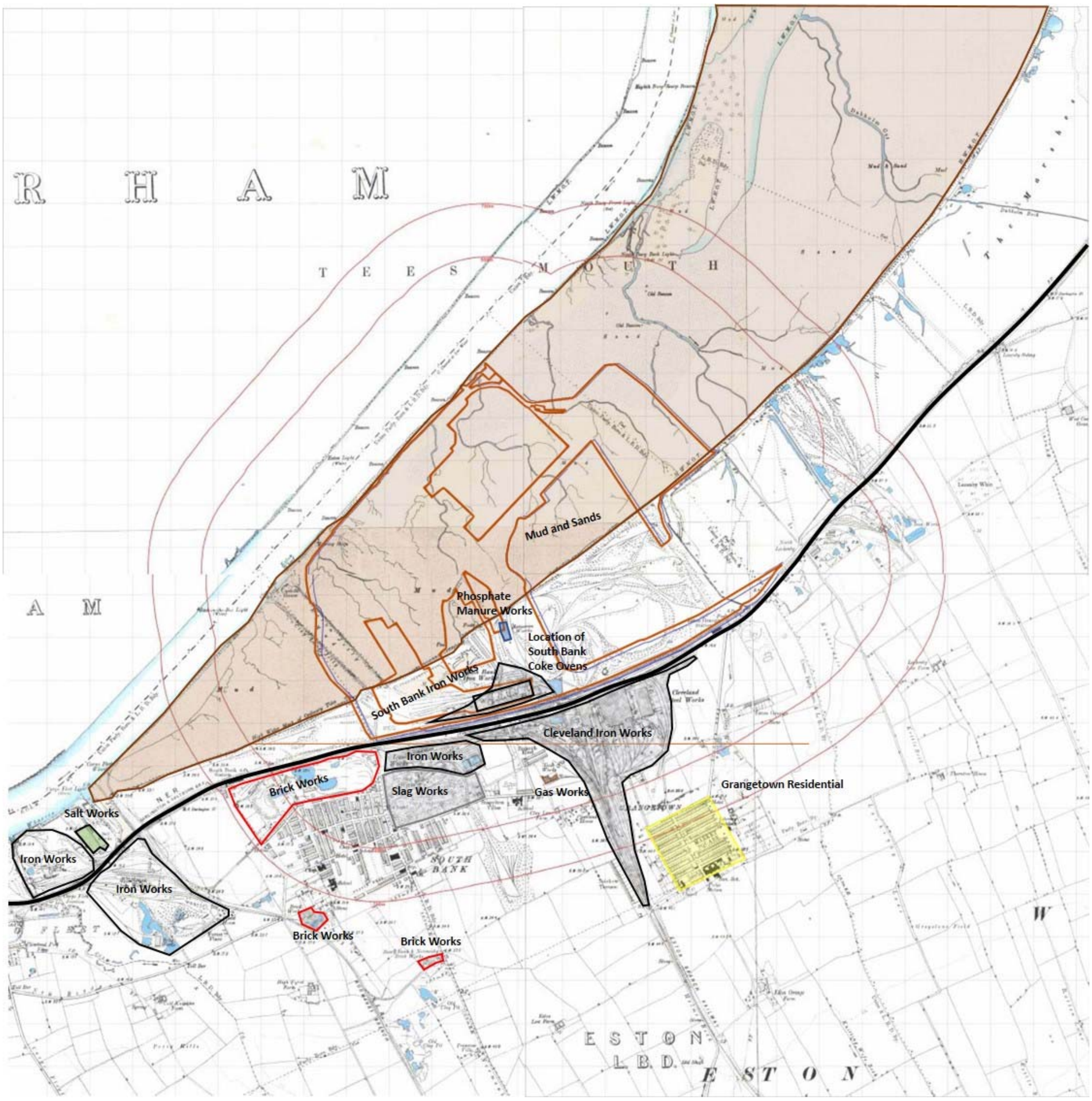
A summary of the historical development of the area, based on historical OS maps, is presented below. The historical maps can be found within the Groundsure Environinsight report in Appendix A. Where relevant, interpretation of the maps is supported by knowledge from the discussions with the client and other stakeholders and previous reports for the area.

Large scale historic maps are available between 1856 and to 2014. Since 1856 the area has undergone significant development following land reclamation between 1897 and 1913.

On-Site: Earliest historic maps available demonstrate minimal development within the area and surrounding areas. Land was principally constituted of low lying scrub land. In closer proximity to the River Tees to the north of the area large areas of land were constituted of mud, sand and marshes.

Off-site: Middlesbrough and Redcar Railway line runs adjacent to the southern boundary of the area (1857). Lands towards the south east of the area is occupied by pasture. A number of becks and streams flow through the area and the surrounding area flowing into the River Tees.

1893 – 1897



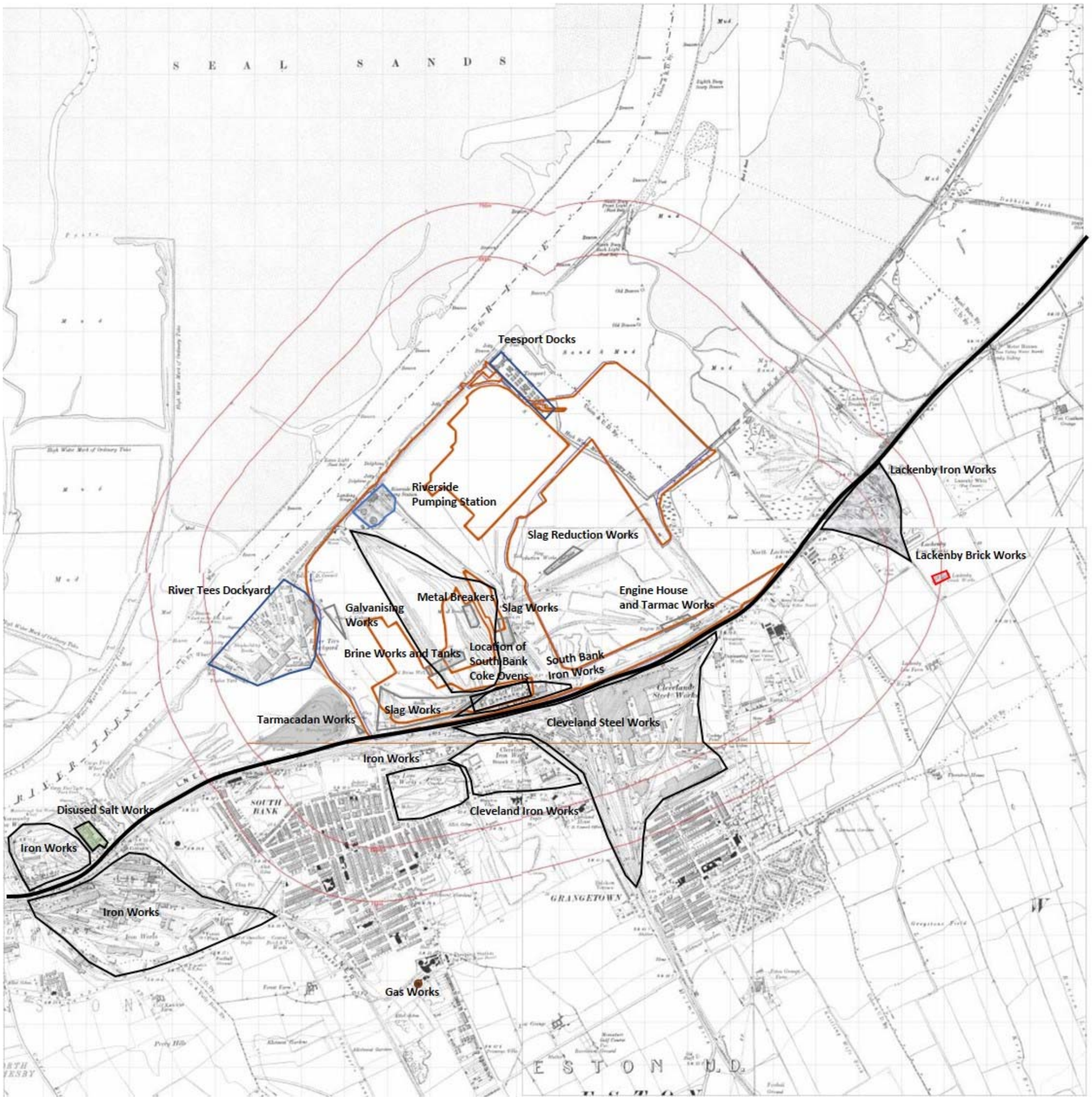
On Site: By 1893 the southern part of the area underwent significant development with the emergence of the South Bank Iron Works and Antonien Works (Phosphate Works) north of the Railway Line. Development of concrete works, and additional slag works in the south-west corner of the area in 1897.

Much of the northern areas of the area are occupied by large areas of sand and mud as a result of tidal action in the Tees. Several wharf buildings and docks were constructed on the banks of the Tees with a jetty connecting the buildings to the mainland. Rail tracks and infrastructure cross the area connecting peripheral areas to the main works.

Off-Site: Areas south of the railway line outside of the area was subject to extensive industrialisation during this period. Much of the land to the south and south-west of the site is occupied by iron, brick, salt and gas works.

Most notable features include the South Bank Iron Works and the Cleveland Steel Works. Some residential development around Grangetown characterised by construction of a large market.

1913 – 1938

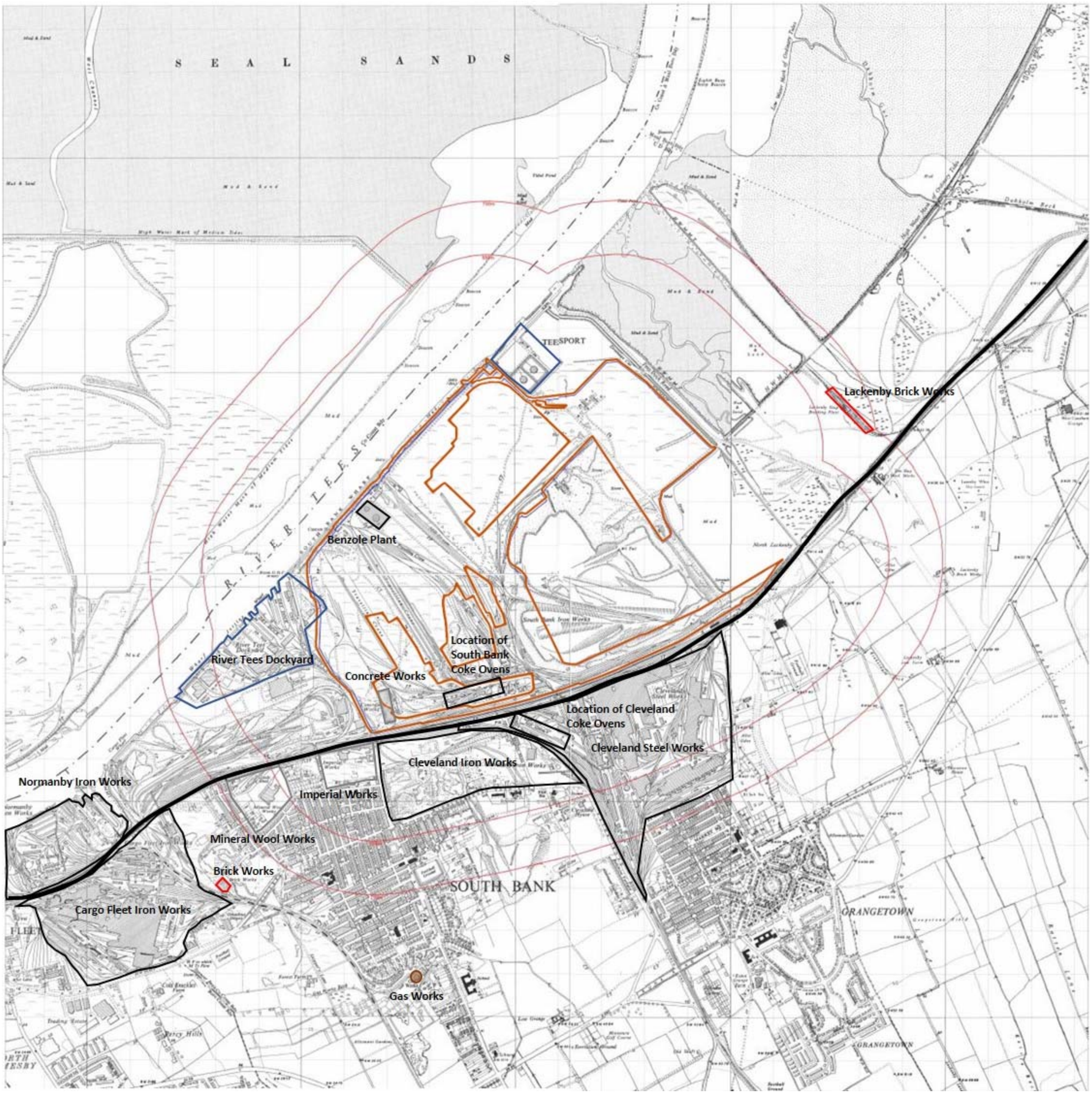


On Site: Significant land reclamation of mud and sand banks in the northern-west area of the area, tracked cranes serving the water front wharf buildings bisect areas formerly occupied by mud and sand. Emergence of two large reservoirs north of the South Bank Works in 1913, reservoirs no longer present by 1927. Construction of Brine wells and tanks north of the South Banks Iron Works. Construction of a number of slag works and concrete works in close proximity to the South Bank Iron Works. Former phosphate manure works repurposed into basic slag works. South Bank Iron Works undergone further development. Additional railway and infrastructure such as tracked travelling cranes constructed during this period. Construction of pumping station on the banks of the Tees. Metal breakers appearing in 1927 on land previously occupied by mud and sand in the centre of the area. By 1915-1929 building in the north west is shown to be a galvanising works.

Off-Site: Construction and growth of Smiths Dock to the south-west, west of the area. Further residential development associated with Grangetown south of the area. Emergence of Slag and Tarmacadam works to the west in 1913, becoming principally orientated around Tarmac manufacturing by 1938. Lackenby Iron and Slag Works constructed to the east of the area.

Further expansion of Cleveland Steel/Iron Works. Development of Clay Lane Iron Works west of South Bank Works. Initial Teesport dock construction identified during this period. Closure of Brickworks south west of the site in 1938 making way for a clay pit. Limited development on and off site between 1927 and 1938.

1938 – 1955

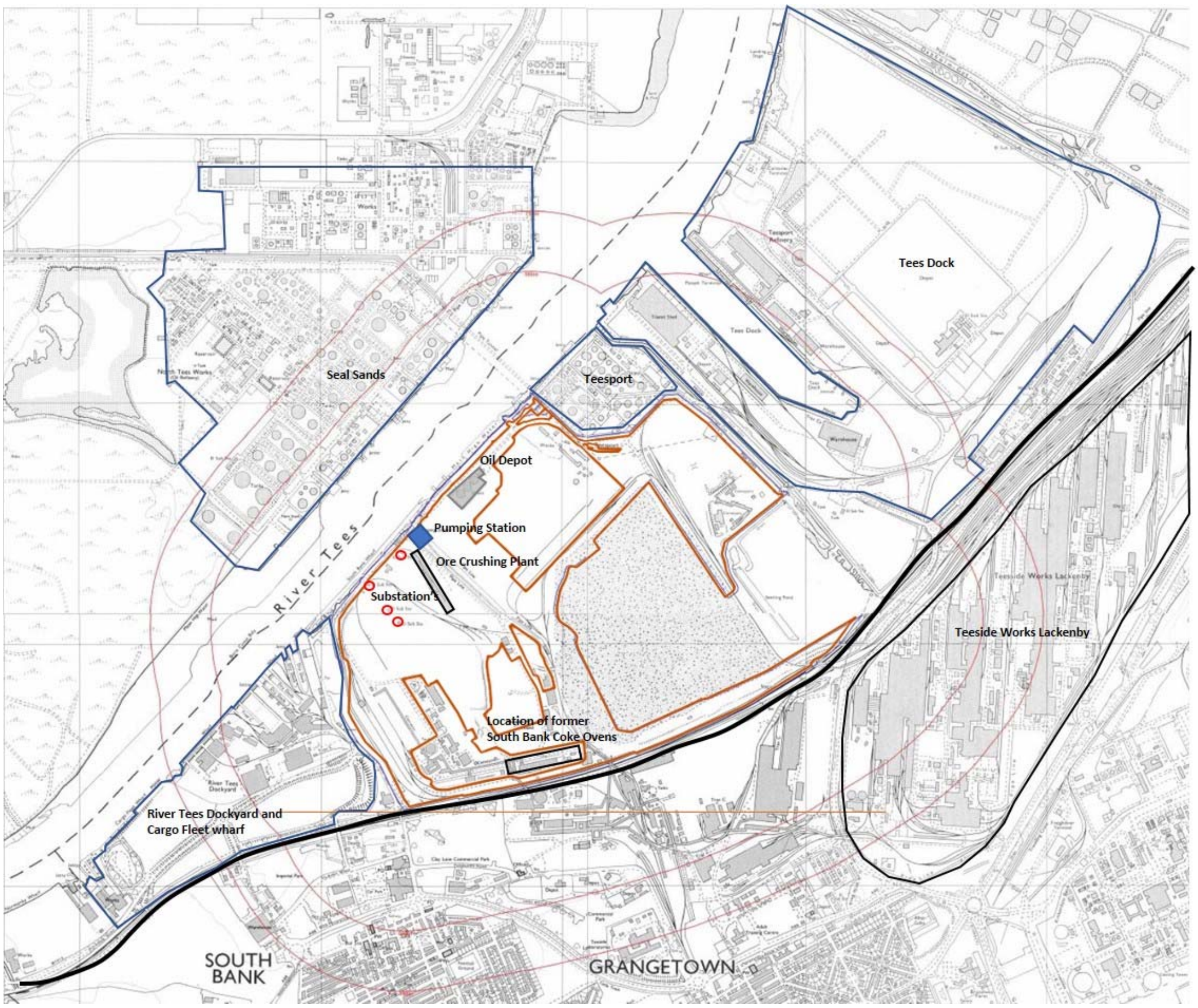


On Site: Significant development of infrastructure serving the South Bank Iron Works, characterised by additional conveyors, travelling cranes and pipelines connecting the works to the South Bank Wharf on the banks of the Tees. A number of tanks and pipes are denoted within the area of the South Bank Iron Works alongside a boiler plant and associated chimneys in the eastern part of the works. During this period brine wells and tanks have been removed with the general area now being used for stockpiling of materials. Eston Sheet and Galvanising Facility on the western boundary no longer present by 1955.

Off-Site: Teesport dry dock expansion to the north-east of the area. Further expansion of Cleveland Steel Works. Mud and sandbanks still occupy much of the area north-east of the area near Teesport development. By 1955 Lackenby Iron Works had been demolished.

Significant expansion of Cleveland Steel Works, Cargo Fleet and Normanby Iron Works by 1955 and residential expansion of Grangetown to the south of the area.

1955-1993



On Site: Removal of travelling cranes from the area used to transport items from the South Bank Iron Works to the docks and wharfs lining the banks of the Tees. Large scale land reclamation both north and south of the Tees can be observed between 1955 and 1988.

Between 1955 and 1959 much of the infrastructure associated with the former South Bank Iron Work has been removed. West of the former South bank Iron Works Site a large undefined rectangular building occupies areas where many of the former coke ovens stood. Located West of the former South Bank Iron Works are the original South Bank Coke Ovens and associated Coke Wharf and Quencher. The buildings occupying the former Cement Works include the Blending Bunkers, Klonne Gas Holder, Repair Shop and Coal Stocking Area. Additional infrastructure associated with a by-product plant is also present inclusive of Booster and Exhaust houses, Condensers and De-Tarrers, Gas Washers, Scrubbers, a Rack Cooler, Acid Storage Tanks, Benzole Storage Tanks and Tar Pump House as well as miscellaneous tanks and sub-stations. Coke Stocking Area is situated to the east, with the two large ore stocking areas to the north.

South Bank Iron Works boundary no longer clearly defined due to ongoing redevelopment. Between 1955 and 1992 four substations were constructed in the north east of the area situated southwest of the Riverside Pumping Station. Construction of an Oil depot north east of the riverside pumping station. During Corus's operation[2] the installation comprised a jetty with the facility for discharging fuel oil from ships of up to approximately 30,000 tonnes capacity, five 10,000 tonne capacity oil storage tanks located within a single bund, a pumphouse for oil distribution and loading of tankers, and two package boilers to provide steam for tank heating and pipeline tracing.

By 1968 an Ore Crushing Plant and associated conveyor and railway lines has been constructed 170m south of Riverside Pumping Station. Tanks associated with a disused Benzole plant south east of the South Bank Wharf.

Off-Site: Further expansion around Teesport and Tees Dock to the north east of the area characterised by construction of storage tanks and additional infrastructure between 1992 and 1993. Demolition of infrastructure and facilities associated with River Tees Docks to the West of the area in close proximity to the Tees. Between 1955 and 1992 large areas of the Cargo Fleet as well as Cleveland Iron Works to the south-west and south of the area respectively were demolished. Between 1955 and 1974 Teesside Works Lackenby was constructed on large areas of former farmland south-east of the area. The development was characterised by construction of production and storage facilities, conveyors, travelling cranes, and cooling towers. Further expansion of industrial sites by 1993 in the south-east.

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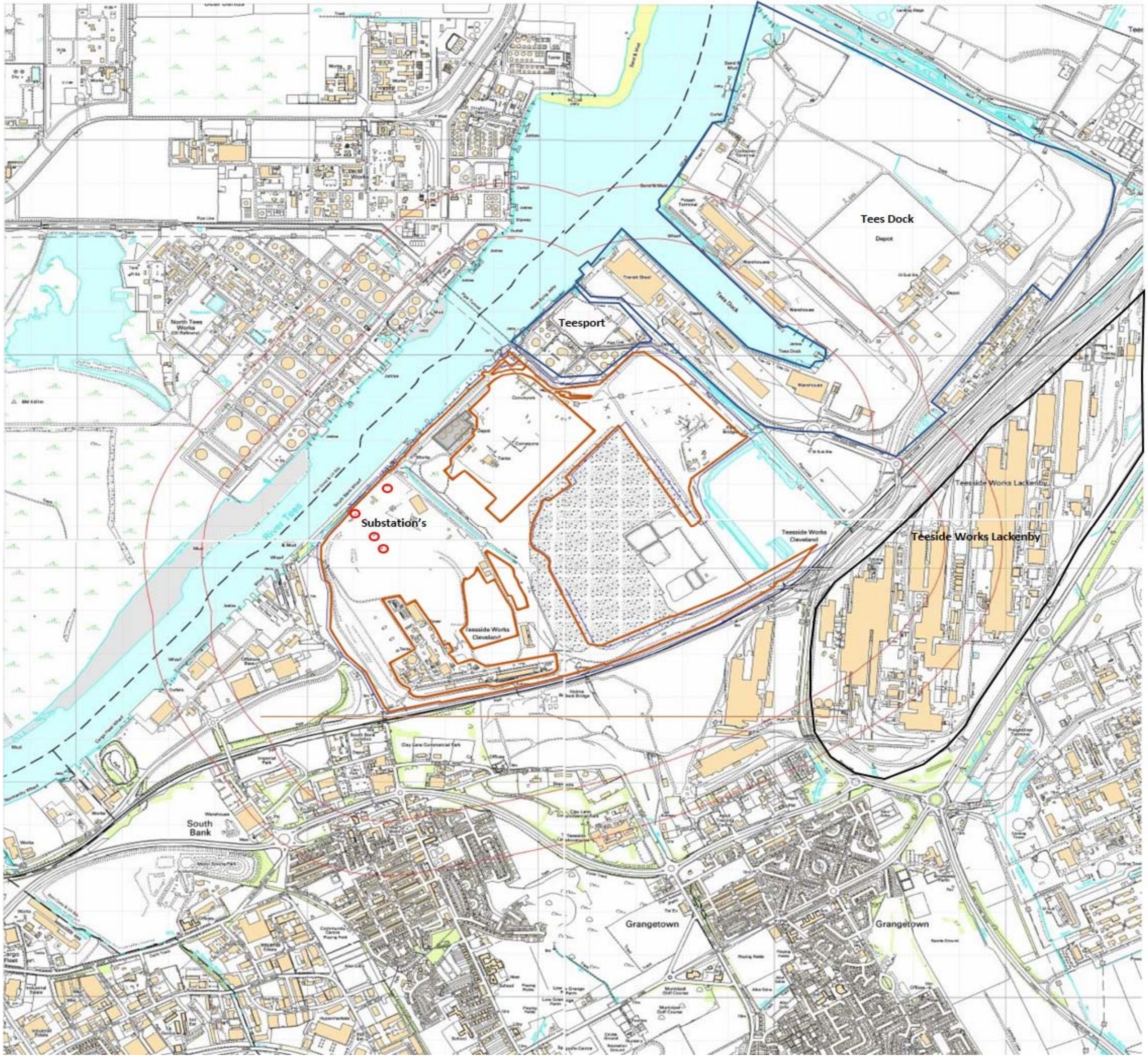
[2] Corus UK LTD. Design of a Site Protection And Monitoring Programme For Cleveland Works, Teesside, October 2004

2002 – Present day



On-Site: Much of the interior of the area is currently undeveloped despite considerable historic land reclamation. Much of the previous infrastructure has been removed with land predominantly used for stockpiling of materials.

Offsite: Further development of the River Tees dockyard to the west of the area in addition to further development of Seal Sands on the north bank of the Tees. Between 2002 and present-day Tees Dock to the north-east of the area has continued to be developed with the construction of additional warehouses, storage facilities and depots associated with the port.

Summary of Area History and Pertinent Features

Since the earliest maps dated 1857, the area and surrounding areas has undergone considerable development. Between 1857 and 1893 significant industrialisation of the south bank began characterised by the construction of the South Bank Iron Works in addition to numerous other iron, slag, brick and gas works with Cleveland Iron Works being constructed offsite between 1897 and 1913. Cargo Fleet Iron Works to the west of the area underwent considerable development from 1893 and 1913.

Much of the north and north east areas of the area situated on land formerly occupied by muds, sands and marsh land. Significant land reclamation of the south bank occurred between 1897 and 1913. It is understood that slag was used to create a high-water embankment. Reclaimed land was subsequently developed characterised by the construction of industrial infrastructure including conveyors, pipelines, travelling cranes, storage tanks and facilities. By 1927 development of Teesport docks began, over time custom houses, wharf buildings and pumping houses were constructed.

Based on historic maps, many of the iron works reached their maximum extent by 1955 prior to being demolished/repurposed by 1992 in addition to much of the supporting infrastructure.

Much of the area is constituted of land formerly associated with the South Bank Iron Works (SBIW).

Notable historic and contemporary features **within the area** which may have implications for land contamination include but are not limited to;

- Antonien Phosphate Works (North) later a Basic Slag Works, suggesting that the phosphate may actually have been being derived from phosphate-rich (basic) slag rather than phosphate rock.
- Land and infrastructure associated with the SBIW inclusive of reservoirs, settlement tanks and ponds chemical and fuel storage tanks, gas holdings, coal and materials stockpiling facilities, waste disposal facilities/refuse heap, material conveyor belts and pipelines (features situated across the site, principally in centre of the area running on a north-south axis).
- Brine works and tanks (South West).
- Sheet metal and Galvanising works (North West).
- Slag works (South and South West).
- Concrete works (South West).
- Benzole plant (North).
- Ore crushing and handling plant (North).
- Electricity Substations (North West).
- Oil depot (North).
- Pumping station (North).

Notable historic and contemporary features **outside of the area boundary** which may have implications for land contamination include but are not limited to;

- Manufacturing infrastructure associated with the SBIW inclusive of coke ovens (South) in addition to land and supporting infrastructure such as coal and materials stockpiling facilities, waste disposal facilities/refuse heap, material conveyor belts and pipelines (features situated across the site, principally in centre of the site running on a north-south axis).
- Slag works (South-West).
- Concrete works (South-West).
- Land and infrastructure associated with the Cleveland Iron and Steel Works (South, South West).
- Normanby, Cargo Fleet Iron Works and associated infrastructure (West).
- Lackenby Iron and Brick Works (East).
- Slag Works (South-West).
- Slag Reduction Works (East).
- Brick Works and associated infrastructure (South West).
- Gas Works and associated infrastructure (South).
- Salt Works and associated infrastructure (West).
- Tarmac Works (to the East & West).
- Mineral Wool Works (South West).
- Imperial Works (South West).
- Seal Sands (North).
- Teesside Works Lackenby (East, South East).
- River Tees Dockyard and associated infrastructure inclusive of docks, wharfs, warehouses (West).
- Teesport inclusive of docks, wharfs, warehouses (North East).
- Tees Dock inclusive of docks, wharfs, warehouses (North East).

Derivatives of the aforementioned features may also be present within and surrounding the area.

Summary of Previous Reports

Previous Report Ref	
Allied Exploration & Geotechnics Limited South Tees Industrial Area- Site C- Ground Investiga1ion **12/07/99** **AEG Contract No. l7JSH**	**Scope of works** The scope of works comprised ● Advancement of six boreholes to depths of between 18.70m BGL (BH-C04) and 22.00m BGL (BH-C03) ● Thirty-three trial pits were mechanically excavated to depths of between 1.80m BGL (TP-C21) and 8.00m BGL (TP-BHC05) using a 360° tracked excavator. ● Analysis of 60 samples for Heavy metals, Pahe, Phenols and Toluene extractable matter ● Analysis of 4 grab samples of water from trial pits ● Geotechnical testing in the field including California Bearing ratio and standard penetration testing ● Geotechnical laboratory testing including Atterburg limits and natural moisture content, particle size distribution, undrained Shear strength, sulphate and pH, **Findings** ***Ground conditions*** With the exception of an initial very shallow layer of variable material (soil, gravels, etc), the made ground deposits are comprised almost entirely of slag, generally assessed as being of a loose to dense nature, with the denser material generally being encountered at depth. The made ground appears to extend down to depths of around 7.0 to 8.5 metres in most parts. However, in borehole BHC6, the made ground was found to extend down to 10.0m below ground. It appears evident that the slag horizon probably prevails across the whole of Site C, substantiating the information acquired at the desk study stage that slag fill was utilised in the original reclamation of the area, which saw it transformed from tidal mudflats into developable land. ***Soil*** *Wood Comment: Lead in soil exceeded the current GAC for commercial end use of 2,300mg/kg. This was in two of the 60 samples with maximum of 2,945.2mg/kg. Concentration of the remaining metals were all below the current GAC for commercial end use.* ***Groundwater*** *The groundwater samples appear to be grab samples from trial pits.*
Enviros **Soil and Groundwater Baseline Characterisation Study Teesside Works** **Summary Report and appendices** **June 2004**	**Scope of works** The report relates to The Cleveland area of the Corus steel works. It includes a summary of the desk study and summary of results. The Cleveland area includes the current site area. Site investigation works were carried out during the April to May 2004. The works comprised ● 123 trial pits to up to 3.5m and ● 11 boreholes to up to 10m. ● Approximately 232soil samples analysed for metals, pH, sulphate cyanide and PAHs, phenol and TPH. Were taken from within the site boundary ● One round of groundwater monitoring from 10 groundwater metals, pH, sulphate cyanide and PAHs, phenol and TPH **Findings** ***Ground conditions*** The area is underlain by infilled material (Made Ground). Made Ground comprises fragments of slag, brick, ash and ferrous metal debris with very occasional pockets of clay. Layers of fused 'pelite' (Blast furnace slag) were encountered in some parts of the site. Oily and tarry deposits and strong organic odours were noted at exploration locations located to the northwest of the By Products Plant (particularly near the benzol storage tanks). Soils: Fill materials across the site are typically characterised by alkaline pH and elevated concentrations of sulphide and sulphate. This is due to the widespread occurrence of slag within Made Ground deposits underlying the site. Lead was elevated above thresholds for commercial end use in 4 of the 238 locations and naphthalene was above the thresholds for commercial end use near the off-site coke ovens. Testing for hydrocarbons was carried out using GC. TPH above 1000mg/kg was identified at 14 of the 232 locations and three exceeded a screen for C10-C40 near the coke ovens. These were mostly near the off-site coke ovens and off-site SLEMS landfill. Benzene was detected near the off-site coke ovens. While zinc was below the GAC elevated zinc concentrations were detected which could lead to soil being classified as hazardous in about 5-10% of samples.

Previous Report Ref	
	Groundwater: Groundwater levels across the site ranged from 0.8 to 7.6mbgl (and 1.17 to 6.84mAOD) and did not conform to any consistent flow pattern although there was evidence for a broad flow direction towards the River Tees. Due to the distribution of boreholes across the site it was not possible to draw any specific conclusions from the water levels observed. Local flow conditions were believed to be complex and possibly localized due to local variations in the depth of Made Ground, variations in permeability of the underlying drift deposits and/or the effect of sub-surface drainage systems. *Wood Comment: the range may also be tidally influenced.* Groundwater samples from the By Products Plant and SLEMS areas also indicated concentrations of hydrocarbon compounds in excess of screening criteria (PAH, BTEX Compounds, TPH and GROs). Free product was noted in groundwater monitoring wells in the By Products area, near the benzol storage tanks. Copper, lead mercury, zinc and cyanide were also above EQS for transitional waters in 2 to 3 of the 10 samples.
CORUS UK LTD. **Design of a Site Protection and Monitoring Programme for Cleveland Works, Teesside,** **October 2004**	**Scope of works** This report set outs the requirement for collecting baseline data for areas where the potentially polluting substances were identified to be stored or used at the Cleveland works. The works were divided into 4 areas and descriptions of the area has been used to support this report **Findings** The need to collect further data as set out below ● The South Bank Coke Ovens: Reference data did not need to be collected. ● South Bank Oil Tank Farm: Reference Data to be collected and reported for the 5 x 100,000 litre capacity heavy fuel oil tanks located at NZ 5370 2250. ● The Solid and Liquids Environmental Management System (SLEMS) – outside the current area): reference data to be collected at the Settling Ponds and Drying Bays located at NZ 5490 2248, and the Oil Mop House located at NZ 5525 2218. ● The slag handling plant operated by Heckett Multiserv Operations: Reference data did not need to be collected. Baseline investigation was proposed.
CORUS UK LTD. **First Phase Reporting of the Site Protection and Monitoring** **Programme** **31 January 2008**	**Scope of works** This document represented the first phase reporting of reference data for the Teesside Works Site Protection and Monitoring Programme ('SPMP'). Reference Data was collected for Cleveland and Redcar where there is likelihood for potential pollution to land. At Cleveland the sources of potential polluting substances that may cause pollution to land were the Heavy Fuel Oil Storage Tanks, South Bank Oil Farm (Area 2), Cleveland Works. The investigation comprises. 3 Boreholes, BH2B1 to BH2B3, were excavated at south bank oil farm. (this was a variation agreed with the EA to the scope in the 2004 report. The boreholes were to a maximum depth of 13m and excavation comprised excavation to 4m with follow-on rotary which was replaced by sonic drilling for the last hole (which was carried out in December 2006. (this is not reflected in the logs) Nine soil samples were analysed form her made ground and 3 groundwater samples were analysis. **Findings** ***Ground conditions*** Made Ground of slag was encountered in all three locations to between 8.50 metres and 10 metres below ground level (bgl). (the logs show Made ground extending to 13m in BH2B3) Silty sand was encountered underlying the Made Ground. This silty sand was considered to be the natural estuarine alluvial deposits. The logs slightly contradict the report. ***Soil*** TPH and PAHs in all nine samples were low with TPH at a maximum of 100mg/kg and benzo(a)pyrene at a maximum of 1.4mg/kg. ***Groundwater*** The groundwater results showed 30 - 62µg/l of TPH at BH2B2 and BH2B3 in July 2007 and none in 1B1 in January 2007. PAHs and BTEX were all below detection. No groundwater level data was provided.

Previous Report Ref	
Arcadis **The Former SSI Steelworks, Redcar: Replacement Cle3/8 Landfill Boreholes CQA Validation Report** **South Tees Site Company Limited**	The CLE 3/8 Landfill Site is located to the southeast of the area and comprises a large area of worked and built-up ground which extends to the southeast. An area of cleared and levelled ground is located in the southwest which is an area that formerly contained stockpiles of slag material and was owned by TATA Steel Limited. **Scope of works** The works comprised re-drilling previous monitoring wells around the northern and western perimeter of the CLE 3/8 landfill. All three boreholes lie within the current site. **Findings** ***Ground conditions*** Made Ground was encountered in all three exploratory holes progressed and ranged in thickness from 8.5-14.4m bgl. This material generally comprised sandy gravel with cobbles and boulders of slag, concrete and brick. The underlying superficial deposits comprised: Tidal Flat Deposits – encountered in BH4R between 14.4 and 15.5m bgl and comprised silty sand. Glaciolacustrine Deposits – encountered in BH4R and BHD between 8.5 and 15.5m bgl, proved to a maximum depth of 19.4m bgl in BH4R, and comprised soft to firm laminated clays. Glacial Till – encountered in BH4R between 19.4 and 20.0m bgl and comprised firm to stiff, slightly sandy, slightly gravelly clay
Summary of key finding of all investigations	Made Ground is present across the site and typically extends to 6.5 to 8m below ground although it is locally deeper. The made ground typically comprises fragments of slag, brick, ash and ferrous metal debris and blast furnace wastes. The Made ground is very hard and typically boreholes have been advanced by trial pitting through the majority of the made ground prior to drilling. Groundwater levels across the site ranged from 0.8 to 7.6mbgl (and 1.17 to 6.84mAOD) and did not conform to any consistent flow pattern although there was evidence for a broad flow direction towards the River Tees. Analysis of the made ground have indicated that the potential contaminant concentrations are generally below commercial end use criteria. Lead was slightly elevated in a small number of samples. There was evidence of localised hydrocarbon contamination in soil and groundwater within the area near the off-site south bank coke ovens and benzol tanks and near the SLEMS landfill and in lower concentrations at South Bank Oil Tank Farm in the north of the site. The testing on site did not include asbestos analysis. It is noted that elsewhere within the Remediation Strategy site and wider STDC area that asbestos has been detected in similar made ground. For instance, a recent site investigation[3] at the Torpedo Ladle Repair Shop - TLRS in the southern part of the larger Former SSI Steelworks Facility identified asbestos in 38 of the 169 samples analysed.

Data Gaps

Asbestos

Made Ground within the area has not been subject to asbestos analysis. This should be included within any future ground investigations.

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[3] Allied Exploration & Geotechnics Limited The Former SSI Steelworks, Redcar – Ground Investigation Contract – Priority Areas Within SSI Landholdings Contract 3 Final Factual Report, June 2018

Landfill Gas

Future development proposals located in close proximity to former landfill sites should be supported by further investigation and an associated Gas Risk Assessment and should incorporate any necessary protection measures appropriate to protect buildings from landfill gas migration.

Future Phase 2 Contaminated Land investigations

It is anticipated that supplementary ground investigation within the site boundary may be required to support specific proposed developments and land parcels as they are brought forward for development.

2.4 Grangetown Prairie

Site Description

The Grangetown Prairie area (the area) is the south western most land parcel and is bound by the Darlington to Saltburn Railway line to the north, by Tees Dock Road to the east and to the west by Eston Road. Immediately to the south of the area within the wider red line site boundary, with vacant former steel works (Torpedo Ladle Repair shop and associated outbuildings), and to the south of this is the Bolckow Industrial Estate. To the east of the area is the South Tees Freight Park.

The area is currently disused and largely derelict, comprising areas of concrete slabs/ hardstanding or unsurfaced ground with sparse emergent scrub vegetation.

The area comprises an area of approximately 55 ha and is generally level with the majority lying between 8 and 9 m AOD. There is a gradual south to north fall, with ground levels ranging from 13m AOD in the extreme south western corner to approximately 7.5m AOD on the north eastern boundary.

Environmental context

Geology & Hydrogeology

Information taken from BGS on-line mapping (**http://www.largeimages.bgs.ac.uk/iip/mapsportal.html?id=1001513**) and the BGS on-line geoviewer (http://mapapps.bgs.ac.uk/geologyofbritain/home.html), previous reports, the Groundsure Report (Appendix B, which includes extracts of the geological mapping) and the following publicly available exploratory records from the BGS GeoIndex web portal:

- NZ52SW629 & 631 – North west corner
- NZ52SW131/A-D – Eastern Section
- NZ52SE20/A 1 & 2 – South east corner.

Strata	Description	Typical Thickness (m)	Typical Depth to Base (m bgl)	Groundwater	Aquifer Status	Comments
Made Ground	Mixed fill, typically granular Slag, firebricks, coke, ash and brick	0.60 – 5.5	0.60 – 5.5	1.95m bgl in BGS Borehole 127. 2.85m bgl in BGS Borehole 13551/13	Not Classified	
Superficial Deposits						
Glaciolacustrine Deposits	Clay and Silt	0.75	3.60	Not Recorded	Unproductive Strata	Significantly thicker in north west corner
Solid Geology						
Redcar Mudstone	Blue Shale, Grey Mudstone and siltstone, thin beds of limestone	Thickness up to 280m, not proven	Not proved	Not Recorded	Secondary Undifferentiated	Only encountered in Boreholes SE120/A1 and SE20/A2.
Penarth Group	Grey to black Mudstone, subordinate limestone and sandstones	Thickness 0-12m	4.95 – 11.0	2.95m bgl in BGS borehole 796709	Secondary B Aquifer	Present as a narrow band through centre of the area only. Only encountered in Borehole 131/C.
Mercia Mudstone	Red Mudstone, subordinate siltstones, locally Halite and thin gypsum beds and sandstones	Thickness up to >1000m, not proven	Not proved	2.95m bgl in BGS Borehole	Secondary B Aquifer	Only encountered in Borehole 131/B.
Sherwood Sandstone	Red Sandstone	Thickness Approximately 250m			Principal Aquifer	

Hydrogeology	Superficial drift deposits underlying the area are classified as unproductive strata[4]. Penarth Group and Mercia Mudstone underlying the superficial deposits are classified as Secondary B Aquifers, and the Redcar Mudstone is a Secondary (undifferentiated) Aquifer. Secondary A aquifers comprise permeable layers that can support local water supplies and may form an important source of base flow to rivers. Secondary B aquifers are mainly lower permeability layers that may store and yield limited amounts of groundwater. Secondary undifferentiated are aquifers where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type/ deposits. Made Ground at the site is typically granular and is therefore also water-bearing, although it does not have a formal aquifer classification. Groundwater in the Made Ground is likely to be in continuity with groundwater in the underlying superficial deposits classified as Secondary aquifers. In addition, there is likely to be hydraulic continuity between groundwater in the Made Ground and shallow superficial deposits and surface waters. Previous ground investigations across the area have encountered the presence of a shallow perched water table within superficial deposits at typical depths of less than 2m below ground level (bgl). Given the variable nature of the superficial deposits, it is likely that water bearing horizons within these superficial deposits are not laterally continuous across the study area. There are no licensed groundwater abstractions within 1km of the area. There are no SPZs within the site or within 1km of the site. In general, groundwater flow in shallow deposits is anticipated to be towards the River Tees to the north or northwest. However, groundwater flow direction in shallow soils across the area is likely to be variable and influenced by the presence of surface water features. The main River Tees is also tidally influenced, and there is likely to be some tidal variability of groundwater in hydraulic continuity with surface waters. The presence of man-made features such as excavations, foundations, basements and underground utilities/ services may also influence groundwater flow. The Sherwood Sandstone Principal Aquifer at depth is of limited hydrogeological concern within the area, as it is overlain by a significant thickness of Mercia Mudstone, which are likely to l limit the vertical connectivity with shallow groundwater.
Groundwater Sensitivity	The groundwater sensivity has been based on The Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008 [5]. The groundwater sensitivity is low. Although the area is underlain by Secondary aquifers, there are no local groundwater abstractions within 2km and the area is not located within an SPZ. Given the widespread former and current heavy industrial use of the site and surrounds, there is likely to be widespread regional degradation of groundwater quality.
Hydrology	The River Tees is located to the approximately 1.2km north of the area, and is classified by the EA as a Main River. The stretch of the River Tees to the north of the area is tidal. There are other minor surface waters courses present within the area. Knitting Wife Beck is present in the east of the area and an unnamed water feature is present in the south west Given the previous development of the area, the surface water drainage is likely to be highly modified, and there are culverted surface waters and below ground drainage present throughout the area.

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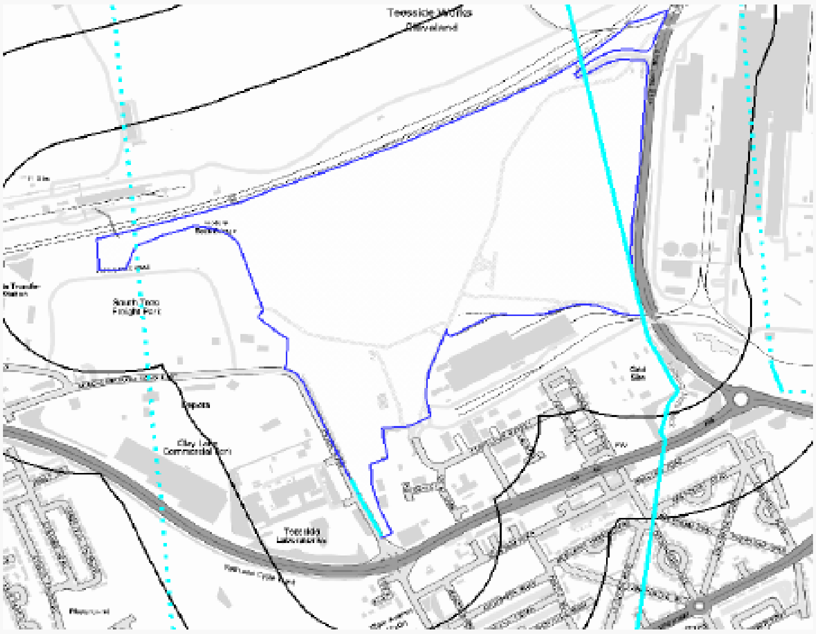
[4] https://magic.defra.gov.uk/MagicMap.aspx

[5] NHBC/ CIEH / Environment Agency, Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008



Note:
Surface waters include the culverted Knitting Wife Beck and the River Tees are likely to be in hydraulic continuity with shallow groundwater in Made Ground and potentially the Superficial deposits and therefore receive groundwater baseflow.

Hydrological sensitivity	The surface water sensitivity is low. The area lies in the catchment of the River Tees, which is over 1km away and is tidally influenced.
Ecology	The Teesmouth and Cleveland Coast SSSI is located 745m north of the area, and within 2km north west and south west of the area. The River Tees forms part of the SSSI. The Teesmouth and Cleveland Coast is also designated as a SPA. The SSSI is also a designated Biodiversity interest Area.
Ecological sensitivity	The ecological sensitivity is assessed as Moderate as there is a SSSI approximately 0.75km from the area. The River Tees to the north receives surface water discharge from the area and is designated as a SSSI. However, the influence of discharges from the site are likely to be limited by the tidal exchange and large volume of the water body.

2.5 Other regulatory database information

Only regulatory data within 250m with the potential to impact the area has been detailed below, please refer to Appendix B for the complete regulatory data set.

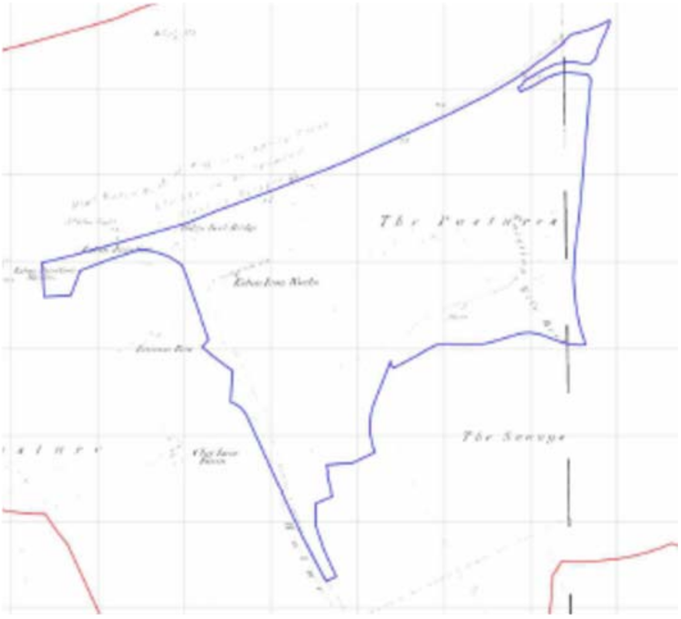
Activity	On-Site	0-250m	Details
Waste management/ transfer/ treatment facilities/disposal	1	1	SSI held a permit for storage of furnace ready scrap for recovery. Issued in December 2014. The permit is listed as issued and revoked. Scot Bros Recycling Limited held a permit for a household, commercial and industrial waste transfer station. Issued in December 1996. Permits for the same location are listed for J W S recycling and Campbell John Waste Management.
Landfill	0	4	The closest landfill is situated approximately 25m to the north of the area and is listed as waste landfilling (excluding inert) and is operated by SSI.
Current Industrial Data	14	99	2 listed as Teesside works, 3 tanks, 6 pylons, 2 pipelines, 1 electricity sub-station.

Activity	On-Site	0-250m	Details
Historical Industrial Data:			
Potentially Contaminative Uses	154	222	Related to the iron and steel works including pits, tanks, heaps, railways, cuttings and gas works.
Tank Database	323	456	Listed as tanks and gas works/holder.
Mineral Extraction and Coal Mining Activities	1	0	Abandoned Brine Wells are listed on site. There is no information listed for coal mines.

2.6 Site history

A summary of the historical development of the area, based on historical OS maps, is presented below. The historical maps can be found within the Groundsure report in Appendix B. Where relevant, interpretation of the maps is supported by knowledge from additional sources:

- Drawing 1X1853 Layout of Cleveland South (Sheet 4).



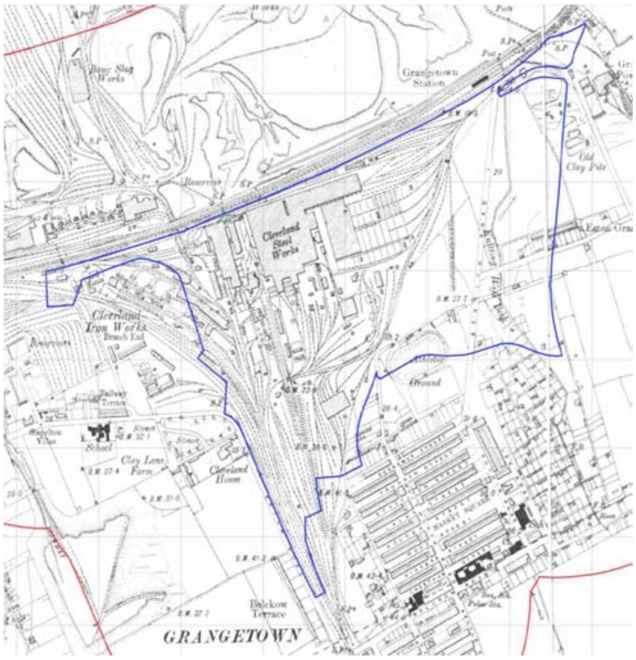
***On-Site:** The majority of the area is shown as agricultural land. Eston Iron Works is shown in the west of the area.

***Off-Site:** Eston Junction Station and Eston Junction are shown in the vicinity of the northern area boundary.

*Detail on the map is unclear, and accurate location and description of area features is therefore difficult to determine.

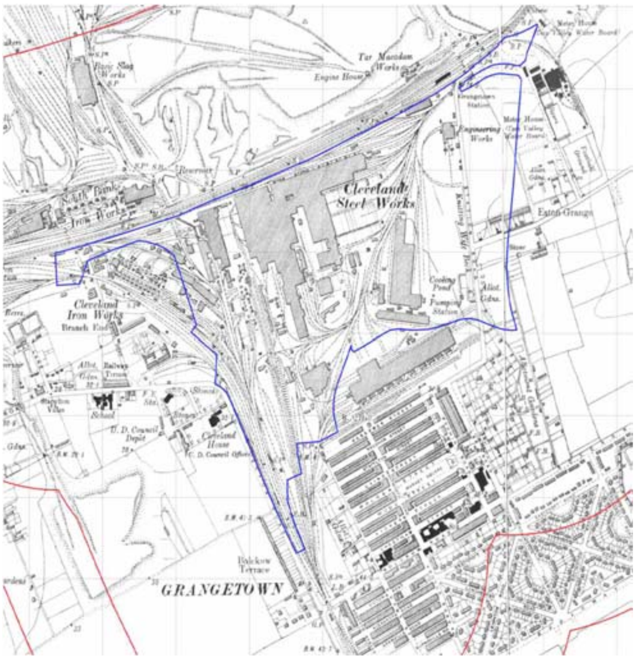
On-Site: Cleveland Steel works is present in the north western part of the area. Railway lines are shown entering the steel works from the south. Cleveland Iron Works is present in the far northwest of the area and extends beyond the boundary. Railway lines run between the iron works and steel works. A water body is located in the far northwest of area between the steel and iron works. Two water bodies are located in the south east of the area and Knitting Wife Beck is located further to the east. Station Road runs north to south to the west of the water bodies. Eston Grange Stone is located on the far east of the area and straddles the boundary.

Off-Site: A gas works is located approximately 50m to the west of the area. A railway line is present adjacent to the north of the area and demarcates the northern boundary. Beyond the railway line is an extensive area of slag heaps. South Bank Iron Works is located beyond the railway line approximately 50m north west of the area along with two surface water bodies. The Antonien Phosphate Works is located approximately 400m north of the area. An iron and slag works are located approximately 400m west of the area. Eston Grange Station is shown adjacent to the area boundary in the north east of the area. An area of terraced housing labelled as Grangetown and Market Square is shown approximately 25m south east of the area at its closest point.



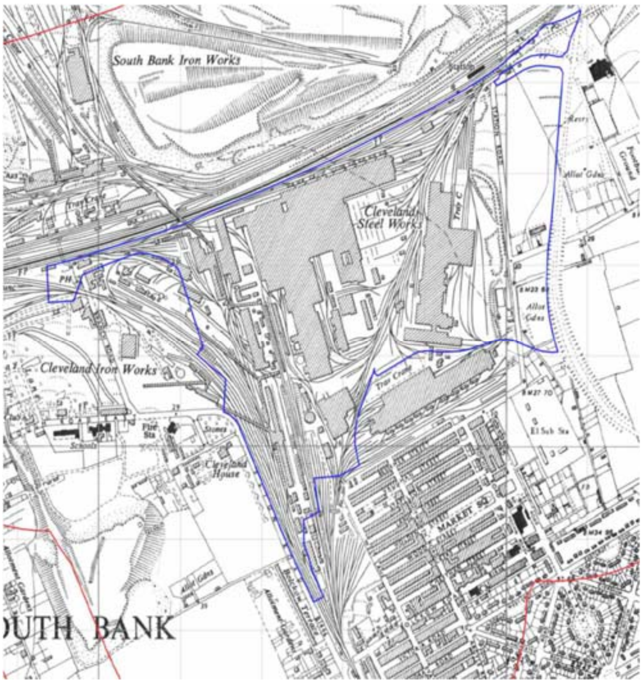
On-Site: Additional railway lines and sidings were constructed to the east and south of the Cleveland Steel Works. Unnamed structures are present to the east and south of the railway lines. The water body in the north west of the area is no longer shown. An athletic ground is shown in the south of the area, the two unnamed water bodies were no longer shown in the south east of the area

Off-Site: A reservoir is shown to the north of the area beyond the railway lines. A salt works is shown within the South Bank Iron Works approximately 100m north. The phosphate works is now shown as a basic slag works. Eston Grange Station has been renamed Grangetown Station.



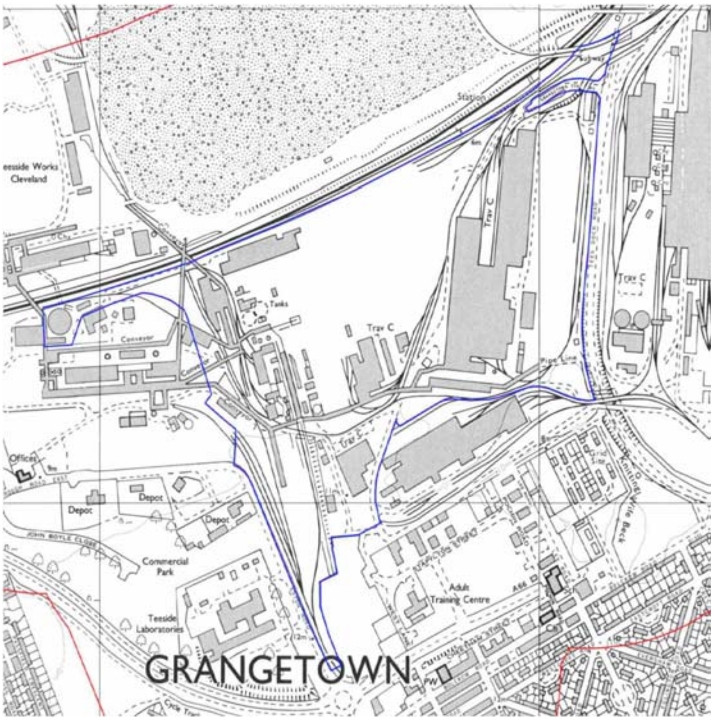
On-Site: The Cleveland Steel Works continued to dominate at this time, with expansion of the main works buildings towards the south. An engineering works is now shown in the north east of the area off Station Road. A cooling pond and pumping station are shown in the south east corner of the area.

Off-Site: The slag heaps continued to be present to the north of the area, along with the basic slag works. The South Bank Iron Works was now shown to the north of the area. A tarmacadam works is shown approximately 50 north of the area. The athletics track has been replaced by a large building adjacent to the south of the area.



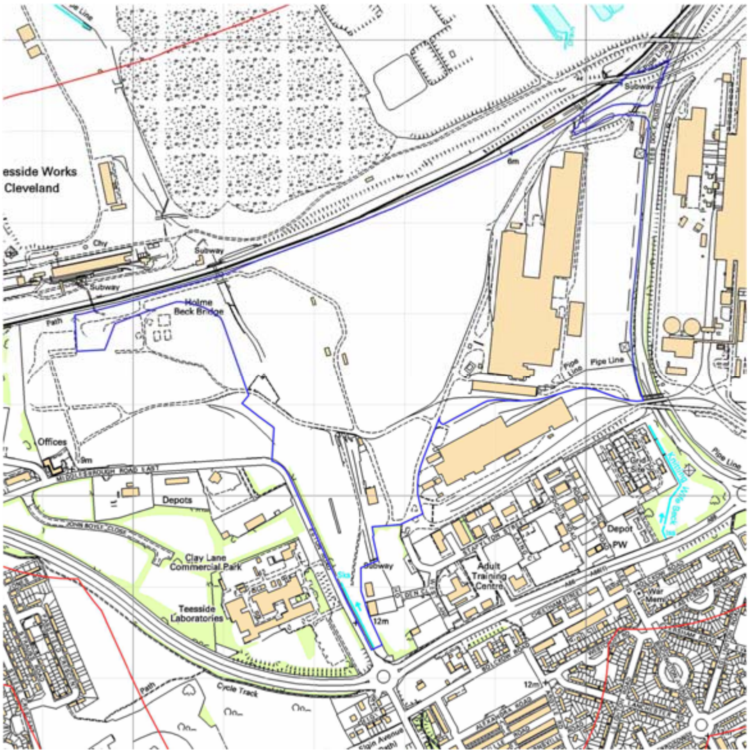
On-Site: The Cleveland Steel Works had expanded, and the building footprint occupied the majority of the central area. The development included boilers, blast furnaces and a cooling tower as shown on site layout plans. A travelling crane is shown in the east of the area. The engineering works in the east of the area was no longer shown.

Off-Site: The South Banks works remained in the area north of the area, comprising works buildings, slag heaps and railway lines. A tarmacadam works is shown approximately 50m north of the area. The athletics track has been replaced by a large works building adjacent to the south of the area. The phosphate works to the north of the area is no longer shown.



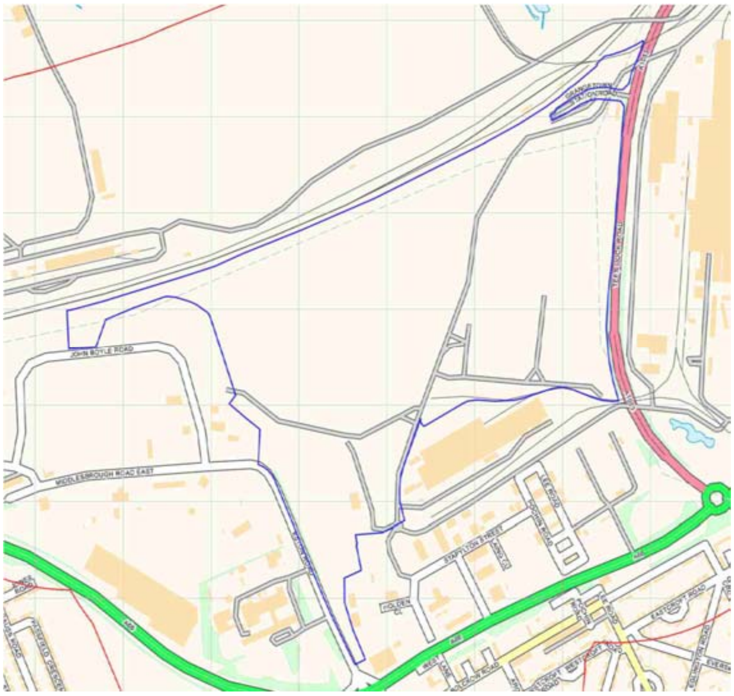
On-Site: The large works buildings in the northern central part of the area are no longer shown. Tanks are shown in the north east of the area which are listed as clarifiers on site layout plans. Conveyor belts are shown on the west of the area linking it with the adjacent works. A circular structure is shown in the far north west of the area which is shown as a gas holder on site layout plans. Many of the railway lines and sidings are no longer present. Travelling cranes are also shown within the area. A pipe line is shown in the far south east.

Off-Site: Multiple buildings, tanks and travelling cranes are shown beyond the Tees Dock Road adjacent to the east of the area. The market hall to the south of the area is now an adult training centre. The layout of buildings to the south of the north west of the area has changed and site layouts indicate this is a blast furnace plant. There remained a large area of slag heaps to the north of the area.



On-Site: Mapping indicates that there had been considerable demolition of site structures in the west and south by this time. Three small unnamed buildings remained in the central part of the area. The large works building in the east of the area is still present, and a pipe line close to the eastern site boundary. Many of the railway lines within the area had been dismantled. Holme Beck Bridge is present on the north western boundary of the area. The south western site boundary was demarcated by a surface water channel.

Off-Site: The works adjacent to the west of the area are no longer present. Land to the west of the area is now occupied as depots, Teesside Laboratories and Clay Lane Commercial Park. Further depots and commercial development had taken place to the south of the area at this time.



On-Site: Further demolition of on-site structures had been carried out. No buildings are present with the exception of one minor building in the south west of the area. Access roads continued to be shown in the southern and eastern parts of the area.

2.7 Summary of Previous Reports

Previous Report Ref	
TS3 Grangetown Prairie – Phase 1 Geoenvironmental Desk Study, CH2M Hill, August 2017.	**Scope of works** This report comprised a data review for the Grangetown Prairie site. The study area extends to approximately 51ha. **Findings** The review findings concluded that the site was formerly part of the Cleveland Iron and Steelworks. The original Cleveland Works was formerly located east of the site but relocated onto the study site prior to 1929. The works comprised the Torpedo Ladle Repair Shop, Bessener Furnace and Mill Buildings along with numerous ancillary works buildings. There was large scale demolition of the works in the 1980s onwards. The site condition at the time of the report comprised hardstanding, grass and scrub vegetation. ***Ground conditions*** ***Soil*** CH2M Hill reviewed the Enviros site investigation carried out in 2004. Site investigation works carried out within the site comprised 3 exploratory holes (2 trial pits, 1 borehole). Investigations revealed Made Ground comprising sand, gravel, cobbles and boulders of slag, clinker, brick concrete and ash, along with relic foundations. Made ground was proven to depths of up to 4m in the north of the site, and in the south of the site, Made Ground exceeded 4.2m in thickness. Made Ground depths on adjacent land indicated Made Ground thicknesses up to 10m. The site was underlain by the Glaciolacustrine deposits comprising clay and silt. Published mapping indicated that Tidal Flat deposits were present adjacent to the north of the site. Enviros investigation (2004) had a limited soils analysis dataset for the Grangetown Prairie site as only 3 exploratory holes were advanced in this area. Exceedances of GAC were encountered as follows: • pH values ranged from 8.6 to 11.1, exceeding the GAC of 10 • Sulphide values ranged from 1712mg/kg to 3450 (GAC 1000mg/kg) • Lead (GAC 750mg/kg)

Previous Report Ref	
	• Zinc (720mg/kg) Enviros investigations (2008) analysed 32 soil samples for heavy metals. One sample exceeded the GAC for lead (SGV of 750mg/kg for commercial use), and the 95% percentile concentration was significantly less than the GAC. Shadbolt Environmental investigations (2011) analysed 35 soil samples, with results compared to GAC for commercial end use at that time. Results indicated that: • pH values exceeded the GAC (pH 9), a maximum value of pH12.4 was recorded. • 2 samples exceeded the GAC of 14mg/kg for benzo(a)pyrene, a maximum value of 42.4mg/kg was recorded. • Lead concentrations were less than GAC of 750mg/kg, a maximum value recorded of 622mg/kg. ***Controlled waters*** Groundwater testing by Enviros (2004) encountered elevated sulphate concentrations. Shadbolt Environmental investigations (2011) analysed groundwater samples, with results reported as 'less than acceptable levels for commercial/ industrial use'. ***Gas*** No results of previous gas monitoring were reported in the CH2M Hill report. **Conceptual Site Model** The report presented a conceptual model, which identified the following potential contamination sources at the site: • Made Ground • Railway Lines • Electrical Substations • Mill Buildings and Plant Equipment • Fuel Tanks • Chimneys • Coke Ovens & Coke Oven Gas Main • Iron & Steel Works **Risk Assessment** Potential pollutant linkages were identified at the site. Risks to selected receptors were assessed as up to moderate or high for all the sources identified.
Summary of Geoenvironmental Information, Cleveland Prairie, Teesside, July 2014.	**Scope of works** The note was a summary of geoenvironmental information held by Tata Steel for the Cleveland Prairie site. The summary included the Torpedo ladle repair shop in the south. The site had been in use for storage of steel stock. **Findings** The potential for land contamination was assessed in April 2005 and documented in the design Site Protection and Monitoring programme (SPMP) submitted to the EA in pursuance of PPC Permit conditions. ***Ground conditions*** The note reported that diesel, lubrication oil, hydraulic oil and greases were identified to be used on site at the boiler yard, stores and steel services areas. The assessment concluded that for the majority of the activities at the installation, there is little likelihood that land pollution or leaks to land would occur during the future life if the installation. The note indicated that Cleveland Prairie site formerly comprised: • Cleveland Steelworks in the east; • Cleveland Coke ovens in the central area; • Cleveland Iron Works in the north; • Clay Lane Iron Works in the west; and • Extensive Rail, Siding area in the west of the site. Cleveland Steelworks was operational site the 1950s, but was closed and decommissioned in the 1980s, with the exception of the South Steel Plant, Medium Section Mill and Drilling Plant

Previous Report Ref

Buildings. Cleveland Coke Ovens were demolished in the 1970s, and sub-surface cellars filled with demolition rubble.
The note commented that ground investigation was carried out by Enviros (2008) and MD (2011).

Soil

The site geology was summarised as follows:

- Made Ground, typical thickness up to approximately 2m, greater in cellars, of slag, brick, concrete, sand;
- Upper Boulder Clay, thickness range 0.3m to 2.6m, comprising grey sandy silty clay;
- Laminated Clay, thickness 1.7-4.5m, clay with varves of yellow brown silty sand;
- Lower Boulder Clay, thickness range 2.4m to 5.8m, red-brown clay with gravel.
- Bedrock – Lower Lias Shale encountered 0.6mAOD to -0.2m AOD, and Mercia Mudstone in the west encountered at between 0.8m AOD and -11.8m AOD.

The note indicated that potential contamination sources include:

- Ammoniacal liquor by product of coke oven cleaning;
- Coke and coke dust;
- Diesel. Oil and greases;
- Heavy metals;
- Hydrocarbons, coal tar, naphthalene, benzole;
- Railway ballast containing metals and PAHs,
- Refractory wastes (considered inert)
- Steel slag, alkaline pH, metals.

Enviros Investigations targeted the Cleveland coke ovens, comprising ten trial pits and analysis of five soil samples. Visual and olfactory evidence of hydrocarbons was encountered, in trial pits, and analysis results detected elevated TPH concentrations. The investigation commented that the contamination was consistent with the former use and was likely to be localised.

In 2008, Enviros investigations encountered elevated PAHs and Extractable hydrocarbons in Made Ground (0.4-0.5m depth). Asbestos was identified in a sample recovered from 2m depth.

Intrusive investigations by Shadbolt Environmental (2011) were carried out on behalf of MD. MD concluded that materials on site could be processed by crushing and screening to provide suitable backfill for a commercial/ industrial land use. This would be subject to investigation and management of localised contamination 'hotspots'.

Controlled Waters

The site is located 750m south east of the Tees dock, and 1.8km south of the River Tees.
Surface water drainage from buildings discharged to the storm water system to Knitting Wife Beck Culvert or Holme Beck Culvert and on to the Solid and Liquid Effluent Management System (SLEMS). There were no groundwater abstractions within 1km of the site and no designated SPZs in the area.
The Glaciolacustrine deposits are classified as (Unproductive strata), and the underlying bedrock is classified as Secondary B aquifer. The Sherwood Sandstone lies at depth (approximately 400-500m AOD). This is abstracted for industrial use approximately 3km to the south west and abstracted 7km to the north east for potable water supply.
Previous ground investigations indicate shallow perched groundwater at 1.5m to 2.5m depth.

Gas

No specific review of ground gas information was included in the note.

Site Sensitivity

The review note concluded that the sensitivities of the site were as follows:

- Groundwater – Low Sensitivity, no groundwater abstractions, thick low permeability drift deposits
- Surface Water – Low Sensitivity, Discharges of surface water to the SLEMS, perched waters in clay deposits of limited connectivity with groundwater in superficial deposits to north which provide baseflow to the Tees.
- Ecology – Low Sensitivity, no designated ecology site within 1km
- Site Users - Low Sensitivity, health & safety procedures followed by contractors and visitors. Construction workers activities managed via appropriate risk assessment.

Previous Report Ref	
Prairie Site, Ground Investigation Factual Report, Shadbolt Environmental, July 2011	**Scope of works** The report comprised the factual reporting of ground investigations at the Prairie site in 2011. The scope of ground investigation comprised: • 13 cable percussion boreholes to up to 10.2m depth; • 15 window sample boreholes; • 23 machine-excavated trial pits. **Findings** ***Ground conditions*** Ground conditions comprised Made Ground of slag (sandy gravel with cobbles, boulders and fused slag) overlying superficial glaciolacustrine deposits of cohesive materials, locally granular soils ***Soil*** A total of 35 soil samples were analysed for a suite of potential contaminants including metals, pH sulphate, sulphur, cyanide, phenols, PAHs and TPH. No interpretation of the data was undertaken by Shadbolt. (CH2M compared the results to GACs, as summarised above.) ***Controlled Waters*** Groundwater was encountered locally as perched water upon clay deposits in the base of the holes, and many of the exploratory holes were dry whilst open. Only 3 samples of groundwater were tested for potential contaminants including heavy metals, pH, sulphate, sulphur, cyanide, phenols, PAHs and TPH. (CH2M compared the results to GACs, as summarised above.) Two samples were from trial pits, and results may not be representative of groundwater conditions. ***Gas*** No gas monitoring data was reported.
Former Corus Cleveland prairie Site, Land off Clay Lane – Ground Investigation Report, MD2, July 2011.	**Scope of Works** MD provided interpretation of the previous Phase 2 site investigations carried out at the Prairie site, and additional ground investigation to determine the presence of potential contamination and potential environmental liabilities. The report interprets the data reported in the Shadbolt Environmental Factual Report (2011). **Findings** The findings concurred with other assessment regarding the site history, confirming the historical development of the site to the Cleveland Iron and Steel works by the 1930s. The main structures were demolished in the 1980s, and the site has been largely derelict since this time. ***Ground conditions*** For assessment purposes, the site was considered as the West Side and the East Side. ***West Side*** Made Ground was of variable thickness, typically 1.2-2.0m, up to 4.2m locally. Superficial deposits underlying Made Ground comprised glacial laminated clay (0.8-0.9m bgl), overlying Redcar Mudstone (5.9m – 9.5m bgl). Perched groundwater was encountered at depths of 0.5-2.5m bgl. There was no evidence of heavy metal concentrations above GACs for commercial/ industrial use. Visual/ olfactory evidence of hydrocarbon contamination was encountered previously at the Coke Works area. Visual evidence of hydrocarbons was present in perched groundwater in the Coke Works, by-products plant, blast furnace and Power Station. Elevated sulphate concentrations related to the presence of slag. Ground gas concentrations generally 'low', with hydrocarbon vapours encountered at the Coke Ovens. ***East Side*** This area is underlain by variable thickness of Made Ground. In the east of the area, superficial alluvium deposits, and in the west is Glacial laminated clay. Bedrock is Mercia Mudstone. Knitting Wife Beck is a culverted watercourse below the site. Potential contamination sources include former railway land, steel works, electrical substations, power station, gas works and tar works. A previous investigation (Contamination Consultants, 2007) comprised 8 boreholes and 13 trial pits in a limited area. Made Ground was encountered up to 2.8m deep underlain by laminated clay. The report identified hydrocarbon contamination and evidence of asbestos. Limited waters analysis was undertaken, which identified potassium locally. **Ground Investigations**

Previous Report Ref	
	Ground investigations were carried out by Shadbolt Environmental. The ground investigations encountered Made Ground to depths of between 0.8m and 3.1m bgl, comprising dark gravel and cobbles of slag with fused slag. Underlying superficial deposits of Alluvial clay was encountered in the east between 1.2-3.9m bgl. Glacial Till was encountered to depths of between 1-10m bgl, comprising laminated clay and sands and gravels. Mercia Mudstone bedrock comprised weathered mudstone gravel at 5.6-8.0m bgl. Perched groundwater was encountered at the base of the Made Ground at depths of 2.3-3.0m bgl. No evidence of ground gas was noted. Chemical analysis results of soils were compared with GACs for commercial/ industrial end use. A total of 38 samples were analysed for a suite of contaminants including pH, metals, cyanides, phenols, sulphates, sulphur, PAHs and TPH. The contaminants were generally below the GAC assessment criteria used, with the exception of pH values (indicating alkaline conditions) and benzo(a)pyrene locally in 2 samples. Groundwater results for the 3 samples tested were reported to be 'within acceptable levels for a proposed commercial/industrial end use'. The screening criteria used were the freshwater Environmental Quality Standards (EQS), and standards given in the UK Water Supply Regulations, along with other superseded assessment criteria. **Risk Assessment** The risk assessment based on the data acquired identified low or low-moderate risks to future site users for a commercial/ industrial land use. The risks to controlled waters (groundwater and surface waters) were assessed as low. Risks to ecological receptors were assessed as low. The risk to future development from off-site landfills was assessed as low. Outline Remediation Methodology The report presented an outline remediation methodology which included excavation, and processing (screening, crushing) of site-won materials, along with localised contamination excavation and removal.
Corus Cleveland Prairie Teesside Site, Phase II Geoenvironmental Assessment for Graphite Resources, Enviros 2007	**Scope of works** The study area comprised only the western part of the current study site boundary at Grangetown Prairie. The Scope of work included a ground investigation comprising 41 trial pits, 10 window sample holes, 8 boreholes, sampling of spoils and waters, chemical testing and gas monitoring. The intrusive investigations targeted those sources identified in the Phase 1 review. **Findings** ***Ground conditions*** The investigation encountered the following: • Concrete, from ground level up to between 0.4 and 4.0m bgl • Made Ground – to between 0.3m and 4.2m bgl, mixed materials including slag; • Alluvium – sandy clay encountered between 0.5m and 2.7m depth • Glacial laminated clay – laminated clay over stiff sandy gravelly clay encountered from 0.8m to 4.3m bgl. • Redcar Mudstone – mudstones and sandstones, depth not proven Visual and olfactory evidence of contamination was encountered, including free product and hydrocarbon odours in the southern and central parts of the site, including at the former Coke Works and by-products plant. Perched groundwater was encountered at depths of 0.5-1.5m bgl. Groundwater flow was interpreted as towards the north/ north west. ***Soil*** Soil analysis results were compared with GACs for commercial/industrial land use. Metals determinands were less than the GAC in all samples, with the exception of a single lead result. The 95th percentile for lead was significantly less than the commercial/industrial GAC. For organic contaminants in soils, the results were all below the GAC for commercial/industrial end use. TPH, PAH species and phenol results were all less than the GACs for commercial/ industrial use calculated using the CLEA methodology by Enviros. PCB results were below detection limits. Asbestos fibres were not detected in the 14 samples analysed. Phytotoxic metals exceeded

Previous Report Ref	
	screening criteria above which there may be harm to vegetation. Sulphate results indicated design sulphate class DS-2, indicating that that protection to buried concrete would be required. ***Controlled waters*** Up to 15 samples of groundwater were analysed for a suite of potential contaminants. The results indicated that for the majority of determinands, the results were less than the GAC values (EQS or UK drinking water standards). Elevated sulphate concentrations in groundwater was attributed to the presence of slag at the site. BTEX compounds exceeded assessment criteria at the former By-products plant. PAHs exceeded the GAC in the area of the Coke Oven and By-products plant. Surface water analysis results indicated that the EQS and DWS GACs were not exceeded, with the exception of PAH results. Leachability testing indicated that for the majority of determinands, the results were less than GAC. Selected determinands including vanadium, zinc, cyanide, toluene, PAHs, hydrocarbons and phenol did however indicate potential mobility. ***Gas*** Gas monitoring of boreholes was carried out, and the results of the monitoring indicated that the majority of the site would be classified as 'Characteristic Situation 1', requiring no special precautions with respect to ground gas. Characteristic Situation 2 was encountered locally due to elevated carbon dioxide concentrations, which indicates that it may be prudent to include gas protection measure to new buildings. **Risk Assessment** The risk assessment identified moderate risks to future site users and controlled waters (perched groundwater), with respect to elevated PAHs and hydrocarbons at the former Coke Works and By-products plant. Moderate risks to buildings with respect to sulphate were also assessed. The risks with respect to phytotoxic metals and ground gases were assessed as low. Recommendations The report recommended that additional investigations, risk assessment and/or remediation be carried out with respect to: • Hydrocarbons at the Coke Oven and By-product plant; • Oily groundwater at the Blast Furnace and Power Station; • Potential degraded water quality at the Holme Beck • Potential contamination of the gasholder in the north west of the site; • Unknown materials in former railway embankments.
Corus Cleveland Prairie Teesside Site, Phase 1 Environmental Review for Graphite Resources, Enviros 2007.	**Scope of works** The scope of works comprised an environmental review to support a planning application and to support land acquisition. **Findings** The report confirmed that the site had been used extensively for iron and steel production, with associated coke ovens and by-products plant. Development had included extensive rail sidings, blast furnaces, mill complex, power station, coke ovens and storage tanks. The site was derelict and most infrastructure removed to ground level. ***Ground conditions*** No specific ground investigation was carried out as part of the Phase 1 assessment. The report reviewed the previous site investigation data including the Enviros (2005) investigation of the former Cleveland Coke Oven. Investigations comprised the excavation of 10 trial pits. The potential contamination sources identified on site were listed as follows: • Historic shafts, north east of site • Infilled Reservoir in north of site • Blast Furnace area in Central area; • Coke Ovens and by-products plant in south west of site; • Iron and Steel buildings in north east of site; • Gas holder in north west and south east; • Power station in north of site; • Railway ballast across the site. ***Soil*** Ground conditions were Made Ground comprising of predominantly loose furnace brick fill, with concrete and reinforced steel, and encountered to depths of almost 2m, but may be greater

Previous Report Ref	
	locally. Concentrations of BTEX compounds in soils were less than the GACs used (SGVs) for commercial/ industrial end use. ***Controlled waters*** Enviros trial pits encountered shallow groundwater between 1m and 2m depth on the western side of the Coke Ovens, which were heavily contaminated by free-phase hydrocarbons. ***Gas*** No specific assessment of gas conditions was reported. **Risk Assessment** The risk assessment identified moderate risks associated with the identified on-site sources of potential contamination. Risks to future site users associated with the off-site landfill sources with respect to ground gases were assessed as Low.
Summary of key finding of all investigations	The Grangetown Prairie site was formerly developed to the Cleveland Iron and Steel works from the 1800s, and included blast furnaces, coke ovens, by-products plant, a power station, steel mills and railway sidings complex. The site has been reclaimed by the deposition of Made Ground across the entire site area, and depths of Made Ground in excess of 4m have been encountered previously. The Made Ground comprised predominantly steelworks slag, with concrete, steel and furnace brick. Superficial deposits underlying the Made Ground comprised Alluvium (sandy clay), and Glaciolacustrine deposits (laminated silt and clay). Perched groundwater has been encountered at the site, at typical depths of approximately <1-3m bgl and has been observed to be perched in Made Ground which overlies superficial clay deposits. Previous investigations have encountered localised contamination at the site. Notably, hydrocarbons, PAHs and BTEX compounds were elevated above screening criteria at the former Coke Oven and the former By-products plant in the western part of the site. Analysis of heavy metals indicates that the results were generally less than screening criteria for a commercial/ industrial use. Results for inorganic determinands exceeded the screening criteria locally, most notably elevated pH (alkaline conditions) present in slag at the site. Analysis of groundwater samples indicates elevated sulphate concentrations, consistent with the widespread presence of slag. Visual and olfactory evidence of contamination has been recorded previously, notably free-phase hydrocarbons at the former Coke Oven and By-products plants. Gas monitoring has indicated that the ground gas conditions are generally Characteristic Situation CS-1 (no gas protection measures required) and CS-2 locally (prudent to include protection to new buildings).

2.8 Data Gaps

Future Phase 2 Contaminated Land investigations

It is anticipated that supplementary ground investigation within the Grangetown Prairie area may be required to support specific proposed developments and land parcels as they are brought forward for development. Asbestos analysis to be included.

2.9 Lackenby Coil Plate Mill

Area Description

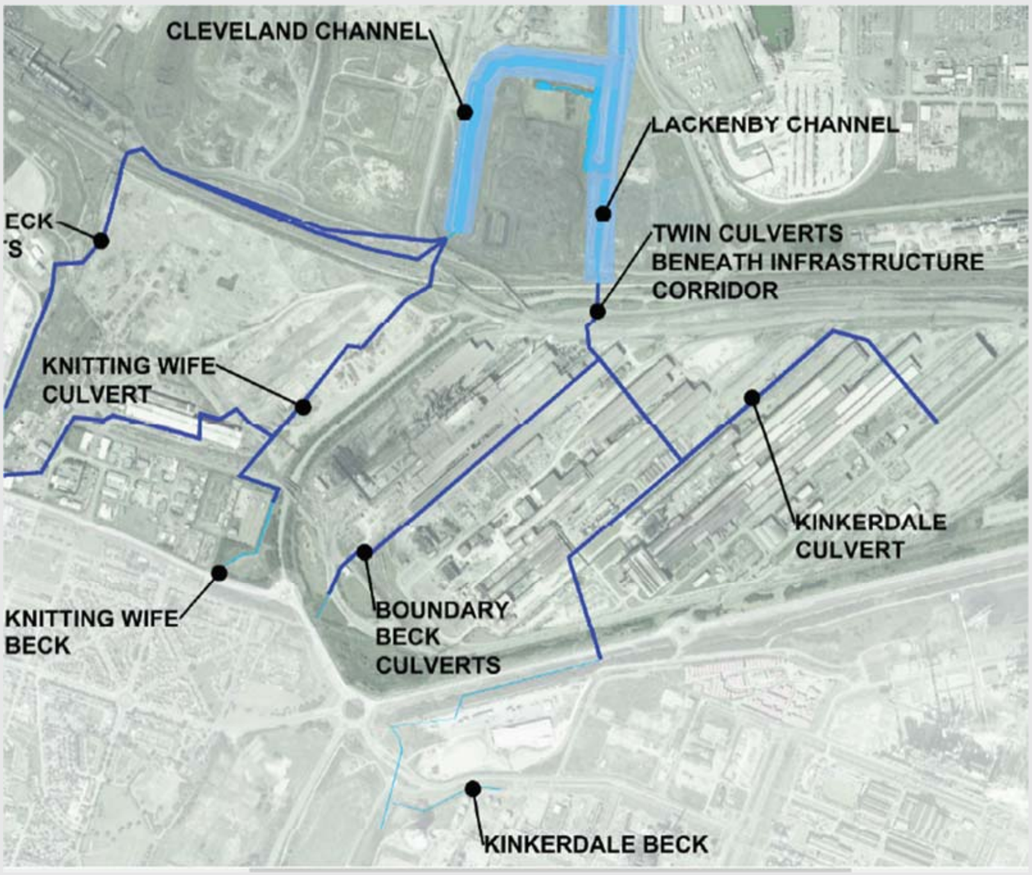
The Lackenby Coil Plate Mill (the area) is the south eastern most parcel on the Site Location Plan, comprising of approximately 25 ha. The area is part of a wider area occupied by the former SSI BOS and CONCAST steelmaking facilities and Tata Steel's vacant coil plate mill. The south western part of the site is bound by Tees Dock Road and the A1053. More generally, to the south east of the site is the Wilton International site.

To the south west of the site is the residential area of Grangetown, however, this is separated by the A1053 and a distance of over 100m at its closest point, although the majority of the residential area is well over 200m from the edge of the Lackenby area.

Environmental Context

Geology & Hydrogeology	Information taken from British Geological Survey's (BGS) mapping website (http://mapapps.bgs.ac.uk/geologyofbritain/home.html), previous site reports, the Groundsure report (included in appendix C). Geological mapping indicated the following stratigraphic sequence • Artificial / Made Ground in the north • Alluvium (isolated pockets potentially impinging on site) • Glacio-lacustrine deposits • Glacial Till (inferred) • Redcar Mudstone • Penarth Mudstone at northern end of site. A number of borehole records are available on the BGS GeoIndex web portal, which have been reviewed for the purpose of this assessment, these are as follows: • NZ52SE26/A-C, E-J, L-M, O-P, R-S • NZ52SE2/A. The findings of these boreholes generally concur with the published mapping and are summarised below:

Strata	**Description**	**Typical Thickness (m)**	**Typical Depth to Base (m bgl)**	**Groundwater**	**Aquifer Status**	**Comments**
Topsoil	Soft to firm, locally firm to stiff locally friable brown or grey silty CLAY	0.2 – 0.3	0.2 – 0.3	9.55 – 7.00	Not Classified	Only present in the southern half of the site
Made Ground	Topsoil onto mixed clay with occasional ash	1.4 – 3.15	1.4 – 3.15	8.75 – 6.10	Not Classified	Only present in the northern half of the site. Groundwater 1.30m bgl (8.15m AOD) in Borehole 26/R
Glaciolacustrine Deposits	Predominantly firm to stiff brown silty CLAY with varies or partings of sand. Upper layer of firm to stiff brown mottled grey silty locally gravelly CLAY noted in many boreholes	1.05 – 4.80	1.25 – 5.10	7.00 – 4.00	Unproductive Strata	Logged as Upper Boulder Clay in some boreholes. Thin layer of silty SAND with clay bands in Borehole 26/O.
Glacial Till	Stiff, locally firm, locally hard reddish brown silty sandy gravelly CLAY	0.5 – 5.8	2.55 – 9.65	6.70 to -1.60	Unproductive Strata	
Weathered Redcar Mudstone	Stiff to hard grey CLAY with shale / weak dark grey weathered SHALE	0.45 – 1.5	4.6 – 11.35	4.60 to 2.35	Secondary Undifferentiated	Base not proven in Borehole 26/C
Redcar Mudstone	Weak to moderately strong dark grey SHALE with occasional layers of siltstone	Not Proved	Not Proved	Not Proved	Secondary Undifferentiated	

Strata	Description	Typical Thickness (m)	Typical Depth to Base (m bgl)	Groundwater	Aquifer Status	Comments
Hydrogeological sensitivity[6]	The superficial deposits are classified as an undifferentiated secondary aquifer. There are no abstraction or source protection zones (SPZ) within 1km of the area.					
Groundwater Sensitivity	The superficial deposits in the vicinity of the area are classified as an undifferentiated Secondary Aquifer. There are no licensed abstractions within 1km of the site and Groundwater Sensitivity is assessed as being Low.					
Hydrology	 There are several culverts within the wider site entering from the south flowing into the River Tees. The River Tees is classified by the EA as a Main River. The Tees is part of the Teesmouth and Cleveland Coast SSSI.					
Hydrological sensitivity	To the north of the site the principal surface water feature is the Lackenby Channel, which in turn discharges into the River Tees. Kinkerdale Culvert, which originates to the east of the area branches off and flows under the northern end of the plate mill before merging with Boundary Beck, prior to discharging into the Lackenby Channel to the north. Overall surface water sensitivity is assessed as being Moderate/high.					
Ecology	To the north of the area is the Teesmouth and Cleveland Coast SSSI, the Teesmouth and Cleveland Coast SPA and Ramsar site.					
Ecological sensitivity	The area is within a wider area that is still operational, and the ecological sensitivity is assessed as being low/Moderate. An Ecological Assessment has been undertaken by the Industry Nature Conservation Association (INCA) in respect of Remediation Strategy area. Except for nesting birds, no protected species were observed in the surveys carried out as part of the assessment.					

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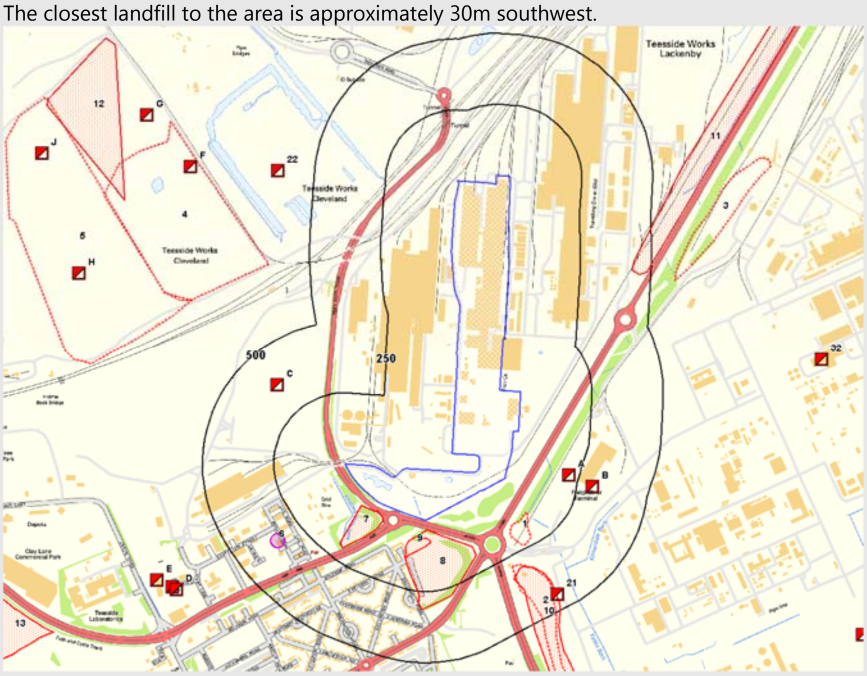
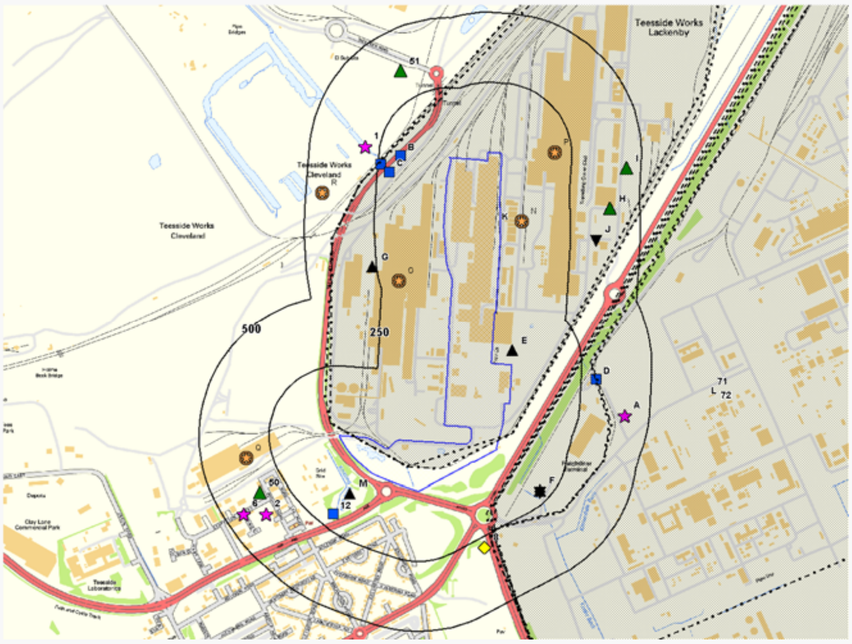
[6] Private water supplies are not included in the database and as such are not considered within the risk assessment, however, there remains the potential for risks to private water supplies however this is considered unlikely in the context of the site and its locality.

Other Regulatory Database Information

Only regulatory data within 250m with the potential to impact the area has been detailed below, please refer to Appendix C for the complete regulatory data set.

Activity	On-Site	0-250m	Details
Potentially Contaminative Land Uses	9	95	Nine potentially contaminative land uses recorded within the area including railway sidings, iron works, electricity substations, unspecified tanks and unspecified ground workings.
Waste management/ transfer/ treatment facilities/disposal	0	1	The closest waste transfer site is 215m east of the area and has been transferred once.
Landfill	0	4	The closest landfill to the area is approximately 30m southwest. 
Sites handling hazardous or explosive substances (inc COMAH or NIHHS) planning hazardous consents	2	7	One current COMAH Upper Tier Operator, South Tees Site Company Limited, that has taken over from the previous COMAH Upper Tier operator, SSI UK Limited. Closest NIHHS is a historical site located 85m southeast of the area.

Activity	On-Site	0-250m	Details
			
Mineral Extraction and Coal Mining Activities	0	1	No coal mining within 75m of the area. One instance of Salt – Brine localised small scale mining may have occurred 30m west of the area.
IPC	0	16	One IPC Authorised site 50m from the area that appears to have been transferred three times historically and is now IPPC[7,8]. One IPC Authorised site 215m from area boundary that appears to have been transferred twelve times historically and is now IPPC.
IPPC	0	10	Nearest IPPC permit is 110m southwest and relates to a new medium combustion plant.
Red Discharge Consents	0	0	No consents within 500m of the area.
Petrol and Fuel Sites	0	0	No sites within 500m of the area.
Tank Database	9	141	Tanks within the area listed as 'Unspecified'.

Area history

A summary of the historical development of the area, based on historical OS maps, is presented below. The historical maps can be found within the Groundsure Environinsight report in Appendix C. Where relevant, interpretation of the maps is supported by knowledge from the discussions with the client and other stakeholders and previous reports for the area.

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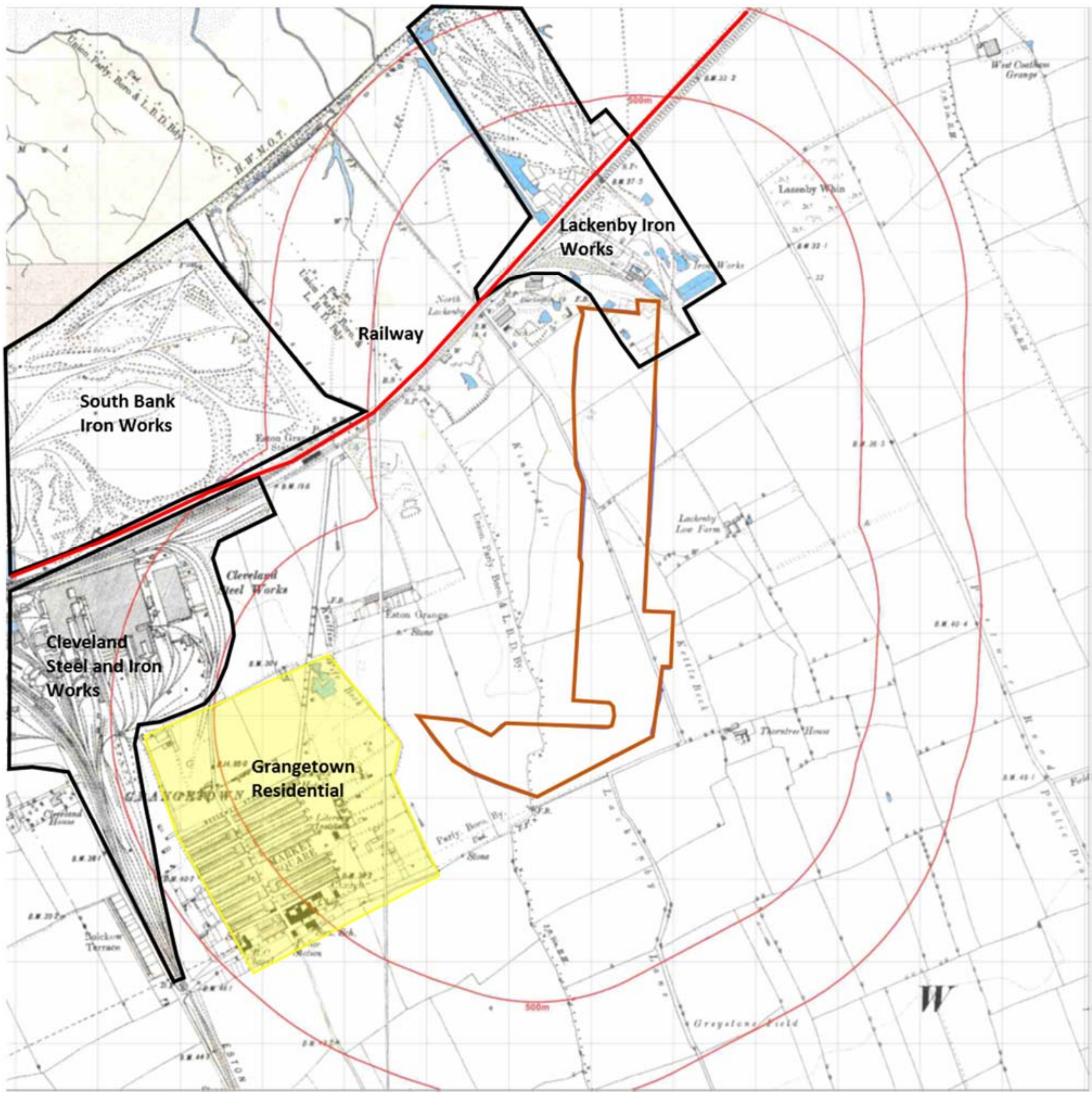
[7] British Steel Teesside Beam Mill – Permit FP3436AT

[8] Teesside Integrated Iron and Steelworks – Permit BK0493

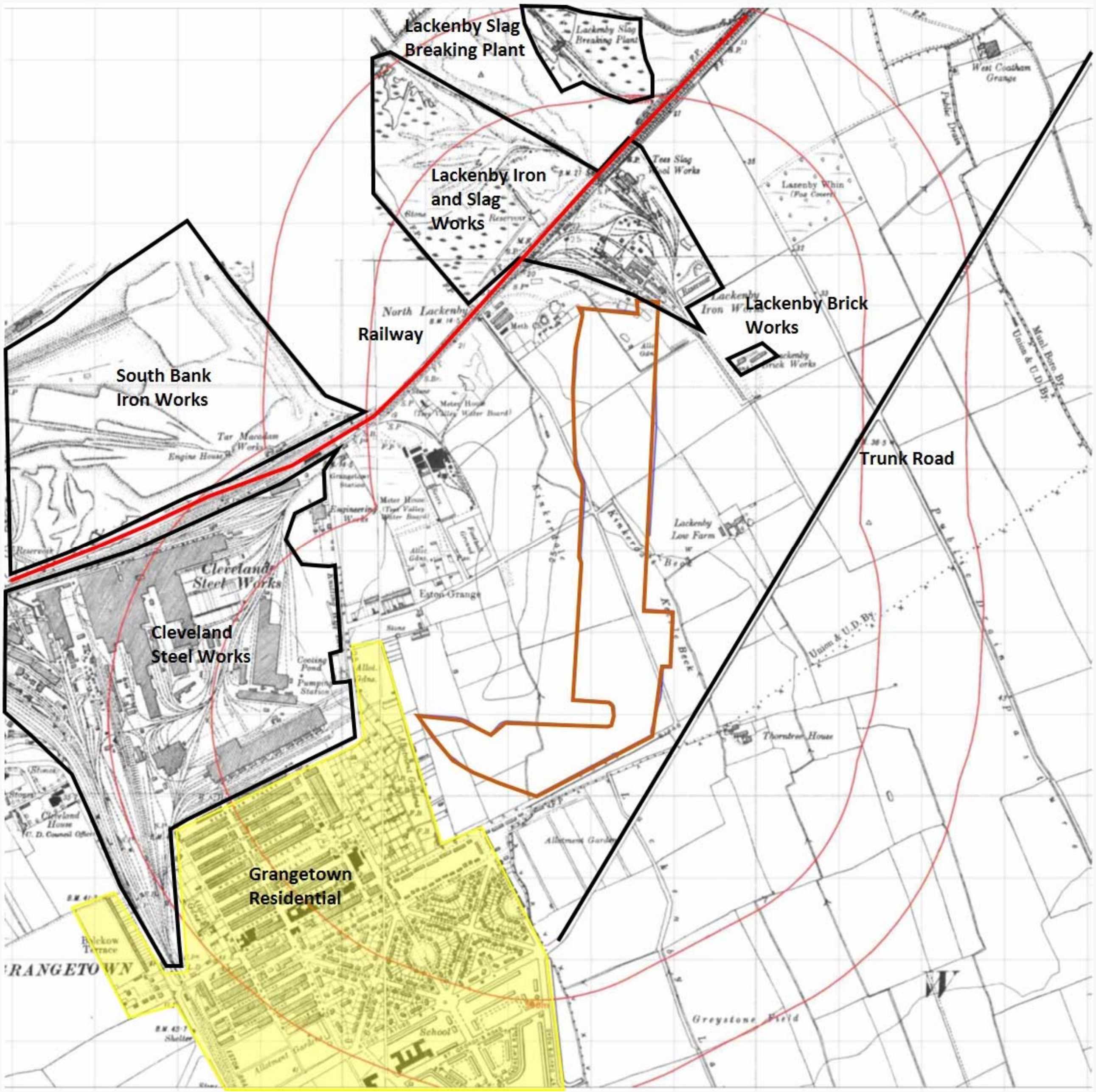
1857 - 1893



On-Site: Earliest historic maps dating to 1857 demonstrate that the area is principally constituted of undeveloped farmland. By 1893 the north of the area occupies land associated with the early phases of Lackenby Iron Works development incorporating two surface water bodies likely associated with the iron production process in addition to a number of tracks and outbuildings. Lackenby Iron Works extends further to the north of the site towards the banks of the Tees.

Off-Site: The South Tees Railway Line runs immediately to the north of the area on an approximate east-west axis. Much of the land to the east of the area is undeveloped, principally constituted of agricultural farmland. By 1893 land to the west of the area underwent significant industrialisation characterised by the emergence of Cleveland Steel Works. Significant development of Grangetown residential housing to the south-west of the area.

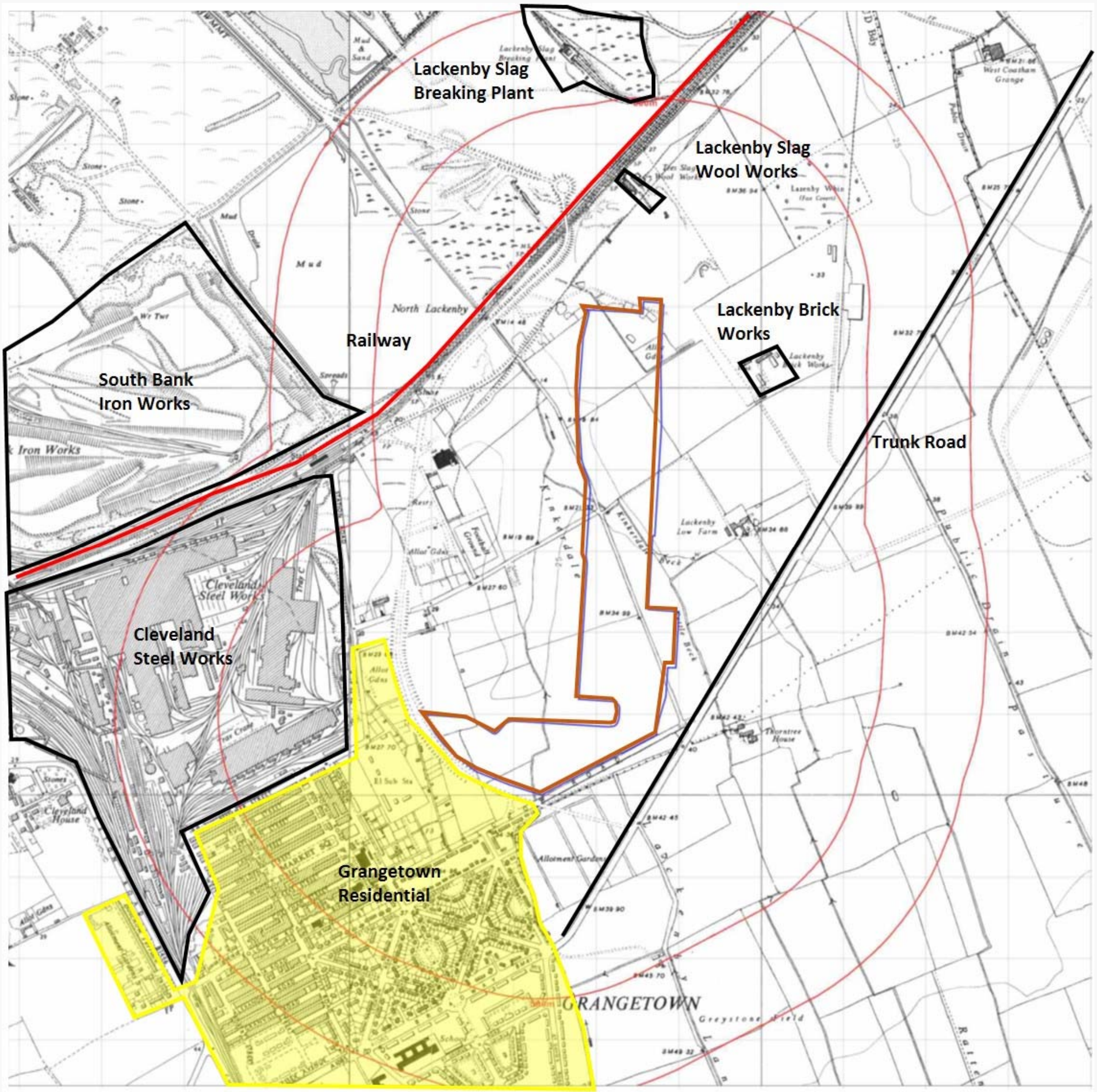
1913 - 1938



On-Site: Similarly to previous mapping much of the area remains undeveloped.

Off-Site: Lackenby Iron Works to the north of the area has undergone further development characterised by the addition of several unspecified structures and supporting infrastructure such as tracks and conveyors. By 1938 To the north-east of the iron works, Tees Slag Wool Works has been constructed in addition to Lackenby Slag Breaking Plant north of the area. Land to the east remains largely undeveloped with the exception of a Lackenby Brickworks. Significant development of residential dwellings and leisure facilities within Grangetown and surrounding areas. Further expansion of Cleveland Steel and Iron Works and supporting infrastructure can be observed during this period. Additional highway infrastructure constructed by 1938 running an an approximate north-east, south-west axis.

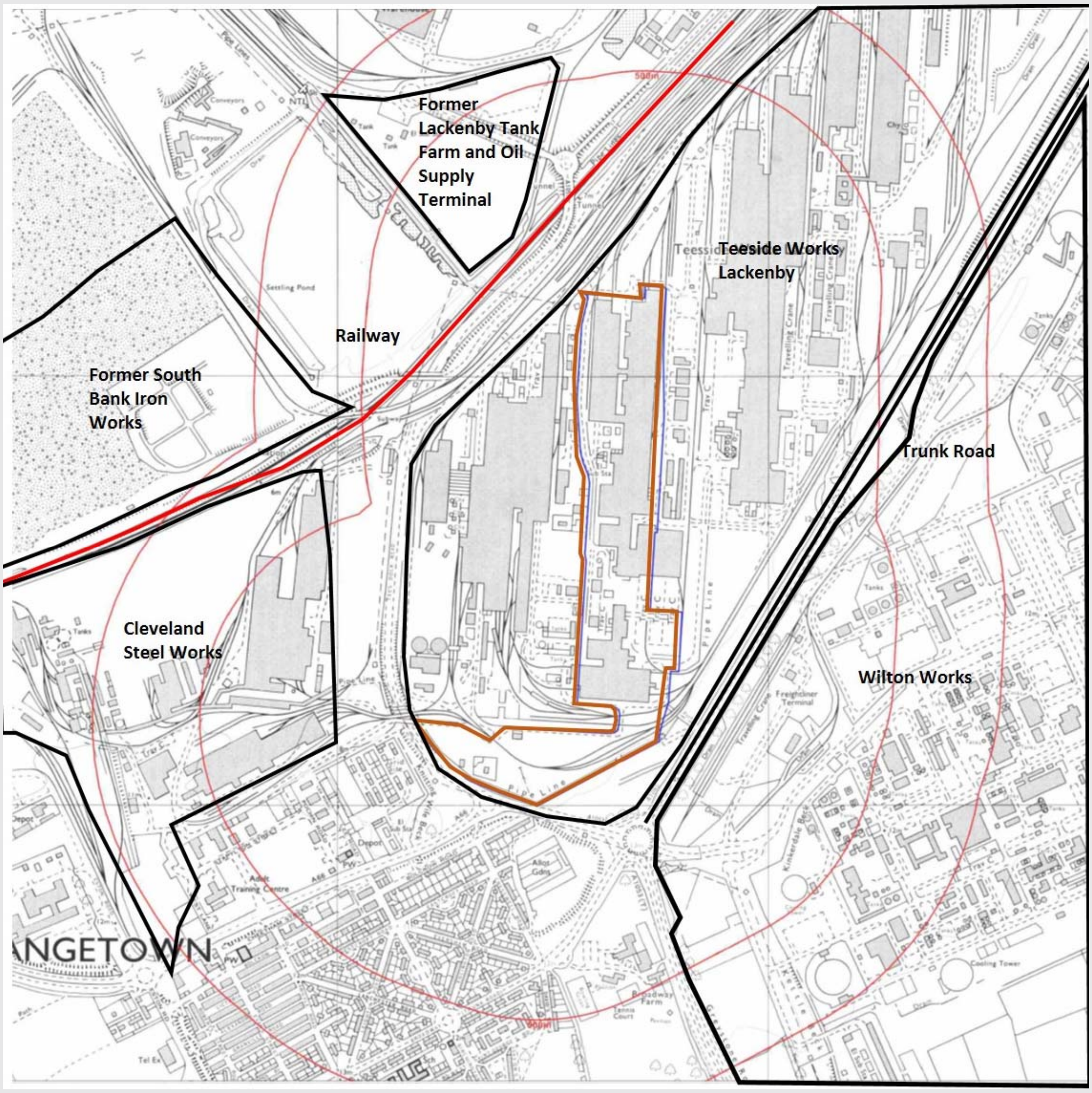
1955



On-Site: Lackenby Iron Works and supporting infrastructure decommissioned and demolished by 1955.

Off-Site: Between 1938 and 1955 Cleveland Steel and Iron Works underwent further expansion reaching its maximum mapped extent by 1955. Lackenby Iron Works and supporting infrastructure decommissioned and demolished by 1955. Land to the east of the area is still largely constituted of greenfield agricultural space. Some minor developments associated with Grangetown residential areas. The South Tees Railway Line continues to run immediately to the north of the site on an approximate east-west axis.

1974 - 1992

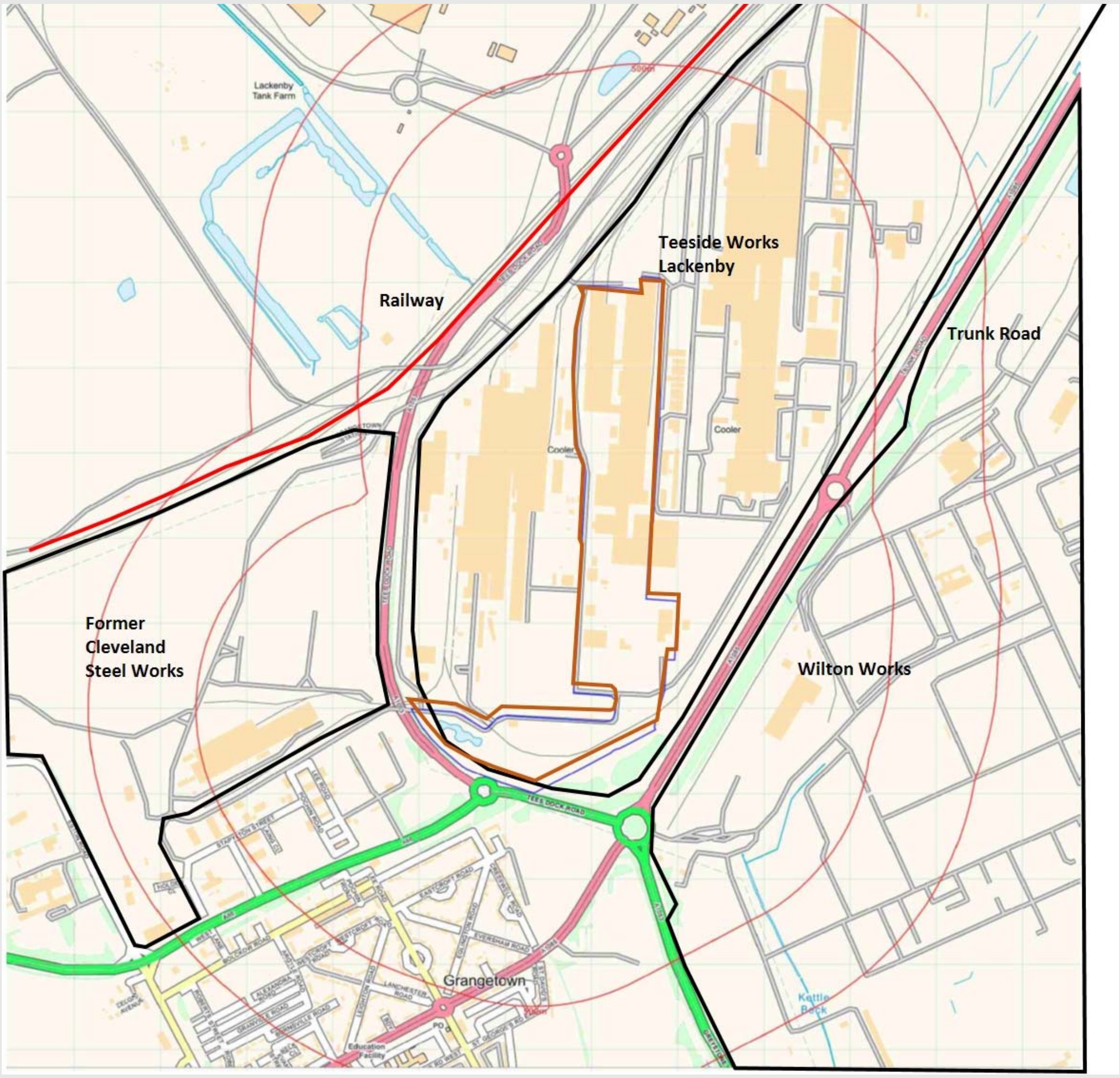


On-site: By 1992 the area and adjacent land to the east has undergone significant industrialisation characterised by the development of Teeside Works Lackenby Plant. Much of the site area is constitued of undefined production and storage facilities with supporting infrastructure inclusive of travelling cranes, pipelines, tanks and a substation situated near the center of the site. The southern extent of the area is largely unoccupied with the exception of a pipeline running on an east-west axis in addition to a number of small undefined buildings.

Off-site: Much of the land occupied by Cleveland Steel and Iron Works to the west of the area has been demolished and subsequently repurposed/redeveloped by 1992. Between 1955 and 1974, land formerly occupied by Lackenby Iron Works to the north of the area was redeveloped into Lackenby Tank Farm and Oil Supply Terminal only to be decommissioned and demolished by 1992.

Teeside Works Lackenby occupies land the north-east, east and west of the area. Much of the land surrounding the area is then constituted of undefined production and storage facilities with supporting infrastructure inclusive of travelling cranes, pipelines, tanks, chimneys, cooling towers and substations. Significant development of highways infrastructure around Teeside Works and Wilton Works by 1992. Construction and development of Wilton Works by 1992, a multi-occupancy site principally involved in the Petro-chemical refinery and energy production. Wilton Works site contains a considerable number of undefined tanks, cooling towers, conveyors and pipelines in addition to production and storage facilites.

2002 – Present day



On-site: A number of the buildings and supporting infrastructure in the southern region of the area have been demolished.

Off-site: Between 1992 and present day, structures and tanks to the west of the area have been demolished. Further demolition of structures associated with the former Cleveland Steel and Iron Works. Large areas of the Wilton Works and supporting infrastructure to the east, south east have been demolished by 2014.

Summary of site history and pertinent features

Earliest historic maps dating to 1857 show that the area and adjacent land is principally constituted of undeveloped farmland. By 1893 the northern area occupies land associated with the early phases of Lackenby Iron Works which was decommissioned by 1955, land to the west of the area underwent significant industrialisation characterised by the emergence of Cleveland Steel Works and South Bank Iron Works. By 1955 existing industrial sites continue to develop characterised by the construction of additional production, storage facilities as well as supporting infrastructure. A number of slag processing, breaking and repurposing works opened by 1938.

By 1992 the area and adjacent land to the east, formerly farmland, underwent significant industrialisation characterised by the development of Teesside Works Lackenby Plant. Much of the area is constituted of undefined production and storage facilities with supporting infrastructure. Wilton Works a multi-occupancy site principally involved in the Petro-chemical refinery and energy production was developed to the east of Teesside Works Lackenby. Between 1955 and 1974, land formerly occupied by Lackenby Iron Works to the north of the area was redeveloped into Lackenby Tank Farm and Oil Supply Terminal only to be decommissioned and demolished by 1992. Much of the infrastructure associated with Cleveland and South Bank Works has been demolished or repurposed by 1992.

Present day maps show that a number of the buildings and supporting infrastructure in the southern region of the area have been demolished. Further demolition of structures associated with the former Cleveland Steel and Iron Works. Large areas of the Wilton Works to the east, south-east have been demolished by 2014.

Notable historic and contemporary features **within the area** which may have implications for land contamination include but are not limited to;

- Site area and adjacent land is predominantly constituted of farmland until 1897.
- Buildings and ponds associated with Lackenby Iron Works (North).
- Teesside Works and associated infrastructure inclusive of undefined production and storage facilities with supporting infrastructure inclusive of travelling cranes, pipelines, tanks and a substation.

Notable historic and contemporary features **adjacent to the area** which may have implications for land contamination include but are not limited to;

- Supporting infrastructure associated with slag processing, breaking and repurposing works (North).
- Supporting infrastructure associated with Lackenby Iron Works inclusive of production and storage facilities, material stock piles, chimneys, conveyors and tracks (North).
- Cleveland Steel and South Bank Iron Works production and storage facilities and associated infrastructure inclusive of travelling cranes, pipelines, tanks, substations, refuse heaps and material stockpiling facilities (West).
- Lackenby Tank Farm and Oil Supply Terminal and supporting infrastructure inclusive of tanks and distribution pipelines (North).
- Teesside Works Lackenby and supporting infrastructure inclusive of travelling cranes, pipelines, tanks, substations, refuse heaps and material stockpiling facilities (immediately adjacent).
- Wilton Works production and storage facilities and supporting infrastructure in addition to travelling cranes, pipelines, tanks, substations, refuse heaps and material stockpiling facilities (East, south-east).

Summary of Previous Reports

Previous Report Ref

Enviros

Soil and Groundwater, Baseline Characterisation Study, Teesside Works

June 2004

Scope of works

This included an investigation into Area 8 described as the Primary Mill.
5 trial pits and 1 borehole were advanced within or on the boundary of the current area.
11 soil samples were analysed, and one round of groundwater monitoring was completed.

Findings

Ground conditions

Made Ground comprising sandy angular medium to coarse gravel, cobbles and boulders of slag, brick and ash was encountered in all locations, to depths of up to 4.0m bgl. Made Ground was found to be underlain by Boulder Clay comprising stiff, sandy, occasionally silty clay with fine to coarse angular to rounded gravel between depths of 0.8 and 3.0m bgl.

Black oily staining and hydrocarbon odours were observed at two locations (8AT1 and 8AT2) at depths of between 1.1 and 2.0m bgl. No further visual and/or olfactory evidence of possible contamination was observed

Soil

Analysis of soil samples did not show concentration for metals, PAHs and TPH above Commercial GACs

Groundwater

Groundwater was encountered at two locations in Made Ground at depths of 0.56m, and ~1.8m bgl; Groundwater levels across the site generally form a consistent pattern indicating groundwater flow in a north-westerly direction (towards the Tees). The pH was alkaline. TPH and PAHs were below detection, but copper exceed the Coastal Waters EQS (not adjusted to DOC).

Corus

DESIGN OF A SITE PROTECTION AND MONITORING PROGRAMME FOR LACKENBY WORKS, TEESSIDE,

CORUS UK LTD.

That does NOT require reference data to be collected.

Scope of works

This set out the required site protection and monitoring plan Part of Area 6 on the current area included the Export Bay of the disused Coil Processing Mill (CPM), water treatment plants and Primary Mill No.2. The latter was used up until August 2000 for secondary heating and rolling of ingots produced from the BOS Plant. After which operations at the Primary Mill No.2 were reduced to the use of the soaking pits for dehydrogenation. Heckett Mulitserv rand two areas

Previous Report Ref	
	for slag handling under a separate IPPC application. Oils and greases were considered sources from this area.
Summary of key finding of all investigations	Made Ground comprising sandy angular medium to coarse gravel, cobbles and boulders of slag, brick and ash was encountered in all locations, to depths of up to 4.0m bgl. Black oily staining and hydrocarbon odours were observed at two locations. ***Soil*** Analysis of soil samples did not show concentration for metals, PAHs and TPH above Commercial GACs. **Groundwater** Groundwater was encountered at two locations in Made Ground at depths of 0.56m, and ~1.8m bgl. Groundwater levels across the site generally form a consistent pattern indicating groundwater flow in a north-westerly direction (towards the Tees) The pH was alkaline. TPH and PAHs were below detection limits, but copper exceed the Coastal wasters EQS (not adjusted to DOC). The testing on site did not include asbestos analysis. It is noted that on the adjacent to land to the west asbestos has been detected in similar Made Ground. For instance, a recent site investigation[9] at the Torpedo Ladle Repair Shop - TLRS in the southern part of the larger Former SSI Steelworks Facility identified asbestos in 38 of the 169 samples analysed.

Data Gaps

Asbestos

Made Ground within the area has not been subject to asbestos analysis. This should be included within any future ground investigations.

Landfill Gas

Future development proposals located in close proximity to former landfill sites should be supported by further investigation and an associated Gas Risk Assessment and should incorporate any necessary protection measures appropriate to protect buildings from landfill gas migration.

Future Phase 2 Contaminated Land investigations

It is anticipated that supplementary ground investigation within the Lackenby Coil Plate Mill area may be required to support specific proposed developments and land parcels as they are brought forward for development.

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[9] Allied Exploration & Geotechnics Limited The Former SSI Steelworks, Redcar – Ground Investigation Contract – Priority Areas Within SSI Landholdings Contract 3 Final Factual Report, June 2018.

2.10 Coatham Marsh (including Warrenby Landfill)

Site details

The Warrenby landfill area is the north eastern most parcel within the redline boundary shown in Figure 2 as Zone 4: Warrenby Landfill & Coatham Marsh (extract below showing area location). The "area" as it will be known throughout this Section, covers approximately 70 ha and comprises an irregularly shaped plot of land to the north of the main A1085 Middlesbrough to Redcar road. The area is centred at approximate NGR NZ 575,245. The area is comprised of three adjacent land parcels separated by the Darlington to Saltburn railway line or internal site road.

- The eastern part of the area is Warrenby Landfill principally utilised for the disposal of slag bi-products and similar waste from iron and steel making. The site is bound to the west by the former Hot Metal Transfer Railway line and to the south by the Darlington to Saltburn Railway line and it is bisected by Fleet Beck watercourse. Immediately to the north and east of the site is undeveloped scrub grassland.
- The north part of the site is also frequently referred to as the 'Teardrop' site.
- The southern part of the site forms part of the 'Steelhouse and surrounding land', although the Steelhouse (Former British Steel Headquarters) is itself outside the current study site boundary.

The site is generally level ground (excluding the Warrenby landfill site) and lies at a ground elevation of between 5 and 10m AOD. The Warrenby Landfill area is raised above the surrounding ground by up to 15m and has an irregular surface profile reflecting the former use for tipping of wastes.

The site is an area of largely disused derelict land, containing former access roads and tracks. The former Hot metal transfer railway cross the site from south to north. The site is partly vegetated by poorly established grass and scrub vegetation, and there are large areas of bare ground Warrenby Landfill. A surface water course (The Fleet) is also present within the south of the site, bisecting the Warrenby landfill to the north from the extension site to the south. Warrenby Landfill is currently not an active waste disposal site. The extension to the landfill south of the Fleet was prepared for the placement of waste steel works materials but not used.

Environmental context

Geology & Hydrogeology	Information taken from BGS on-line mapping (**http://www.largeimages.bgs.ac.uk/iip/mapsportal.html?id=1001513**) and the BGS on-line geoviewer (http://mapapps.bgs.ac.uk/geologyofbritain/home.html), previous reports and the Groundsure report included in Appendix D. Several borehole records are available on the BGS GeoIndex web portal, which have been reviewed for the purpose of this assessment, these are as follows: - NZ52SE26/A-C, E-J, L-M, O-P, R-S - NZ52SE2/A.

Strata	Description	Typical Thickness (m)	Typical Depth to Base (m bgl)	Groundwater	Aquifer Status	Comments
Made Ground	Mixed fill, typically granular Slag, firebricks, coke, ash and brick	0.60 – 5.55	0.60 – 7.0	1.95m bgl in BGS Borehole 127. 2.85m bgl in BGS Borehole 13551/13	Not Classified	

Superficial Deposits						
Blown Sand	Fine to medium grained sands, silty sand	0.75	3.60	Not Recorded	Secondary A	Present in proximity to coastal margins only to north east
Tidal Flat Deposits	Variable deposits of Silt, peat, clay and sand layers	1.80 – 7.65	5.40 – 10.65	3.15m bgl in BGS borehole 13551/14. 5.70m bgl in BGS borehole BH13551/12B	Secondary A/ Undifferentiated	Present in zone to south east of River Tees
Glacio-lacustrine Deposits	Soft brown clayey SILT/silty CLAY with localised sand traces	>2.25 – 4.50	5.50 – 10.65	4.20m bgl in BGS borehole BH156	Unproductive Strata	
Glacial Till	Stiff brown or red locally silty, gravelly CLAY	>1.35 – 3.75	10.45 > 12.00	Not Recorded	Secondary Undifferentiated	Predominantly present in area of Coatham Marsh and to the south and east
Solid Geology						
Redcar Mudstone	Blue Shale, Grey Mudstone and siltstone, thin beds of limestone	Thickness up to 280m, not proven	Not proved	Not Recorded	Secondary Undifferentiated	
Penarth Group	Grey to black Mudstone, subordinate limestone and sandstones	Thickness 0-12m			Secondary B Aquifer	
Mercia Mudstone	Red Mudstone, subordinate siltstones, locally Halite and thin gypsum beds and sandstones	Thickness up to >1000m, not proven			Secondary B Aquifer	
Sherwood Sandstone	Red Sandstone	Thickness Approximately 250m			Principal Aquifer	

Hydrogeology	Superficial drift deposits of Glacial Till underlying the area are classified as a Secondary (undifferentiated) Aquifer[10]. An area of Secondary A Aquifer is present in the north east extending inland from the coast. This area of Secondary A Aquifer is co-incident with the outcrop of superficial Blown Sands and Tidal Flat deposits. Glaciolacustrine deposits are classified as unproductive strata. The Penarth Group and Mercia Mudstone underlying the superficial deposits are classified as Secondary B Aquifers, and the Redcar Mudstone is a Secondary (undifferentiated) Aquifer. Secondary A aquifers comprise permeable layers that can support local water supplies and may form an important source of base flow to rivers. Secondary B aquifers are mainly lower permeability layers that may store and yield limited amounts of groundwater. Secondary undifferentiated are aquifers where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type/ deposits. Made Ground is typically granular and is therefore also water-bearing, although it does not have a formal aquifer classification. Groundwater in the Made Ground is likely to be in continuity with groundwater in the underlying superficial deposits classified as Secondary aquifers. In addition, there is likely to be hydraulic continuity between groundwater in the Made Ground and shallow superficial deposits and surface waters. Previous ground investigations across the area have encountered the presence of a shallow perched water table within superficial deposits at typical depths of between 1.5m and 2.5m below ground level (bgl). A previous investigation (Enviros, 2004) interpreted groundwater to have a general flow to the east. Given the variable nature of the superficial deposits, it is likely that water bearing horizons within these superficial deposits are not laterally continuous across the study area. There are no licensed groundwater abstractions within 1km of the area There are no SPZs within the site or within 1km of the area. In general, groundwater flow in shallow deposits is anticipated to be towards the River Tees to the north or northwest. However, groundwater flow direction in shallow soils across the area is likely to be variable and influenced by the presence of surface water features. The main River Tees is also tidally influenced, and there is likely to be some tidal variability of groundwater in hydraulic continuity with surface waters. The Sherwood Sandstone Principal Aquifer at depth is of limited hydrogeological concern at the site, as it is overlain by a significant thickness of Mercia Mudstone, which will limit the vertical connectivity with shallow groundwater.
Groundwater Sensitivity	The groundwater sensitivity is low. Although the area is underlain by Secondary aquifers, there are no local groundwater abstractions and the area is not located within a SPZ. Given the widespread former and current heavy industrial use of the site and surrounds, there is likely to be widespread regional degradation of groundwater quality.
Hydrology	The River Tees is located approximately 2km to the north of the area, and is classified by the EA as a Main River. The stretch of the River Tees to the north of the area is tidal. There are other minor surface waters courses present within the area. To the east the Fleet Beck and Mill Race culvert at Coatham Marshes, which discharge into the Dabholm Gut; this in turn discharges to the River Tees. The Kinnerdale Beck, Knitting Wife Beck and other minor watercourses enter the wider study area from the south in the western area. The Cleveland Channel and the Lackenby Channel are also present. Other surface water features include the Tees dock and the Bran Sands lagoon adjacent to the south bank of the River Tees. The south of the Coatham Marsh and area is crossed by The Fleet. Areas adjacent to The Fleet may be affected by flooding. Surface waters including the River Tees are likely to be in hydraulic continuity with shallow groundwater in Made Ground and Superficial deposits and therefore receive groundwater baseflow.
Hydrological sensitivity	The surface water sensitivity is low. There are minor surface waters which cross the area, and discharge to the River Tees. The River Tees is tidally influenced in the stretch downgradient of the area.

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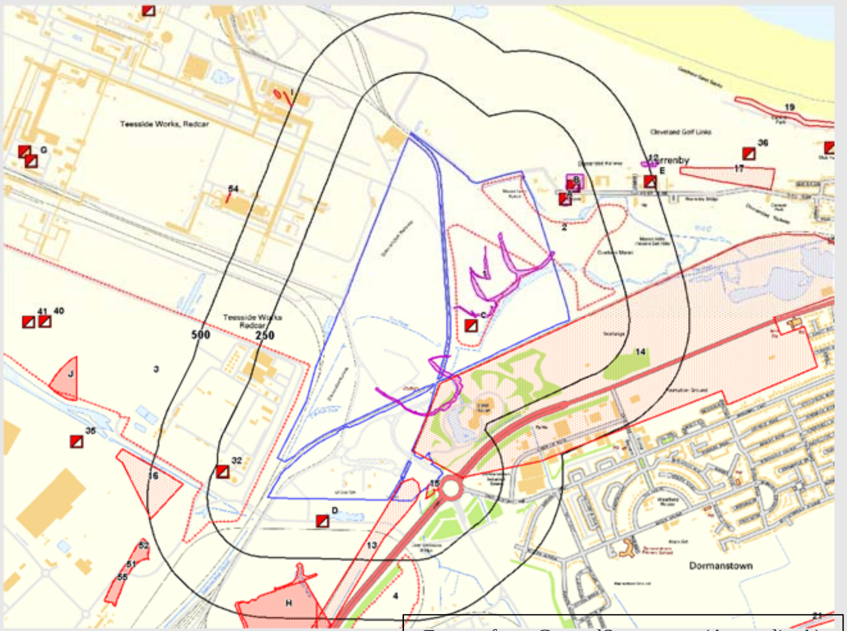
[10] https://magic.defra.gov.uk/MagicMap.aspx

Ecology	The Teesmouth and Cleveland Coast SSSI is located adjacent to the east of Coatham Marshes, and the River Tees to the north forms part of the SSSI. The Teesmouth and Cleveland Coast is also designated as a SPA and a RAMSAR site. An extension to the SPA is proposed which includes areas within the study site at Coatham Marsh.
Ecological sensitivity	The ecological sensitivity is assessed as Moderate as there is a SSSI and SPA less than a 0.2km from the area at Coatham Marshes. The River Tees to the north receives surface water discharge from the area and is designated as a SSSI. However, the influence of discharges from the area are likely to be limited by the tidal exchange and large volume of the River Tees receiving water. The Coatham Marsh Local Wildlife Site also lies to the east of the site.

2.11 Other regulatory database information

Only regulatory data within 250m with the potential to impact the site has been detailed below, please refer to Appendix E for the complete regulatory data set.

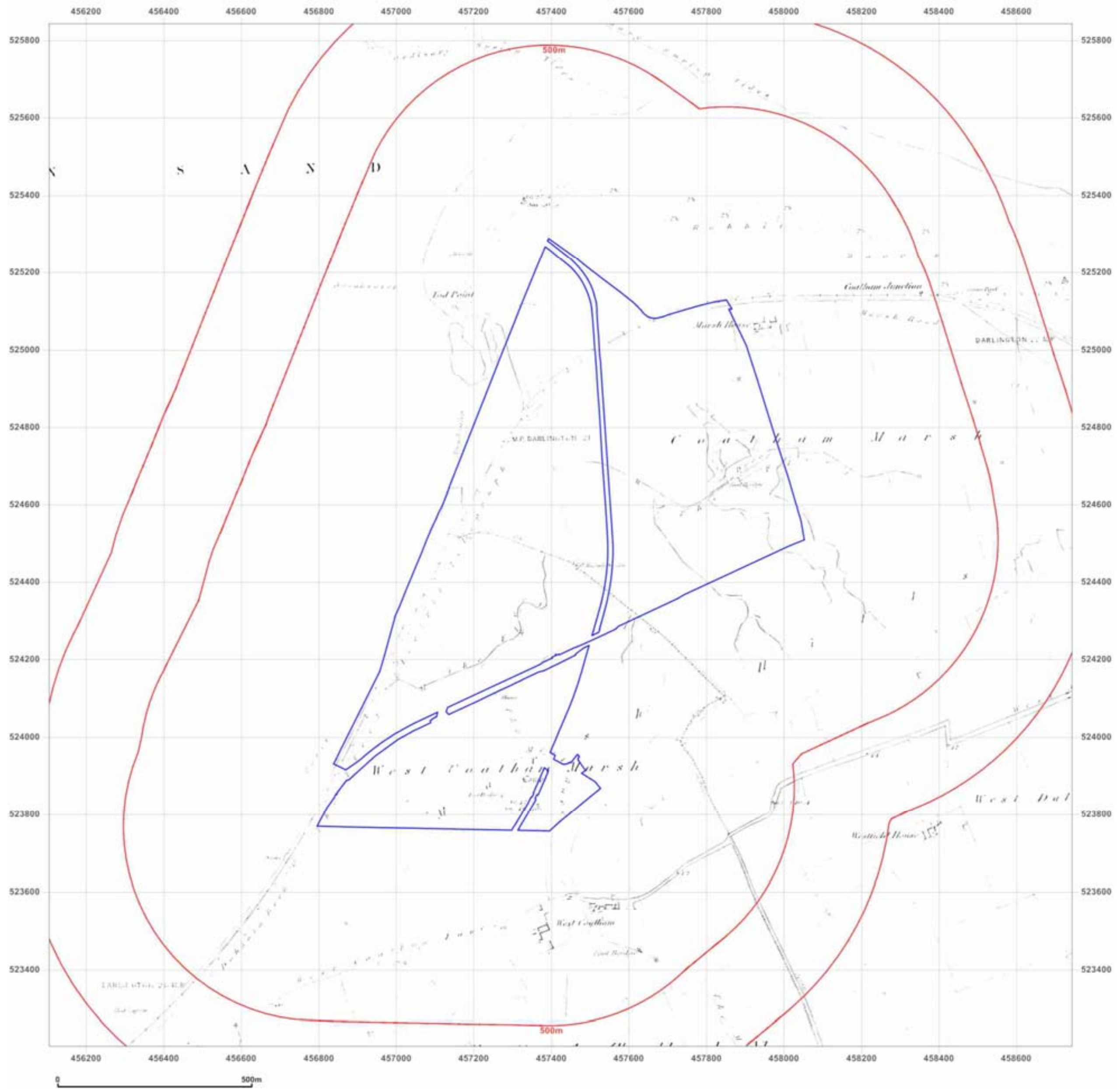
Activity	On-Site	0-250m	Details
Potentially Contaminative Land Uses	96	83	These mainly correspond to unspecified heaps, cuttings and railway infrastructure.
Waste management/ transfer/ treatment facilities/disposal	6	16	There are two sites of Ground Workings and Refuse Heaps located on the area, as well as four waste management sites, two owned by Corus Construction & Industrial and two by Tata Steel UK Limited, accepting Household, Commercial & Industrial Waste Landfill.
Landfill	5	7	The area is designated as a landfill, as summarised below: Operator: TATA Landfill type: A04: Household, Commercial & Industrial Waste Landfill There are two landfills located within 250m: Distance: 30m Operator: York Potash Processing & Ports Limited Landfill Type: A02: Other Landfill Site taking Special Waste Distance: 230m Operator: I C I Chemicals & Polymers Ltd Landfill Type: A07: Industrial Waste Landfill (Factory curtilage)

Activity	On-Site	0-250m	Details
			 Extract from GroundSure report (Appendix A)
Sites handling hazardous or explosive substances (inc COMAH or NIHHS) planning hazardous consents	3	3	Three COMAH & NIHHS sites within the area: Company: British Steel Corporation Ltd Operational Status: Historical NIHHS Site Tier: - Company: Sahaviriya Steel Industries UK Limited Operational Status: Historical COMAH Site Tier: COMAH Upper Tier Operator Company: South Tees Site Company Limited Operational Status: Current COMAH Site Tier: COMAH Upper Tier Operator
Mineral Extraction and Coal Mining Activities	N/A	N/A	No mining coal mining activities within 75m of the area. No non-coal mining activities within 50m of the area.

Area history

A summary of the historical development of the area, based on historical OS maps, is presented below. The historical maps can be found within the Groundsure report in Appendix D. Where relevant, interpretation of the maps is supported by knowledge from the discussions with the client and other stakeholders and previous reports for the area.

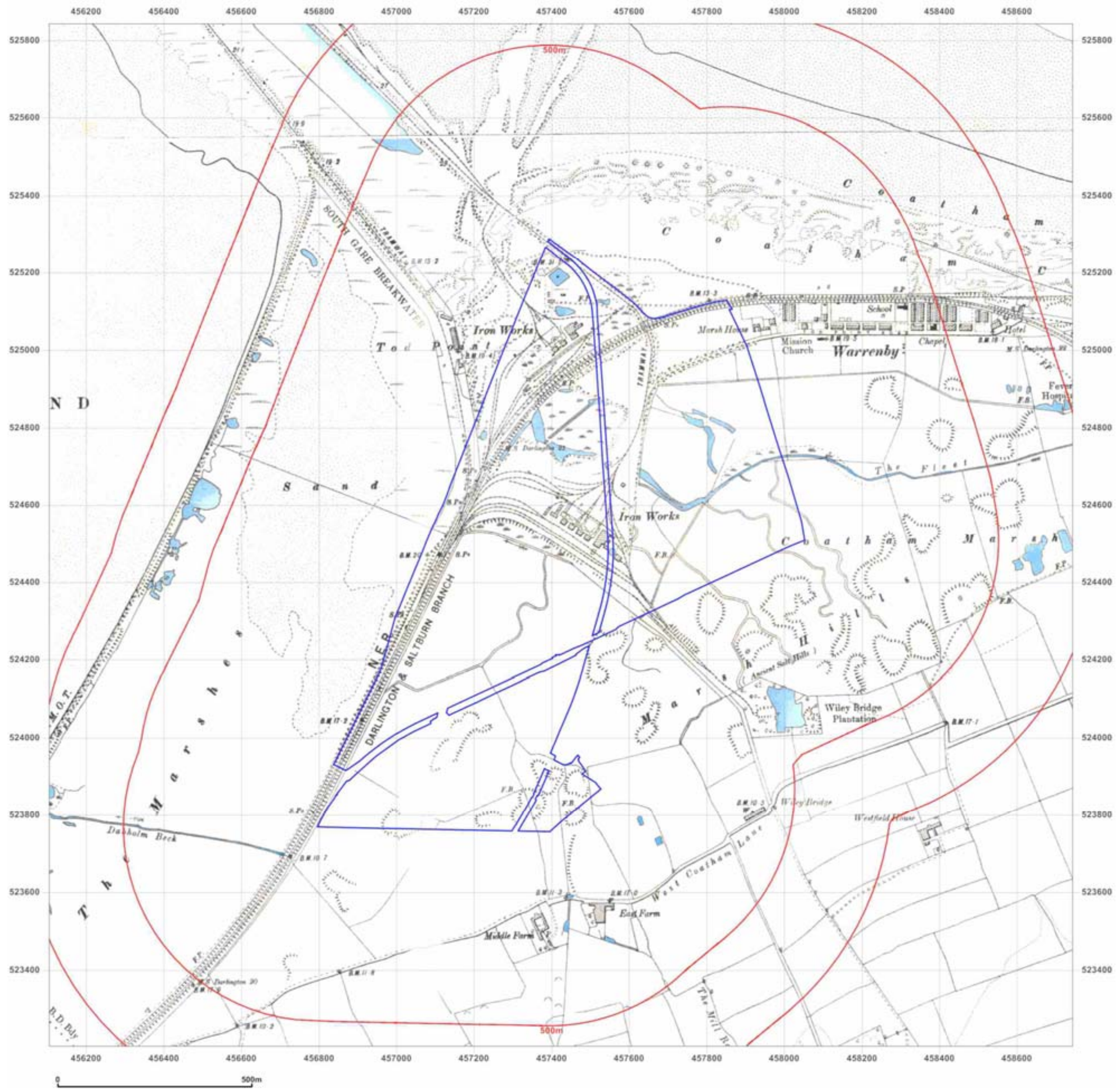
1856-1857



On-site: The area is largely undeveloped agricultural land. M.P. Darlington line runs from the southwest corner of the area, along the west site boundary and through the north of the area.

Off-site: The surrounding land is largely undeveloped agricultural land and sand. A small cluster of buildings can be seen just beyond the northeast corner of the area, labelled 'Marsh House'. Coatham Junction can be seen northeast of the area and is related to the M.P. Darlington trainline. Small structure northwest of the area labelled 'Tod Point' can also be seen. 'Middle Farm' and 'East Farm' can be seen to the southeast of the area.

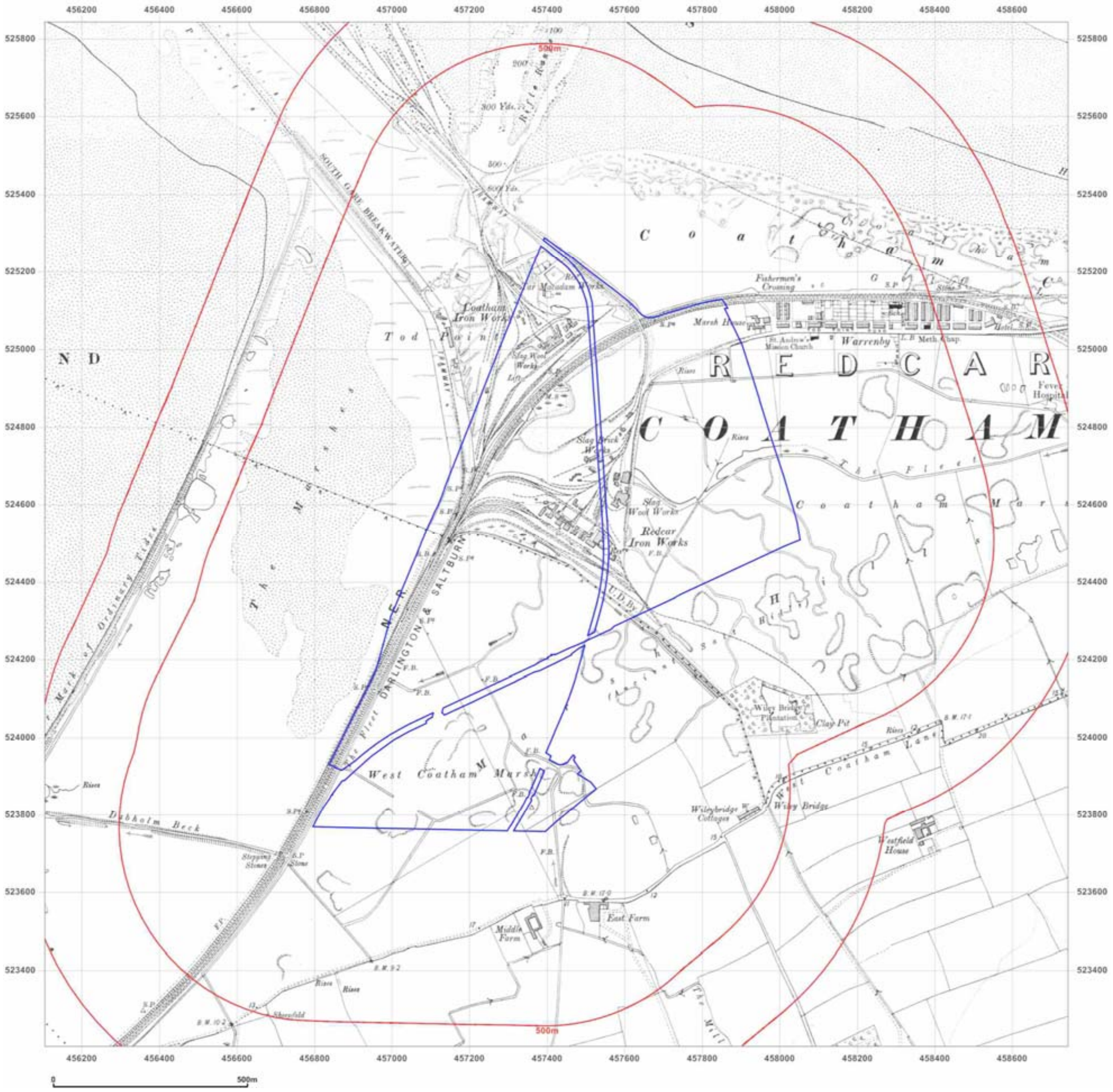
1893



On-site: The central areas had been developed to the Redcar Iron & Steel Works, with four blast furnace chimneys evident. The area was served by a complex of railway sidings. A tramway connected the north of iron works to the docks and the Tees estuary. South of the iron works, the area was undeveloped at this time. The north of the site was subject to earthworks/ tipping activity, for construction of site infrastructure including tramways, and previous drainage was truncated. The Coatham Iron Works was present beyond the Darlington to Saltburn railway line. Majority of the south area is shown as undeveloped, occupying part of West Coatham marsh. A series of mounds are present throughout the area possibly related to the annotated 'Marsh Hills and ancient salt hills'. A series of drainage channels cross the area. The course of these channels suggests they have been significantly altered in the past. A main drain crosses the area in an approximate northwest to southeast orientation within the northeast part of the area, linking to the Wiley Bridge Plantation located just to the south.

Off-site: Much of the surrounding land is still undeveloped and agricultural land and sand. Marsh House can still be seen northwest of the area. Coatham Station can no longer be seen on the map, and a large development is now in its place, labelled 'Warrenby'. Middle Farm and East Farm are still visible at this point, with a new development labelled 'Wiley Bridge Plantation' approximately half way between the farms and Warrenby. 'Wiley Bridge Cottage' now visible east-southeast of the site. East of the area a series of rail lines is present linking to the adjacent Redcar Iron Works with one line extending to the Wiley Bridge Plantation.

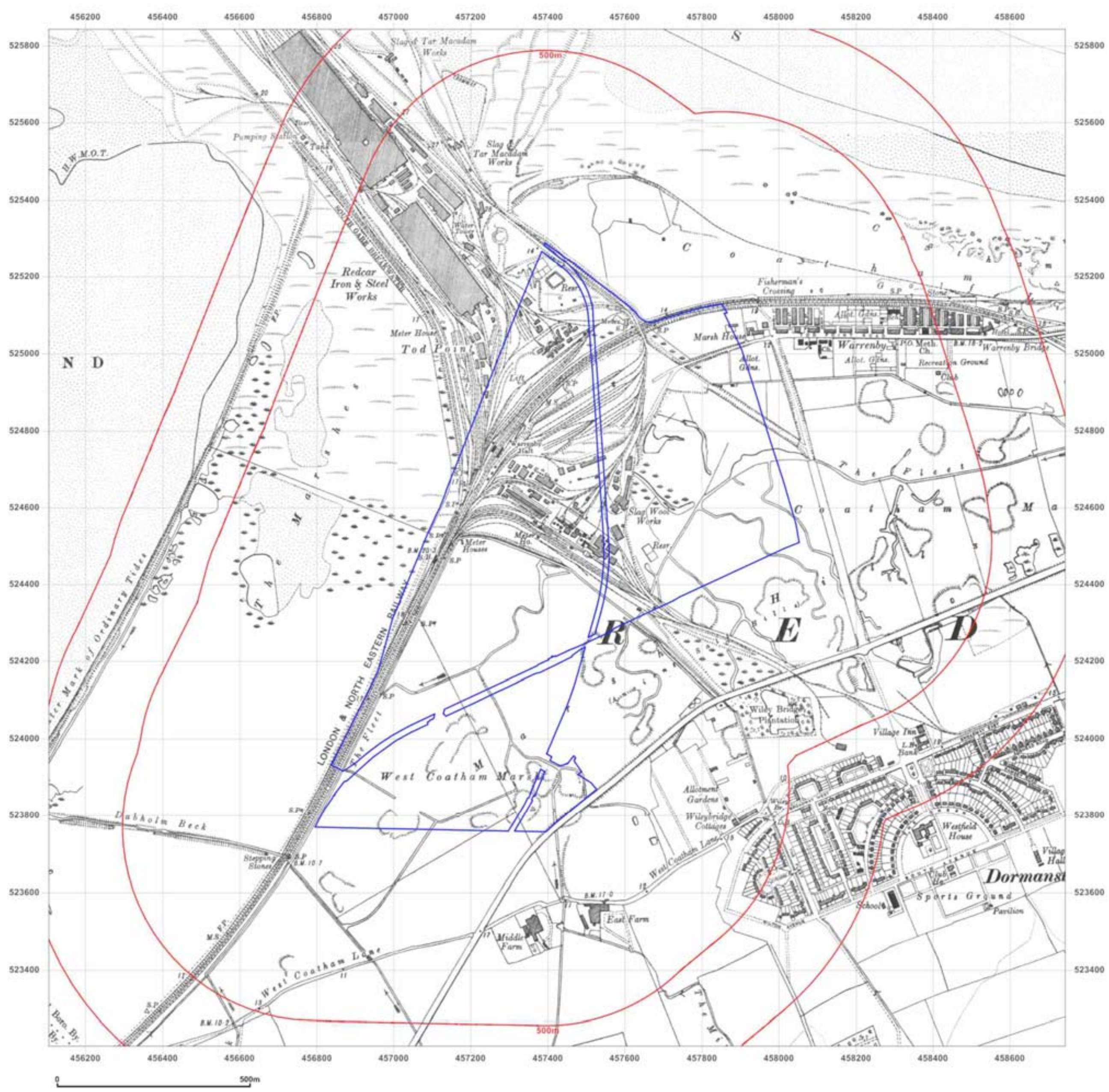
1913



On-site: Expansion of the railway sidings and tramways north of the Iron works, and expansion of the filled area. Reduction in the number of railway lines extending towards Wiley Bridge Plantation. Slag Wools Works shown within the main Iron Works buildings, and one north of the Iron Works buildings. A Slag Brick Works was also present to the north of the Iron Works. No change to the majority of southern area.

Off-site: Majority of land remains unchanged. Land to the west of the area previously labelled 'Sand' is now labelled 'The Marshes'. Reduction in the number of railway lines extending towards Wiley Bridge Plantation.

1927



On-site: Significant expansion of developed area to the west of the main Iron Works buildings, new buildings included chimneys, tanks and water coolers. The rail & tramway lines north of the Iron Works underwent significant expansion. The Slag Brickworks and the Slag Wool Works were also expanded at that time. A reservoir was shown to the east of the Iron Works. The majority of the southern area remains unchanged.

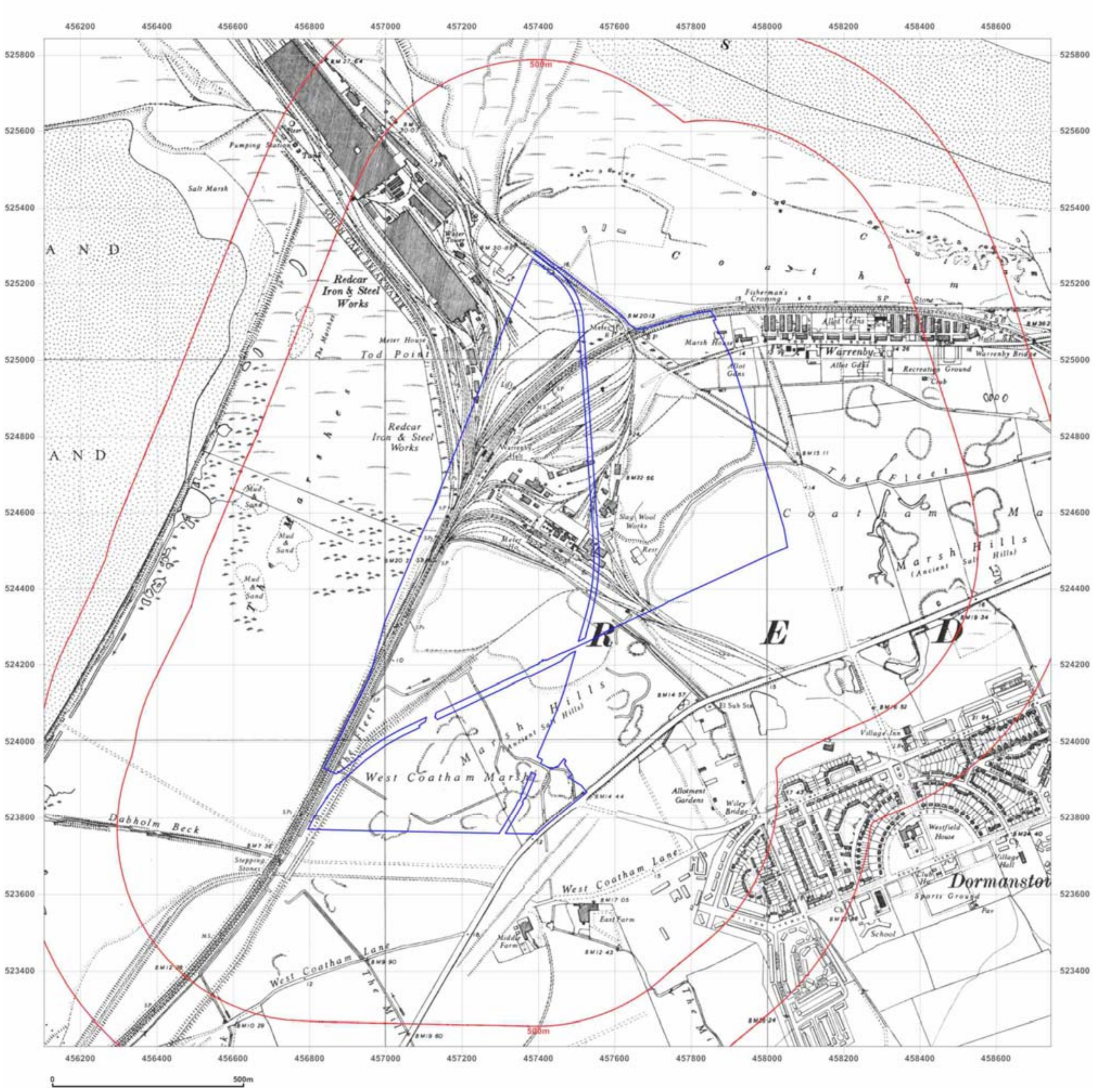
Off-site: To the east, northeast of the main drain, new rail lines have been developed that link to a new residential area (Dormanstown) to the south. Between the rail lines and the main drain, the area is recorded as reeds. A road has also been developed along the southern perimeter of the area. Two small circular features, possibly ponds, are located close to the southern perimeter close to the main drain. A large road can now be seen running along the southeast most boundary from south to northeast direction, through the Wiley Bridge Plantation.

1938

On-site: The area remains unchanged at this time.

Off-site: Surrounding land largely unchanged apart from further development at Dormanstown to the southeast.

1953

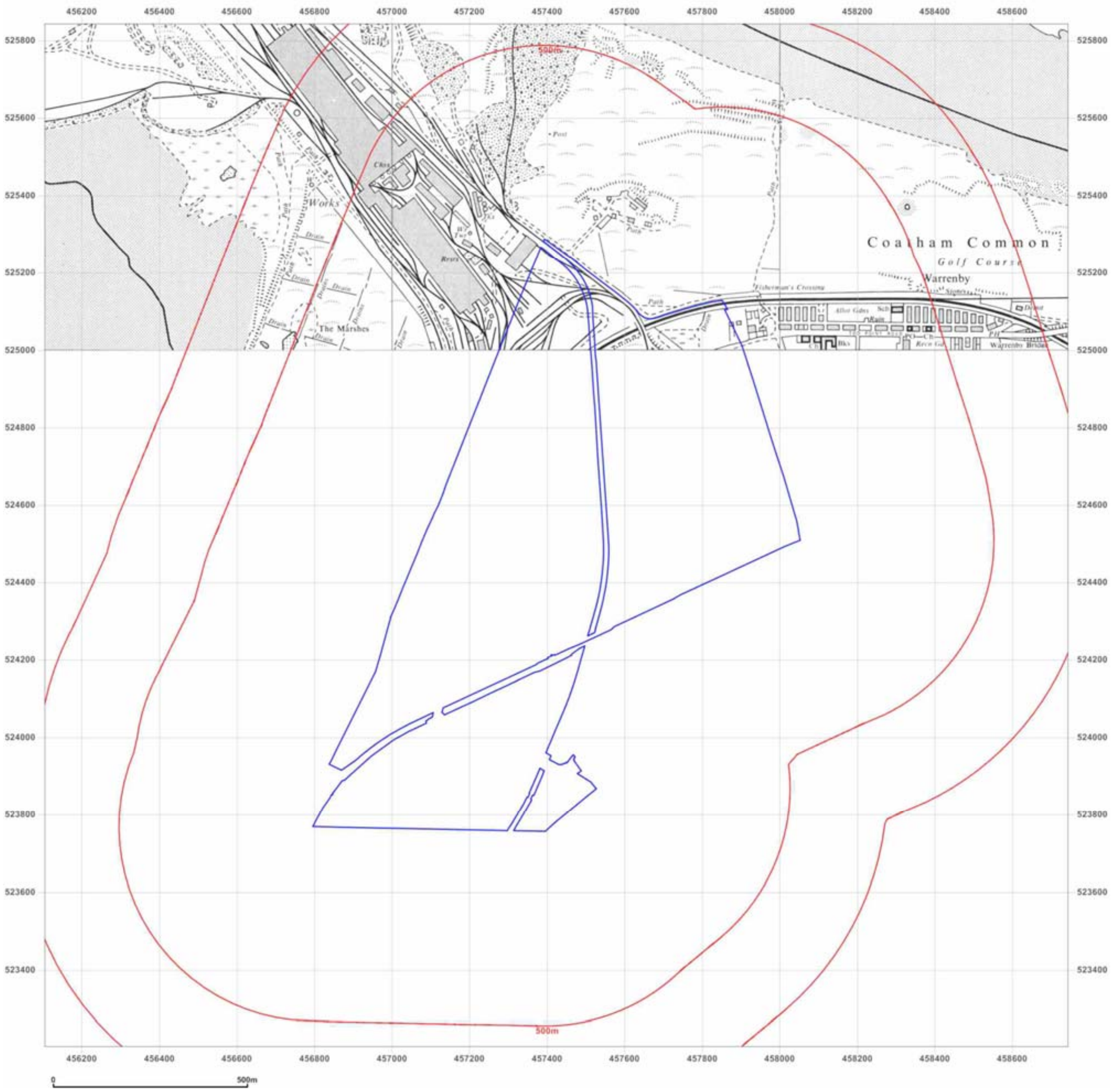


On-site: Main blast furnaces redeveloped into single large building, with associated railway/ tram lines. An extensive area of infilling was shown extending form the site towards the south east, resulting in amendment to the surface water drainage channels. Redevelopment included water coolers and a water tank east of the main steelworks buildings. The Mill Race surface water entered the area in the south.

The majority of the changes are in the eastern sections of the area. Along the northern boundary, a large tip body has been pushed out from Redcar Ironworks/steelworks into the site. The rail development includes some possible building structures, a conveyor and a platform. The circular features noted on the 1929 edition are confirmed as ponds. In addition, on the northern edge of the main drain crossing, the site an electricity substation has been constructed. The drain is now annotated 'The Fleet'. The road to the south of the area has been upgraded and appears as a dual carriageway. The construction of a roundabout is partially completed along the southern section of the site. Within the southern and southwest sector of the area, the drainage pattern has been amended. This includes 'The Mill Race' that flows in a northerly direction; this enters the area from the south and links to another channel that runs in an east northeast direction. A track is also annotated close to this drain.

Off-site: Further development of the rail lines are shown to the east of the area but it is noted that these have been truncated by the road along the southern boundary.

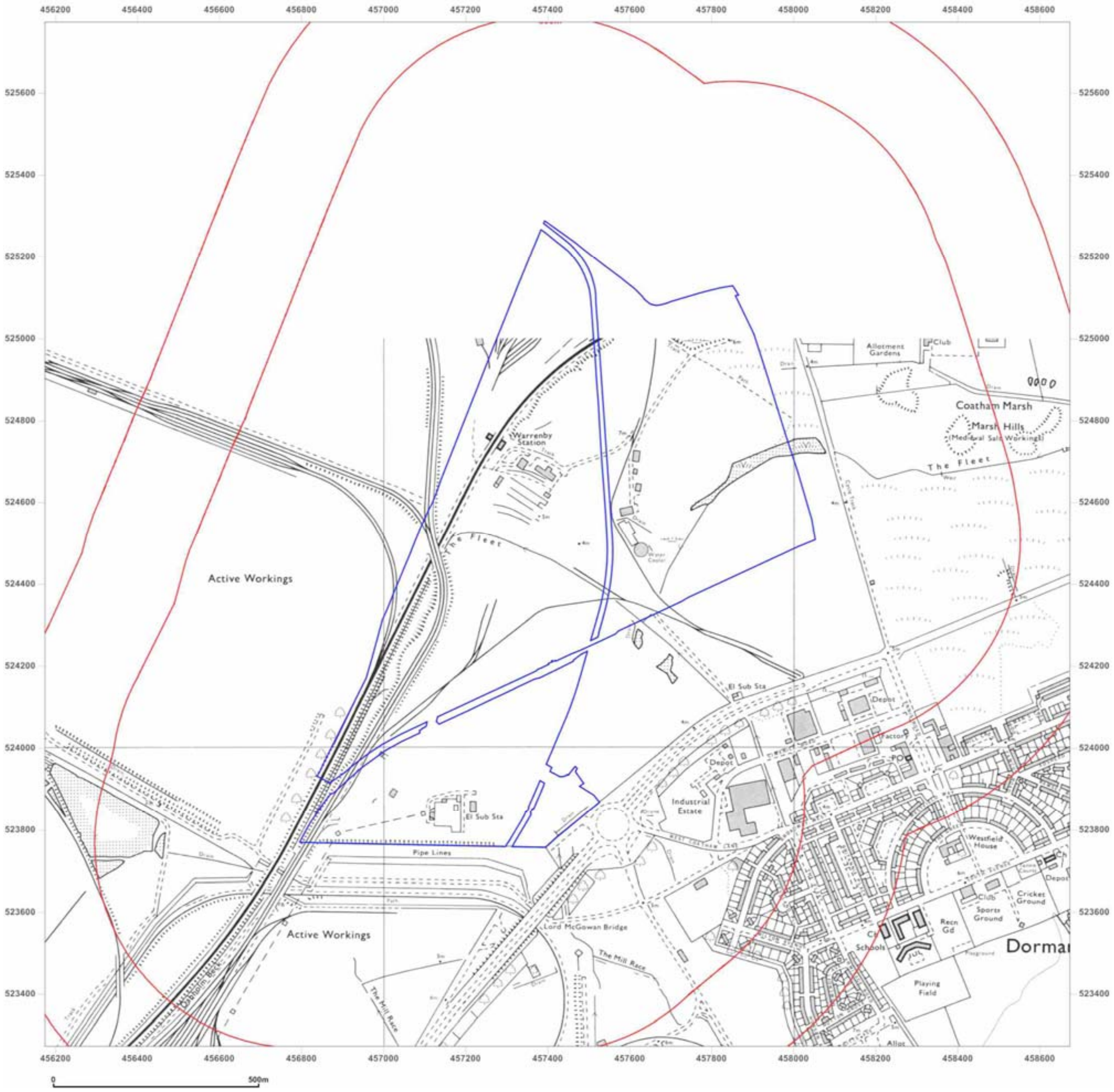
1969



On-site: Only the northmost areas of the area can be seen in this mapping and lacks much of the labelling. The areas visible in mapping at this time are unchanged.

Off-site: Only the northmost areas of the area can be seen in this mapping and lacks much of the labelling. Area immediately beyond the northmost site boundary has new development but is unlabelled. Area west-northwest of the area, below Redcar Iron & Steel Works, now has a series of drains. Coatham Common Golf Course can now be seen north of Warrenby.

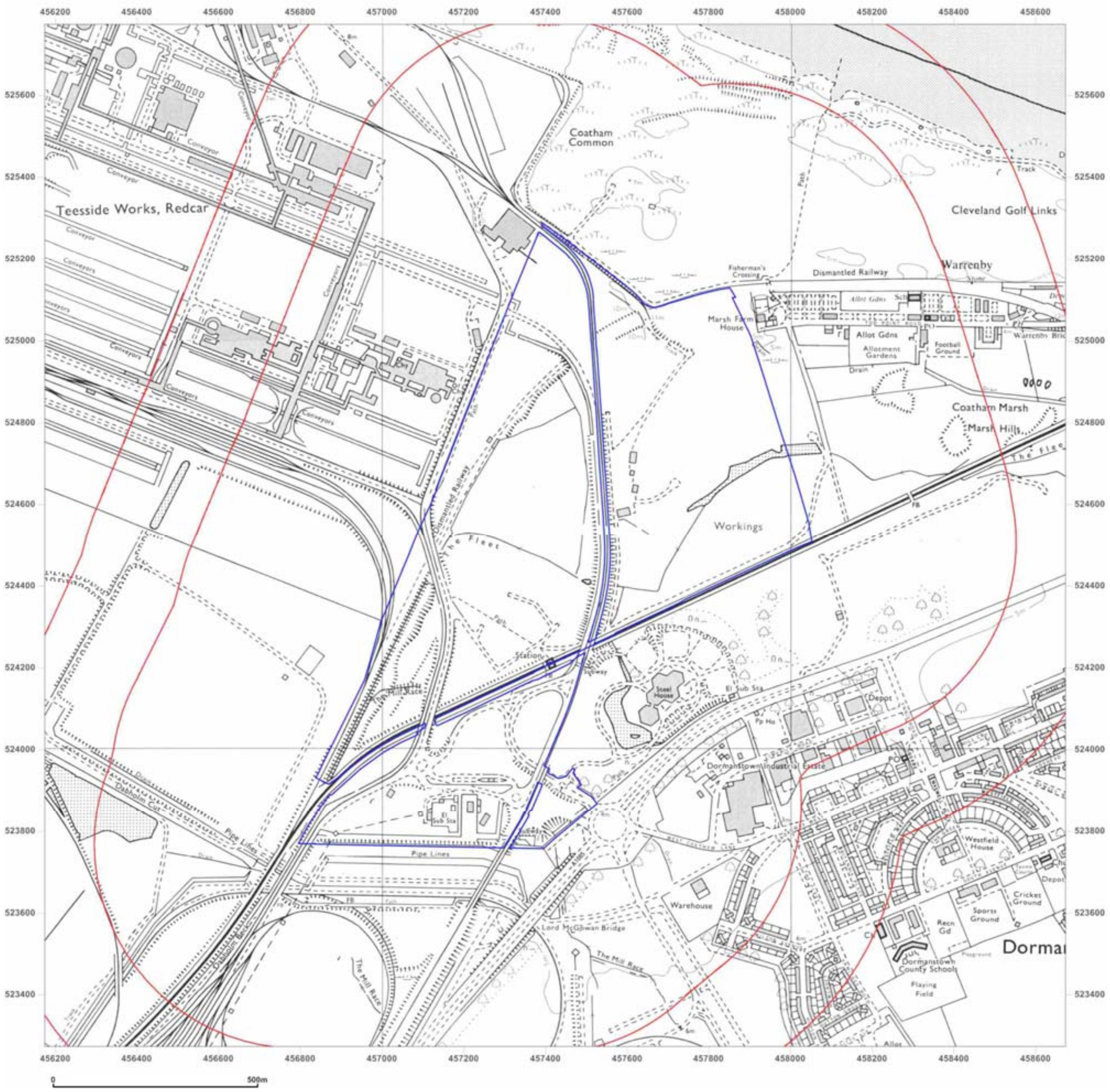
1974



On-site: Much of the development in the centre of the area associated with the historic Coatham Iron Works are now gone, as well as most of the tracks. Additional rail lines shown along the western boundary.

Off-site The surrounding areas remain the same.

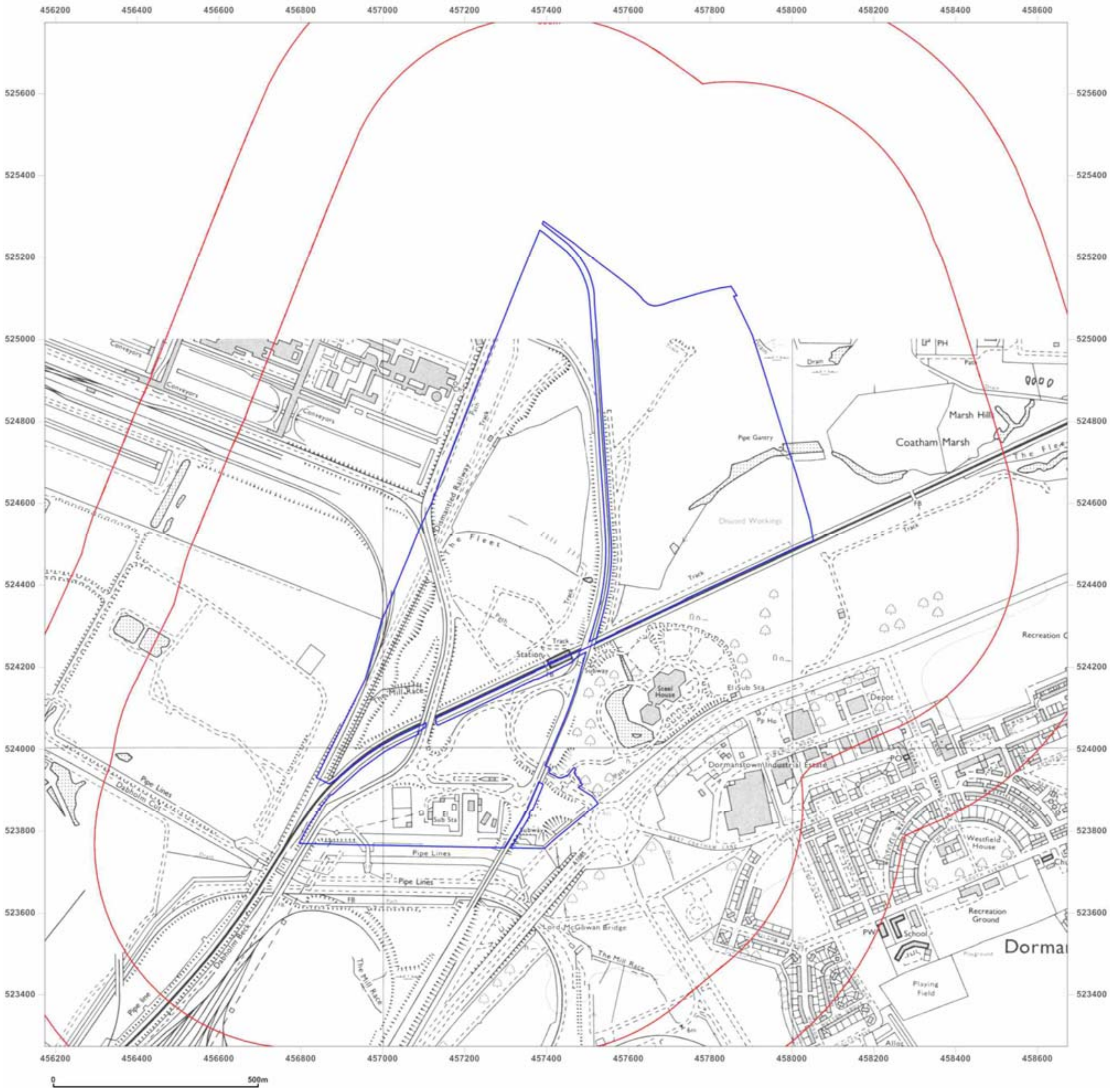
1983



On-site: Further demolition and removal of buildings associated without historical Coatham Iron Works. The Steel House building had been constructed to the adjacent to the southeast of the area, and a station constructed on the Darlington to Saltburn railway line. A new steelworks had been constructed to the south west of the area, which was served by a new road and rail network. This survey period records a major change to the southern area. The Fleet has been incorporated into a large lake feature that is located to the southwest of Steel House. The intake to the lake has been diverted along the southern boundary. A new internal road network and rail line (Hot Metal Route) pass through the area with a separate rail line located along the northern boundary. A rail station (British Steel Redcar) is also present on the northern boundary. The majority of the area appears to have been landscaped. At the south western limit of the area a large electricity substation has been developed with associated pylons linking to the south west. Possibly associated with the substation is an area of hardstanding and buildings (to the east). A weighbridge is recorded adjacent to the northern boundary of the substation. To the south of the electricity substation a pipe crossing is recorded. Annotations on the plan refer to the South Teesside Works Lackenby and Teesside Works Redcar.

Off-site: This survey period records a major change to the area. Steel House and associated car parking facilities have been developed to the east-southeast. Redcar Iron & Steel Works now labelled 'Teesside Works, Redcar'.

1991



On-site: Majority of the area unchanged, with the exception of a few buildings associated with the substation.

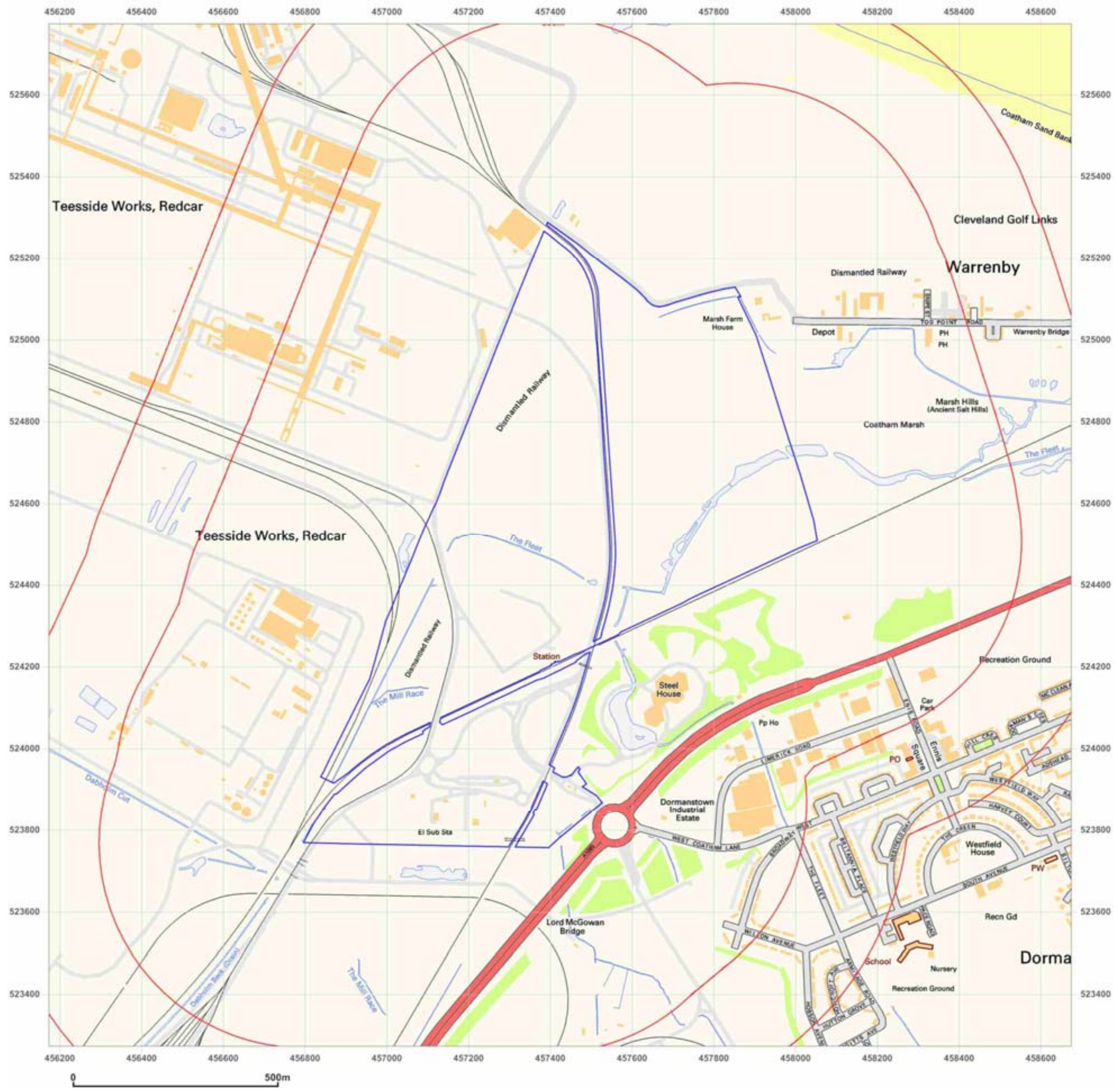
Off-site: Majority of the surrounding area unchanged, with the exception of a new development south of the Teesside Works.

2002

On-site: The area remains unchanged.

Off-site: This survey records a major development at Teesside Works to the west. The last to the west-southwest of the area that was previously mostly undeveloped is now a large Sewage Works. Pipelines appear to have been rerouted around the sewage works, with new roads and a bridge over the drain to the south now visible.

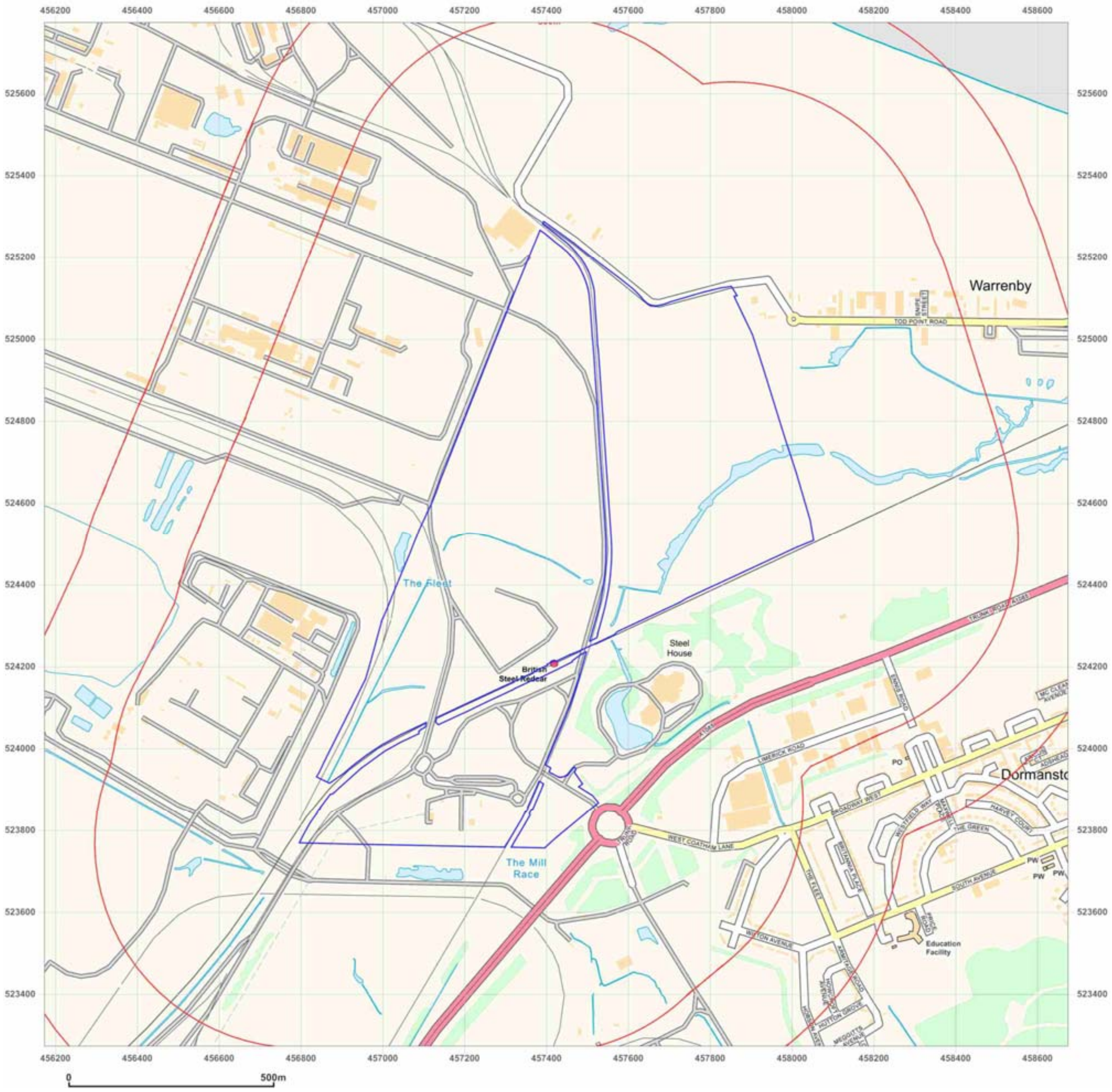
2010



On-site: Majority of the as area is shown in 2002. In 2006, hard standing area to the west of the substation appears to be covered in waste materials and includes a series of containers and one small building. Some piles of dumped materials are also present adjacent to the western side of the hardstanding. Hardstanding area to the west of the substation gone in 2010 survey.

Off-Site: No changes from previous mapping.

2014



On-site: No changes from previous mapping.

Off-site: No changes from previous mapping.

Summary of site history and pertinent features

Since the earliest maps dated 1856, the area and surrounding areas has undergone considerable development and demolition. Between 1856 and 1893, significant industrialisation began in the northwest and centre of the site with the construction of two separate iron works and sizeable expansion of the Darlington & Saltburn Branch trainline running through the area and connecting the two industrial sites. In the 1913 survey, the iron works located in the northwest and centre of the area are now known as 'Coatham Iron Works' and 'Redcar Iron Works' respectively. Much of the northeast and south of the area remain undeveloped at this time.

In the 1927 surveys, significant expansion of the former Coatham Iron Works to the northwest of the area and is now labelled 'Redcar Iron & Steel Works'. Less significant development at the former Redcar Iron Works located in the centre of the site and is no longer labelled; it is assumed that Coatham Iron Works and Redcar Iron Works are joined at this time. A significant increase in the number of train tracks covering the northwest quadrant of the area.

By 1974, much of the development relating to the original Redcar Iron Works has now gone, and surrounding infrastructure supplying the town of Dormanstown and Warrenby progressed significantly.

In 2002 surveys, development is as appears today. The former Redcar Iron & Steel Works has undergone significant transformation is now known as 'Teesside Works, Redcar' and has gained a large Sewage Works to the south.

Notable historic and contemporary features within the area which may have implications for land contamination include but are not limited to;

- Infrastructure associated with historic Redcar Iron Works located at the centre of the site including pump houses, meter houses, pipes, tanks, refuse piles, blast furnaces, water coolers, reservoirs, sluice, overhead pipes, cranes, chimneys, and subways (Central)
- Infrastructure associated with historic Coatham Iron Works located in the northwest corner of the site including reservoirs, tar macadam works, water towers, chimneys
- Slag Brick Works (Central)
- Slag Wool Works (Central, Northwest)
- Land and infrastructure associated with the trainline (Southwest, Northeast)
- Electricity substations (Southwest)

Notable historic and contemporary features in close proximity to the area, outside of the boundary which may have implications for land contamination include but are not limited to;

- Land and infrastructure associated with the Teesside Works, Redcar (Northwest)
- Land and infrastructure associated with the trainline (Southwest, Northeast)
- Slag Works (Northwest)
- Tarmacadam Works (Northwest)
- Storage tanks (Northwest)
- Water coolers (Northwest)

Summary of Previous Reports

Previous Report Ref	
Data Review **TS2 Tear Drop Site – Phase 1 Geoenvironmental Desk Study, CH2M Hill, August 2017**	**Scope of Works** This report was a data review for the northern part of the study area at Coatham Marsh & Warrenby Landfill. The area is approximately 65ha. **Findings** The majority of the site was undeveloped. Warrenby Landfill dominates the site and covers some 7 ha; it holds around one million cubic metres of waste materials, comprising predominantly steelmaking slags, with small amounts of paper and canteen wastes.

Previous Report Ref

The review identified that the central area of the site was developed to the Redcar Iron Work by 1874, and the area south of the Work remaining largely undeveloped. Land north of the Iron Work was infilled by 1894, and a Slag Wool and Slag Brick works constructed in that area. The former Coatham Ironworks was present within the north west of the site, to the west of the hot metal route. These were subsequently demolished by the 1950s, and the Redcar Iron Works was demolished by the 1970s. Regrading works in the south of the site had been undertaken as part of present-day road and railways. Review of regional bomb risk maps indicated a Moderate UXB risk.
The site held a COMAH upper tier establishment classification associated with PAH in the Coke Oven Gas Main.
In addition to Warrenby landfill, an active landfill accepting special wastes was identified at Bran Sands close to the west of the site.

Ground Investigation
Review of previous data indicates the following:
Soil
Made Ground present across the site, variable deposits, up to around 4-5m in thickness (excluding the Warrenby Landfill area), comprising slag, firebricks, bricks, ash, rubble, fused slag.

Data reviewed included Enviros 2004 ground investigations, which comprised 2 boreholes and 10 trial pits. Made Ground depth not fully proven in most locations.

CH2M Hill reassessed the data acquired by Enviros in 2004 and assessed soil data based on current generic assessment criteria (GAC). Of the 22 samples of Made Ground analysed, results indicated the following exceedances of GAC:

- Ph – 6 samples (GAC <5 to >10)
- Boron – 2 samples (GAC 3 mg/kg)
- PAHs – 1 sample (GAC 40mg/kg)
- Lead – 1 sample – GAC 750mg/kg)
- Zinc – 2 samples 720 mg/kg
- Acid soluble sulphate – 4 samples (GAC 1000mg/kg)
- Water soluble sulphate – 3 samples (GAC 12,000mg/kg)

CH2M Hill also compared results to the Suitable for Use Levels (S4UL) and for lead, Category 4 Screening Levels (C4SL). None of the screening values were exceeded.
Ground investigations at Warrenby Landfill encountered very dense slag to a depth of up to 7m bgl.

Underlying superficial Tidal flat deposits of sands and silts, with Blown Sand present in the south locally. Deposits are underlain by Glacial Till, which is in turn underlain by the Redcar Mudstone Formation.

The report concluded that contaminants of concern included asbestos, heavy metals, PCBs, hydrocarbons, sulphides, sulphates, carbonates and ground gas from domestic wastes.

Water
CH2M Hill reviewed the Enviros (2004) groundwater monitoring data. One round of testing was conducted, and cyanide and sulphur results exceeded the Tier 1 screening values in groundwater in one borehole location.

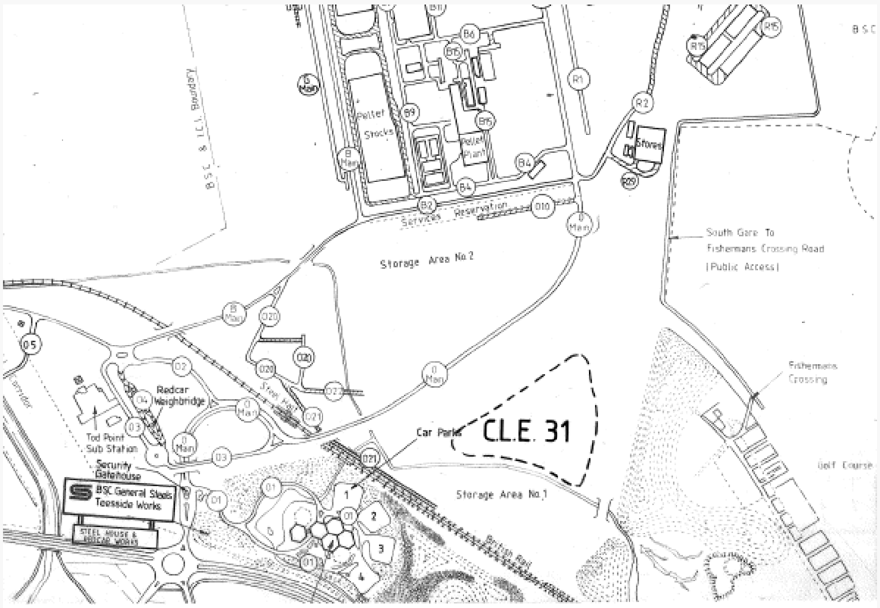
Superficial deposits were classified as a Secondary A aquifer, with bedrock classified as a Secondary (undifferentiated) aquifer.
Surface waters at the site include the Fleet and Mill Race.

Gas
Potential deposition of domestic wastes and other wastes locally in landfill may give rise to ground gases.

Recommendations
The report included the following recommendations:

Previous Report Ref	
	- Further desk based research on the Coke Oven Gas Pipeline decommissioning and implications, confirmation of the Landfill closure application status, and UXO study. - Intrusive investigation comprising 40 trial pits and 9 boreholes in the former Redcar Iron works area, and 40 trial pits and 5 boreholes on the Warrenby Landfill area. A further 5 boreholes were proposed on the remainder of the site.
Data Review TS1 Steel House and Surrounding Area – Phase 1 Geoenvironmental Desk Study, CH2M Hill, August 2017	**Scope of Works** This report was a data review for an area which includes the south of the current Coatham Marshes and Warrenby Landfill study area, south of the Saltburn to Darlington railway. The area is approximately 35ha. The study included assessment of land east of the hot metal route, which lies outside the current study area boundary. **Findings** The site originally comprised agricultural fields, and 1894 mapping indicated that the site was crossed by drainage channels and comprised marsh and ancient salt hills at that time. The former Redcar Iron Works was located adjacent to the north west of the study area. The Redcar Iron Works slag tip encroached onto this site. The site was redeveloped during the 1970s, by the construction of the Steel House and Hot Metal route, which linked the Redcar blast furnace with the Basic Oxygen Steelmaking (BOS) and Concast plant. The Steel House was located outside of the current Coatham marsh & Warrenby landfill study area. Review of regional bomb risk maps indicated a Moderate UXB risk. Potential sources of contamination at the site included the electrical plant at substations, and a fuel dump identified close to the western boundary of the study area, along with general Made Ground. **Ground Investigation** No specific ground investigations undertaken during data review, but review of previous data indicates the following: **Soil** The site was reclaimed from the mudflats and marshland, and Made Ground is expected to be present. The composition of the Made Ground was not established at the time of the report, although the most likely source is slag and other wastes derived from the local steelmaking industry. Underlying superficial Tidal flat deposits comprise of sands and silts, with Glaciolacustrine clay and silt present towards the south and west of the site. Deposits may be laminated, very soft and contains traces of peat. Deposits are underlain by Glacial Till, which is in turn underlain by the Redcar Mudstone Formation. Potential contaminants as per the T2 Tear drop site data review 2017 - asbestos, heavy metals, PCBs, hydrocarbons, sulphides, sulphates, carbonates and ground gas from domestic wastes **Water** Superficial deposits were classified as a Secondary A aquifer, with bedrock classified as a Secondary (undifferentiated) aquifer. The Fleet surface water is predominantly culverted through the site. **Gas** Potential deposition of domestic wastes and other wastes locally may give rise to ground gases. **Recommendations** The report included the following recommendations: - Further desk based research on borehole logs, halite mineral rights, permit review and UXO study. - Intrusive investigation comprising 9 boreholes, 35 trial pits, geophysical survey and specific drum sampling.
Warrenby Landfill HRA Review, Stantec 2018	**Scope of Works** The scope of the report was to undertake a Hydrogeological Risk Assessment of the Warrenby Landfill on behalf of Tata, following an EA request to move the site into definitive closure. The report took into account additional monitoring data.

Previous Report Ref	
	Findings Three phases of landfill were identified at the site, as follows: Phase 1 – Old waste, closed to deposition for decades Phase 2 – Under licence, subject to the HRA review Phase 3 - Planned landfill, never received wastes. Four monitoring boreholes are Phase 2 were subject to additional monitoring. Control levels were reviewed, and the quarterly monitoring frequency for various parameters was recommended to be maintained. **Ground Investigation** **Water** Groundwater quality was found to not have changed significantly. Data indicated the continued presence of brackish water and low-level impact from the site, with no deterioration in groundwater quality. Control levels were proposed for ammoniacal nitrogen, chromium, lead, nickel and sulphate.
Landfill Closure Report for CLE31, Teesside, TATA Steel, 01 June 2015	**Scope of Works** The scope comprised a review of information on the Warrenby Landfill area to support landfill closure. **Findings** The site occupies approximate 7ha of land and contains approximately one million cubic metres of waste material, predominantly steelmaking slag and some paper and canteen wastes. The site was licensed in 1977, and accepted wastes until May 2002. The report estimated the yearly inputs to the landfill as: - General waste - 2000tonnes - Canteen waste – 1000 tonnes - BOS Slag – 59,000 tonnes The majority of the waste is therefore assumed as slag wastes (>95%). **Soil** The landfill (Phase 2) was constructed on slag ballast with a nominal clay layer. The competence of the clay layer was never proven, and the landfill is considered as unlined. **Water** Groundwater is reported as several metres below the base of the landfill. There is no leachate collection infrastructure. The Fleet Beck flows close to the eastern side of the landfill and has been subject to monitoring inspections. **Gas** Previous monitoring indicated no methane production, and minimal carbon dioxide concentrations (<0.2%). Monitoring ceased in 2004. Recent EA surface emission monitoring did not encounter significant surface emissions. There is no landfill gas collection infrastructure at the landfill. **Capping** As part of the Waste Management license, a condition required that on completion a low permeability cap shall be placed over the deposited materials to a depth of not less than 1m, placed to a specified low permeability, and laid to encourage run-off. However, discussion with the EA indicated that a low permeability cap was not required and could be justified by a hydrogeological risk assessment. **Recommendations** Based on the findings of the HRA, TATA proposed that the site be capped with 1m of soils, although a low permeability cap was not proposed. Further quarterly monitoring and survey was proposed following capping, to identify changes or landfill settlement. The report author considered that the information presented provided sufficient information in order that the site could be considered definitively closed.

Previous Report Ref	
Waste Disposal Licence, CLE 31/2 Cleveland County Council, 1980	This document was the waste disposal licence, under the CPOA 1974, relating to the deposit of wastes at Warrenby landfill at approximate NGR NZ 580245. The permit allowed deposition of slag, clay, subsoil and topsoil (max 1430 tonnes per day) and paper / canteen wastes (max 20 tonnes per day).
South Teesside Waste Disposal Sites, Currently Licenced Tips, Drawing No. X-108701 (undated)	This drawing showed the extent of the licenced tipping areas at Warrenby Landfill (Referenced CLE 31). The drawing also indicates that in the south of the site is the Tod Point substation, the Redcar weighbridge, and various access routes. Adjacent to the licensed landfill are shown Storage Area No.1, and Storage Area No.2. 
Summary of key finding of all investigations	The area has been used for deposition of Made Ground for land reclamation purposes, and also waste disposal. North and central areas were developed to iron and steel works, with these buildings and structures largely demolished by the 1970s. Warrenby Landfill occupies central and eastern parts of the site and has been used for disposal of wastes derived from the nearby steelworks. There is an off-site enclave within the south of the site used as an electrical substation and associated electrical plant. There is limited ground investigation information available within the area. However, based on the data available and for the surrounding land, Made Ground is likely to be present throughout the area up to approximately 5m in thickness, comprising steelworks derived slag waste. The waste depths in the Warrenby tip have been recorded in excess of 7m. Data review indicates that the potential contaminants of concern at the area include asbestos, heavy metals, PCBs, ammoniacal nitrogen, sulphites, sulphates, carbonates and ground gas. Localised areas of potential higher risk are the former coke works and blast furnaces in the former iron and steel works. The area includes the Warrenby Landfill, which is a permitted landfill site containing around one million cubic metres of predominantly slag wastes, although other wastes including paper and canteen wastes have been disposed in the landfill. Groundwater below the Warrenby Landfill was reported as around 2m below the level of the landfill. A hydrogeological risk assessment of the landfill indicates that groundwater quality is not significantly deteriorating in the vicinity of the landfill. Previous ground gas monitoring also indicates that the landfill is not generating significant volumes of ground gas (methane or carbon dioxide). The gas regime is likely to be characteristic situation CS-1. There are no capping materials present over wastes at Warrenby Landfill. The site permit however requires the construction of 1m of capping materials. The hydrogeological risk assessment concluded that the capping did not necessarily need to be of low permeability material given the limited evidence of groundwater deterioration but should be designed to encourage run off.

Data Gaps

Future Phase 2 Contaminated Land investigations

It is anticipated that supplementary ground investigation within the red line site boundary may be required to support specific proposed developments and land parcels as they are brought forward for development.

3. Conceptual Model & Environmental Risk Assessment

The following section presents the Conceptual Model (CM) and Environmental Risk Assessment established through the appraisal of the site. This is based on assessments made by third parties on behalf of STDC and former land owners. Reference should be made to the reports referenced in Section 1 and summarised in Section 2.

Given the extensive ground characterisation information available no additional intrusive investigations have been undertaken specifically to support the outline remediation strategy. It is anticipated that supplementary ground investigation within the site may be required to support specific proposed developments and allow Generic Quantitative Risk Assessment (GQRA) of contemporary data.

3.1 Conceptual Model

The CM and plausible contaminant linkages are defined below based on the desk study review of publicly available information collated in the previous sections. The CM is carried out in line with CLR11 and is based on the proposed industrial land use. The CM provides an assessment of the site's potential contamination status and identifies the presence of potentially significant contaminant linkages that require further consideration.

3.2 Preliminary risk assessment

In order for land contamination risk to be realised, a '**contaminant linkage**' must exist. A contaminant linkage requires the presence of a:

- source of contamination;
- receptor capable of being harmed; and
- pathway capable of exposing a receptor to the contaminant.

A preliminary risk assessment has been undertaken for potential contaminant linkages to identify potentially unacceptable risks on a qualitative basis. Risk is therefore based on a consideration of both:

- The likelihood of an event (probability – takes into account both the presence of the hazard and receptor and the integrity of the pathway); and
- The severity of the potential consequence (takes into account both the potential severity of the hazard and the sensitivity of the receptor).

The method of dealing with identified risks and the level of significance of those risks will be a function of site use. The risk assessment is based on the future proposed land use and assumes no control measures to manage the risk (e.g. source removal or capping) have been incorporated in the development.

The preliminary risk assessment is presented in Table 3.3.

3.3 Potential contamination (sources)

A review of the site's history and environmental setting has identified potential contaminant sources on the site and the surrounding area, as summarised below in Table 3.1. The list of contaminants has been established through a review of Annexe 3 in the Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008 Volume 2.

Table 3.1 Current and historical contaminant sources

No.	Source	Likely Contaminants	Location	Source to be considered further?
1	Made Ground including demolished buildings and structures - slag - ash - demolition rubble - backfilled water features - organic materials	Asbestos, heavy metals, hydrocarbons, elevated pH (alkaline conditions), Sulphate/sulphides, cyanides, carbon dioxide and methane	Whole site	Yes
2	Iron and Steel Works – including Bessemer Works and Pig Casting, Lackenby Iron Works, Cleveland Steel Works, South Bank Iron Works	heavy metals, hydrocarbons, pH, Sulphate/sulphides	On-site	Contamination from process considered as part of general Made Ground assessment
3	Coke Ovens (south Bank & Grangetown Prairie) and the former by-product plants, including historic Benzole	Phenol, hydrocarbons including benzene and naphthalene, heavy metals, sulphate, sulphide, pH, cyanides, ammonia	Indirect northern, western and southern areas	Yes
4	Steel Mills and associated infrastructure / other steel mills	Asbestos, heavy metals, hydrocarbons, Sulphate/sulphides	On-site, Off-site (adjacent)	Contamination from process considered as part of general Made Ground assessment
5	Galvanising works	heavy metals (especially zinc), hydrocarbons, pH, Sulphate/sulphides, cyanide	On-site North west	Contamination from process considered as part of general Made Ground assessment
6	Landfills	heavy metals, hydrocarbons, pH, Sulphate/sulphides Methane and Carbon dioxide	Warrenby Landfill and adjacent to the site (South Bank)	Yes
7	Fuel Oil Depot / tank farms and storage tanks	hydrocarbons	On-site North	Yes
8	Coke Oven Gas Main	Hydrocarbons	On site	Contamination from the pipeline considered as part of Made Ground assessment

No.	Source	Likely Contaminants	Location	Source to be considered further?
9	Slag handling / Slag Works – including Tees Slag Wool Works Lackenby Slag Breaking Plant, Slag Brick Works	heavy metals, hydrocarbons, pH, Sulphate/sulphides, phosphate	On-site	Contamination from process considered as part of general Made Ground assessment
10	Phosphate works and basic slag works	heavy metals, hydrocarbons, pH, Sulphate/sulphides, phosphate		Contamination from process considered as part of general Made Ground assessment
11	Brine Wells and Salt Works	Sodium Chloride		No. Contamination related to sodium chloride. – unlikely to pose a significant impact to health or to water near the estuary
12	Docklands and railway Sidings Coal, raw materials and finished products, waste products	Elevated pH Heavy metals and metalloids Sulphates/sulphides Fuels, oils and grease		Contamination from process considered as part of general Made Ground assessment
13	Substations and oil filled cables	Oils and PCBs		Yes

3.4 Potential receptors and exposure pathways

The potential receptors and associated pathways that have been identified are shown in Table 3.2.

Table 3.2 Pathways and Receptors

Receptors	Potential pathways
Future site users (industrial end use)	Dermal contact, accidental ingestion, inhalation of dusts, vapours, fibres and gases. Direct and following tracking back into buildings. Ingestion includes that of contaminated drinking water subsequent to degradation of water supply pipe construction material as a result of chemical attack.
Buildings and Services	Direct contact, migration through permeable strata and ingress and accumulation of gases. Degradation of water supply pipe construction material or infrastructure and construction materials as a result of chemical attack.
Controlled Waters: (Undifferentiated secondary Aquifer in the Tidal Flats)	Leaching, infiltration and migration via permeable strata
Controlled Waters: Surface water (Tees Estuary SSSI)	Surface water run-off, infiltration and migration via baseflow / permeable strata

With regards to the above human health potential exposure pathways, the critical receptor for the proposed end use, in line with the CLEA model (SC050021/SR3), is identified as a working female adult (aged 16 to 65 years old).

3.5 Exclusion from risk assessment

Current site users

Users of the site in its current configuration are not considered as part of this assessment.

Redevelopment workers

The CM does not consider risks to construction/ site maintenance workers on the basis that risks to workers will be dealt with under the Health and Safety at Work Act (1974) and regulations made under the act. site-specific contamination data obtained from all site investigations should be included in the pre-construction information (requirement of Construction Design and management Regulations 2015) for the proposed works, to enable any contractors to address potential risk from contamination as necessary in their risk assessments and method statements. Moreover, as the exact details of the method adopted are not currently known, it is not considered appropriate to provide a wide ranging and speculative risk assessment for redevelopment workers.

Invasive species

Invasive species (such as Japanese knot weed and giant hogweed) are not considered within the risk assessment for contamination. An ecology survey has been carried out at the site and Giant Hogweed has been identified. However, invasive species are considered to be a constraint to remediation / redevelopment rather than a contaminated land risk issue and would be anticipated to be assessed / addressed further in appropriate documentation relating to the remediation or contractor's method statements for ground preparation.

Unexploded ordnance (UXO)

Assessment of UXO is outside the scope of the current report.

Geotechnical constraints

Geotechnical development constraints are outside the scope of the current report.

Table 3.3 Preliminary Risk Assessment – Risks to future site users and environment from current/historic sources

Potential Source	Potential Pollutant	Potential Receptors	Potential Pathways to Receptors	Associated Hazard [severity]	Likelihood of Occurrence	Risk/ Significance
Made Ground including demolished buildings and structures **- slag** **- ash** **- demolition rubble** **- backfilled water features** **- organic materials**	Asbestos	Future site users (commercial/ industrial end use)	Inhalation fibres: Direct and following tracking back into buildings	Health Hazard (severe)	**Likely** Detected in Made Ground on site. Potential to track back asbestos into buildings if present to surface or in shallow soil. Asbestos analysis was not scheduled for testing in all historic investigations. In addition, it must be noted that the approach to asbestos screening changed and any pre c.2014 'non-detections' should be treated with caution; asbestos may be present that would not have been detected by the previous analysis approach.	**High**
	Heavy metals, hydrocarbons, pH, Sulphate/sulphides, cyanides	Future site users (commercial/ industrial end use)	Dermal contact, accidental ingestion, inhalation of dusts, vapours, fibres and gases. Direct and following tracking back into buildings	Health Hazard (Medium)	**Likely** Made Ground across the site is typically characterised by widespread elevated pH (strong alkaline conditions) and elevated concentrations of sulphide and sulphate. Localised lead, hydrocarbons, PAHs and BTEX compounds elevated above screening criteria. Although previous investigations have reported localised visual and olfactory evidence of contamination, testing of Made Ground has generally reported determinands analysed to be below the commercial/industrial GACs.	**Moderate/High**
		Services	Direct contact with water pipes	Tainting of water supply (Medium)	**Low Likelihood** Slightly elevated TPH in groundwater near fuel oil depot. Potential for migration through plastic pipes	Moderate/low

Potential Source	Potential Pollutant	Potential Receptors	Potential Pathways to Receptors	Associated Hazard [severity]	Likelihood of Occurrence	Risk/ Significance
		Groundwater	Leaching, infiltration and migration via permeable strata	Pollution of undifferentiated secondary Aquifer (Medium)	**Low Likelihood** Elevated heavy metals in a small number of samples and alkaline pH identified in groundwater. Groundwater generally within Made Ground and connectivity of perched water not clear.	Moderate/low
		Surface water (Tees Estuary SSSI)	Surface water run-off, infiltration and migration via baseflow / permeable strata	Pollution of Tees Estuary (Medium)	**Low Likelihood** Elevated heavy metals in a small number of samples and alkaline pH identified in groundwater. Groundwater generally within Made Ground and connectivity of perched water not clear. Potential for migration into the Tees but dilution likely.	Moderate/low
	Carbon dioxide and methane	Future site users (commercial end use) and Buildings	Migration via permeable strata and accumulation in buildings	Explosion and asphyxiation (Severe)	**Low likelihood** Gas regime not known. Limited degradable material identified in Made Ground. Sources likely to have low gas production given the age of the fill.	**Moderate**
Landfills	Carbon dioxide and methane	Future site users (commercial/ industrial end use) and Buildings	Migration via permeable strata and accumulation in buildings	Explosion and asphyxiation (Severe)	**Low likelihood** Gas regime not known. Potential for lateral migration in Made Ground to areas near landfills.	**Moderate**
Fuel oil Depot and storage tanks	Hydrocarbons	Future site users (commercial/ industrial end use)	Dermal contact, accidental ingestion, inhalation of dusts and vapours, direct and following tracking back into buildings	Health Hazard (Medium)	**Likely** Previous SPMP monitoring in 2004 and 2007 for the fuel oil depo reported TPH below the GAC for commercial/industrial end use. Potential for additional spills but fuel oil of relatively low toxicity. There is no evidence of significant leakage from other historic gasoil and smaller fuel storage tanks, some may have been single skin and status of contemporary integrity testing unknown.	**Moderate**

Potential Source	Potential Pollutant	Potential Receptors	Potential Pathways to Receptors	Associated Hazard [severity]	Likelihood of Occurrence	Risk/ Significance
		Services	Direct contact with water pipes	Tainting of water supply (Medium)	**Low Likelihood** Slightly elevated TPH in groundwater near fuel oil depot. Potential for migration through plastic pipes	Moderate/low
		Groundwater	Infiltration and Migration via permeable strata	Pollution of undifferentiated secondary Aquifer (Medium)	**Low Likelihood** Slightly elevated TPH in groundwater near fuel oil depot. Groundwater generally within Made ground and connectivity of perched water not clear. Potential for migration into the Tees	Moderate/low
		Surface water (Tees Estuary SSSI)	Infiltration and Migration via permeable strata	Pollution of Tees Estuary (Medium)	**Low Likelihood** Slightly elevated TPH in groundwater near fuel oil depot. Groundwater generally within Made ground and connectivity of perched water not clear. Potential for migration into the Tees but significant dilution likely.	Moderate/low
Historic Benzole tanks and South Bank Coke Works, Coke Oven Gas Main and By-Products Plant:	Phenol, hydrocarbons including benzene and naphthalene, heavy metals, sulphate, sulphide, pH, cyanides, ammonia	Future site users (commercial/ industrial end use)	Dermal contact, accidental ingestion, inhalation of dusts, vapours. Migration of gases and accumulation in buildings	Health Hazard (Medium)]	**Low likelihood** Naphthalene and TPH identified in soil near the coke ovens and benzol tanks. Potential for migration into building	Moderate/low
		Services	Direct contact with water pipes	Tainting of water supply (Medium)	**Low Likelihood** Naphthalene .and TPH identified in soil near the coke ovens and benzol tanks. Potential for migration into building	Moderate/low
		Groundwater	Infiltration and Migration via permeable strata	Pollution of undifferentiated secondary Aquifer (Medium)	**Low Likelihood** Slightly elevated TPH in groundwater near coke ovens and free product noted near coke ovens and benzol. Groundwater generally within Made ground and connectivity of perched water not clear.	Moderator/low
		Surface water (Tees Estuary SSSI)	Infiltration and Migration via permeable strata	Pollution of Tees Estuary (Medium)	**Low Likelihood** Slightly elevated TPH in groundwater near coke ovens and free product noted near coke ovens and benzol. Groundwater generally within Made ground and connectivity of perched water not clear. Potential for migration into the Tees. Impact likely to be localised	Moderate/low
Substations and oil	Oils and PCBs	Future site	Dermal contact, accidental	Health Hazard	**Low likelihood**	Moderate/low

Potential Source	Potential Pollutant	Potential Receptors	Potential Pathways to Receptors	Associated Hazard [severity]	Likelihood of Occurrence	Risk/ Significance
filled cables		users (commercial/ industrial end use)	ingestion, inhalation of dusts, vapours, fibres and gases. Direct and following tracking back into buildings	(Medium)	PCBs and oil have low mobility. Likely to be near sources.	
		Services	Direct contact with water pipes	Tainting of water supply (Medium)	**Unlikely** PCBs and oil have low mobility.	Low
		Groundwater	Infiltration and Migration via permeable strata	Pollution of undifferentiated secondary Aquifer (Medium)	**Unlikely** PCBs and oil have low mobility. Likely to be near sources.	Low
		Surface water (Tees Estuary SSSI)	Infiltration and Migration via permeable strata	Pollution of Tees Estuary (Medium)	**Unlikely** PCBs and oil have low mobility. Likely to be near sources. Dilution likely	Low

3.6 Risk Evaluation

The preliminary risk assessment for the site, together with previous task specific ground investigations, has identified the presence of contaminants at concentrations which pose potentially significant risks to receptors including future site users.

In order to gain a more detailed understanding of any remediation works necessary to render the site suitable for use, a risk evaluation has been completed. This comprises a detailed review of the potentially significant contaminant linkages, the critical receptors and the key exposure pathways for each contaminant of concern. This information has been used to inform the Remediation Options Appraisal (presented in Section 4), ensuring that options are selected relevant to each of the key contaminant linkages.

It should be noted that the risk associated with the construction of foundation solutions, notably piling, will be dealt with under a separate geotechnical assessment for proposed future developments at the design stage. As such geotechnical/ foundation solutions have not been considered further within the Remediation Strategy.

Despite the long history of industrial activity on site and in the general STDC area, previous investigation work and site assessment, suggest there to be large areas of land previously occupied by operations of a lower contaminative nature, where ground remediation and site preparation requirements will be minimal for future industrial land use. Examples are areas previously given over to steel mills with large ground slabs, used for manufacturing steel products, and those areas used principally for materials storage, in contrast with the front/heavy end process industries within iron and steel making, together with coke production and associated by-products, which are more likely to leave a legacy of localised ground contamination.

3.7 Key Contaminant Linkages

The following key contaminant linkages of concern have been defined with regard development of the site:

- **Iron and Steel Works** – The site and the wider Teesside area has an extensive industrial legacy including almost 170 years of iron and steel making, together with auxiliary works. Previous investigation of the land has confirmed the presence of contaminants including heavy metals, hydrocarbons and abnormal pH. Based on a range of exposure pathways viable pollutant linkages are present to future onsite human health through inhalation, ingestion and direct contact.
- **Made Ground** –The site is known to extensively comprise reclaimed land, made up of slag, together with supplementary Made Ground deposits comprising ash and demolition rubble giving rise to a range of contaminants including heavy metals, abnormal pH and sulphate/sulphides. The ubiquitous nature of such materials across the site and its prevalence at the surface is one of the key pollutant linkages of concern regarding development of the site.
- **Hazardous Ground Gases** – Previous investigation of adjacent land has identified the presence of ground gases (methane (flammable gas) and carbon dioxide) which are likely to be derived from the historical legacy of landfilling, infilling and reclamation both on and off the site. Based on ground gas concentrations and a range of exposure pathways, the presence of ground gases are likely present a 'High to Very High' risk to current and future onsite and offsite human health (e.g. asphyxiation) and 'Moderate to Very High' to onsite and offsite properties (e.g. explosion). Given the nature of contaminants, there is also the potential for risks to human health from exposure to volatile organic compounds (VOCs). The hazardous ground gas risk will need to be assessed separately for specific future developments based on their intended construction form.
- **Asbestos** – Investigation data has identified the presence of asbestos in Made Ground which is likely to be derived from the historical legacy of landfilling, infilling and reclamation activities as

well as operational aspects associated with the site. Based on a range of exposure pathways, if the asbestos becomes disturbed and airborne, it will likely present a 'Moderate to High' risk to current and future onsite and offsite human health through inhalation.

- A range of metals, phenols, aliphatic hydrocarbons, PAH's, VOCs, SVOCs and aromatic hydrocarbon contaminants were identified within the soil with the potential to impact groundwater quality. Based on the low sensitivity, productivity aquifer and saline intrusion into groundwater beneath the site and surrounding area from the River Tees estuary, the site presents a 'Low to Moderate' risk to groundwater. Groundwater within the area is recognised by the Environment Agency as being non-viable.
- A range of metals, phenols, aliphatic hydrocarbons, PAH's VOCs, SVOCs and aromatic hydrocarbon contaminants were identified within the soil with the potential to impact surface water quality. Based on the former and current industrial land uses, and the influences of saline intrusions of the River Tees, the sensitivity of the surface water bodies is considered to be low, therefore the site would present a 'Low to Moderate' risk to surface water bodies. Moreover, contaminants potentially entering the surface water bodies would likely be subject to dilution and dispersion during migration. If contaminants did manage to enter the surface water bodies, further dilution and dispersion would likely occur especially when entering the River Tees. Given the industrial land use surrounding the site and the likelihood that the surface water bodies are acting as drainage for a wider industrial area, establishing a true causal relationship between site derived contaminants and the surrounding surface water bodies would prove challenging.

Key contaminant linkages identified as requiring some form of mitigation are summarised in Table 3.4.

Table 3.4 Key Contaminant Linkages

Contaminant Linkage No.	Contaminant Linkage Description
CL1	Future site users and inhalation of asbestos fibres associated with Made Ground.
CL2	Future site users and dermal contact, accidental ingestion, inhalation of dusts, vapours, fibres and gases associated with Made Ground.
CL3	Future site users and gas migration into buildings from landfills.
CL4	Future site users and dermal contact, accidental ingestion, inhalation of vapours associated with fuel storage facilities.

4. Remediation Options Appraisal

The document considers the overall land remediation strategy for the site in relation to the Development Masterplan. As outlined in Section 3, several potentially significant contaminant linkages have been identified. In accordance with CLR11, a Remediation Options Appraisal has been undertaken.

4.1 Remediation Objectives

The proposed redevelopment of available land at South Tees is for industrial end uses.

The objective of the remediation strategy is to take a balanced approach to remediation. As outlined in the Regeneration Masterplan, the objective is to mitigate the level of ground remediation required across the STDC area, minimise conflicts with the many safety restrictions (including various prevailing safety hazard zones) and avoid introducing future end users that would otherwise conflict with the existing industrial and commercial activities within the area.

The objective of the appraisal is to determine which option (or group of options) is most suitable for breaking the identified significant pollutant linkages. Breaking of the contaminant linkages is required to manage the associated risks and to prepare the site for redevelopment.

Remediation Criteria

In addition to ensuring that the site is suitable for its proposed end use, together with the technical feasibility of remediation options, the remediation criteria needs to be reasonable based on practicality, effectiveness, durability, costs and time involved. Any proposed remediation activities also need to take into consideration development requirements, such as the removal of legacy below ground structures as part of remediation, ground preparation or construction phase works.

Compliance with the remediation objectives will be met based on a do minimum / do necessary approach, appropriate to meet development needs while minimising pollution or other adverse effects on the local environment. The site, and wider STDC area, is of such a size that there is flexibility to arrange end user site allocations to minimise conflict with localised, more heavily contaminated areas.

It is acknowledged within the Regeneration Masterplan that not all the STDC area will be redeveloped and it is accepted within the overarching remediation strategy that some of the most contaminated locations may be remediated only to the minimum extent necessary for long-term safekeeping as managed open space. Such areas include the operational landfills, which are to be retained as waste management facilities, together with those considered to be of heritage value.

The outline remediation strategy also needs to consider the potential opportunity presented by the landfills. Although the end solution is anticipated to involve reshaping, capping, installation of leachate and gas management measures, and completion via implementation of a structured landscaping scheme. A large part of the landfill area is licensed to receive wastes from iron and steel making processes. Therefore, the option to utilise this area as a repository for residual, unsuitable materials from ground remediation and site preparation activities could compliment other remediation options through both cost-effective remediation and an environmentally sustainable alternative to off-site disposal.

The outline remediation options appraisal is outlined in Section 4.3.

4.2 Regulatory Requirements

As discussed earlier in Section 1.4 any future development will be controlled via the Planning Regime. Future planning permission may be granted, subject to the discharge of a number of Planning Conditions, including those relating to land contamination guided by the Development Principle STDC9 of the SPD.

The key requirements of the Planning Regime which require consideration at the Remediation Options Appraisal stage is the need to develop a Remediation Strategy to bring the site to a condition suitable for use by removing unacceptable risk to receptors. The outline Remediation Strategy must meet the approval of RCBC and must ensure that the site will not qualify as 'Contaminated Land' under Part 2A. The approved Remediation Strategy shall be implemented within the time frame agreed with RCBC.

As per standard planning conditions any development shall be stopped immediately in the event that contamination not previously identified is found to be present and details of the contamination shall be reported immediately in writing to the Local Planning Authority.

Preserving Heritage Assets

In addition to the technical and pragmatic remediation criteria STDC and RCBC acknowledge the potential opportunity to preserve some of the area's industrial heritage. Policy LS4 of the Local Plan identifies that the Dorman Long Tower at South Bank Coke Ovens is of heritage and cultural importance and it is acknowledged through the SPD that asset retention may well mitigate the burden and cost associated with demolition and remediation, subject to the identification of viable management options.

4.3 Selection of feasible remediation options

There are numerous options available for either source removal or breaking the identified key contaminant linkages (Table 3.4). These can be divided into six principle categories:

- Civil engineering
- Biological
- Chemical
- Physical
- Stabilisation and solidification
- Thermal

Table 4.1 presents a comprehensive matrix of potentially feasible remediation options within each of the categories screen against a range of generic contaminant groups. This has been used for the initial screening of remediation options. For completeness, contaminant groups not previously identified on site as key contaminant linkages have been presented to assist rapid reappraisal of the overarching approach should previously unidentified contaminants be encountered in the future.

Short list of feasible remediation options

The key drivers for remediation activities are to ensure that the site is suitable for the proposed industrial end uses.

As far as possible the options appraisal has looked to build from the known form of developments outlined within the regeneration masterplan, with the flexibility in the redevelopment to arrange end user site allocations to minimise conflict with localised, more heavily contaminated areas wherever possible. This includes taking advantage of hard standing, roadways etc to minimise remediation requirements.

Remediation options associated solely with groundwater have not been taken forward for further appraisal, however hydraulic or permeable reactive barriers together with natural attenuation may be considered in the future at a local scale to compliment other remediation options. Although controlled water risks are not the principal driver, in line with industry best practice, CLR11 guidance, the ethos of the NPPF and development principle of the SPD, the prevention of pollution and betterment of the existing conditions will be integral to the successful delivery of any remediation scheme.

Thermal remediation methods of incineration and desorption, together with stabilisation and solidification methods of hydraulic binders or vitrification have not been taken forward for evaluation due to energy input requirements and comparatively low treatment volumes. They may be appropriate for local remediation of targeted hotspots but are not considered to be viable for widespread deployment on the site.

Solvent extraction, air sparging, soil vapour extraction (SVE) and dual phase SVE have not been carried forward for evaluation due to the absence of widespread solvent and/or hydrocarbon contamination. Chemical oxidation and dehalogenation are also not applicable to the remediation of heavy metals or asbestos. Soil flushing, surface amendments or soil washing are not appropriate for asbestos contamination.

Biological remediation methods are not applicable for the remediation of asbestos or the ubiquitous heavy metals present within the sites Made Ground deposits. The low nutrient and high pH typical of the Made Ground would also prohibit targeted remediation of hydrocarbons without notable pre-treatment / augmentation or dilution.

Localised in ground barrier solutions may be applicable on a local scale but are not considered, particularly where they may compliment any landfill gas mitigation measures but are not considered to be appreciate for site wide deployment.

4.4 Outline Remediation Options Appraisal

The outline remediation options appraisal is presented in Table 4.2 and considers contaminant linkages CL1, CL2 and CL4 identified in Table 3.4. CL3 has been excluded from the appraisal on the basis that development principle STDC9 of the SPD has already established that '*development proposals located in proximity to former landfill sites should be supported by a Gas Risk Assessment and should incorporate any necessary protection measures, such as those to protect buildings from landfill gas migration*'.

Exposure pathways for commercial/industrial end use include direct soil and indoor dust ingestion, skin contact with soils and dusts, and inhalation of dust and vapours. As it is not pragmatic to remove all potentially impacted materials the overarching remediation strategy needs to consider options to break contaminant linkages is to manage the associated risks and to prepare the site for redevelopment without constraints.

Applicable media **S** = Soils, Made Ground and sediments **W** = Groundwater and surface water		**Organic substances**							**Inorganic substances**				
		Volatile organic compounds (VOCs)	Halogenated hydrocarbons	Non-halogenated hydrocarbons	**Polyaromatic hydrocarbons (PAHs)**	**Polychlorinated biphenyls (PCBs)**	**Dioxins and furans**	Pesticides and herbicides	**Heavy metals**	**Non-metals**	**Asbestos**	**Cyanides**	Explosives
Method	**Remediation options**	Applicable media							Applicable media				
Civil engineering	Containment - cover systems	S	S	S	S	S	S	S	S	S	S	S	S
	Containment - hydraulic barriers	W	W	W	W	W	W	W	W	W		W	W
	Containment - in ground barriers	S, W	S, W	S, W	S, W	S, W	S, W	S, W	S, W	S, W		S, W	S, W
	Excavation and disposal	S	S	S	S	S	S	S	S	S	S	S	S
Biological	Natural attenuation	W	W	W	W			W	W	W			W
	Biopiles	S		S	S			S					S
	Bioventing	S	S	S	S								
	Biosparging	S, W	S, W	S, W	S, W			S, W					
	Landfarming	S		S	S			S					S
	Slurry phase biotreatment	S	S	S	S		S	S				S	S
	Windrow turning	S		S	S			S					S
Chemical	Chemical oxidation	S, W	S, W	S, W	S, W			S, W		S, W			
	Chemical dehalogenation	S	S			S	S						
	Soil flushing	S	S	S	S				S				
	Surface amendments								S	S			
	Solvent extraction	S	S	S	S	S	S	S					S
Physical	Soil vapour extraction (SVE)	S	S	S									
	Dual phase SVE	S, W	S, W	S, W									
	Air sparging	W	W	W									
	Permeable reactive barriers	W	W	W	W	W	W	W	W	W		W	W
	Soil washing		S	S	S	S		S	S	S		S	
Stabilisation and solidification	Hydraulic binders (such as cement)			S	S	S	S	S	S	S	S	S	
	Vitrification	S	S	S	S	S	S	S	S	S		S	S
Thermal	Incineration	S	S	S	S	S	S	S	S	S		S	S
	Thermal desorption	S	S	S	S	S		S	S		S	S	

Table 4.1 Outline Remediation Options Appraisal

Contaminant Linkage	Technique	Summary of Technique	Logistical Requirements	Advantages	Disadvantages	Relative Cost	Conclusion
CL1, CL2 & CL4	Capping of the site with a minimum of 0.3 m of material	Placement of chemically suitable for use materials over contaminated ground. Designed to reduce hazard to human health and enable a clean zone for construction and placement of utilities and associated infrastructure.	Site regrading and in-ground structure removal anticipated to approximately 2.5m bgl. Minimal to no compaction of the underlying material is envisaged prior to placement of suitable cover material. A no dig layer may be considered necessary given the depth of capping. Subject to construction requirements relating to the development, a low permeability break layer may be required. A clean service run area may be required to protect both future land users (maintenance) and utility assets.	Cost effective for use across entirety of site. Significantly reduces hazard to human health. Well established / proven technique. Easily incorporated into the redevelopment of the site and appropriate to phased development of discrete land parcels. The installation of positive drainage and a reduction in surface water percolation through the contaminated made ground to the River Tees.	Will not treat contaminant sources. Contaminant source remains in-situ. Capping material must chemically meet site specific assessment criteria and be geotechnically suitable. Suitable for use materials may need to be imported.	Low to medium	Proven cost-effective technique in the UK, subject to sourcing and transport of capping materials. Environmentally sustainable for the wider development with reuse of materials. Protection of in-ground service/ infrastructure and also future maintenance workers. STDC may be able to utilise materials derived from their wider development works, thereby a sustainable approach.
CL1, CL2 & CL4	Excavation and disposal	Excavation of the contaminated material and off-site disposal to landfill (including those within STDC wider area) or off-site treatment facility.	Vast amounts of groundwork required. Appropriate levels of site investigation to characterise and delineate conditions to reduce the need for movement and/or disposal. Logistical transport arrangements. Dewatering of come materials required and then disposal of potentially contaminated water.	Removes source of contamination. Easily incorporated into the redevelopment of the site. Existing adjacent landfills permitted to accept iron and steel industry wastes. Very low risk of technique failing.	Not a sustainable technique. Waste would require segregation dependent on type and level of contamination. Capacity of adjacent landfills not enough to accept all potentially contaminated Made Ground. Very costly, as material sent off-site for disposal will need to be replaced with imported material. Very unsustainable.	Very high	Standalone remediation option: Relative cost is high to very high. Not considered environmentally sustainable. Environmentally, logistically and economical viable if combined with other techniques for target disposal and utilising existing landfills within the STDC area.
CL1, CL2 & CL4	Hard Surfacing	Use of concrete and or other appropriate hard surfacing to break pathway	Large scale concrete requirement. Protection against aggressive soils will be required. Clean service runs and/or barrier pipes (see below) likely to be required. A clean service run area may be required to protect both future land users (maintenance) and utility assets.	Significantly reduces hazard to human health. Well established / proven technique. Relatively easily incorporated into the redevelopment of the site.	Not very sustainable. Requires a great deal of long-term management and maintenance of the site. Protection of in ground workers and assets required in short and long term	High to very high	Standalone remediation option: Relative cost is high to very high and not viable given the site area. Not considered environmentally sustainable. Cost effective and sustainable when considered as a complimentary option to other techniques and incorporated into development layout design.

4.5 Selection of final feasible remediation options

The selection of feasible remediation options (Section 4.3) set out the evaluation of options excluded. The SPD acknowledges that areas of the site may be subject to different levels of contamination and the approach of the STDC will be to assess the degree of contamination and to adopt a ground remediation strategy that will deal with the contamination based on site delivery and viability.

Given the size of the site, together with the range and distribution of contaminants, and apparent limited risks to potential future industrial end users the most appropriate **overarching remediation option** comprises the formation of a minimum capping layer across the site to physically break Made Ground contaminant linkages. This is consistent with the Regeneration Masterplan and remediation objective to take a balanced approach to the level of ground remediation required across the STDC area. In areas of the development residual Made Ground contaminant linkages may be broken by the development itself due to the presence of the hardstanding/building slab associated with the development. Clean service runs will be required to protect both future land users (notably maintenance workers) and utility assets.

This overarching approach is compatible with the phased remediation of the site and flexibility of layout design, allowing development hard surfacing to also contribute to remediation solutions. As set out in the remediation criteria, any proposed remediation activities need to take into consideration development requirements, such as the removal of legacy below ground structures as part of remediation, ground preparation or construction phase works. It is anticipated that most areas will require the grubbing out of relic structures resulting in initial enabling works typically involving the reworking of the initial couple of metres below ground level. The option for selective excavation and disposal at the adjacent hazardous waste facility of limited 'hotspots' of contamination complements a capping approach as a balanced approach to remediation and ensures that the site is suitable for its proposed end use. The clean service runs will typically be installed as part of the enabling earthworks to prepare the site for redevelopment.

To enable the protection of the remediation capping layer during both the construction and full site operational phase, it may be necessary to provide an additional layer of engineering fill. This would be provided as part of the building construction phase of works, and the form and nature of any additional layer will be dealt with under a separate application. As such this does not form part of the current Remedial Strategy.

The final form of remediation for each phase will be determined through the engineering design. Future developments will be supported with a simple design statement confirming how the proposed development ties in with the overarching remediation strategy.

5. Proposed Remediation Works

The recommended outline remediation strategy is based on our current understanding of the site.

5.1 Outline of Proposed Remediation

Given the size of the site it is not feasible to remediate the whole site as a single operation. Redevelopment will be phased over numerous years. Consequently, a pragmatic approach will be for remediation works to be undertaken as part of the development platform construction phase for individual land parcels, this will allow remediation tasks to be incorporated into the design of the development.

As stated above, the engineering design for each phase will need to determine the remediation approach based on the intended layout and form of development, to render the site suitable for use. The remediation design statement for each phase will set out how the proposed development conforms with the outline remediation strategy. For future developments regulated under the planning regime a design statement will be submitted to support the specific planning application, specifying the form of development and the manner in which the site will be remediated to render it suitable for use. The design statement as a minimum should include:

- Plan of the proposed development.
- Details of proposed capping, including use of concrete slab, highway, hard standing and capping of open space.
- Any notable variations and associated mitigation from the outline remediation strategy.

Additional ground investigation and/or site specific risk assessment may be required to inform the above.

5.2 Development Platform Remediation – Proposed Works

Initial enabling activities will comprise demolition of legacy structures and ground preparation operations including vegetation clearance and infilling of voids.

The outline remediation strategy does not require the existing site levels to be raised beyond remediation cover system requirements and to enable a level platform for ease of the development.

Site won and imported clean cover soils will be placed under a controlled methodology, mainly driven by geotechnical requirements, to form the development platform. Therefore, the materials are likely to be put down in compacted layers to satisfy these requirements. Clean service runs will need to be incorporated into the development, as appropriate.

Subject to viability and if piling is used in the final design it may be possible to re-use pile and foundation arising's within the confines of the site, beneath the capping layer. This will be subject to chemical analysis of the arising's to ensure they are in keeping with the soil chemistry in the shallow Made Ground and do not lead to leachable contaminants.

To enable the protection of the remediation capping layer during both the construction and full site operational phase, it may be necessary to provide an additional layer of engineering fill, of approximately 0.5 m. This would be provided as part of the building construction phase of works, and the form and nature of any additional layer will be dealt with under a separate application. As such this does not form part of the current Remedial Strategy.

Verification Works

Confirmatory chemical analysis to ensure suitability for use of any capping materials will be required before placement commences and monitored throughout the works. The land parcel specific remediation design statement will set out the testing frequency. All materials will be subject to visual and olfactory assessment during the works, if deemed necessary additional confirmatory analysis will be undertaken. Site specific remediation criteria are not anticipated to be required for the proposed redevelopment of the site. Suggested generic screening criteria, together with determinands to be analysed for those listed in Table 5.1.

Table 5.1 Chemical Suitability Assessment Criteria (Industrial/ Commercial) for Soils

Determinand	Assessment Criteria (mg/kg)	Assessment Criteria Source
Asbestos	Non-detect	-
Arsenic	640	C4SL (Commercial)
Cadmium	410	C4SL (Commercial)
Chromium III	8,600	LQM/CIEH S4UL (Commercial/ Industrial)
Chromium VI	49.00	C4SL (Commercial)
Copper	68,000	LQM/CIEH S4UL (Commercial/ Industrial)
Lead	2,300	C4SL (Commercial)
Nickel	980	LQM/CIEH S4UL (Commercial/ Industrial)
Selenium	12,000	LQM/CIEH S4UL (Commercial/ Industrial)
Zinc	730,000	LQM/CIEH S4UL (Commercial/ Industrial)
Inorganic mercury	1,100	LQM/CIEH S4UL (Commercial/ Industrial)
Benzo(a)pyrene	77	Wood GAC (Commercial/ Industrial)
Naphthalene	1,900	Wood GAC (Commercial/ Industrial)

Additional verification of the placement of the materials will be undertaken based on geotechnical characteristics required to develop the building platform.

It will also be necessary to ensure that a suitable thickness of capping has been placed across the site and this will be demonstrated through surveying of the site before and after remediation works.

Disposable of unsuitable materials

Where materials are chemically and physically suitable they will be retained on site. A site wide MMP will be in operation for re-use of materials. As noted above the existing adjacent landfills, within the wider STDC area, will be utilised wherever appropriate. Responsibility for the correct handling, storage, sampling, analysis and classification of such material will rest with the appointed remediation contractor.

Discovery of Unrecorded Contamination during the Works

Although areas of the site and wider area have been subject to extensive previous ground investigation, there remains the potential for unrecorded contamination which may be encountered during the remediation or site preparation works. The assessment of such material may be based on visual / olfactory evidence of contamination initially, with the material set aside for sampling and analysis to confirm whether the material can be retained or requires off-site disposal. The material will be stored within the site, in a suitable location, pending sampling and analysis. Responsibility for the correct handling, storage, sampling, analysis and classification of such material will rest with the appointed remediation contractor.

5.3 Verification Reporting

The proposed methods of verification are detailed in Section 5.2. Reporting of the verification works is required to provide evidence that the remediation works have been undertaken in accordance with the land parcel remediation design statement (specification) and approved outline remediation strategy, for the benefit of the regulators and future developers. The Verification Report shall also form part of the Health and Safety File.

Verification Reports will be prepared in accordance with CLR11 and include:

- Factual account of all works undertaken, supported with as-built drawings, where appropriate;
- Environmental monitoring records;
- Duty of care information for any wastes removed off-site;
- Confirmation of capping layer thickness;
- Re-appraisal of contaminant linkages post-works; and
- Remediation Statement to confirm works completed or highlight any works which remain outstanding.

5.4 Future Site Maintenance / Redevelopment

Under the requirements of both the Health & Safety at Work Act and the Construction, Design, Management Regulations, 2015 a Health and Safety file is required to be prepared following the completion of the remediation works. The Health and Safety File is to be made available to those intending to undertake any works at the site which involves ground disturbance so that appropriate safe systems of work can be prepared which manage the potential for exposure to contaminants that remain in the ground following redevelopment. The Health and Safety File should also outline requirements for reinstatement of any hardstanding and cover systems on completion of any works to ensure the works have not left any contamination at surface which may pose risk to site users.

6. Control of the Works

6.1 Design Statement

The remediation design statement for each phase will set out how the proposed development conforms with the outline remediation strategy. For future developments regulated under the planning regime a design statement will be submitted to support the specific planning application, specifying the form of development and the manner in which the site will be remediated to render it suitable for use. The design statement as a minimum should include:

- Plan of the proposed development.
- Details of proposed capping, including use of concrete slab, highway, hard standing and capping of open space.
- Any notable variations and associated mitigation from the outline remediation strategy.

6.2 Implementation Plan

In line with CLR11, the works shall be delivered in accordance with a Design Statement. This document shall set out:

- Overview of the remediation objectives, in line with the Remediation Strategy;
- The detailed design of the works, which shall be used to develop the Remediation Works Technical Specification, and which shall be based on the Remediation Strategy;
- Roles and responsibilities with regard to managing and delivering the works;
- Programme for the works;
- Supervision requirements;
- Regulatory permit requirements; and
- Verification requirements.

6.3 Construction (Design and Management) (2015) Regulations

The remediation works will be carried out on behalf of the Client by an appointed remediation contractor, who will be appointed as ‘Principal Contractor’ under the Construction (Design and Management) Regulations 2015 (CDM 2015).

6.4 Site Supervision

The remediation works will be supervised by both a suitably qualified and experienced geoenvironmental engineer.

6.5 Materials Management Plan

In accordance with the CL:AIRE Definition of Waste Code of Practice, a Materials Management Plan (MMP) will be produced for the works. All recoverable materials will be tracked through this document, with waste materials detailed in the Waste Management Plan (summarised in Section 6.6). The overall approach is to retain as much material on site as possible, thereby minimising the requirement to export materials off-site for disposal, thus reducing landfill burden and minimising CO_2 emissions from waste transport. The MMP will be subject to review by a Qualified Person (QP).

6.6 Environmental & Waste Management

The remediation works will be undertaken in accordance with the remediation contractor's Environmental Management Plan (EMP) and WMP.

Potential environmental impacts arising from the remediation works, measures to mitigate those impacts and those responsible for their implementation are outlined below.

Waste

The remediation contractor shall prepare a WMP for the works. This document shall identify all anticipated waste streams associated with the works and identify appropriate disposal routes. It shall also include mitigation measures to be implemented to ensure no nuisance arises from waste storage such as odour or littering. The document shall be updated throughout the works to include all waste consignment notes.

Dust

Dust may be generated during excavation, haulage, backfilling and soil stockpiling, particularly during periods of dry weather. It will be the responsibility of the remediation contractor to ensure no nuisance arises. Mitigation measures to be adopted include:

- Maintenance of site traffic routes, and enforcement of speed limits to minimise the potential generation of dust.
- All wagons leaving the site to be sheeted.
- Water sprays to be used during operations as and when required to minimise potential for dust generation.
- Road sweeper to be deployed to clean public highways adjacent to site, where required. Road sweepers are not appropriate for the internal roadways.

Noise & Vibration

Noise and vibration will be associated principally with the breaking out and crushing of any hard materials present in the areas that are to be subject to remediation. The contractor will be required to use the most suitable equipment appropriate to the task, considering noise levels and anticipated duration of the task, to minimise potential for nuisance. In addition, consideration shall be given to restricting works to particular hours, where required.

Odour

Odours may arise during the works, however the potential for generation of significant odours is expected to be relatively low. If significant odours are noted, appropriate mitigation measures will be implemented by the remediation contractor. This may, for example, include covering odorous materials, amending working practices to minimise odours and/or utilising odour suppression and mitigation equipment.

Vapours

Organic vapours were not encountered at significant concentrations during previous site or adjacent site investigation works. Therefore, it is not considered that monitoring of organic vapours is required during the works.

Surface Water

The remediation contractor shall implement appropriate mitigation measures to protect any surface water drains during the works to ensure no pollutants or sediments enter the surface water network. This will include siting soil stockpiles and temporary storage tanks away from surface water drain entry points and where necessary, protecting those entry points with impermeable barriers or covers.

Traffic

Vehicle movements associated with the works are unavoidable. The remediation contractor will be required to implement a Construction Traffic Management Plan (CTMP) which will outline any measures required to minimise disruption and nuisance to adjacent land users.

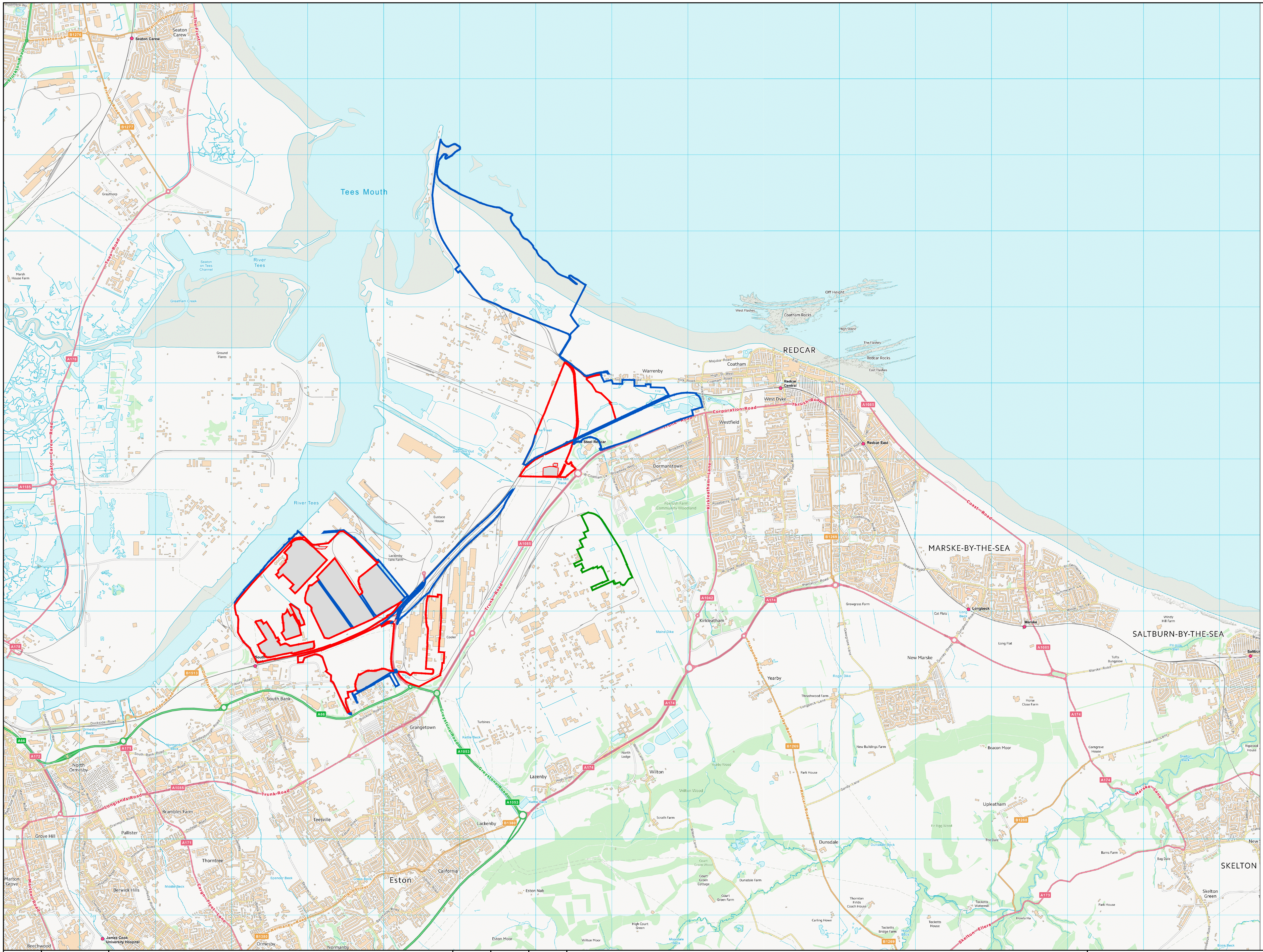
Mud on Roads

There is a potential for mud to be carried out of the site on to local roads during the works. Mitigation measures will be implemented, where necessary, and may include use of a wheel wash and/or deployment of a road sweeper.

Licences / Permits

All relevant environmental permits will be obtained and maintained by the remediation contractor, if required. The remediation contractor will be responsible for adhering to any conditions specific to such permits.

Figures



NOTES:

1. All units are in metres unless otherwise noted.

2. This drawing has been produced using information taken from South Tees Development Corporation drawings STDC–SCW–XX–PLA–0001 dated May 2019 and STDC–SCW–XX–GEN–0003 dated April 2019.

KEY:

🟦 STDC Land ownership boundaries

🟥 Proposed STDC works red line planning boundaries

🟩 Sirius Wilton site boundary

▨ Areas not included within works

0 km 3 km

Scale 1:50,000 @ A3

REV	DATE		DWN	CHK	APP
P01.1	18/06/19	FIRST ISSUE	AB	MR	MR
		REVISIONS			
REV	DATE		DWN	CHK	APP
P02	24/06/19	Minor amendments to spot level text	AB	MR	MR

PROJECT TITLE: Former Steel Works
South Tees

DRAWING TITLE: Site Location Plan

SCALES : 1:50,000 @ A3 Original Drawing Size – A3

CLIENT:
South Tees Development Corporation

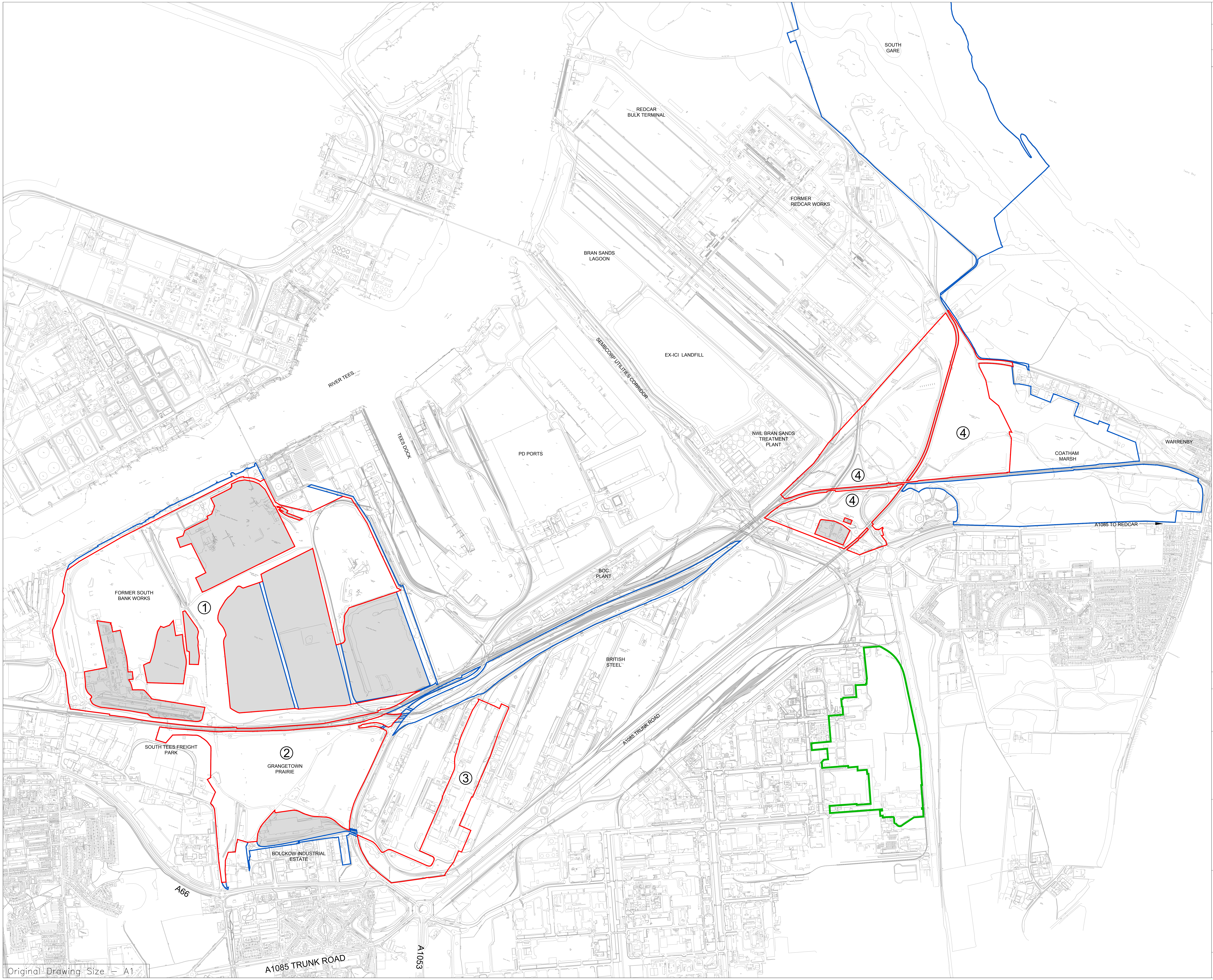
REF:

Canon Court, Abbey Lawn,
Abbey Foregate,
Shrewsbury SY2 5DE.
Tel: (01743) 342000
Fax: (01743) 342010

wood.

DRAWING No.
41825–WOOD–XX–XX–DR–OC–0002_A_P02

H:\Projects\41825 South Tees DC Remediation Support\D Design_Technical\Drawings\Wood\AutoCAD\41825-WOOD-XX-XX-DR-OC-0002_S2_P02.dwg Originator: ANDY.BANNISTER



Original Drawing Size – A1

		DESCRIPTION			
REV A	DATE 18/06 2019	FIRST ISSUE	DWN AB	CHK MR	APP MR

REVISIONS

REV	DATE		DWN	CHK	APP
P02	24/06 2019	Amendment to planning boundaries and associated changes to text in key	AB	MR	MR

NOTES:

1. All units are in metres unless otherwise noted.
2. This drawing has been produced using information taken from South Tees Development Corporation drawings STDC–SCW–XX–PLA–0001 dated May 2019 and STDC–SCW–XX–GEN–0003 dated April 2019.
3. Zoned solely for the purpose of historical site review and environmental context appraisal to support overarching remediation Strategy

Zone 1: Former South Bank Works
Zone 2: Grangetown Prairie
Zone 3: Lakenby Coil Plate Mill
Zone 4: Warrenby Landfill & Coatham Marsh

KEY:

🟦	STDC Land ownership boundaries
🟥	Proposed STDC works red line planning boundaries
🟩	Sirius Wilton site boundary
▨	Areas not included within works

DRAFT

0m 200m 400m 600m 800m
SCALE 1:10,000

SCALES: 1:10,000 @ A1

PROJECT TITLE:
Former Steel Works
South Tees

DRAWING TITLE:
Site Zones for Environmental Context

CLIENT:
South Tees Development Corporation

REF:

CANON COURT, ABBEY LAWN,
ABBEY FOREGATE,
SHREWSBURY,
SHROPSHIRE
SY2 5DE
TEL: (01743) 342000
FAX: (01743) 342100

wood.

DRAWING No.
41825–WOOD–XX–XX–DR–OC–0001_A

Rev.
P02

The environmental risk assessment aims to assess the significance of each potential contaminant linkage. The key to the classification is that the designation of risk is based upon the consideration of both:

- **The magnitude of the potential consequence (i.e. severity).** It takes into account both the potential severity of the hazard and the sensitivity of the receptor.
- **The magnitude of probability (i.e. likelihood).** It takes into account both the presence of the hazard and receptor and the integrity of the pathway.

The definitions for the qualitative risk assessment have been taken from "Guidance for the Safe Development of Housing on Land Affected by Contamination" Annex 4 R&D Publication 66: 2008 Volume 2.

The Likelihood Probability Classifications of SPR Linkage being realised is presented in Table E.1

Table E.1 Likelihood Probability Classifications of SPR Linkage being realised

Classification	Definition	Examples
Unlikely	There is pollutant linkage, but circumstances are such that it is improbable that an event would occur even in the very long-term.	a) Elevated concentrations of toxic contaminants are present below hardstanding. b) Light industrial unit <10 yrs. old containing a double skinned UST with annual integrity testing results available.
Low Likelihood	There is pollutant linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a long period such an event would take place and is less likely in the shorter term.	a) Elevated concentrations of toxic contaminants are present in soils at depths >1m in a residential garden, or 0.5-1.0m in public open space. b) Ground/groundwater contamination could be present on a light industrial unit constructed in the 1990s containing a UST in operation over the last 10 years – the tank is double skinned but there is no integrity testing or evidence of leakage.
Likely	There is pollutant linkage and all the elements are present and in the right place which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.	a) Elevated concentrations of toxic contaminants are present in soils at depths of 0.5-1.0m in a residential garden, or the top 0.5m in public open space. b) Ground/ groundwater contamination could be present from an industrial site containing a UST present between 1970 and 1990. The tank is known to be single skin. There is no evidence of leakage although there are no records of integrity tests.
High Likelihood	There is pollutant linkage and an event would appear very likely in the short-term and almost inevitable over the long-term, or there is evidence at the receptor of harm or pollution	a) Elevated concentrations of toxic contaminants are present in soils in the top 0.5m in a residential garden. b) Ground/groundwater contamination could be present from chemical works, containing a number of USTs having been in operation on the same site for over 50 years.

"Potential Consequence of Contaminant Linkage" gives an indication of the sensitivity of a given receptor to a particular source or contaminant of concern under consideration. It is based on full exposure via the particular linkage being examined. The classification of consequence is presented in Table E.2.

Table E.2 Outline of Hazard Consequence Classifications for Receptor Types from Contamination Impact:

Classification	Human Health	Controlled Water	Ecology	Property Structures/ Crops and animals	Examples
Severe	Highly elevated concentrations likely to result in "significant harm" to human health as defined by the EPA 1990, Part 2A, if exposure occurs.	Equivalent to EA Category 1 pollution incident including persistent and/or extensive effects on water quality; leading to closure of a potable abstraction point; major impact on amenity value or major damage to agriculture or commerce.	Major damage to aquatic or other ecosystems, which is likely to result in a substantial adverse change in its functioning or harm to a species of special interest that endangers the long-term maintenance of the population.	Catastrophic damage to crops, buildings or property.	Significant harm to humans is defined in circular 01/2006 as death, disease*, serious injury, genetic mutation, birth defects or the impairment of reproductive functions. Major fish kill in surface water from large spillage of contaminants from site. Highly elevated concentrations of Hazardous or priority substances present in groundwater close to small potable abstraction (high sensitivity). Explosion, causing building collapse (can also equate to immediate human health risk if buildings are occupied).
Medium	Elevated concentrations which could result in "significant harm" to human health as defined by the EPA 1990, Part 2A if exposure occurs.	Equivalent to EA Category 2 pollution incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to agriculture or commerce.	Significant damage to aquatic or other ecosystems, which may result in a substantial adverse change in its functioning or harm to a species of special interest that may endanger the long-term maintenance of the population.	Significant damage to crops, buildings or property.	Significant harm to humans is defined in circular 01/2006 as death, disease*, serious injury, genetic mutation, birth defects or the impairment of reproductive functions. Damage to building rendering it unsafe to occupy e.g. foundation damage resulting in instability. Ingress of contaminants through plastic potable water pipes.

Classification	Human Health	Controlled Water	Ecology	Property	Examples
				Structures/ Crops and animals	
Mild	Exposure to human health unlikely to lead to "significant harm".	Equivalent to EA Category 3 pollution incident including minimal or short lived effect on water quality; marginal effect on amenity value, agriculture or commerce.	Minor or short lived damage to aquatic or other ecosystems, which is unlikely to result in a substantial adverse change in its functioning or harm to a species of special interest that would endanger the long-term maintenance of the population.	Minor damage to crops, buildings or property.	Exposure could lead to slight short-term effects (e.g. mild skin rash). Surface spalling of concrete.
Minor	No measurable effects on humans	Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems.	Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems.	Repairable effects of damage to buildings, structures and services.	The loss of plants in a landscaping scheme. Discoloration of concrete.

The risk matrix to link the likelihood and consequence is shown in Table E.*3*

Table E.3 Risk Matrix

Likelihood:	**Unlikely**	**Low Likelihood**	**Likely**	**High Likelihood**
Potential Consequence:				
Severe	Moderate/low risk	Moderate Risk	High Risk	Very High Risk
Medium	Low	Moderate/low risk	Moderate Risk	High Risk
Mild	Very low risk	Low Risk	Moderate/low risk	Moderate Risk
Minor	Very low risk	Very low risk	Low Risk	Low Risk

The overall risk definitions are summarised in Table E.4

Table E.4 Risk Definitions

Risk	**Definition**
Very Low	It is a low possibility that harm could arise to a designated receptor, but it is likely at worst, that this harm if realised would normally be mild or minor.
Low	It is possible that harm could arise to a designated receptor from identified hazard, but it is likely at worst, that this harm if realised would normally be mild. It is unlikely that the site owner/or occupier would face substantial liabilities from such a risk. Further investigative work (which is likely to be limited) to clarify the risk may be required. Any subsequent remediation works are likely to be relatively limited.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely, that the harm would be relatively mild. Further investigative work is normally required to clarify the risk and to determine the potential liability to site owner/occupier. Some remediation works may be required in the longer term.
High	Harm is likely to arise to a designated receptor from an identified hazard at the site without remediation action. Realisation of the risk is likely to present a substantial liability to the site owner/or occupier. Investigation is required as a matter of urgency to clarify the risk. Remediation works may be necessary in the short-term and are likely over the longer term.
Very High	There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without remediation action OR there is evidence that severe harm to a designated receptor is already occurring. Realisation of that risk is likely to present a substantial liability to be site owner/or occupier. Investigation is required as a matter of urgency and remediation works likely to follow in the short-term.

Appendix H2: Scoping Correspondence with RCBC

creating a better place

Environment Agency

David Pedlow
Redcar & Cleveland Borough Council
Redcar & Cleveland House
Kirkleatham Street
Redcar
TS10 1RT

Our ref: NA/2019/114630/01-L01
Your ref: R/2019/0427/FFM

Date: 8 Augus 2019

Dear David

DEMOLITION OF STRUCTURES AND ENGINEERING OPERATIONS ASSOCIATED WITH GROUND PREPARATION AND TEMPORARY STORAGE OF SOILS AND ITS FINAL USE IN THE REMEDIATION AND PREPARATION OF LAND FOR REGENERATION AND DEVELOPMENT LAND AT FORMER SOUTH BANK WORKS; GRANGETOWN PRAIRIE; BRITISH STEEL AND WARRENBY AREA

Thank you for referring this application which we received on 10 July 2019. We have reviewed the documentation and have the following comments to make.

Environment Agency Position

Flood Risk

The proposed application will only meet the National Planning Policy Framework’s requirements if the following planning **condition** is included.

Condition

The work will be carried out in accordance with the submitted flood risk assessment and drainage strategy (June 2019, wood) and consistent with the layout identified in *STDC-SCW-XX-PLA-0002 Materials Storage Site Location Plan with mounds.*

- The storage mounds must be sited exclusively in Flood Zone 1

Reason

To prevent flood flows from being displaced and prevent increased risk of flooding elsewhere.

Environmental Permitting Regulations Permits - informative

Temporary Storage

Grangetown Prairie: The proposed mounds in this area are outside of the boundary of existing EPR permits regulated by the installations team.

Metal Recovery Site: The proposed mound is within the permitted area of EPR permit PP3338MT. The permit issued to Harsco Metals Group Limited is still live and there are some operations relating to slag and metal recovery still being undertaken by Harsco and their subcontractors. These operations are helping to reduce the amount of waste left on site following closure of steel making operations and should be allowed to continue.

Warrenby Landfill Area: The proposed mounds in this area are outside of the boundary of existing EPR permits regulated by the installations team.

Permanent restoration

Warrenby and Grangetown Prairie: These are outside of areas with EPR permits regulated by the installations team.

South Bank: Some of this area is within the area covered by EPR permit JP3638HM held by SSI UK Ltd (in liquidation). Parts of this area are also within a COMAH upper tier establishment. The operator of the COMAH establishment is South Tees Site Company Ltd. They are about to begin a phased decontamination project with the aim of removing contaminated residues in pipes, vessels, sumps and other structures with the aim of being able to demonstrate that the site is no longer subject to the COMAH regulations. These decontamination operations should be completed prior to any demolition or longer term restoration of the site.

Lackenby: The restoration area proposed is assumed to be shown by Drawing STDC-SIZ-LA-PLA-001. Within this area there are two small areas which are within the boundary of EPR permits held by Harsco Metals Group Ltd (FP3338MT) and British Steel UK Ltd (in administration) (FP3436AT).

See generic note relating to **Restoration of land subject to EPR permit**:
Prior to commencement of any operation to store or permanently use soil for restoration on any part of the site covered by an EPR permit the Environment Agency will need to be satisfied that the necessary measures referred to in paragraph 14 of Schedule 5 of the Environmental Permitting (England and Wales) Regulations 2016 have been taken.

Surrender applications
14.—(1) The regulator must accept an application for the surrender of an environmental permit in whole or in part under regulation 25(2) if it is satisfied that the necessary measures have been taken—
(a) to avoid a pollution risk resulting from the operation of the regulated facility and, in the case of a permit authorising the carrying on of a flood risk activity (in whole or in part), to avoid any of the risks specified in sub-paragraph (3), and
(b) to return the site of the regulated facility to a satisfactory state, having regard to the state of the site before the facility was put into operation.
(2) Sub-paragraph (1) does not apply to an application for the surrender of any part of an environmental permit (or if applicable, the whole permit) that authorises the carrying on of a radioactive substances activity at a nuclear site.
(3) The risks specified in this sub-paragraph are—
(a) risk of flooding;
(b) risk of harm to the environment;
(c) risk of detrimental impact on drainage.

Land & Water - informative

The Flood Risk Assessment and Drainage strategy, Section 5 Sediment Management, states the contractor will be required to follow a Construction Environment Management Plan. It also states that a discharge of contaminated surface water may need a discharge permit. The stockpiles of soil are to be imported and be used for land remediation, and therefore we would not expect any contamination. Any contaminated soils identified on site as part of the works should be removed off site for appropriate disposal. If the applicant intends to treat contaminated soils on site that is likely to be a waste permitted activity. It is not clear if the imported soil is classed as clean or contaminated.

Section 5 states that if a permit is required, it will take up to 20 days to be approved. We advise that it will take much longer than that for any permit required, and the applicant should therefore be aware of this.

Section 5.2 also states that secondary methods to minimise silt loss, such as covering the storage mounds and using geotextile silt fencing at the toe of storage slopes, could be used. These options should be encouraged as best practice to minimise silt loss at source, rather than reliance on methods to remove silt loss from the surface water.

Groundwater & Contaminated Land - Advice to LPA

This development site will have been the subject of past industrial activity which poses a medium risk of pollution to controlled waters.

We recommend that the applicant refers to our published ‘Guiding Principles for Land Contamination’ which outlines the approach which should be adopted when managing this site’s risks to the water environment.

We also advise that the applicant consult with Environmental Health / Environmental Protection Department for advice on generic aspects of land contamination management. Where planning controls are considered necessary, we recommend that the environmental protection of controlled waters is considered alongside any human health protection requirements. This approach is supported by paragraph 170 of the National Planning Policy Framework.

Waste – informative to applicant

We would advise the applicant to consult the local area office to discuss the implications of the proposed temporary storage of materials on Warrenby Landfill Site. No material must be stored on the landfill site until approval is granted by the Environment Agency. Please contact the local area officer: NE-Waste@environment-agency.gov.uk

The Technical Note - *Storage of imported soils for land remediation* further mentions the variation of the landfill permit from the current permit holder Tata to STDC. This would not be a variation but would require a transfer permit application. The applicant may consider seeking pre application advice from the Environment Agency concerning this proposed transfer and potential permitting implications across the **whole** proposed scheme.

Please be aware as of the 1st April 2018 the pre application process has changed. Any pre application queries are now coordinated by the Permitting and Support Centre (P&SC) for both simple and complex applications.

The basic level of pre application advice is free. If you require more in depth advice, an enhanced pre application service is available. The enhanced service costs £100 an hour plus VAT.

Please follow the link on the gov.uk website to the relevant pre application page and pre app form: https://www.gov.uk/government/publications/environmental-permit-pre-application-advice-form

The webpage further explains the basic and enhanced pre app and any associated costs. If you cannot access the form, please contact the Environment Agency and they will send a paper copy. Email: enquiries@environment-agency.gov.uk; Telephone 03708 506 506 (call charges).

Please contact me if you have any questions regarding this response.

Yours sincerely

Marion Williams
Planning Advisor

Direct dial 02077140989
Direct e-mail marion.williams@environment-agency.gov.uk

Appendix H3: Site Layout and Areas Plan

Ledgend

Areas of Concern
🟨 Benzol Plant
🟧 Heavy Fuel Oil

Redline
🟥 Site Redline
🟩 SLEMS
🟦 Metals Recovery Area

Notes:

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CONTACT ARCADIS IN CASE OF ANY QUERIES.

Title: South Bank Wharf - Site Redline

Site: Redcar Steelworks - South Bank Wharf

Client:
South Tees Developement Corporation

Project:
10035117

Date: 26/05/2020
Drawn By: JALM
DRG No: 10035117-AUK-XX-XX-DR-ZZ-0072-01-SBW_Redline

ARCADIS Design & Consultancy for natural and built assets

Appendix H4: The Former SSI Steelworks, Redcar: Former SLEMS Landfill, Intrusive Investigation Report

Design & Consultancy
for natural and
built assets

THE FORMER SSI STEELWORKS, REDCAR: FORMER SLEMS LANDFILL

Intrusive Investigation Report

South Tees Site Company Limited

Document Ref: Redcar Steelworks-AUK-XX-XX-RP-GE-0001-P1-SLEMS_BOS_Oxide_Assessment

January 2019

Incorporating

CONTACTS

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Arcadis.
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LS1 4BN

The Former SSI Steelworks, Redcar: Former SLEMS Landfill

Intrusive Investigation Report

Author	Jonathan Miles/Ben Le Grice
Checker	Neil Thurston
Approver	Paul Wrigley
Report No	Redcar Steelworks-AUK-XX-XX-RP-GE-0001-P1-SLEMS_BOS_Oxide_Assessment
Date	JANUARY 2019

Version control

Version	Date	Author	Changes
1	January 2019	Ben le Grice, Jonathan Miles	

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Figure 2	**Site Layout**
Figure 3	**1960 Site Plan**
Figure 4	**1952 Ordnance Survey Map**
Figure 5	**Enviros Plan**
Figure 6	**2002 Topographic Plan**
Figure 7	**2011 Topographic Plan**
Figure 8	**2018 Topographic Plan and Volume Calculation**

APPENDIX B

Study Limitations

APPENDIX C

2012 Site plan and Photographs Provided by STSC

APPENDIX D

Trial Pit and Borehole Logs

APPENDIX E

Chemical Analysis Summary and Certificates

1 INTRODUCTION

1.1 Project Background

The former SSI landholdings are made up of eleven discrete, sizeable land parcels situated in the Redcar, Lackenby, Grangetown and South Bank conurbations of the Borough of Redcar & Cleveland, within the industrial area generally known as 'South Tees'.

The South Lackenby Effluent Management System (SLEMS) Landfill represents one of these parcels of land. The landfill was historically used for the deposition of waste materials from the steelmaking process, particularly the disposal of basic oxygen steel oxide (BOS Oxide), also known as Basic Oxygen Furnace (BOF) dust, which has a potential resale value in the manufacture of construction materials.

1.2 Contract Details

Arcadis (UK) Limited (Arcadis) were appointed by South Tees Site Company Limited (STSC) to oversee and manage a ground investigation undertaken by Allied Exploration and Geotechnics Limited (AEG) and to provide consultancy advice with respect to the calculation of the amount of BOS Oxide present within the SLEMS landfill.

1.3 Project Aims and Objectives

The overarching aim of the works was to provide an estimate of the amount of BOS oxide present within the SLEMS landfill. As technical consultant, our specific objectives of this phase of works were to:

- Manage and technically supervise the site works, undertaken by AEG, on behalf of STSC;
- Direct the site works to ensure compliance by the ground investigation contractors with existing site management protocols and procedures;
- Specify the requirements for laboratory analysis;
- Analyse the results of ground investigations; and,
- Prepare an interpretative technical report (this document);

1.4 Scope of Work

This report relates to the physical ground investigation works relating to the SLEMS Landfill.

Figure 1 and 2 within Appendix A provide details of the facility location and the site investigation areas.

The initial scope for the investigation included the use of cable percussion boreholes to confirm the thickness of BOS oxide, however due to poor recovery and difficulties in drilling through layers of slag, the scope was amended to use trial pitting to collect information on the distribution of strata beneath the site, with works conducted in two phases. Phase 1 was carried out in December 2017 and involved cable percussion drilling (BH 3, 4, 5, 6, 8 & 9) and trial pitting (TP1-TP5, TPBH03, TPBH04 &TPBH05), while Phase 2 was carried out in March 2018 and included the excavation of trial pits only (TP101-TP111). The final scope of works completed is summarised below.

- Site service and utilities clearance of exploratory locations by STSC operatives
- Phase 1- six no cable percussion boreholes to maximum depth of 17.00m (note 5 of 6 boreholes terminated at shallow depth due to refusal on slag or other obstructions).
- Phase 1- eight no machine excavated trial pits;
- Phase 2 - Advancement of 11no. trial pits using a 20 tonne tracked 360 Excavator to a target depth of 4.5m bgl or refusal;
- Review of previous intrusive investigations at the Site; and,
- Reporting.

1.5 Reliability of Information / Limitations

A complete list of Arcadis Study Limitations is presented in Appendix B.

It should be noted that ground conditions between exploratory holes may vary from those identified during this ground investigation; any design should take this into consideration. It should also be noted that groundwater levels may be subject to diurnal, tidal, seasonal, climatic variations and those recorded in this report are solely dependent on the time the ground investigation was carried out and the weather before and during the investigation.

1.6 Reliance

This report has been prepared for the use of the STSC. The contents of this report may not be used or relied upon by any person other than this party without the express written consent and authorisation of Arcadis.

2 DESK STUDY AND SITE CONSEPTUALISATION

This section incorporates a review of publicly available records, records provided by STSC, and data collected as part of the site investigation works by AEG. (Borehole logs 4154a SLEMS Investigation Final Borehole logs).

2.1 Site Location

The SLEMS landfill is located within the Cleveland Works area of the larger Former SSI Steelworks Facility. The centre of the site is approximately located at Ordnance Survey (OS) National Grid Reference: 455012, 522260.

A site location plan is presented as Figure 1 in Appendix A.

2.2 Site Description and Recent Operational Practice

The SLEMS Landfill is a mounded land raise approximately 22 Ha in area rising to a maximum elevation of approximately 20m above Ordnance datum (AOD) and approximately 15m above the surrounding area. An overhead pipe bridge and a warehouse structure housing excavators are present on the south-eastern Site boundary.

The upper surface of the landfill comprises stockpiles of BOS oxide material divided into bays. A series of settling ponds are present in the southern section of the site; formerly an aqueous suspension of BOS oxide was pumped from the BOS Plant into these ponds. Settled material dredged from the ponds was then deposited in adjacent drying bays before being placed at a final deposition point within the landfill.

The site is bounded on the south-west, north-west and north-east edges by water channels. During SSI operation these were routinely dredged and the arisings placed within the SLEMS landfill. Stockpiles of this dredged material are present in the south west and north east of the Site. The north and north western sections of the Site include a tidal overspill area.

It is understood that while the Site was mainly used for the settling and storage of BOS Oxide, slag generated on other parts of the Site was used to surface temporary roadways and create bund walls.

The current site layout is shown on Figure 2 in Appendix A

2.3 Site History

The deposition of waste materials at SLEMS is thought to have begun in the 1950's based on the Enviros report "Corus UK Ltd. – Soil and Groundwater Baseline Characterisation Study Teesside Works – Interpretative Report Volume 1, 2 and 3 of 3, June 2004".

On historical OS maps from 1953-1955 presented as part of the Enviros report "Corus Cleveland Prairie Teesside Site Phase 1 Environmental Assessment, August 2007" the site is labelled as mud having been shown on earlier maps as part of the Tees Estuary. On British Steel Drawing 1x5947 dated 30th September 1966 the site is labelled as SLEMS and includes a settlement pond on its western edge; silt drying beds are shown just to the north, the site is also labelled a "silt extraction plant". The historical maps are presented below as Figures 3 and 4 and included in Appendix A.

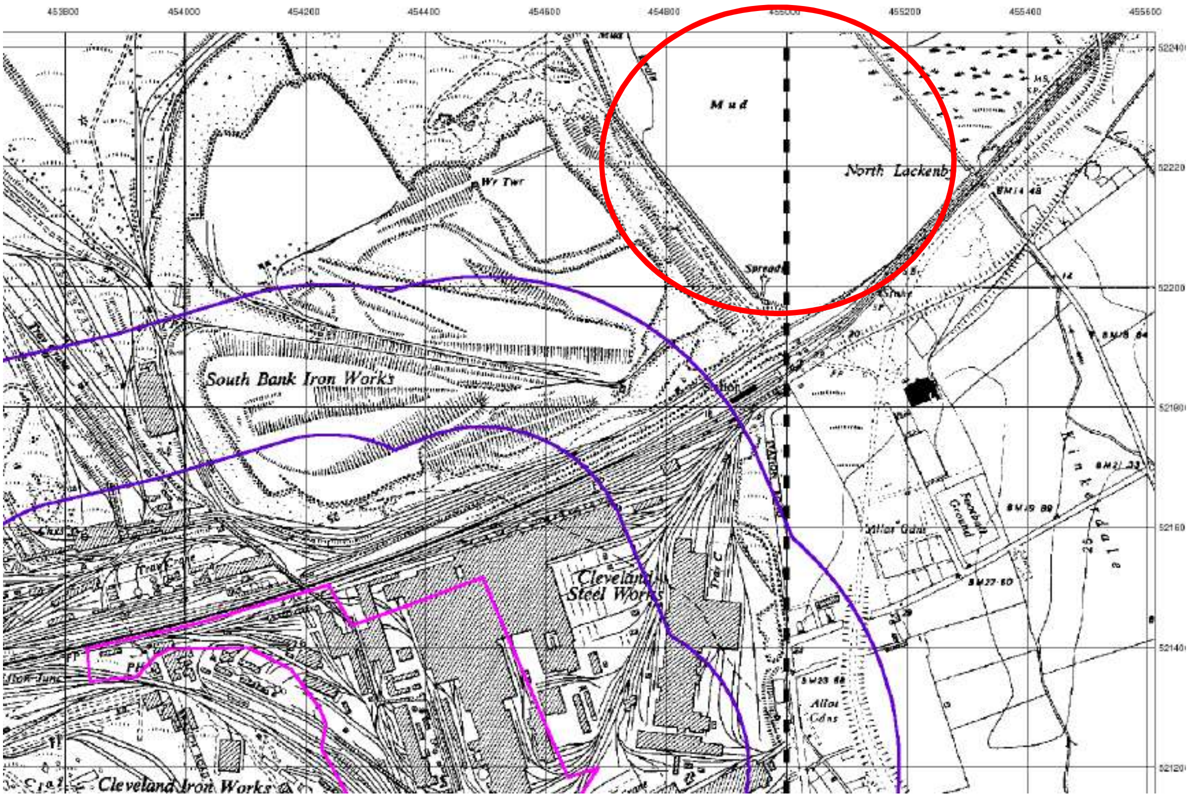


Figure 3: 1953 to 1955 OS mapping

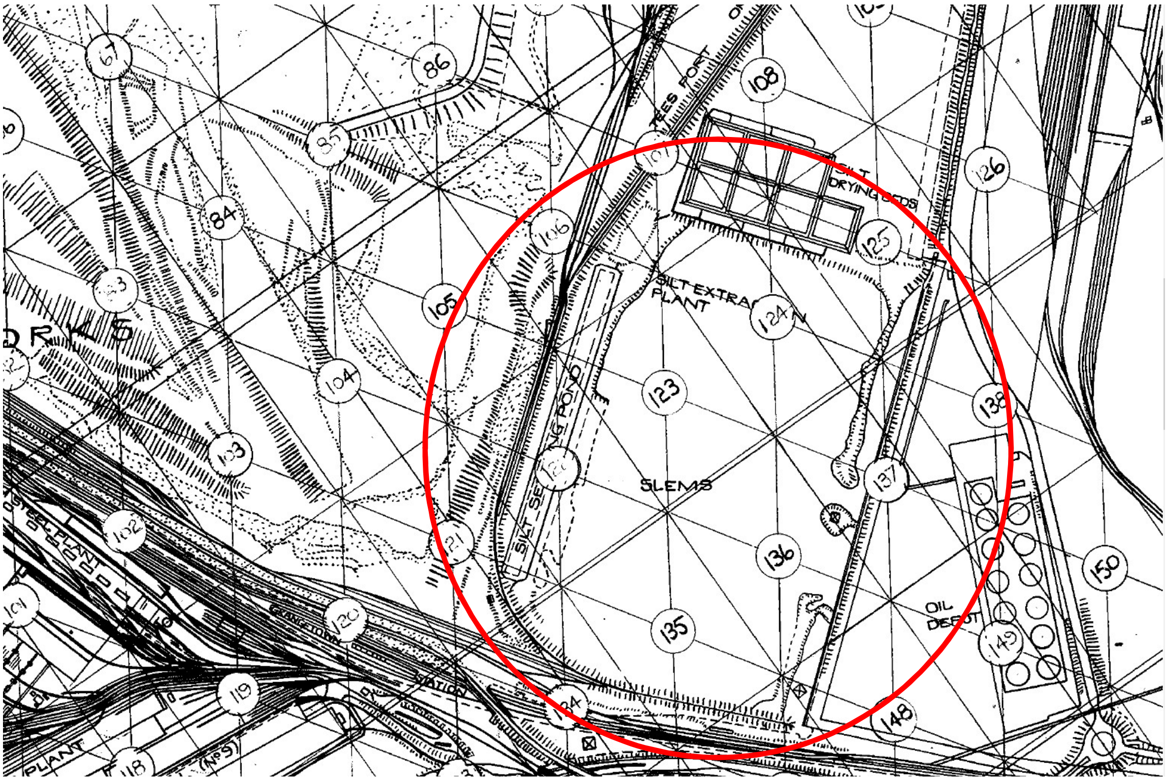


Figure 4: Excerpt from British Steel Drawing 1x5947

Information provided by STSC suggests that the SLEMS landfill was formed by placing a layer of slag across the footprint of the landfill to form a firm surface. Further deposits of slag were used to form walls between "cells" which were used to stockpile material. Conversations with the site contractor, David

Jones, indicates that during periods of inclement weather, the surface of the BOS oxide can become difficult to traffic and in such conditions slag was also used to provide a trafficable surface.

BOS oxide was transferred to the site in slurry form via a pipeline before being allowed to settle, and dry in settling ponds in the south west of the area. When dry enough to handle, the material was transferred to the holding bays for storage. It is also understood that periodically, sediment (including BOS oxide) was dredged from the Lackenby and Cleveland channels, dried, and added to the stockpiles.

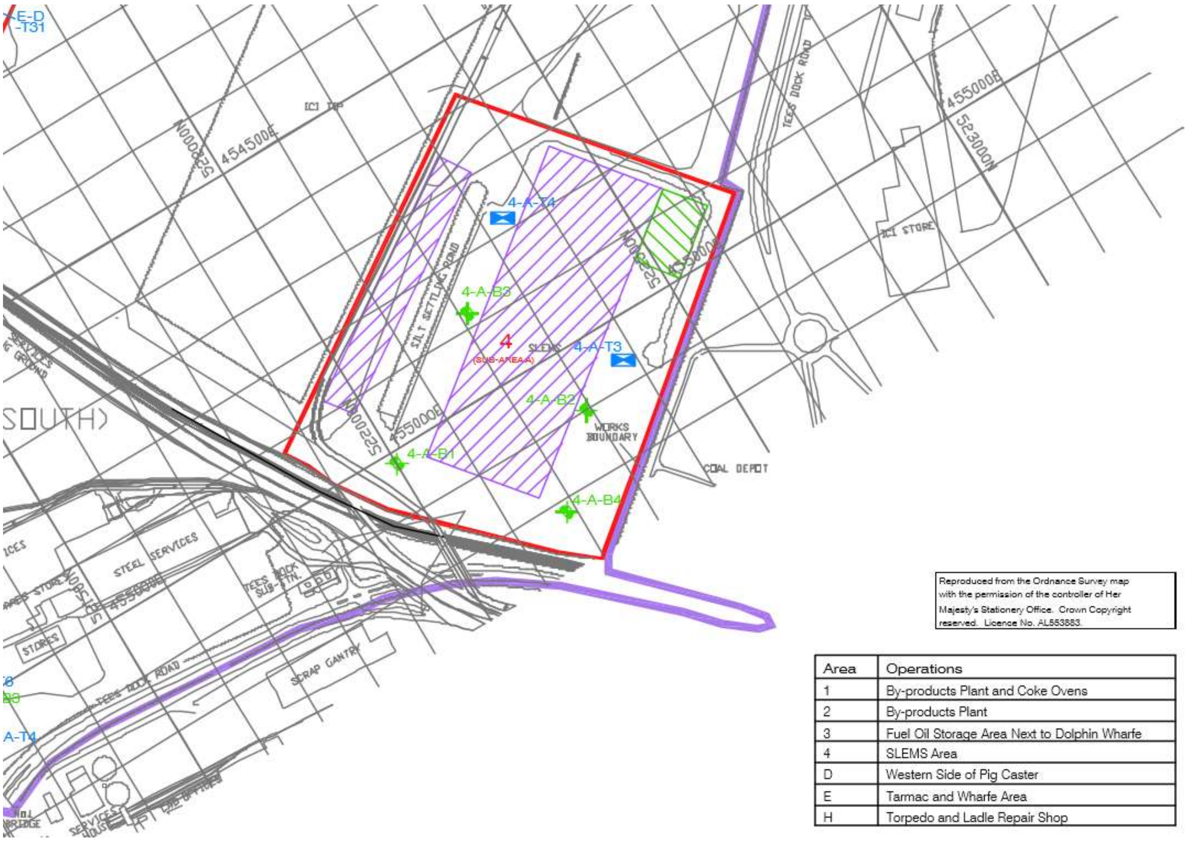
A copy of a site plan and photographs from 2012 provided by STSC is included in Appendix C.

2.4 Geology

A review of British Geological Survey (BGS) data indicates the landfill is underlain by Tidal Flat Deposits (TFD) of sand silt and clay; these are likely to be underlain by interbedded Glaciolacustrine Deposits (GL) predominantly comprising laminated clays and silt and Glacial Till (GT) predominantly comprising slightly gravelly clay. The underlying bedrock is the Mercia Mudstone formation.

The following borehole records have also been identified for the site:

Reference	BH ID and Location	Depth (m bgl)	Ground Conditions (all depths m below ground level)	Elevation
BGS	Borehole NZ52SW315 (1967)Adjacent to northern boundary	10	Slag fill to 3.30m Silty sand (TFD) to 4.6m Firm silty clay (GL) to 5.8m Stiff gravelly clay (GT) to 10.05m Mercia Mudstone	Surface level 3.3m AOD Natural deposits from approximately 0.0m AOD
	Borehole NZ52SE13551/241 South east corner	4.6	Slag fill to 0.9m Gravel to 1.2m Very stiff Stony Clay (GT) to 4.6m	Not available
	4AB1 – See Figure 5	6.5	Slag fill – very sandy gravel to 3m Slag fill – very gravelly cobbles to 5.9m (oily) Made Ground – soft slightly gravelly clay to 6.5m (hydrocarbon odour), potentially natural.	Surface Level 7.1m AOD Potential natural deposits from approximately 1.6m AOD
	4AB2 – See Figure 5	6.5	Slag fill – clayey sandy gravel to 2m No recovery 2.0-4.0m Slag Fill – silty sandy gravel to 4.8m (hydrocarbon odour) Firm slightly gravelly clay to 6.5	Surface Level 4.82m AOD Natural deposits from approximately 0.02m AOD
	4AB3 – See Figure 5	7.1	Slag fill – clayey sandy gravel to 1.1m Slightly gravelly clay to 2.0m (hydrocarbon / solvent odour) Made Ground- soft blue/grey/brown clay to 6.3m (solvent odour) Soft brown clay to 7.1	Surface Level 7.17m AOD Natural deposits from approximately 0.87m AOD
	4AB4 – See Figure 5	6.7	Slag fill – clayey sandy gravel to 4.6m Stiff brown sandy gravelly clay to 6.7m	Surface Level6.64m AOD Natural deposits from approximately 2.04m AOD
	Trial pit 4AT3– See Figure 5	4	Slag fill of cobbles and boulders in a brown granular matrix including refractory bricks rubble and wood	Not available
	Trial pit 4AT4– See Figure 5	3.2	Slag Fill - Cobbles of slag in a grey slag dust to 0.8 Slag fill - Gravel cobbles and boulders in a brown clayey sand to 2.5 Slag Fill – Cobbles of slag in a very sandy clay matrix to 3.0m (hydrocarbon product) Made Ground – sandy clay with frequent organic peat to 3.2m (hydrocarbon odour)	Not available
Arcadis 2017	BH08	17	Made Ground – Silty gravelly sand with bands of slag cobbles to 14m Silty sand (TFD) to 17.0m	Surface Level 12.06m AOD Natural deposits from approximately -1.94m AOD



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Area	Operations
1	By-products Plant and Coke Ovens
2	By-products Plant
3	Fuel Oil Storage Area Next to Dolphin Wharfe
4	SLEMS Area
D	Western Side of Pig Caster
E	Tarmac and Wharfe Area
H	Torpedo and Ladle Repair Shop

Figure 5: Extract from Enviros 2004 report showing SLEMS investigation locations

2.5 Topography

Two historic topographical surveys are known to have been undertaken of the SLEMS Landfill. An extract from the 2002 survey (Corus drawing A119236) is shown below as Figure 6 and also presented in Appendix A. The topographical survey indicated the maximum height of the landfill was approximately 12.89m AOD with the surrounding land levels ranging between 3.55m AOD and 7.24m AOD. The landfill comprises two settling ponds and three drying beds in the south corner with a fourth long drying bed running down the south western edge of the landfill in a similar location to settling pond shown on Figures 4 and 5. The centre and highest part of the landfill is marked as a drying and loading area with the northern end of the landfill marked as an overflow area.

The 2011 survey (AC Environmental Services drawing SLEMS-IN-002) shown below as Figure 7 and also presented in Appendix A does not cover as wide an area as the 2002 survey but provides a more detailed picture of the areas it does cover. The elevations indicated a significant increase in landfill levels to a maximum of 20.80m AOD.

STSC have also provided Arcadis with a copy of a recent aerial survey of the SLEMS area. This survey was undertaken in 2018 and records the maximum elevation of the site at 20m AOD. This model has been used for the subsequent volume calculations discussed in Section 4.

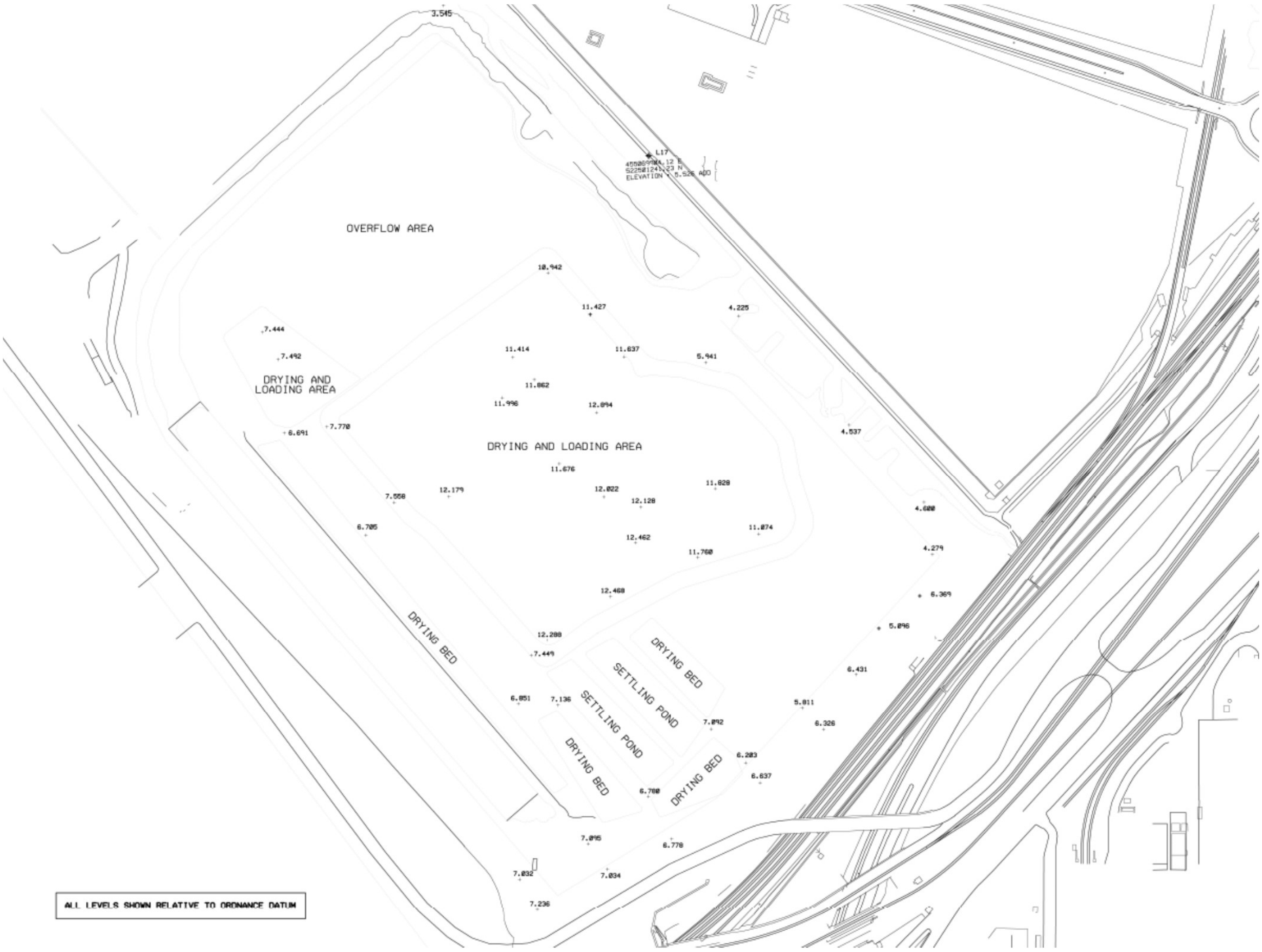

Figure 6: Extract from 2002 Topographical Survey

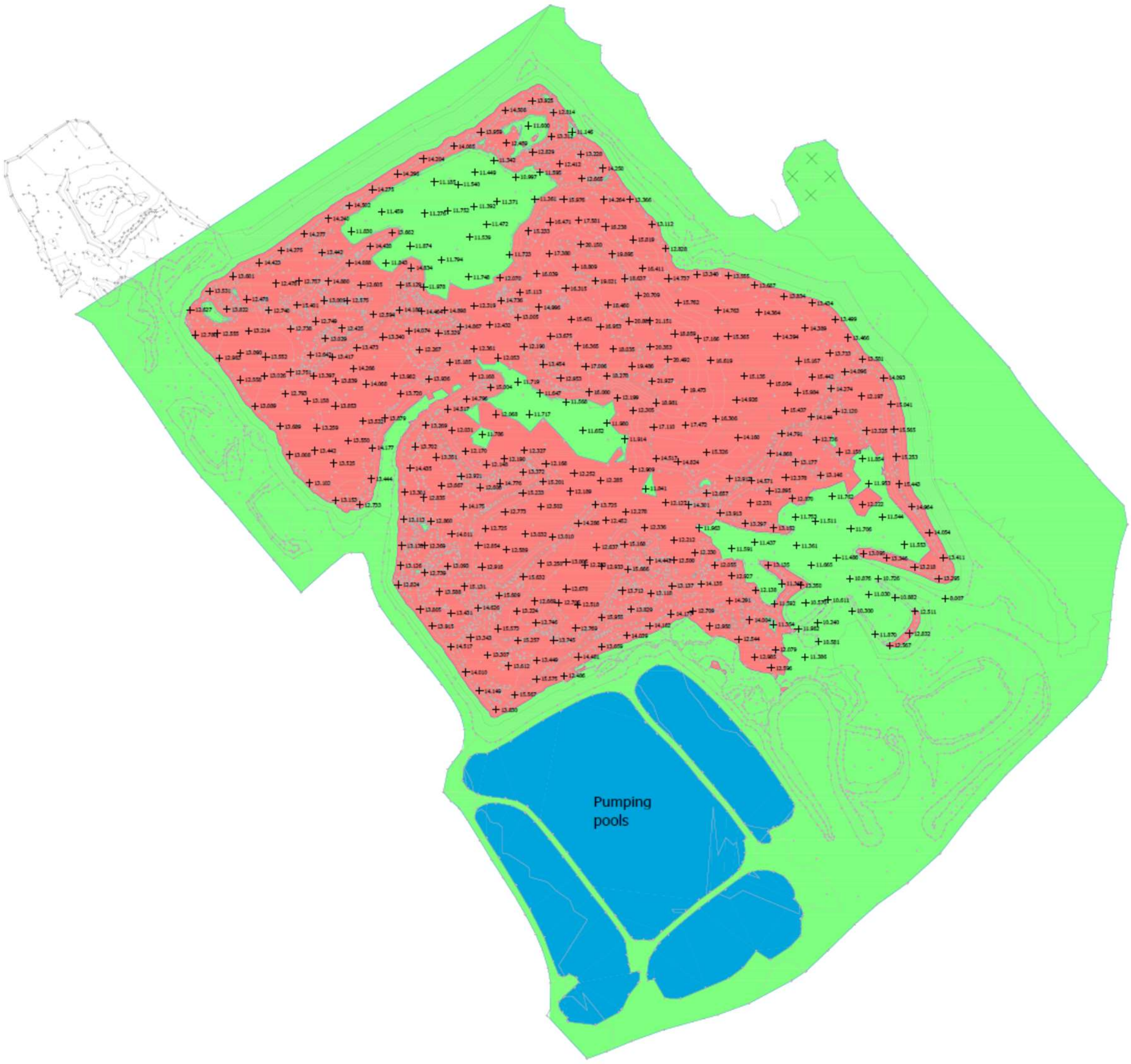

Figure 7: Extract from 2011 topographical survey

3 SLEMS LANDFILL CHARACTERISATION

3.1 Ground Conditions

In general, the ground conditions were found to comprise layers of BOS oxide typically recovered as a slightly gravelly silt, with layers of slag, refractory bricks or other wastes. Due to the presence of slag cobbles and boulders, the majority of the boreholes had to be terminated before confirming the full depth of the mound. Also, it should be noted that the quantity of the fine silt like BOS oxide recovered from the cable percussion boreholes was limited and the boreholes may overestimate the quantity of gravel and larger particles. Beneath the made ground, natural deposits were found to consist of glacial till, or black sands and laminated silts of the Tidal Flat Deposits.

The following table provides an overview of the materials encountered within the landfill during the investigation across the site, further detail is provided on the trial pit and borehole logs Appendix D.

3.1.1 Made Ground

Identification of BOS Oxide

BOS Oxide was generally encountered as a black silt containing abundant metallic ‘dust’ and occasional gravel. Bluish grey weathering was identified in some locations, and locally the BOS Oxide was noted to be red and possibly baked, site operatives suggested this may have been related to combustion of the oxide. The following variations in BOS Oxide deposits were identified:

Variation	Locations
BOS Oxide Silt locally fused to a stiff to friable consistency.	TP106 (0.0m-0.3m bgl) TP108 (0.0m 1.4m bgl) TP109 (0.0m-5.0m bgl) TP110 (0.0m-0.9m bgl)
BOS Oxide Silt fused to extremely weak to very weak rock consistency.	TP102 3.4m-5.0m bgl TP104 (2.5m-3.3m bgl) TP108 (3.1m-3.7m bgl) TP106 (2.4m-3.1m bgl)
BOS Oxide Silt oxidised to dark reddish brown	TP104 (2.5m-3.3m bgl)
BOS Oxide Silt has light blue colour	TP105 (E) (0.1m-1.45m bgl)
BOS Oxide Silt oxidised to red to orange.	TP105 (W) (0.0m-5.0m bgl) Anecdotal information indicates this location was the site of a historical ground fire.
Mixed BOS Oxide and Slag	TP109 (3.8m-5.0m bgl) TP111 (1.6m-4.5m bgl)

Identification of Slag

Slag identified within the landfill was observed to be generally light grey to white in colour, with vesicles commonly infilled with partially hydrated lime. Slag was generally recovered as a coarse, angular gravel mixed with whole and part refractory bricks, with clasts locally fused by the action of lime. Minor deposits of other waste, including metal machine parts were also encountered within slag layers.

Mixed slag/refractory brick gravel was encountered in discrete deposits in all locations with the exception of TP105 and TP109. A thin layer (0.1m) of slag was encountered at the surface in the eastern section of TP105 only, and minor (10%) slag was observed within BOS Oxide deposits in TP109. Slag layers vary in thickness from 0.6m in TP111 to 4.0m in TP101, with an average thickness of 1.7m.

Other Made Ground Materials

Minor pockets of brown clay and silt, interpreted as representing channel dredgings were identified in locations TP104, TP106, TP107, TP109.

3.1.2 Natural Geology

Natural deposits were identified in one borehole (BH08) and three trial pits during phase 1 of the investigation as summarised below.

BH ID and Location	Depth (m bgl)	Elevation (m AOD)	Ground Conditions (all depths m below ground level)
BH8	14.00	-1.939	Dense black silty SAND
TP1	3.80	4.300	Firm brown sandy slightly gravelly CLAY
TP2	2.00	3.879	Laminated black brown SILT
TP5	2.30	4.836	Firm brown sandy gravelly CLAY

Natural deposits were not identified in any of the locations advanced during the second phase of investigation.

3.2 On-Site Environmental Screening, Visual and Olfactory Evidence

Hydrocarbon odours were detected in TP109-TP111, with a sheen noted upon water and saturated soils from TP109 and TP111.

3.3 Groundwater Strikes

Groundwater was encountered at 3.8m bgl in TP109 and at 4.0m bgl in TP111.

3.4 BOS Oxide Distribution

Results of intrusive investigation did not indicate a pattern in BOS Oxide distribution across the Site. Trial Pits advanced in the southern section of the Site (lower elevation), were generally observed to contain fewer slag deposits than locations advanced through the raised section of the Site.

To assist with determining the proportion of the various materials present on site, an approximate percentage has been made based on the thickness of discrete layers encountered during the Phase 2 trial pitting. The borehole data has been omitted due to the possibility of oversize material being “driven” ahead by the drilling technique which and the limited recovery of the finer material.

The approximate distribution of materials at the Site is summarised in the table below:

Location	Depth to Base (m bgl)	Total layer thickness (m)		Estimated Percentage Content*		
		BOS Oxide	Slag Deposit	BOS Oxide	Slag Deposits	Dredged Silts
TP101	4.5	0.5	4	11	89	-
TP102	5	3.95	1.05	79	21	-
TP103	5	2.4	2.6	48	52	-
TP104	3.3	2.55	0.75	77	23	-

Location	Depth to Base (m bgl)	Total layer thickness (m)		Estimated Percentage Content*		
		BOS Oxide	Slag Deposit	BOS Oxide	Slag Deposits	Dredged Silts
TP105 (E)	4	3.9	0.1	97	3	-
TP105 (W)	4	4	-	100	-	-
TP106	3.9	1	2.9	26	74	-
TP107	4.5	2.3	2.2	46	49	5
TP108	5	3.3	1.7	66	34	-
TP109	5	5	-	98	2	-
TP110	4.5	0.9	3.6	20	80	-
TP111	4.5	3.9	0.6	87	13	-
Average proportion				63	37	<1

*Percentage estimates account for inclusions and mixed material within predominantly BOS Oxide or Slag based layers.

3.5 Chemical Analysis

Chemical analysis results are presented in Appendix D. Metals and hydrocarbons were detected in the deposits within the landfill therefore appropriate PPE and dust suppression should be used to protect workers if the material is excavated and transported from site, further appropriate controls should be in place to prevent dust generation during transport.

No asbestos fibres or asbestos containing material were identified

A portion of the material within the landfill is saturated, appropriate measures should be in place to dewater this material prior to transportation from site, water treatment may be required before this water can be discharged.

It is beyond the scope of this report to discuss the suitability of the material for commercial reuse based on the chemical analysis.

4 BOS OXIDE VOLUME ESTIMATES

The ground conditions at the site include a thickness of made ground consisting of BOS oxide, slag and other wastes. This material rests on a basal layer of compacted slag which rests upon the natural tidal flat deposits and glacial till. The elevation of the interface between the natural deposits and the bottom of the basal slag layer varies from approximately -1.9m AOD (AEG borehole BH08) to +4.8m AOD (AEG Trial pit 5), a summary of the elevation of the interface is shown below.

Location	Consultant	Year	Elevation (m AOD)	Made Ground Interface (m AOD)
BH 4 AB1	Environ	2004	7.10	Not recorded
BH 4AB2	Environ	2004	4.82	0.02
BH 4AB3	Environ	2004	7.17	0.87
BH 4AB4	Environ	2004	6.64	2.04
NZ52SW315 (off site to north)	BGS	1967	3.28	0
BH08	Arcadis	2017	12.06	-1.939
TP01	Arcadis	2017	8.1	4.3
TP02	Arcadis	2017	5.879	3.879
TP05	Arcadis	2017	7.136	4.836

As can be seen from the above, the base of the SLEMS mound varies by several metres across the site. The borehole information also suggests that the thickness of the basal slag layer varies. It has therefore been necessary to make an assumption of the elevation of the upper surface of the basal slag layer, which has been assessed as being approximately2.5 to 3.5 m AOD based on the available borehole information and topographic elevation of the area outside of the SLEMS mound. .

CAD Civils has then been used to estimate the total volume of the mound above this elevation using the most recent topographic survey. This provides an estimated total volume of 738,425 m^3.

As noted above, the mound includes a mix of materials, however BOS oxide is estimated to comprise approximately 60% of the total volume (based on the findings from the recent trial pitting). This would suggest that the mound may contain in the order of 440,000 m^3 of reclaimable BOS Oxide.

Prior to sale, the BOS oxide is currently processed to remove oversize and unsuitable material. We understand that the BOS oxide is screened prior to sale, and that a proportion of unsuitable oversize material is removed. We are not aware of the proportion of unsuitable material which is generated, but have assumed that an estimated 10 to 15% of the total volume of BOS oxide will be unsuitable due to inclusions of slag, bund walls etc. This would suggest that approximately 44,000 to 60,000 m^3 of material is unsuitable, leaving a volume in the order of 380,000 to 400,000m^3 of BOS oxide (assuming base of mound at 2.5mAOD).

Carrying out a similar exercise assuming the base of the BOS oxide is at an average of 3.5m AOD yields an estimated volume of recoverable BOS oxide of 300,000 to 360,000 m^3.

It should be noted that these estimates are based on a number of assumptions including depth to the base of the BOS oxide deposit within the mound, the percentage of BOS oxide present and the quantity of unsuitable material which may be encountered. No allowance has been made for bulking, as it is assumed the BOS oxide is generally in a poorly compacted state. These estimates should therefore be considered as an indication of the likely quantity of material present, rather than a measured quantity, and the quantity of recoverable BOS oxide present may vary from the figures quoted.

APPENDIX A

Figures

Figure 1 Site Location Plan

NOTES

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LICENSE NUMBER 100050351

0 1 2
Kilometers

KEY

▨ SITE LOCATION

N

TITLE: SITE LOCATION PLAN

SITE: REDCAR STEELWORKS

PROJECT: 10013655

CLIENT: SOUTH TEES SITE COMPANY

FIGURE 1

DATE: 10/01/18

PRINT: A4

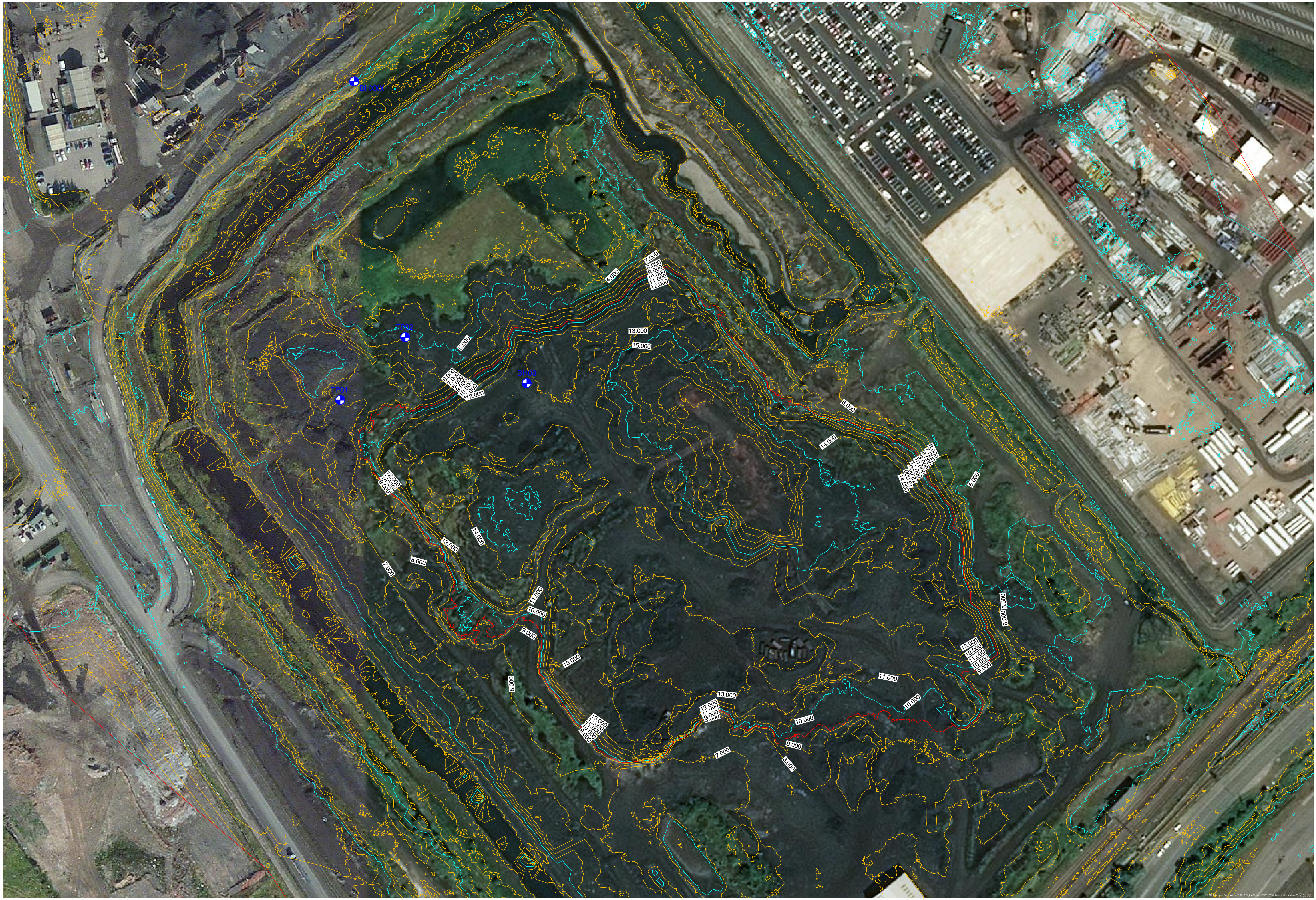
DRAWN BY: BNB

REV: -

DRG.No.: 10013655-AUK-XX-XX-DR-ZZ-15-P1

ARCADIS Design & Consultancy for natural and built assets

Figure 2 Site Layout


BHXXX
TP02
TP01
BH08
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7.000
8.000
9.000
10.000
11.000
12.000
13.000
15.000
5.000
6.000
14.000

Figure 3 1960 Site Plan

ENVIROS

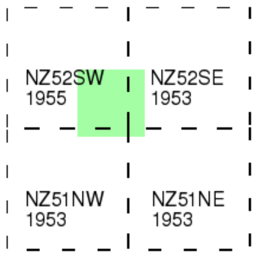
Ordnance Survey Plan

Published 1953 - 1955

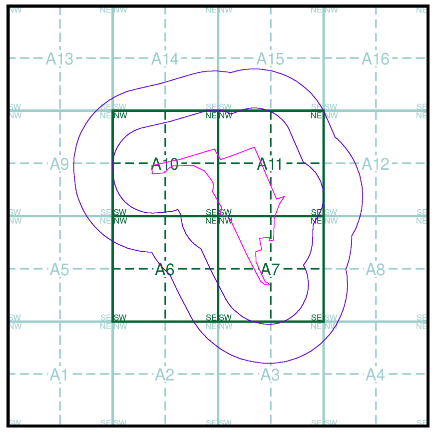
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



N

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National Grid Reference:	454340, 521150
Slice:	A
Site Area (Ha):	22.55
Search Buffer (m):	500

Site Details

South Tees Prairie Area, Teesside Works, Tees Dock Road, MIDDLESBROUGH, Cleveland

LANDMARK®
Information Group

Tel: 0870 850 6670
Fax: 0870 850 6671
Web: www.envirocheck.co.uk

Figure 4 1952 Ordnance Survey Map

IX-5947

REFERENCE DRG'S :-

FOR LAYOUT OF CLEVELAND NORTH OF BRITISH RAILWAYS	SEE DRG. Nº.	IX-5860 (SHEET 1).
FOR LAYOUT OF CLEVELAND NORTH OF BRITISH RAILWAYS	SEE DRG. Nº.	IX-5861. (SHEET 2).
FOR LAYOUT OF CLEVELAND SOUTH OF BRITISH RAILWAYS	SEE DRG. Nº.	IX-5853 (SHEET 3).
FOR LAYOUT OF CLEVELAND SOUTH OF BRITISH RAILWAYS	SEE DRG. Nº.	IA-29921 (SHEET 4).
FOR LAYOUT OF [illegible]	SEE DRG. Nº.	7X-827.
FOR LAYOUT OF CLEVELAND, LACKENBY & REDCAR WORKS.	SEE DRG. Nº.	7X-382 (1/2500 SCALE).
FOR LAYOUT OF CLEVELAND, LACKENBY & REDCAR WORKS	SEE DRG Nº	7X-678 (1/5000 SCALE)
FOR LAYOUT OF REDCAR WORKS	SEE DRG Nº	IX-5962

BRITISH STEEL CORPORATION
[illegible]

DEPT. PLANT DRAWN AT M.D.O

TITLE LAYOUT OF CLEVELAND LACKENBY AND REDCAR WORKS
KEY PLAN OF 1/250TH LAYOUT DETAIL DRAWINGS

DRAWN BY R.D.A. DATE [illegible]
TRACED BY OZALID. DATE 30.9.66
CHECKED BY DATE
PASSED BY DATE

WORKS INDEX-CODE:-G.W.L.
ORDER NO.
DRAWING NO. IX-5947

REFERENCE DRAWINGS

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3	IA-29956	85	IA-30038	167	IA-30120
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5	IA-29958	87	IA-30040	169	IA-30122
6	IA-29959	88	IA-30041	170	IA-30123
7	IA-29960	89	IA-30042	171	IA-30124
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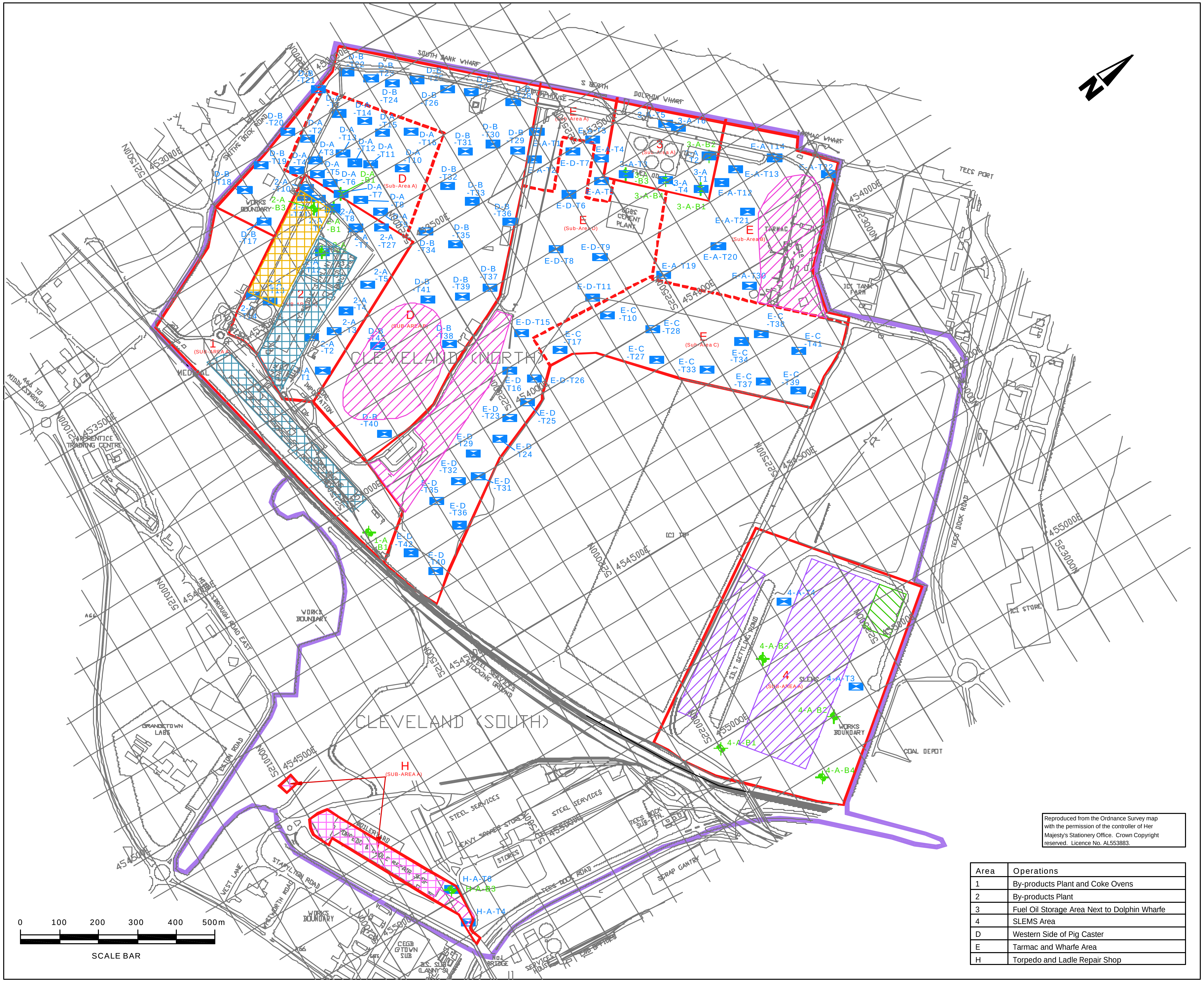
1 off HC EDO 29/9/70
(14)

Figure 5 Enviros Plan



KEY:

- Proposed Teesco Boundaries
- Enviros Sampling Boundaries
- ✦ Borehole
- ⊠ Trial Pit
- ▨ Area of Plant
- ▨ Area of Plant, Buildings and Mobile Tools
- ▨ Area of Mobile Tools and Stockpiles
- ▨ Access Constricted
- ▨ Above ground services
- ▨ Concrete Hardstanding

NOTES:

Reproduced from the Ordnance Survey map with the permission of the controller of Her Majesty's Stationery Office. Crown Copyright reserved. Licence No. AL553883.

Area	Operations
1	By-products Plant and Coke Ovens
2	By-products Plant
3	Fuel Oil Storage Area Next to Dolphin Wharfe
4	SLEMS Area
D	Western Side of Pig Caster
E	Tarmac and Wharfe Area
H	Torpedo and Ladle Repair Shop

REV.	DESCRIPTION	DATE

CORUS

CLEVELAND

FIGURE 5

EXPLORATORY HOLE LOCATION PLAN

SCALE 1:6,500	CAN CO0520017A
CONTENT RLP	DRAWN JSF
CHECKED	DATE JUNE 2004

ENVIROS

Ref: I:\DG\CADTEAM\new-cans\CO052\0017a\
Plot date: Jun 22, 2004 - 10:48am
File name: JSF1826.dwg

Figure 6 2002 Topographic Plan

DRG. NO. A119236^{A}

WORK TO DIMENSIONS & REPORT ERRORS TO D.O. - IF IN DOUBT - ASK

ALL LEVELS SHOWN RELATIVE TO ORDNANCE DATUM

REVISION A 25.10.02	UPDATED SDB	REVISION		REVISION	
REVISION		REVISION		REVISION	
REVISION		REVISION		REVISION	

C
A
D

CONFIDENTIAL - CORUS GROUP

0 10 MILLIMETRES 150

ITEM	NO. REQ'D	MATERIAL	DESCRIPTION	REMARKS	WEIGHT OF ONE ITEM

DRAWN BY S.D.BLYTHE		DATE SEPT.2002	
CHECKED BY		DATE	
DRAWING SCALE(S)		PLOTTING SCALE	
1:1000		1:1000	
COST CENTRE		PLANT REGISTER	PLANT ITEM

corus
Teesside Works

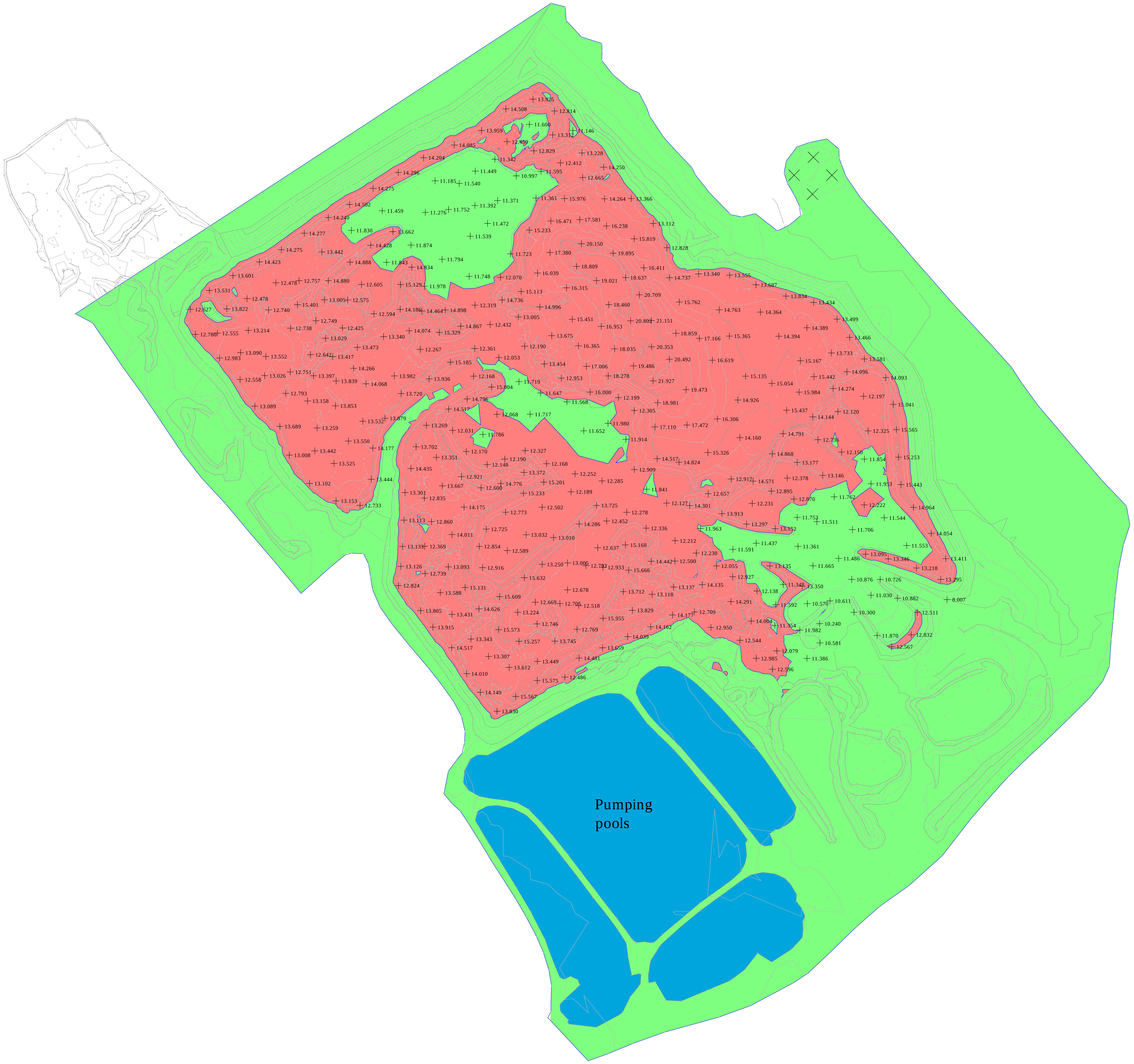
WORKS LACKENBY	PLANT GENERAL
SECTION OF PLANT LAYOUTS	
SUB SECTION SLEMS	
DETAIL ELEVATION SURVEY SLEMS SEPTEMBER 2002	
INDEX CODE SURVEY	DRAWING NO. A119236^{A}

2D

Figure 7 2011 Topographic Plan

Rev -

Drawing Number SLEMS-IN-002



ac ENVIRONMENTAL SERVICES

Tel: 0333 200 0125

Email: geoff@acenvironmental.co.uk

Job Title
SSI Steel Works

Location
Redcar, Middlesborough

Client
SSI

Notes:
Surface area of ground above 12m: 46,212 m2

Rev	Date	Description

Do Not Scale - If In Doubt, Ask

Drawing Status
Information Only

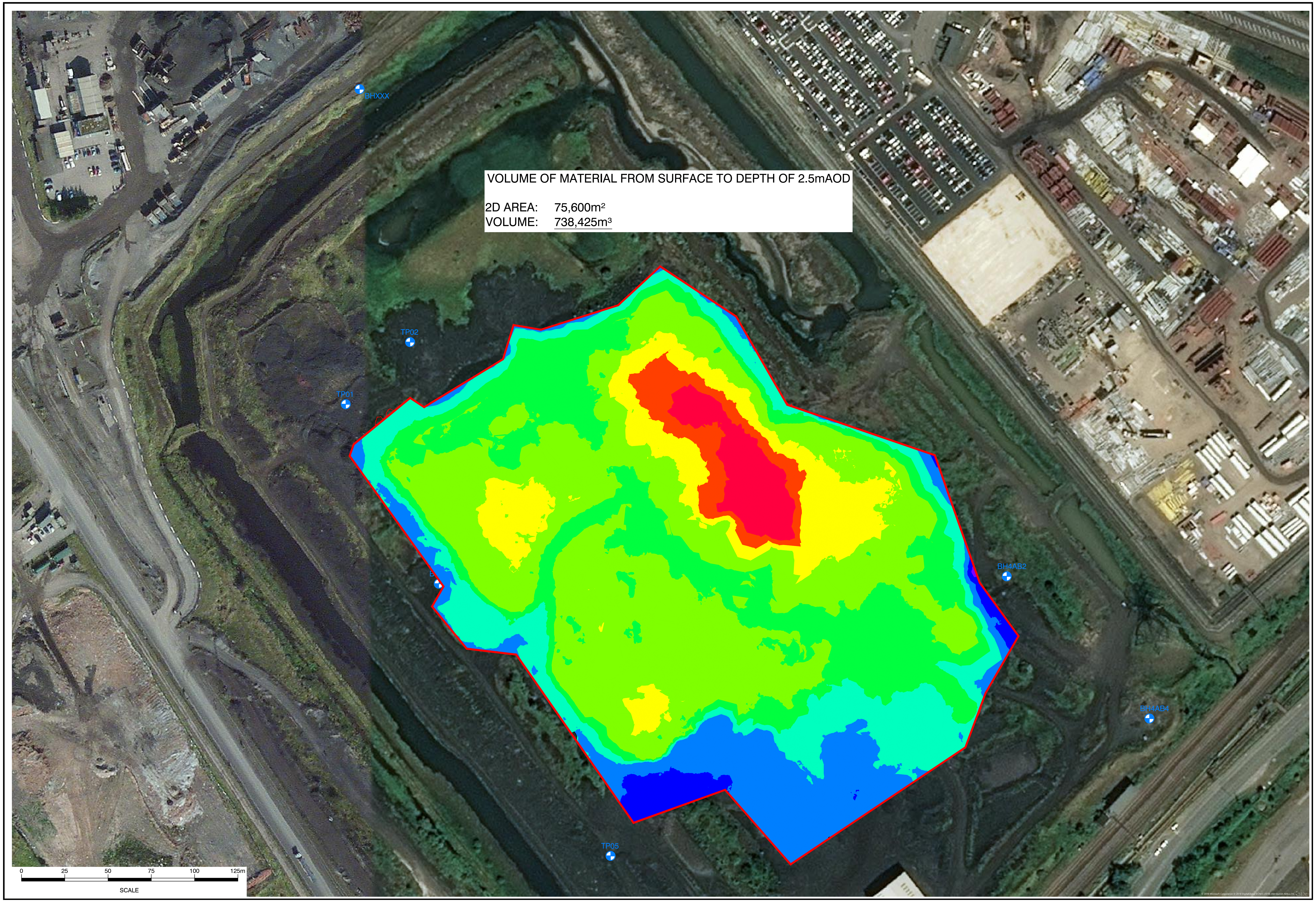
Drawing Title
SLEMS Stockpile Survey
With Baseline (12m)

Scale: NTS
Date Drawn: 17 Nov 2011
Drawn By: LW
Reviewed By: PC
Original Size: A0 L

Drawing Number
SLEMS-IN-002

Rev
-

Figure 8 2018 Topographic Plan and Volume Calculation


VOLUME OF MATERIAL FROM SURFACE TO DEPTH OF 2.5mAOD

2D AREA: 75,600m²
VOLUME: 738,425m³

APPENDIX B

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) Limited (Arcadis), with all reasonable skill, care and diligence within the terms of the Appointment and with the resources and manpower agreed with South Tees Site Company (STSC) (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 correct 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 been 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.

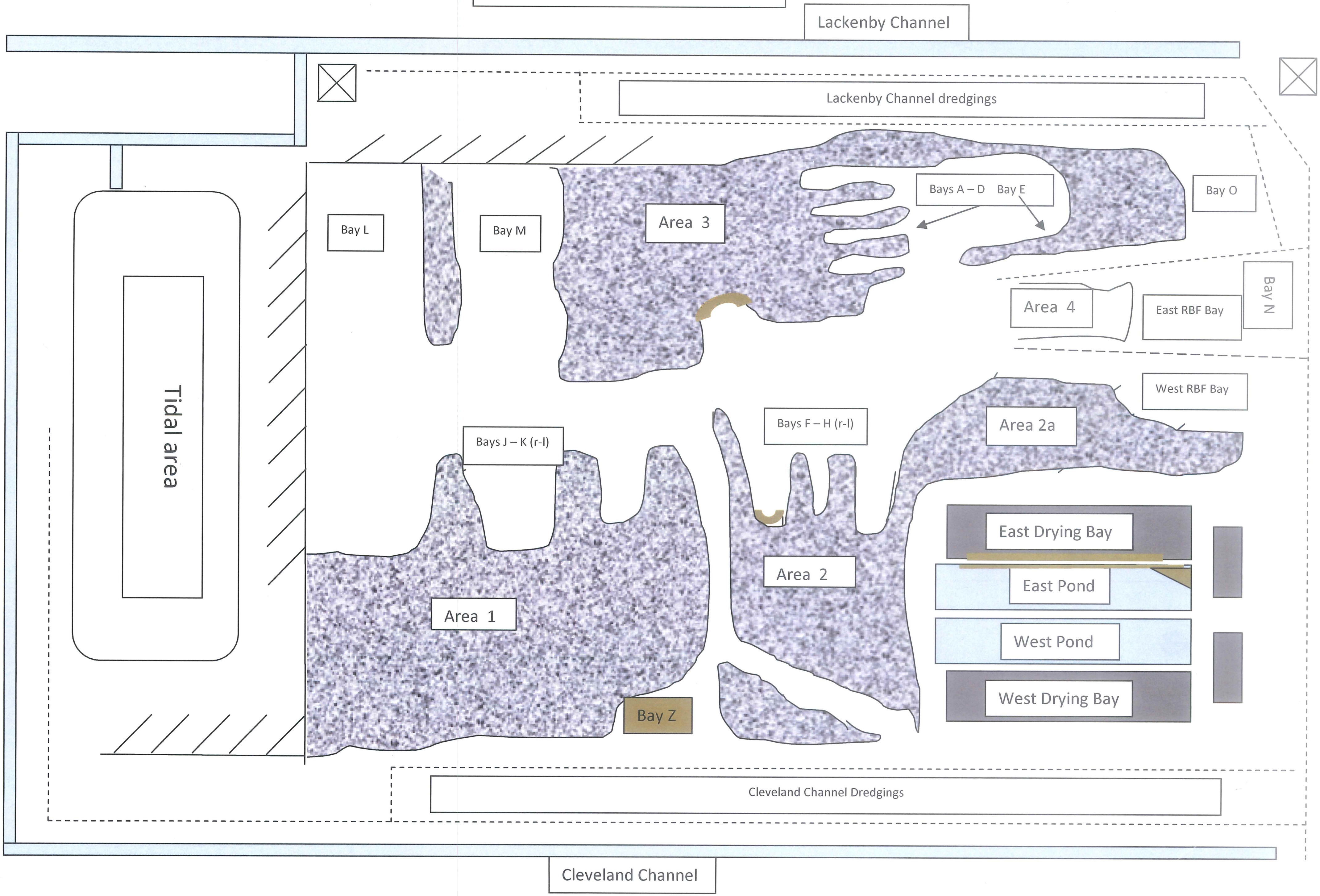
11. If below ground intrusive investigations have been conducted as part of the scope, service tracing for safe location of exploratory holes has been carried out. The location of underground services shown on any drawing in this report has been determined by visual observations and electromagnetic techniques. 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 issue

APPENDIX C

2012 Site plan and Photographs Provided by STSC

SLEMS LAYOUT MARCH 2012



Area 4	Being filled with material from RBF east and west bays	RBF Pond analysis.ht	Area 4.jpg
East pond	To be emptied ready to accept BOS slurry		East_West pond.jpg
East drying bay	As above. Filled with BOS oxide and a mixed material contaminated with Ballast which is being moved to Bay Z		E drying bay.jpg
West pond	Empty ready for use		West pond.jpg
West drying bay	Empty ready for use		
E RBF bay	See Area 4	See area 4	E RBF pond.jpg
W RBF bay	See Area 4	See area 4	W RBF pond.jpg
Cleveland channel dregings	All full	SLEMS layout -Cleveland channel.	Cleveland channel dredgings.jpg
Lackenby Channel dredgings	All full	SLEMS layout -Lackenby channel.	Lackenby Channel dredgings.jpg

Key

Existing oxide material	▨


Area 3
10m (approx)
Contaminated wall at base of Area 3


Lakenby Channel dredgings


Cell N


Cell O


Area 2a


Area 3


Area 4


West drying bay
West pond
East pond


East drying bay


West drying bay
Cleveland Channel
West pond


East RBF pond


West RBF Pond


Cleveland Channel
dredgings


Bay C
Bay B
Bay A

Bay F
Bay G
Bay H


Bay F
Bay G


Bay I
Area 1, approx 75m
Bay J
Bay K


Contaminated wall of Bay H

APPENDIX D

Trial Pit and Borehole Logs

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20, Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

BOREHOLE RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455027.373 N:522230.718			**BH03**
Method (Equipment): Cable Percussion (Dando 2000)		**Ground Level (m(AOD)):** 12.500	**Start Date:** 19/12/2017	**Sheet:** 1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
1.00	ES1				▨		MADE GROUND (Black grey silty sandy gravel with high cobble and boulder content and fragments of metal. Gravel is fine to coarse angular to subangular and includes slag, ash, brick, concrete and limestone).	▒
1.50	B2				▨	(3.10)		▒
2.00	ES3				▨			▒
2.50	B4			9.400	▨	3.10		▒
							Borehole terminated at 3.10m BGL - unable to progress due to tools jamming.	

Boring Progress and Water Observations					Chiselling			Water Added	
Date	Depth	Casing	Casing Dia (mm)	Water Standing	From	To	Hours (hh:mm)	From	To
19/12/2017	0.00	0.00			3.00	3.10	02:30		
19/12/2017	3.10	3.10	250	Dry					

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

Print Date and Time: 12/06/2018 11:30:19

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20, Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

BOREHOLE RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation			**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454977.784 N:522184.632		**BH04**
Method (Equipment): Cable Percussion (Dando 2000)	**Ground Level (m(AOD)):** 14.267	**Start Date:** 18/12/2017	**Sheet:** 1 of 1

SAMPLES & TESTS				STRATA				
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument/ Backfill
0.40	J1			12.267	▨	(2.00) 2.00	MADE GROUND (Black sandy very gravelly silt with fragments of metal. Gravel is fine to medium subangular to angular and includes slag and ash).	▒
0.80	B2							
1.20	ES3							
2.00	B4			11.267	▨	(1.00) 3.00	MADE GROUND (Grey silty sandy gravel with low cobble content and fragments of metal. Gravel is fine to coarse subangular to angular and includes slag and ash. Cobbles and boulders include slag).	▒
2.40	ES5							
2.60	J6							
2.80	B7							
							Borehole terminated at 3.00m BGL - unable to progress.	

Boring Progress and Water Observations					Chiselling			Water Added	
Date	Depth	Casing	Casing Dia (mm)	Water Standing	From	To	Hours (hh:mm)	From	To
18/12/2017	0.00	0.00			2.00	2.20	00:30	1.20	2.20
18/12/2017	2.20	2.20	200	Dry	2.40	3.00	04:00	2.20	3.00
19/12/2017	2.20	2.20	200	Dry					
19/12/2017	3.00	3.00	200	Dry					

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

Print Date and Time: 12/06/2018 11:30:20

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Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20, Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

BOREHOLE RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455112.979 N:522291.077			**BH05**
Method (Equipment): Cable Percussion (Dando 2000)		**Ground Level (m(AOD)):** 14.329	**Start Date:** 18/12/2017	**Sheet:** 1 of 1

SAMPLES & TESTS				STRATA				
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument/ Backfill
				14.029		(0.30) 0.30	(1) MADE GROUND (Black gravelly sand).	
						(1.10)	MADE GROUND (Black sandy gravelly silt with pockets of brown orange clay and fragments of metal. Gravel is fine to medium subangular to angular and includes slag).	
1.00	ES1							
1.20	J2							
1.20	B3			12.929		1.40		
1.50-1.95	SJ4	N23					MADE GROUND (Black grey sandy silty gravel with high cobble and boulder content and fragments of metal. Gravel is fine to coarse subangular to angular and includes slag, ash and brick. Cobbles and boulders are subangular to angular and include sandstone,	
1.50-1.95	B5						at c.1.50m BGL ... medium dense.	
2.00	ES6							
						(2.70)		
3.00	ES7						from c.3.00m BGL ... driller notes gravel includes concrete and lime.	
3.20	J8							
3.60	B9							
4.00	ES10			10.229		4.10	at c.4.10m BGL ... driller notes slag.	
							Borehole terminated at 4.10m BGL - unable to progress.	

Boring Progress and Water Observations					Chiselling			Water Added	
Date	Depth	Casing	Casing Dia (mm)	Water Standing	From	To	Hours (hh:mm)	From	To
15/12/2017	0.00	0.00			3.00	4.00	02:30		
15/12/2017	4.00	4.00	250	Dry	4.00	4.10	03:00		
18/12/2017	4.00	4.00	250	Dry	4.10	4.10	04:30		
18/12/2017	4.10	4.00	250	Dry					

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

Print Date and Time: 12/06/2018 11:30:20

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20, Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

BOREHOLE RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation			**Exploratory Hole No.** BH06
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454996.666 N:522269.584		
Method (Equipment): Cable Percussion (Dando 2000)	**Ground Level (m(AOD)):** 12.081	**Start Date:** 14/12/2017	**Sheet:** 1 of 1

SAMPLES & TESTS				STRATA				
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument/ Backfill
					▨		MADE GROUND (Black slightly silty sandy gravel with medium to high cobble content and fragments of metal. Gravel is fine to coarse subangular to angular and includes slag and clinker. Cobbles are subangular to angular and include slag).	▒
0.20	J1							
0.60	B2							
1.00	ES3							
1.20	CB4	N25					at c.1.20m BGL ... medium dense.	
2.00	ES5							
2.50	CB6	1/0.94					at c.2.50m BGL ... very dense.	
3.00	ES7							
3.50	CB8	1/1.26						
						(7.40)		
							from c.3.90m BGL ... driller notes slag.	
4.30-4.60	B9							
5.00	CB10	1/0.94						
5.50	ES11							
6.00	CB12	1/1.26						
6.50	ES13							
				4.681		7.40	at c.7.40m BGL ... cobbles and boulders include slag.	
							Borehole terminated at 7.40m BGL - unable to progress.	

Boring Progress and Water Observations				
Date	Depth	Casing	Casing Dia (mm)	Water Standing
14/12/2017	0.00	0.00		
14/12/2017	3.00	3.00	250	
14/12/2017	4.60	4.60	200	3.96
15/12/2017	4.60	4.60	200	Dry
15/12/2017	7.40	7.40	200	6.19

Chiselling			Water Added	
From	To	Hours (hh:mm)	From	To
0.60	0.90	00:30	4.00	4.30
2.10	2.40	01:00	6.90	7.40
4.00	4.40	03:00		
4.40	6.00	03:45		
6.20	6.50	00:45		
6.60	6.80	00:30		
7.40	7.40	02:00		

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) From 3.90m BGL - driller notes very slow drilling.
(4) Chiselling break down for 4.40-6.00m BGL - 4.40-4.90m (1hr), 4.90-5.40m (1hr15mins) and 5.40-6.00m (1hr30mins).

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

Print Date and Time: 12/06/2018 11:30:21

BOREHOLE RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation			**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454912.638 N:522362.633		**BH08**
Method (Equipment): Cable Percussion (Dando 2000)	**Ground Level (m(AOD)):** 12.061	**Start Date:** 30/11/2017	**Sheet:** 1 of 3

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
							MADE GROUND (Black slightly silty gravelly sand. Gravel is fine to medium subangular to angular and includes slag, ash and iron ore).	
1.00	ES1					(2.00)		
1.20	J2							
1.20	B3							
1.50-1.95	SJ4	N4					at c.1.50m BGL ... very loose and loose.	
1.50-1.95	B5							
				10.061		2.00		
2.00	ES6						MADE GROUND (Black slightly silty gravelly sand. Gravel is fine to coarse subangular to angular and includes ash, slag and iron ore).	
2.20	J7							
2.30	B8							
2.50-2.95	SJ9	N4					at c.2.50m BGL ... very loose and loose.	
2.50-2.95	B10							
3.00	ES11							
3.20	J12							
3.30	B13					(3.00)		
3.50-3.95	SJ14	N12					at c.3.50m BGL ... medium dense.	
3.50-3.95	B15							
4.00	ES16							
4.20	J17							
4.40	B18							
4.50-4.95	SJ19	N8					at c.4.50m BGL ... loose.	
4.50-4.95	B20							
				7.061		5.00		
5.00	ES21						MADE GROUND (Dense black slightly silty gravelly sand with cobbles/boulders noted. Gravel is fine to coarse subangular to angular and includes ash, slag, iron ore and iron oxide. Cobbles/boulders are angular and include iron ore and slag).	
5.20	J22							
5.40	B23							
5.50-5.95	SJ24	N35						
6.00	ES26					(2.40)		
6.50-6.95	SJ27	N40						
6.50-6.95	B28							
7.00	ES29							
7.20	J30							
				4.661		7.40		
7.40	B31						MADE GROUND (Black very clayey/silty gravelly sand with cobbles noted. Gravel is fine to coarse subangular to angular and includes ash and slag. Cobbles are angular and include iron ore and slag).	
7.50-7.95	SJ32	N52					at c.7.50m BGL ... very dense.	
7.50-7.95	B33							

Boring Progress and Water Observations					Chiselling			Water Added	
Date	Depth	Casing	Casing Dia (mm)	Water Standing	From	To	Hours (hh:mm)	From	To
30/11/2017	0.00	0.00							
30/11/2017	2.00	2.00	250	Dry					
01/12/2017	2.00	2.00	250	Dry					
01/12/2017	5.50	5.50	250	Dry					
05/12/2017	5.50	5.50	250	Dry					
05/12/2017	8.00	8.00	250	0.00					

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20, Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

BOREHOLE RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454912.638 N:522362.633			BH08
Method (Equipment): Cable Percussion (Dando 2000)		**Ground Level (m(AOD)):** 12.061	**Start Date:** 30/11/2017	**Sheet:** 2 of 3

Depth	Type No	Test Result	Water	Reduced Level	Depth (Thickness)	DESCRIPTION
8.00	ES34					*(Continued...)* MADE GROUND (Black very clayey/silty gravelly sand with cobbles noted. Gravel is fine to coarse subangular to angular and includes ash and slag. Cobbles are angular and include iron ore and slag).
					(2.60)	
9.50	B35					
				2.061	10.00	
				1.961	(0.10) 10.10	(1) MADE GROUND (Boulder).
10.20	ES36					MADE GROUND (Dense black slightly silty very gravelly sand with cobbles noted. Gravel is fine to coarse subangular to angular and includes ash, slag and iron ore. Cobbles are angular and include slag).
10.50-10.95	C37	N33				
					(1.90)	
11.00	ES38					
11.10	J39					
11.30	B40					
11.50-11.95	C41	N32				
				0.061	12.00	
12.00	ES42					MADE GROUND (Dense black silty slightly gravelly sand. Gravel is fine to medium subangular to angular and includes ash and slag).
12.50-12.95	J43	N30				
12.50-12.95	B44					
					(2.00)	
13.00	ES45					
13.50-13.95	SJ46	N33				
13.50-13.95	B47					
				-1.939	14.00	
14.00	ES48					Dense black silty SAND.
14.10	J49					
14.30	B50					
14.50-14.95	SJ51	N34				
15.00	ES52					
					(3.00)	
15.50-15.95	S53	N38				
15.50-15.95	B54					

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
06/12/2017	8.00	8.00	250	Dry
06/12/2017	8.50	8.50	250	Dry
11/12/2017	8.50	8.50	250	Dry
11/12/2017	9.50	9.50	250	Dry
12/12/2017	9.50	9.50	200	Dry
12/12/2017	10.10	10.10	200	Dry
13/12/2017	10.10	10.10	200	0.00

Chiselling

From	To	Hours (hh:mm)
8.50	9.50	01:00
9.50	10.00	01:30
10.00	10.00	00:45
10.00	10.10	00:30

Water Added

From	To
10.20	15.00

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

Print Date and Time: 12/06/2018 11:30:22

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20, Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

BOREHOLE RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation			**Exploratory Hole No.** **BH08**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454912.638 N:522362.633		
Method (Equipment): Cable Percussion (Dando 2000)	**Ground Level (m(AOD)):** 12.061	**Start Date:** 30/11/2017	**Sheet:** 3 of 3

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
16.00	ES55						*((Continued...))* Dense black silty SAND.	
16.10	J56							
16.50	B57	N39						
16.50	SJ58							
16.50	B59			-4.939		17.00		
17.00	ES60						Borehole complete at 17.00m BGL.	

Boring Progress and Water Observations				
Date	Depth	Casing	Casing Dia (mm)	Water Standing
13/12/2017	17.00	17.00	200	16.00

Chiselling			Water Added	
From	To	Hours (hh:mm)	From	To

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

Print Date and Time: 12/06/2018 11:30:22

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BOREHOLE RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation			**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454994.111 N:522361.611		**BH09**
Method (Equipment): Cable Percussion (Dando 2000)	**Ground Level (m(AOD)):** 19.569	**Start Date:** 11/12/2017	**Sheet:** 1 of 2

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
0.20	J1						MADE GROUND (Black slightly silty sandy gravel with cobbles noted and fragments of metal. Gravel is fine to coarse subangular to angular and includes slag and clinker. Cobbles are subangular to angular and include slag).	
0.50	B2							
1.20	ES3							
1.50-2.00	CB4	N43					from c.1.50m BGL ... dense to very dense.	
2.20	ES5							
2.30	J6							
2.40	B7							
2.50-3.00	CB8	N31						
3.20	ES9							
3.50-4.00	CB10	1/3.00				(7.40)		
4.20	B11	1/0.00						
4.20	C12							
4.50-5.00	CB13	N37						
5.20	J14							
5.30	B15							
5.40	ES16							
5.50-6.00	CB17	N58						
6.20	ES18							
6.50-7.00	CB19	1/0.00						
7.20	J20			12.169		7.40		
7.40	C21	1/0.00					MADE GROUND (Very dense black slightly silty sandy gravel with cobbles and boulders noted with fragments of metal. Gravel is fine to coarse subangular to angular and includes slag and clinker. Cobbles and boulders are subangular to angular and include slag).	
7.40	J22							
7.50	CB23					(1.10)		

Boring Progress and Water Observations				
Date	Depth	Casing	Casing Dia (mm)	Water Standing
11/12/2017	0.00	0.00		
11/12/2017	1.50	1.50	200	Dry
13/12/2017	1.50	1.50	200	Dry
13/12/2017	4.20	4.20	200	Dry
14/12/2017	4.20	4.20	200	Dry
14/12/2017	7.40	7.40	200	0.00
15/12/2017	7.40	7.40	200	Dry

Chiselling			Water Added	
From	To	Hours (hh:mm)	From	To
3.80	4.00	02:30	1.20	1.50
4.00	4.20	02:30	4.00	4.20
4.20	4.40	01:30	4.20	7.40
7.00	7.40	06:00	7.40	8.40
7.40	8.00	03:30		
8.00	8.40	05:00		

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Between 1.50-8.40m BGL - driller notes very slow progress.

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

Print Date and Time: 12/06/2018 11:30:24

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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BOREHOLE RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation			**Exploratory Hole No.** **BH09**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454994.111 N:522361.611		
Method (Equipment): Cable Percussion (Dando 2000)	**Ground Level (m(AOD)):** 19.569	**Start Date:** 11/12/2017	**Sheet:** 2 of 2

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
8.20	ES24			11.069	▨	8.50	*(Continued...)* MADE GROUND (Very dense black slightly silty sandy gravel with cobbles and boulders noted with fragments of metal. Gravel is fine to coarse subangular to angular and includes slag and clinker. Cobbles and boulders are subangular to angular and include slag).	▩
8.50	J25	1/0.00					Borehole terminated at 8.50m BGL - due to very slow progress.	

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
15/12/2017	8.40	8.40	200	0.00
18/12/2017	8.40	8.40	200	Dry
18/12/2017	8.50	8.50	200	Dry

Chiselling			Water Added	
From	To	Hours (hh:mm)	From	To
8.40	8.50	01:30		

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Between 1.50-8.40m BGL - driller notes very slow progress.

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

Print Date and Time: 12/06/2018 11:30:24

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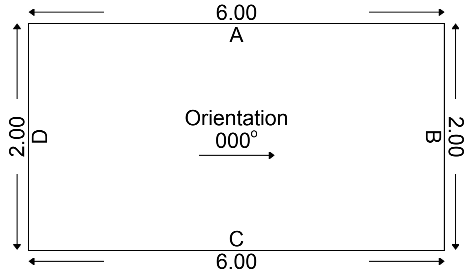
TRIAL PIT RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation				**Exploratory Hole No.** BH03TP
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455027.373 N:522230.718			
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 12.500	**Start Date:** 20/12/2017	**Sheet:** 1 of 3

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
					▨		MADE GROUND (Black grey silty sandy gravel with high cobble and boulder content and fragments of metal. Gravel is fine to coarse angular to subangular and includes slag, ash, brick, concrete and limestone).
1.00	B1				▨		
1.00	ES2				▨		
2.00	ES3				▨		
					▨	(5.00)	
3.00	B4				▨		
4.00	ES5				▨		
				7.500	▨	5.00	
5.00	ES6						Trial pit complete at 5.00m BGL.

PLAN



GROUNDWATER
No groundwater inflow observed.

STABILITY
Pit sides and base stable throughout excavation.

GENERAL REMARKS

ADDITIONAL INFORMATION

Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

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TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455027.373 N:522230.718			BH03TP
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 12.500	**Start Date:** 20/12/2017	**Sheet:** 2 of 3

Figure BH03TP.1
BH03TP

Figure BH03TP.2
BH03TP

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TRIAL PIT RECORD

Project: SLEMS Landfill Investigation				**Status:-** FINAL
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455027.373 N:522230.718			**Exploratory Hole No.** BH03TP
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 12.500	**Start Date:** 20/12/2017	**Sheet:** 3 of 3

Figure BH03TP.3
BH03TP Spoil

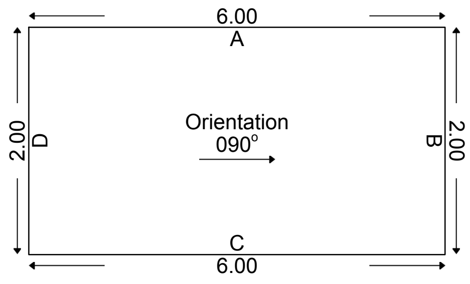
TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454977.784 N:522184.632			BH04TP
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 14.267	**Start Date:** 20/12/2017	**Sheet:** 1 of 3

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
				12.267	▨	(2.00) 2.00	MADE GROUND (Black sandy gravelly silt with fragments of metal. Gravel is fine to medium subangular to angular and includes slag and ash).
2.00 2.00	ES1 B2			10.767	▨	(1.50) 3.50	MADE GROUND (Grey sandy silty gravel with low cobble/boulder content and fragments of metal. Gravel is fine to coarse subangular to angular and includes slag, clinker and cinder. Cobbles and boulders include slag).
3.50	ES3						Trial pit complete at 3.50m BGL.

PLAN



GROUNDWATER

No groundwater inflow observed.

STABILITY

Pit sides and base stable throughout excavation.

GENERAL REMARKS

ADDITIONAL INFORMATION

Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

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TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454977.784 N:522184.632			BH04TP
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 14.267	**Start Date:** 20/12/2017	**Sheet:** 2 of 3

Figure BH04TP.1
BH04TP

Figure BH04TP.2
BH04TP

TRIAL PIT RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454977.784 N:522184.632			**BH04TP**
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 14.267	**Start Date:** 20/12/2017	**Sheet:** 3 of 3

Figure BH04TP.3
BH04TP

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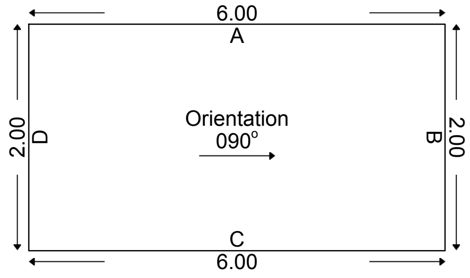
TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation			**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455112.979 N:522291.077		BH05TP
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 14.329	**Start Date:** 20/12/2017	**Sheet:** 1 of 3

SAMPLES & TESTS				STRATA			
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick- ness)	DESCRIPTION
				12.829	▨	(1.50) 1.50	MADE GROUND (Black sandy gravelly silt with pockets of brown orange clay and fragments of metal. Gravel is fine to medium subangular to angular and includes slag).
3.50	B1			9.829	▨	(3.00) 4.50	MADE GROUND (Black grey sandy silty gravel with high cobble and boulder content and fragments of metal. Gravel is fine to coarse subangular to angular and includes slag, ash and brick. Cobbles and boulders are subangular to angular and include sandstone, concrete and slag).
4.50	ES2						Trial pit complete 4.50m BGL.

PLAN



GROUNDWATER
No groundwater inflow observed.

STABILITY
Pit sides and base stable throughout excavation.

GENERAL REMARKS

ADDITIONAL INFORMATION

Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

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TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation			**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455112.979 N:522291.077		BH05TP
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 14.329	**Start Date:** 20/12/2017	**Sheet:** 2 of 3

Figure BH05TP.1
BH05TP

Figure BH05TP.2
BH05TP

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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TRIAL PIT RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation			**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455112.979 N:522291.077		**BH05TP**
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 14.329	**Start Date:** 20/12/2017	**Sheet:** 3 of 3

Figure BH05TP.3
BH05TP

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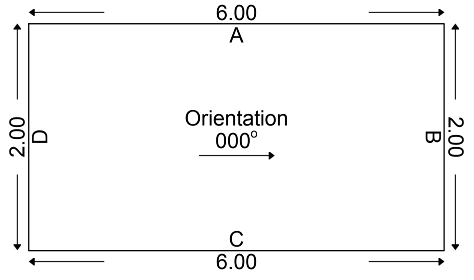
TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.** TP01
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454806.065 N:522353.231			
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 8.100	**Start Date:** 20/12/2017	**Sheet:** 1 of 3

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
0.50 0.50 0.50	B1 J2 ES3			7.300	▨	(0.80) 0.80	MADE GROUND (Black slightly silty slightly sandy slightly silty gravel with fragments of metal. Gravel is fine to coarse angular to subangular and includes slag).
1.00 1.00 1.00	B4 J5 ES6			6.100	▨	(1.20) 2.00	MADE GROUND (Grey slightly silty slightly sandy gravel with low to high cobble and boulder content and fragment of cloth, wood and metal. Gravel is fine to coarse angular to subangular and includes ash and slag. Cobbles and boulders are angular to subangular and include slag).
2.50 2.50 2.50	B7 J8 ES9			4.300	▨	(1.80) 3.80	MADE GROUND (Grey sandy gravel. Gravel is fine to coarse angular to subangular and include slag and brick).
				3.900	▤	(0.40) 4.20	Firm brown sandy slightly gravelly CLAY. Gravel is fine to medium subangular to angular and includes sandstone and mudstone.
4.20	ES10						Trial pit complete at 4.20m BGL.

PLAN



GROUNDWATER
No groundwater inflow observed.

STABILITY
Pit sides and base stable throughout excavation.

GENERAL REMARKS

ADDITIONAL INFORMATION

Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

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TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454806.065 N:522353.231			TP01
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 8.100	**Start Date:** 20/12/2017	**Sheet:** 2 of 3

Figure TP01.1
TP01

Figure TP01.2
TP01

Print Date and Time: 12/06/2018 11:30:55

TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454806.065 N:522353.231			TP01
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 8.100	**Start Date:** 20/12/2017	**Sheet:** 3 of 3

Figure TP01.3
TP01 Spoil

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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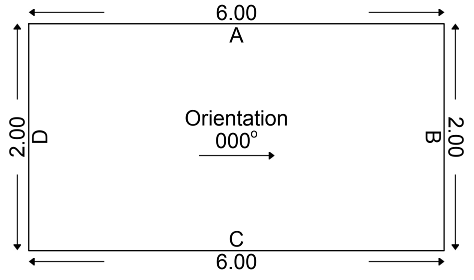
TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.** TP02
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454843.159 N:522388.888			
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 5.879		**Start Date:** 20/12/2017	**Sheet:** 1 of 3

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
1.50 1.50	B1 ES2		▼1	3.879	▨	(2.00) 2.00	MADE GROUND (Black slightly sandy gravel with fragments of metal. Gravel is fine to coarse angular to subangular and include slag).
2.00 2.50	B3 ES4			2.979	×	(0.90) 2.90	Laminated black brown SILT.
							Trial pit complete at 2.90m BGL.

PLAN



GROUNDWATER

Water strike at 2.00m BGL (slight inflow).

STABILITY

Pit sides and base stable throughout excavation.

GENERAL REMARKS

ADDITIONAL INFORMATION

Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

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TRIAL PIT RECORD

Project: SLEMS Landfill Investigation				**Status:-** FINAL **Exploratory Hole No.** TP02
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454843.159 N:522388.888			
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 5.879	**Start Date:** 20/12/2017	**Sheet:** 2 of 3

TRIAL PIT RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454843.159 N:522388.888			**TP02**
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 5.879	**Start Date:** 20/12/2017	**Sheet:** 3 of 3

Figure TP02.3
TP02 Spoil

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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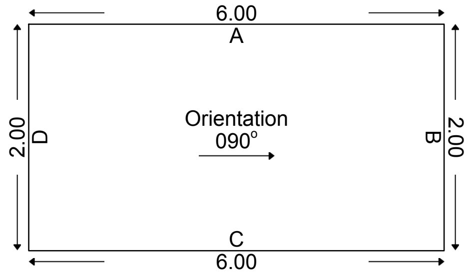
TRIAL PIT RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation			**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455197.482 N:522152.020		**TP03**
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 7.100	**Start Date:** 18/12/2017	**Sheet:** 1 of 3

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
1.00 1.00 1.00	B1 J2 ES3			5.500	▨	(1.60) 1.60	MADE GROUND (Laminated brown clayey silt).
1.60	B4			5.300	▨	(0.20) 1.80	MADE GROUND (Grey cobbles and boulders with fragments of metal. Cobbles and boulders include slag).
							Trial pit complete at 1.80m BGL.

PLAN



GROUNDWATER
Water strike at 1.60m BGL (slight inflow).

STABILITY
Pit sides and base stable throughout excavation.

GENERAL REMARKS

ADDITIONAL INFORMATION

Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

Print Date and Time: 12/06/2018 11:31:00

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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Regional Office: Unit 20, Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

TRIAL PIT RECORD

Status:- FINAL				
Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455197.482 N:522152.020			TP03
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 7.100	**Start Date:** 18/12/2017		**Sheet:** 2 of 3

Figure TP03.1
TP03

Figure TP03.2
TP03

Print Date and Time: 12/06/2018 11:31:01

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TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455197.482 N:522152.020			TP03
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 7.100	**Start Date:** 18/12/2017	**Sheet:** 3 of 3

Figure TP03.3
TP03 Spoil

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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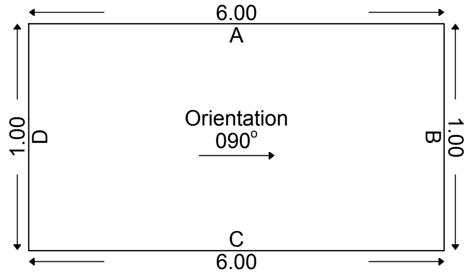
TRIAL PIT RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation			**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455071.578 N:522118.278		**TP04**
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 7.176	**Start Date:** 18/12/2017	**Sheet:** 1 of 3

SAMPLES & TESTS				STRATA			
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
					▨		MADE GROUND (Black sandy slightly gravelly silt with fragments of metal. Gravel is fine to medium angular to subangular and includes slag and brick).
1.00 1.00 1.00	B1 J2 ES3				▨		
					▨	(3.50)	
2.00 2.00 2.00	ES4 B5 J6				▨		
3.00 3.00 3.00	ES7 B8 J9				▨		
				3.676		3.50	at c.3.50m BGL ... grey green cobbles and boulders.
							Trial pit complete at 3.50m BGL.

PLAN



GROUNDWATER

No groundwater inflow observed.

STABILITY

Pit sides and base stable throughout excavation.

GENERAL REMARKS

ADDITIONAL INFORMATION

Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

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TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455071.578 N:522118.278			TP04
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 7.176	**Start Date:** 18/12/2017	**Sheet:** 2 of 3

Figure TP04.1
TP04

Figure TP04.2
TP04

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TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455071.578 N:522118.278			TP04
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 7.176	**Start Date:** 18/12/2017	**Sheet:** 3 of 3

Figure TP04.3
TP04 Spoil

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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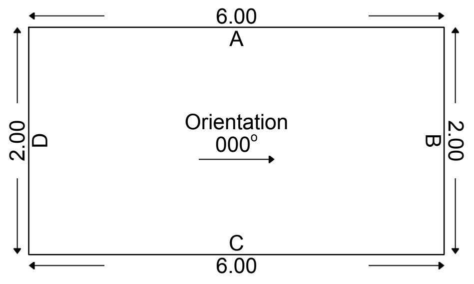
TRIAL PIT RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454959.268 N:522092.616			**TP05**
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 7.136	**Start Date:** 20/12/2017	**Sheet:** 1 of 3

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
0.00-1.50 0.00-1.50 0.00-1.50	B1 J2 ES3						MADE GROUND (Black slightly silty slightly sandy gravel with fragments of metal. Gravel is fine to coarse angular to subangular and includes slag).
						(2.30)	
1.50 1.50	B4 J5						
2.00	ES6			4.836		2.30	
2.50 2.50 2.50	B7 J8 ES9					(0.90)	Firm brown sandy gravelly CLAY. Gravel is fine to medium subangular to subrounded and includes mudstone and sandstone.
				3.936		3.20	
							Trial pit complete at 3.20m BGL.

PLAN



GROUNDWATER
No groundwater inflow observed.

STABILITY
Pit sides and base stable throughout excavation.

GENERAL REMARKS

ADDITIONAL INFORMATION

Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

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TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454959.268 N:522092.616			**TP05**
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 7.136	**Start Date:** 20/12/2017	**Sheet:** 2 of 3

Figure TP05.1
TP05

Figure TP05.2
TP05

TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation			**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454959.268 N:522092.616		TP05
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 7.136	**Start Date:** 20/12/2017	**Sheet:** 3 of 3


CONTRACT NAME SSI STEELWORKS
CONTRACT NO 4154A
CLIENT S T S C LTD
LOCATION TP 05
DEPTH

Figure TP05.3
TP05 Spoil

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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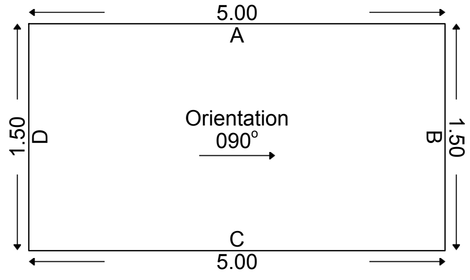
TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation			**Exploratory Hole No.** TP101
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454868.564 N:522338.688		
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 12.245	**Start Date:** 28/03/2018	**Sheet:** 1 of 3

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
				11.745	▨	(0.50) 0.50	MADE GROUND (Black silt).
2.00 2.00	B2 ES1			7.745	▨	(4.00) 4.50	MADE GROUND (Grey sandy gravel with fragments of plastic and electrical components. Gravel is fine to coarse angular to subangular and includes slag and brick).
							Trial pit complete at 4.50m BGL.

PLAN



GROUNDWATER
No groundwater inflow observed.

STABILITY
Pit sides and base stable throughout excavation.

GENERAL REMARKS

ADDITIONAL INFORMATION

Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

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TRIAL PIT RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454868.564 N:522338.688			**TP101**
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 12.245	**Start Date:** 28/03/2018	**Sheet:** 2 of 3

Figure TP101.1
TP101 - Trial Pit Short Face

Figure TP101.2
TP101 - Trial Pit Long Face

TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454868.564 N:522338.688			TP101
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 12.245	**Start Date:** 28/03/2018	**Sheet:** 3 of 3

Figure TP101.3
TP101 - Trial Pit Spoil

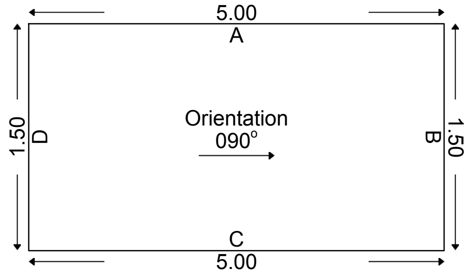
TRIAL PIT RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation			**Exploratory Hole No.** TP102
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454915.204 N:522346.272		
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 12.370	**Start Date:** 28/03/2018	**Sheet:** 1 of 1

SAMPLES & TESTS				STRATA			
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
				11.670	▨	(0.70) 0.70	MADE GROUND (Black silt).
				10.620	▨	(1.05) 1.75	MADE GROUND (Grey sandy gravel. Gravel is fine to coarse angular to subangular and includes slag, brick and hydrated lime).
2.50 2.50	B2 ES1			8.970	▨	(1.65) 3.40	MADE GROUND (Black blue silt. Engineer notes lightly cemented. Recovered as fine to coarse angular gravel).
4.50	B3			7.370	▨	(1.60) 5.00	MADE GROUND (Red black silt. Engineer notes lightly cemented. Recovered fine to coarse angular gravel).
							Trial pit complete at 5.00m BGL.

PLAN



GROUNDWATER
No groundwater inflow observed.

STABILITY
Pit sides and base stable throughout excavation.

GENERAL REMARKS

ADDITIONAL INFORMATION

Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

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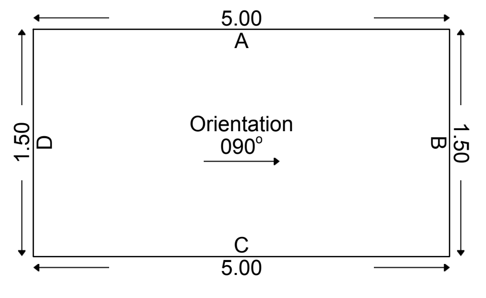
TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.** TP103
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454990.925 N:522406.533			
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 13.067	**Start Date:** 28/03/2018		**Sheet:** 1 of 3

SAMPLES & TESTS				STRATA			
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
1.00 1.00	B1 ES2			11.667	▨	(1.40) 1.40	MADE GROUND (Black silt).
				10.767	▨	(0.90) 2.30	MADE GROUND (Black silt).
				8.167	▨	(2.60) 4.90	MADE GROUND (Grey sandy gravel. Gravel is fine to coarse angular to subangular and includes slag).
				8.067	▨	(0.10) 5.00	MADE GROUND (Soft black silt with blue staining within fissures).
							Trial pit complete at 5.00m BGL.

PLAN



GROUNDWATER
No groundwater inflow observed.

STABILITY
Pit sides and base stable throughout excavation.

GENERAL REMARKS

ADDITIONAL INFORMATION

Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

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TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454990.925 N:522406.533			TP103
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 13.067	**Start Date:** 28/03/2018	**Sheet:** 2 of 3

Figure TP103.1
TP103 - Trial Pit Short Face

Figure TP103.2
TP103 - Trial Pit Long Face

TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation			**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454990.925 N:522406.533		TP103
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 13.067	**Start Date:** 28/03/2018	**Sheet:** 3 of 3

Figure TP103.3
TP103 - Trial Pit Base

Figure TP103.4
TP103 - Trial Pit Spoil

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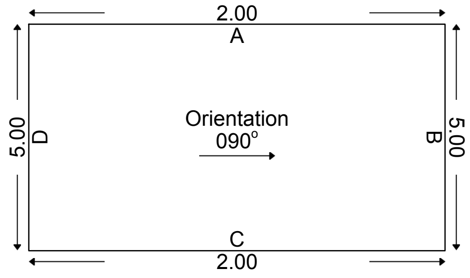
TRIAL PIT RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454932.298 N:522303.415			**TP104**
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 14.156	**Start Date:** 28/03/2018	**Sheet:** 1 of 3

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
1.00	ES1			12.556	▨	(1.60) 1.60	MADE GROUND (Black silt).
2.00	ES2			11.656	▨	(0.90) 2.50	MADE GROUND (Black gravelly silt. Gravel is fine to medium angular to subangular and includes slag).
				10.856	▨	(0.80) 3.30	MADE GROUND (Grey sandy gravel with high cobble and boulder content. Gravel is fine to coarse angular to subangular and includes slag. Cobbles and boulders are angular and include slag).
3.50 3.50	B4 ES3			9.156	▨	(1.70) 5.00	MADE GROUND (Black and red gravelly silt. Gravel is fine to medium angular and includes iron stained dried/cemented BOS slurry).
							Trial pit complete at 5.00m BGL.

PLAN



GROUNDWATER
No groundwater inflow observed.

STABILITY
Pit sides and base stable throughout excavation.

GENERAL REMARKS

ADDITIONAL INFORMATION

Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

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TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454932.298 N:522303.415			TP104
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 14.156	**Start Date:** 28/03/2018	**Sheet:** 2 of 3

Figure TP104.1
TP104 - Trial Pit Short Face

Figure TP104.2
TP104 - Trial Pit Long Face

TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454932.298 N:522303.415			TP104
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 14.156	**Start Date:** 28/03/2018	**Sheet:** 3 of 3

Figure TP104.3
TP104 - Trial Pit Spoil

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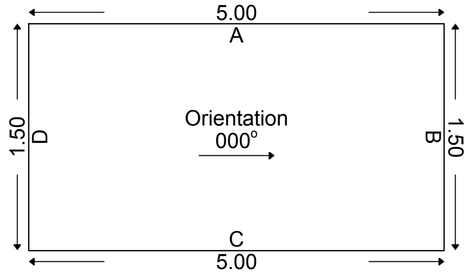
TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation			**Exploratory Hole No.** TP105
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455029.401 N:522319.272		
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 19.272	**Start Date:** 28/03/2018	**Sheet:** 1 of 3

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION
1.00	B1			17.872	▨	(1.40) 1.40	MADE GROUND (Grey blue silt. Gravel is fine to coarse angular and includes slag and ironstone).
3.00 3.00	B2 ES3			15.272	▨	(2.55) 4.00	MADE GROUND (Red gravelly silt. Gravel is fine to coarse angular and includes dried/cemented BOS slurry).
							Trial pit complete at 4.00m BGL.

PLAN



GROUNDWATER
No groundwater inflow observed.

STABILITY
Pit sides stable below

GENERAL REMARKS

ADDITIONAL INFORMATION

Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

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TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation			**Exploratory Hole No.** TP105
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455029.401 N:522319.272		
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 19.272	**Start Date:** 28/03/2018	**Sheet:** 2 of 3

Figure TP105.1
TP105 - Trial Pit Short Face

Figure TP105.2
TP105 - Trial Pit Long Face

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TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455029.401 N:522319.272			TP105
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 19.272	**Start Date:** 28/03/2018	**Sheet:** 3 of 3

Figure TP105.3
TP105 - Trial Pit Spoil

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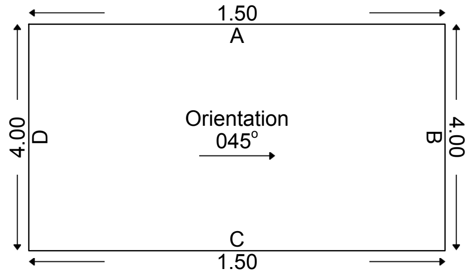
TRIAL PIT RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454949.445 N:522261.704			**TP106**
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 12.684	**Start Date:** 27/03/2018	**Sheet:** 1 of 3

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
				12.184	▨	(0.50) 0.50	MADE GROUND (Black slightly gravelly silt. Gravel is angular to subangular and includes dried/cemented BOS slurry and slag).
1.40	B1			10.284	▨	(1.90) 2.40	MADE GROUND (Black brown silt).
2.50	ES2			9.584	▨	(0.70) 3.10	MADE GROUND (Grey sandy gravel. Gravel is fine to coarse angular to subangular and includes slag and brick).
				8.784	▨	(0.80) 3.90	MADE GROUND (Grey gravelly sand. Gravel is fine to coarse angular and includes slag).
							Trial pit terminated at 3.90m BGL - unable to progress.

PLAN



GROUNDWATER
No groundwater inflow observed.

STABILITY
Pit sides and base stable throughout excavation.

GENERAL REMARKS

ADDITIONAL INFORMATION

Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

Print Date and Time: 12/06/2018 11:31:20

TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454949.445 N:522261.704			TP106
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 12.684	**Start Date:** 27/03/2018	**Sheet:** 2 of 3

Figure TP106.1
TP106 - Trial Pit Short Face

Figure TP106.2
TP106 - Trial Pit Long Face

TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation			**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:454949.445 N:522261.704		TP106
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 12.684	**Start Date:** 27/03/2018	**Sheet:** 3 of 3

Figure TP106.3
TP106 - Trial Pit Spoil

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20, Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

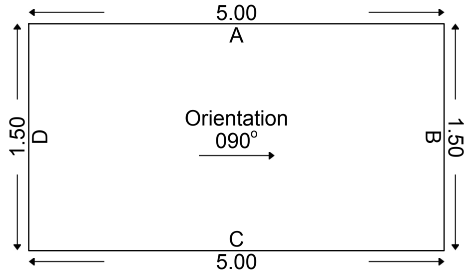
TRIAL PIT RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation				**Exploratory Hole No.** **TP107**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455082.493 N:522282.442			
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 14.928	**Start Date:** 29/03/2018	**Sheet:** 1 of 3

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
1.00 1.00	B1 ES3			13.228	▨	(1.70) 1.70	MADE GROUND (Black silt).
				11.928	▨	(1.30) 3.00	MADE GROUND (Firm laminated black brown slightly sandy clay with interbeds of black silt).
3.50	B2			10.428	▨	(1.50) 4.50	MADE GROUND (Grey sandy gravel with fragments of wood and plastic. Gravel is fine to coarse angular to subangular and includes slag and brick).
							Trial pit complete at 4.50m BGL.

PLAN



GROUNDWATER
No groundwater inflow observed.

STABILITY
Pit sides and base stable throughout excavation.

GENERAL REMARKS

ADDITIONAL INFORMATION

Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

Print Date and Time: 12/06/2018 11:31:24

TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation			**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455082.493 N:522282.442		TP107
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 14.928	**Start Date:** 29/03/2018	**Sheet:** 2 of 3

Figure TP107.1
TP107 - Trial Pit Short Face

Figure TP107.2
TP107 - Trial Pit Long Face

TRIAL PIT RECORD

Status:- **FINAL**

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455082.493 N:522282.442			**TP107**
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 14.928	**Start Date:** 29/03/2018	**Sheet:** 3 of 3

Figure TP107.3
TP107 - Trial Pit Spoil

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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Regional Office: Unit 20, Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

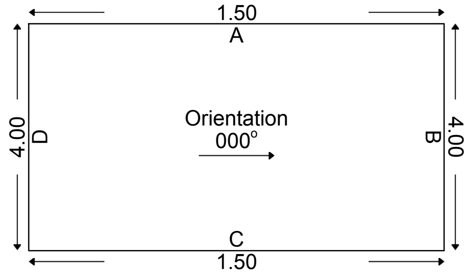
TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation			**Exploratory Hole No.** TP108
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455004.039 N:522177.496		
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 14.081	**Start Date:** 27/03/2018	**Sheet:** 1 of 3

SAMPLES & TESTS				STRATA			
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
				12.681	▨	(1.40) 1.40	MADE GROUND (Black slightly sandy silt).
1.50	B1			10.981	▨	(1.70) 3.10	MADE GROUND (Grey sandy gravel with low cobble content and fragments of wood, plastic, fabric, rubber and metal. Gravel is fine to coarse angular to subangular and includes clag. Cobbles and boulders are angular and include slag and brick).
				10.381	▨	(0.60) 3.70	MADE GROUND (Grey gravel. Gravel is fine to coarse angular and includes cemented slag and dried/cemented BOS slurry).
				9.081	▨	(1.30) 5.00	MADE GROUND (Brown slightly sandy slightly gravelly silt. Gravel is fine to medium angular and includes slag).
5.00	ES2						Trial pit complete at 5.00m BGL.

PLAN



GROUNDWATER
No groundwater inflow observed.

STABILITY
Pit sides and base stable throughout excavation.

GENERAL REMARKS

ADDITIONAL INFORMATION		
Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

Print Date and Time: 12/06/2018 11:31:27

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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Regional Office: Unit 20, Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455004.039 N:522177.496			TP108
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 14.081	**Start Date:** 27/03/2018	**Sheet:** 2 of 3

Figure TP108.1
TP108 - Trial Pit Short Face

Figure TP108.2
TP108 - Trial Pit Long Face

TRIAL PIT RECORD

Project: SLEMS Landfill Investigation				**Status:-** FINAL
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455004.039 N:522177.496			**Exploratory Hole No.** TP108
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 14.081	**Start Date:** 27/03/2018	**Sheet:** 3 of 3

Figure TP108.3
TP108 - Trial Pit Spoil

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20, Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

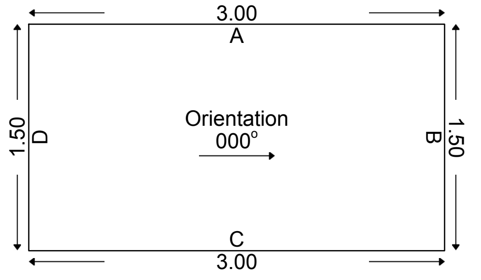
TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.** TP109
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455017.927 N:522161.278			
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 7.240	**Start Date:** 27/03/2018		**Sheet:** 1 of 3

SAMPLES & TESTS				STRATA			
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
					▨	(3.70)	MADE GROUND (Black very sandy silt with interbeds of fine to medium angular to subangular slag).
2.00	ES2						
				3.540		3.70	
3.70	ES1		1 ▼		▨	(1.30)	MADE GROUND (Black grey very silty gravel with low cobble and boulder content. Gravel is fine to coarse angular to subangular and includes slag. Cobbles and boulders are angular to subangular and include slag. Hydrocarbon odour noted).
				2.240		5.00	
							Trial pit complete at 5.00m BGL.

PLAN



GROUNDWATER

Water strike at 3.80m BGL (slow inflow) - hydrocarbon sheen noted.

STABILITY

Pit sides and base stable throughout excavation.

GENERAL REMARKS

ADDITIONAL INFORMATION

Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

Print Date and Time: 12/06/2018 11:31:29

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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Regional Office: Unit 20, Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455017.927 N:522161.278			TP109
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 7.240	**Start Date:** 27/03/2018	**Sheet:** 2 of 3

Figure TP109.1
TP109 - Trial Pit Short Face

Figure TP109.2
TP109 - Trial Pit Long Face

Print Date and Time: 12/06/2018 11:31:30

TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455017.927 N:522161.278			TP109
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 7.240	**Start Date:** 27/03/2018	**Sheet:** 3 of 3

Figure TP109.3
TP109 - Trial Pit Spoil

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20, Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

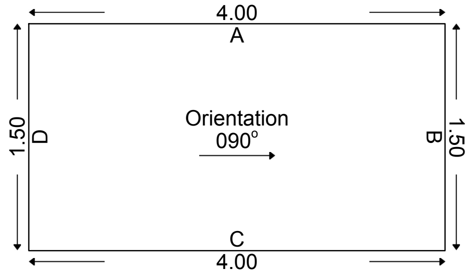
TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation			**Exploratory Hole No.** TP110
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455132.369 N:522222.153		
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 11.729	**Start Date:** 29/03/2018	**Sheet:** 1 of 3

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
				11.129	▨	(0.60) 0.60	MADE GROUND (Black silt).
0.50	B1						
				7.229	▨	(3.90) 4.50	MADE GROUND (Grey sandy gravel. Gravel is fine to coarse angular to subangular and includes slag).
4.50	ES2						Trial pit completed at 4.50m BGL.

PLAN



GROUNDWATER

No groundwater inflow observed.

STABILITY

Pit sides and base stable throughout excavation.

GENERAL REMARKS

ADDITIONAL INFORMATION

Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

Print Date and Time: 12/06/2018 11:31:32

ALLIED EXPLORATION & GEOTECHNICS LIMITED
Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20, Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455132.369 N:522222.153			TP110
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 11.729	**Start Date:** 29/03/2018	**Sheet:** 2 of 3

Figure TP110.1
TP110 - Trial Pit Short Face

Figure TP110.2
TP110 - Trial Pit Long Face

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20, Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation			**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455132.369 N:522222.153		TP110
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 11.729	**Start Date:** 29/03/2018	**Sheet:** 3 of 3

Figure TP110.3
TP110 - Trial Pit Spoil

Print Date and Time: 12/06/2018 11:31:34

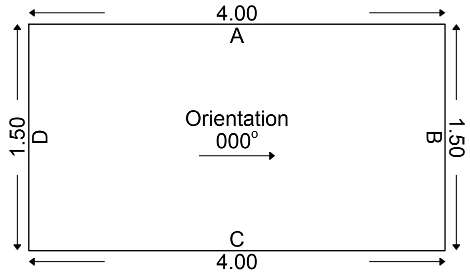
TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation			**Exploratory Hole No.** TP111
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455178.014 N:522178.826		
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 7.376	**Start Date:** 28/03/2018	**Sheet:** 1 of 3

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
				6.376	▨	(1.00) 1.00	MADE GROUND (Black brown clayey slightly gravelly silt. Gravel is fine to medium angular to subangular and includes slag and dried/cemented BOS slurry).
				5.776	▨	(0.60) 1.60	MADE GROUND (Grey sandy gravel. Gravel is fine to coarse angular to subangular and includes slag).
4.00	ES1		1 ▼	2.876	▨	(2.90) 4.50	MADE GROUND (Black slightly gravelly silt. Gravel is fine to medium angular to subangular and includes slag. Hydrocarbon odour noted).
							Trial pit complete at 4.00m BGL.

PLAN



GROUNDWATER

Water strike at 4.00m BGL.

STABILITY

Pit sides and base stable throughout excavation.

GENERAL REMARKS

ADDITIONAL INFORMATION

Sketch Diagram:	No Sketch Taken	
Photographs:	Yes	See additional sheets.

UNDERGROUND SERVICES

Depth	Orientation	Type	Diameter (mm)	Condition

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by: KW	Logged by: A. Rees	Contract No. **4154A**

Print Date and Time: 12/06/2018 11:31:34

TRIAL PIT RECORD

Status:- FINAL			
Project: SLEMS Landfill Investigation			**Exploratory Hole No.** TP111
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455178.014 N:522178.826		
Method (Equipment): Machine Excavated (JCB 3CX)	**Ground Level (m(AOD)):** 7.376	**Start Date:** 28/03/2018	**Sheet:** 2 of 3

Figure TP111.1
TP111 - Trial Pit Short Face

Figure TP111.2
TP111 - Trial Pit Short Face

TRIAL PIT RECORD

Status:- FINAL

Project: SLEMS Landfill Investigation				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E:455178.014 N:522178.826			TP111
Method (Equipment): Machine Excavated (JCB 3CX)		**Ground Level (m(AOD)):** 7.376	**Start Date:** 28/03/2018	**Sheet:** 3 of 3

Figure TP111.3
TP111 - Trial Pit Spoil

APPENDIX E

Chemical Analysis Summary and Certificates

The Former SSI Steelworks, Redcar: Former SLEMS Landfill BOS Oxide Assessment

Asbestos screen

Sample ID	Material Type	Result
TP101 1 2.00	SOIL	NAD
TP102 1 2.50	SOIL	NAD
TP103 2 1.00	SOIL	NAD
TP105 3 3.00	SOIL	NAD
TP107 3 1.00	SOIL	NAD
TP110 2 4.50	SOIL	NAD
TP108 2 5.00	SOIL	NAD
TP109 1 3.80	SOIL	NAD
TP106 2 2.50	SOIL	NAD
TP104 1 1.00	SOIL	NAD

Certificate of Analysis

Certificate Number	18-00689-1	22-Jan-18
Client	Allied Exploration & Geotechnics Limited Unit 25 Stella Gill Industrial Estate Pelton Fell DH2 2RG	
Our Reference	18-00689-1	
Client Reference	4154A	
Order No	CH-1400	
Contract Title	4154A - SLEMS Landfill Investigation	
Description	11 Soil samples.	
Date Received	10-Jan-18	
Date Started	10-Jan-18	
Date Completed	22-Jan-18	
Test Procedures	Identified by prefix DETSn (details on request).	
Notes	**This report supersedes 18-00689, amendments.** Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.	

Approved By

Adam Fenwick
Contracts Manager

mCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

UKAS TESTING
2139

Summary of Chemical Analysis
Matrix Descriptions

Our Ref 18-00689-1
Client Ref 4154A
Contract Title 4154A - SLEMS Landfill Investigation

Sample ID	Other ID	Depth	Lab No	Completed	Matrix Description
BH03TP	3	2	1282515	15/01/2018	Dark grey, gravelly SAND
BH03TP	6	5	1282516	15/01/2018	Dark grey, gravelly SAND
BH04TP	1	2	1282517	15/01/2018	Dark brown sandy GRAVEL (sample matrix outside MCERTS scope of accreditation)
BH04TP	3	3.5	1282518	15/01/2018	Dark brown sandy GRAVEL (sample matrix outside MCERTS scope of accreditation)
BH05TP	2	4.5	1282519	15/01/2018	Dark brown sandy GRAVEL (sample matrix outside MCERTS scope of accreditation)
TP01	3	0.5	1282520	15/01/2018	Dark brown gravelly, sandy CLAY
TP01	9	2.5	1282521	15/01/2018	Dark brown gravelly, sandy CLAY
TP02	2	1.5	1282522	15/01/2018	Dark brown gravelly, sandy CLAY
TP02	4	2.5	1282523	15/01/2018	Dark grey sandy GRAVEL (sample matrix outside MCERTS scope of accreditation)
TP05	9	2.5	1282524	15/01/2018	Dark brown gravelly, sandy CLAY
TP05	3	0.00-1.50	1282525	15/01/2018	Dark grey sandy GRAVEL (sample matrix outside MCERTS scope of accreditation)

Summary of Chemical Analysis
Soil Samples

Our Ref 18-00689-1
Client Ref 4154A
Contract Title 4154A - SLEMS Landfill Investigation

			Lab No	1282515	1282516	1282517	1282518	1282519
			Sample ID	BH03TP	BH03TP	BH04TP	BH04TP	BH05TP
			Depth	2.00	5.00	2.00	3.50	4.50
			Other ID	3	6	1	3	2
			Sample Type	ES	ES	ES	ES	ES
			Sampling Date	20/12/17	20/12/17	20/12/17	20/12/17	20/12/17
			Sampling Time	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
Metals								
Aluminium	DETSC 2301*	1	mg/kg	8300	9800	3900	5500	10000
Antimony	DETSC 2301*	1	mg/kg	3.9	3.5	5.0	5.2	3.5
Arsenic	DETSC 2301#	0.2	mg/kg	3.1	7.0	0.7	0.9	1.9
Barium	DETSC 2301#	1.5	mg/kg	140	230	38	65	210
Beryllium	DETSC 2301#	0.2	mg/kg	0.5	0.6	< 0.2	0.3	0.2
Boron, Water Soluble	DETSC 2123#	0.2	mg/kg	13	14	5.0	4.8	11
Cadmium	DETSC 2301#	0.1	mg/kg	0.5	0.5	0.6	2.8	1.4
Chromium	DETSC 2301#	0.15	mg/kg	240	200	330	330	200
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	13	220	17	14	16
Iron	DETSC 2301	25	mg/kg	55000	45000	83000	100000	81000
Lead	DETSC 2301#	0.3	mg/kg	41	50	25	92	100
Manganese	DETSC 2301#	20	mg/kg	14000	21000	7400	7300	10000
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	0.05	< 0.05	< 0.05	0.10
Molybdenum	DETSC 2301#	0.4	mg/kg	1.8	2.0	2.2	2.0	2.4
Nickel	DETSC 2301#	1	mg/kg	7.2	9.3	9.7	6.4	6.8
Vanadium	DETSC 2301#	0.8	mg/kg	460	950	210	240	180
Zinc	DETSC 2301#	1	mg/kg	170	160	150	640	440
Inorganics								
pH	DETSC 2008#			12.6	12.6	12.7	12.7	12.5
Sulphur (free)	DETSC 3049#	0.75	mg/kg	< 0.75	1.6	< 0.75	1.4	< 0.75
PAHs								
Naphthalene	DETSC 3303#	0.03	mg/kg	0.11	0.14	< 0.03	0.05	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	0.05	0.13	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	0.04	0.08	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	0.08	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	1.7	3.3	0.07	0.19	0.24
Anthracene	DETSC 3303	0.03	mg/kg	0.18	0.32	< 0.03	0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	2.4	3.5	0.12	0.27	0.20
Pyrene	DETSC 3303#	0.03	mg/kg	1.6	2.3	0.13	0.28	0.24
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.66	0.93	0.03	0.08	0.12
Chrysene	DETSC 3303	0.03	mg/kg	0.85	1.2	0.05	0.15	0.16
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.97	1.3	0.04	0.10	0.27
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.34	0.50	< 0.03	0.03	0.10
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.41	0.55	< 0.03	0.03	0.16
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.29	0.44	< 0.03	< 0.03	0.14
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	0.10	0.14	< 0.03	< 0.03	0.04
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.36	0.52	< 0.03	< 0.03	0.19
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	10	15	0.44	1.2	1.9

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 18-00689-1
Client Ref 4154A
Contract Title 4154A - SLEMS Landfill Investigation

			Lab No	1282520
			Sample ID	TP01
			Depth	0.50
			Other ID	3
			Sample Type	ES
			Sampling Date	20/12/17
			Sampling Time	n/s
Test	**Method**	**LOD**	**Units**	
Metals				
Aluminium	DETSC 2301*	1	mg/kg	540
Antimony	DETSC 2301*	1	mg/kg	7.2
Arsenic	DETSC 2301#	0.2	mg/kg	5.7
Barium	DETSC 2301#	1.5	mg/kg	18
Beryllium	DETSC 2301#	0.2	mg/kg	< 0.2
Boron, Water Soluble	DETSC 2123#	0.2	mg/kg	1.3
Cadmium	DETSC 2301#	0.1	mg/kg	12
Chromium	DETSC 2301#	0.15	mg/kg	71
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	45
Iron	DETSC 2301	25	mg/kg	180000
Lead	DETSC 2301#	0.3	mg/kg	720
Manganese	DETSC 2301#	20	mg/kg	3400
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05
Molybdenum	DETSC 2301#	0.4	mg/kg	5.2
Nickel	DETSC 2301#	1	mg/kg	23
Vanadium	DETSC 2301#	0.8	mg/kg	27
Zinc	DETSC 2301#	1	mg/kg	4800
Inorganics				
pH	DETSC 2008#			10.4
Sulphur (free)	DETSC 3049#	0.75	mg/kg	< 0.75
PAHs				
Naphthalene	DETSC 3303#	0.03	mg/kg	0.19
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.16
Anthracene	DETSC 3303	0.03	mg/kg	0.04
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.19
Pyrene	DETSC 3303#	0.03	mg/kg	0.31
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	0.04
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.92

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 18-00689-1
Client Ref 4154A
Contract Title 4154A - SLEMS Landfill Investigation

			Lab No	1282521	1282522	1282523	1282524	1282525
			Sample ID	TP01	TP02	TP02	TP05	TP05
			Depth	2.50	1.50	2.50	2.50	0.00-1.50
			Other ID	9	2	4	9	3
			Sample Type	ES	ES	ES	ES	ES
			Sampling Date	20/12/17	20/12/17	20/12/17	20/12/17	20/12/17
			Sampling Time	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
Metals								
Aluminium	DETSC 2301*	1	mg/kg	3100	1100	10000	8400	11000
Antimony	DETSC 2301*	1	mg/kg	6.0	19	10	16	8.1
Arsenic	DETSC 2301#	0.2	mg/kg	0.6	19	46	54	9.6
Barium	DETSC 2301#	1.5	mg/kg	58	59	250	390	140
Beryllium	DETSC 2301#	0.2	mg/kg	< 0.2	< 0.2	1.6	0.9	0.4
Boron, Water Soluble	DETSC 2123#	0.2	mg/kg	5.2	1.7	15	11	6.5
Cadmium	DETSC 2301#	0.1	mg/kg	< 0.1	76	19	43	7.3
Chromium	DETSC 2301#	0.15	mg/kg	460	130	140	130	370
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	7.4	160	92	190	51
Iron	DETSC 2301	25	mg/kg	74000	400000	170000	230000	160000
Lead	DETSC 2301#	0.3	mg/kg	6.2	1700	3600	2100	720
Manganese	DETSC 2301#	20	mg/kg	7400	6600	6100	13000	9500
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	0.26	3.1	1.2	0.58
Molybdenum	DETSC 2301#	0.4	mg/kg	1.7	8.3	2.4	5.6	3.2
Nickel	DETSC 2301#	1	mg/kg	17	33	32	42	19
Vanadium	DETSC 2301#	0.8	mg/kg	260	47	180	160	240
Zinc	DETSC 2301#	1	mg/kg	27	18000	8400	11000	2500
Inorganics								
pH	DETSC 2008#			12.7	9.2	9.7	8.7	12.5
Sulphur (free)	DETSC 3049#	0.75	mg/kg	< 0.75	< 0.75	< 0.75	100	< 0.75
PAHs								
Naphthalene	DETSC 3303#	0.03	mg/kg	0.04	0.12	97	0.93	0.06
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	11	0.25	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	0.08	< 0.03	120	2.4	0.06
Fluorene	DETSC 3303	0.03	mg/kg	0.40	< 0.03	68	1.3	0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	7.7	0.29	100	1.3	0.16
Anthracene	DETSC 3303	0.03	mg/kg	3.7	0.12	24	0.51	0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	3.9	0.18	48	1.9	0.11
Pyrene	DETSC 3303#	0.03	mg/kg	2.3	0.22	36	1.2	0.12
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.66	0.17	14	0.44	0.04
Chrysene	DETSC 3303	0.03	mg/kg	0.73	0.18	15	0.51	0.05
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.47	0.59	13	0.35	0.08
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.18	0.15	4.3	0.10	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.18	0.28	7.7	0.19	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.10	0.14	2.7	0.07	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	0.04	0.06	0.83	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.12	0.22	3.6	0.09	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	21	2.7	570	11	0.75

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 18-00689-1
Client Ref 4154A
Contract 4154A - SLEMS Landfill Investigation

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1282515	BH03TP 2.00 SOIL	20/12/17	GJ 250ml x2, GJ 60ml x2, PT 1L x2	Naphthalene (14 days), PAH MS (14 days), pH + Conductivity (7 days)	
1282516	BH03TP 5.00 SOIL	20/12/17	GJ 250ml x2, GJ 60ml x2, PT 1L	Naphthalene (14 days), PAH MS (14 days), pH + Conductivity (7 days)	
1282517	BH04TP 2.00 SOIL	20/12/17	GJ 250ml x2, GJ 60ml x2, PT 1L x2	Naphthalene (14 days), PAH MS (14 days), pH + Conductivity (7 days)	
1282518	BH04TP 3.50 SOIL	20/12/17	GJ 250ml x2, GJ 60ml x2, PT 1L x2	Naphthalene (14 days), PAH MS (14 days), pH + Conductivity (7 days)	
1282519	BH05TP 4.50 SOIL	20/12/17	GJ 250ml x2, GJ 60ml x2, PT 1L x2	Naphthalene (14 days), PAH MS (14 days), pH + Conductivity (7 days)	
1282520	TP01 0.50 SOIL	20/12/17	GJ 250ml x2, GJ 60ml x2, PT 1L x2	Naphthalene (14 days), PAH MS (14 days), pH + Conductivity (7 days)	
1282521	TP01 2.50 SOIL	20/12/17	GJ 250ml x2, GJ 60ml x2, PT 1L x2	Naphthalene (14 days), PAH MS (14 days), pH + Conductivity (7 days)	
1282522	TP02 1.50 SOIL	20/12/17	GJ 250ml x2, GJ 60ml x2, PT 1L x2	Naphthalene (14 days), PAH MS (14 days), pH + Conductivity (7 days)	
1282523	TP02 2.50 SOIL	20/12/17	GJ 250ml x2, GJ 60ml x2, PT 1L x2	Naphthalene (14 days), PAH MS (14 days), pH + Conductivity (7 days)	
1282524	TP05 2.50 SOIL	20/12/17	GJ 250ml x2, GJ 60ml x2, PT 1L x2	Naphthalene (14 days), PAH MS (14 days), pH + Conductivity (7 days)	
1282525	TP05 0.00-1.50 SOIL	20/12/17	GJ 250ml x2, GJ 60ml x2, PT 1L x2	Naphthalene (14 days), PAH MS (14 days), pH + Conductivity (7 days)	

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 2002	Organic matter	%	0.1	Air Dried	No	Yes	Yes
DETSC 2003	Loss on ignition	%	0.01	Air Dried	No	Yes	Yes
DETSC 2008	pH	pH Units	1	Air Dried	No	Yes	Yes
DETSC 2024	Sulphide	mg/kg	10	Air Dried	No	Yes	Yes
DETSC 2076	Sulphate Aqueous Extract as SO4	mg/l	10	Air Dried	No	Yes	Yes
DETSC 2084	Total Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2084	Total Organic Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2119	Ammoniacal Nitrogen as N	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide free	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide total	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Phenol - Monohydric	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC 2130	Thiocyanate	mg/kg	0.6	Air Dried	No	Yes	Yes
DETSC 2321	Total Sulphate as SO4	%	0.01	Air Dried	No	Yes	Yes
DETSC 2325	Mercury	mg/kg	0.05	Air Dried	No	Yes	Yes
DETSC 3049	Sulphur (free)	mg/kg	0.75	Air Dried	No	Yes	Yes
DETSC2123	Boron (water soluble)	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Arsenic	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Barium	mg/kg	1.5	Air Dried	No	Yes	Yes
DETSC2301	Beryllium	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Cadmium Available	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cadmium	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cobalt	mg/kg	0.7	Air Dried	No	Yes	Yes
DETSC2301	Chromium	mg/kg	0.15	Air Dried	No	Yes	Yes
DETSC2301	Copper	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Manganese	mg/kg	20	Air Dried	No	Yes	Yes
DETSC2301	Molybdenum	mg/kg	0.4	Air Dried	No	Yes	Yes
DETSC2301	Nickel	mg/kg	1	Air Dried	No	Yes	Yes
DETSC2301	Lead	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC2301	Selenium	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC2301	Zinc	mg/kg	1	Air Dried	No	Yes	Yes
DETSC 3072	Ali/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETS 062	Benzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Ethylbenzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Toluene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	m+p Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	o Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3311	C10-C24 Diesel Range Organics (DRO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	C24-C40 Lube Oil Range Organics (LORO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	EPH (C10-C40)	mg/kg	10	As Received	No	Yes	Yes

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 3303	Acenaphthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Acenaphthylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(b)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(k)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(g,h,i)perylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Dibenzo(a,h)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Indeno(1,2,3-c,d)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Naphthalene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Phenanthrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3401	PCB 28 + PCB 31	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 52	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 101	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 118	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 153	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 138	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 180	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB Total	mg/kg	0.01	As Received	No	Yes	Yes

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS. No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.

DETS

Certificate of Analysis

Certificate Number	18-08351-2	26-Apr-18
Client	Allied Exploration & Geotechnics Limited Unit 25 Stella Gill Industrial Estate Pelton Fell DH2 2RG	
Our Reference	18-08351-2	
Client Reference	4154A	
Order No	CH-1400	
Contract Title	SLEMS Landfill Investigation	
Description	10 Soil samples.	
Date Received	10-Apr-18	
Date Started	10-Apr-18	
Date Completed	26-Apr-18	
Test Procedures	Identified by prefix DETSn (details on request).	
Notes	This report supersedes 18-08351-1, Extra Testing Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.	

Approved By

Adam Fenwick
Contracts Manager

mCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

UKAS
TESTING
2139

Summary of Chemical Analysis
Matrix Descriptions

Our Ref 18-08351-2
Client Ref 4154A
Contract Title SLEMS Landfill Investigation

Sample ID	Other ID	Depth	Lab No	Completed	Matrix Description
TP101	1	2	1322675	18/04/2018	Black sandy GRAVEL (Possible made ground - slag) (sample matrix outside MCERTS scope of accreditation)
TP102	1	2.5	1322676	18/04/2018	Dark brown very clayey SAND
TP103	2	1	1322677	18/04/2018	Dark brown gravelly, very sandy CLAY
TP105	3	3	1322678	18/04/2018	Brown gravelly, clayey SAND
TP107	3	1	1322679	18/04/2018	Dark grey gravelly, very clayey SAND
TP110	2	4.5	1322680	18/04/2018	Dark grey slightly sandy GRAVEL (Possible made ground - slag) (sample matrix outside MCERTS scope of accreditation)
TP108	2	5	1322681	18/04/2018	Dark brown very sandy CLAY
TP109	1	3.8	1322682	18/04/2018	Dark brown very, sandy CLAY
TP106	2	2.5	1322683	18/04/2018	Dark brown very sandy CLAY
TP104	1	1	1327120	18/04/2018	Black sandy CLAY

Summary of Chemical Analysis
Soil Samples

Our Ref 18-08351-2
Client Ref 4154A
Contract Title SLEMS Landfill Investigation

			Lab No	1322675	1322676	1322677	1322678	1322679	1322680
			Sample ID	TP101	TP102	TP103	TP105	TP107	TP110
			Depth	2.00	2.50	1.00	3.00	1.00	4.50
			Other ID	1	1	2	3	3	2
			Sample Type	ES	ES	ES	ES	ES	ES
			Sampling Date	28/03/18	28/03/18	28/03/18	28/03/18	28/03/18	28/03/18
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Metals									
Aluminium	DETSC 2301*	1	mg/kg	14000	8400	2900	1800	1800	6400
Antimony	DETSC 2301*	1	mg/kg	6.1	4.6	15	14	13	9.2
Arsenic	DETSC 2301#	0.2	mg/kg	2.0	6.6	7.8	11	11	2.1
Barium	DETSC 2301#	1.5	mg/kg	460	120	86	50	51	110
Beryllium	DETSC 2301#	0.2	mg/kg	0.6	1.0	< 0.2	< 0.2	< 0.2	< 0.2
Boron, Water Soluble	DETSC 2123#	0.2	mg/kg	0.9	7.0	0.9	2.6	1.2	3.2
Cadmium	DETSC 2301#	0.1	mg/kg	0.4	26	25	58	31	3.1
Chromium	DETSC 2301#	0.15	mg/kg	390	40	110	140	130	610
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	20	20	94	170	130	22
Iron	DETSC 2301	25	mg/kg	130000	270000	470000	620000	520000	200000
Lead	DETSC 2301#	0.3	mg/kg	36	1500	1000	1200	1100	93
Magnesium	DETSC 2301*	1	mg/kg	31000	11000	5300	4900	4600	31000
Manganese	DETSC 2301#	20	mg/kg	33000	1200	5900	6600	5800	18000
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	0.42	0.13	0.10	0.15	< 0.05
Molybdenum	DETSC 2301#	0.4	mg/kg	3.0	1.4	5.7	11	9.0	4.6
Nickel	DETSC 2301#	1	mg/kg	8.8	23	34	54	47	60
Silicon	DETSC 2301*	10	mg/kg	30000	36000	22000	9200	12000	45000
Vanadium	DETSC 2301#	0.8	mg/kg	400	46	61	60	56	530
Zinc	DETSC 2301#	1	mg/kg	190	9300	8700	5500	5800	440
Inorganics									
pH	DETSC 2008#			12.6	8.5	9.2	10.6	9.3	12.6
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.2	75	2.0	< 0.1	1.5	0.5
Organic matter	DETSC 2002#	0.1	%	0.7	5.2	5.2	1.0	4.3	1.5
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	15	1100	860	650	290	17
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	2.7
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	2.2	< 1.5	< 1.5	< 1.5	< 1.5	5.6
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	14	< 3.4	< 3.4	< 3.4	< 3.4	29
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	17	< 10	< 10	< 10	< 10	38
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	9.8
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	1.3	< 0.6	< 0.6	< 0.6	< 0.6	25
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	5.7	< 1.4	< 1.4	< 1.4	< 1.4	80

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 18-08351-2
Client Ref 4154A
Contract Title SLEMS Landfill Investigation

			Lab No	1322675	1322676	1322677	1322678	1322679	1322680
			Sample ID	TP101	TP102	TP103	TP105	TP107	TP110
			Depth	2.00	2.50	1.00	3.00	1.00	4.50
			Other ID	1	1	2	3	3	2
			Sample Type	ES	ES	ES	ES	ES	ES
			Sampling Date	28/03/18	28/03/18	28/03/18	28/03/18	28/03/18	28/03/18
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	120
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	25	< 10	< 10	< 10	< 10	150
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	0.22	0.07	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.07
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	0.10	< 0.03	< 0.03	< 0.03	0.51
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	0.38	< 0.03	< 0.03	< 0.03	0.22
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.13	1.3	0.16	< 0.03	0.05	0.97
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	0.12	< 0.03	< 0.03	< 0.03	0.15
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.14	0.37	0.11	< 0.03	0.05	1.3
Pyrene	DETSC 3303#	0.03	mg/kg	0.10	0.44	0.16	< 0.03	0.11	1.2
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.04	< 0.03	< 0.03	< 0.03	< 0.03	0.48
Chrysene	DETSC 3303	0.03	mg/kg	0.05	< 0.03	< 0.03	< 0.03	< 0.03	0.54
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.59
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.21
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.41
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.29
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.04
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.31
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.49	2.9	0.50	< 0.10	0.21	7.2
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	0.4	0.4	< 0.3	< 0.3	< 0.3	< 0.3

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Summary of Chemical Analysis
Soil Samples

Our Ref 18-08351-2
Client Ref 4154A
Contract Title SLEMS Landfill Investigation

			Lab No	1322681	1322682	1322683	1327120
			Sample ID	TP108	TP109	TP106	TP104
			Depth	5.00	3.80	2.50	1.00
			Other ID	2	1	2	1
			Sample Type	ES	ES	ES	ES
			Sampling Date	27/03/18	27/03/18	27/03/18	27/03/18
			Sampling Time	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
Metals							
Aluminium	DETSC 2301*	1	mg/kg	8200	920	6200	2100
Antimony	DETSC 2301*	1	mg/kg	11	14	6.7	15
Arsenic	DETSC 2301#	0.2	mg/kg	43	13	28	14
Barium	DETSC 2301#	1.5	mg/kg	72	44	120	68
Beryllium	DETSC 2301#	0.2	mg/kg	0.9	< 0.2	0.7	< 0.2
Boron, Water Soluble	DETSC 2123#	0.2	mg/kg	6.0	2.9	1.6	1.6
Cadmium	DETSC 2301#	0.1	mg/kg	75	37	28	94
Chromium	DETSC 2301#	0.15	mg/kg	34	170	40	120
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	26	160	42	140
Iron	DETSC 2301	25	mg/kg	240000	560000	220000	21000
Lead	DETSC 2301#	0.3	mg/kg	3100	830	2500	1600
Magnesium	DETSC 2301*	1	mg/kg	7300	6700	6500	4700
Manganese	DETSC 2301#	20	mg/kg	1600	9300	830	4500
Mercury	DETSC 2325#	0.05	mg/kg	0.29	0.10	0.54	0.35
Molybdenum	DETSC 2301#	0.4	mg/kg	2.7	6.8	3.9	6.3
Nickel	DETSC 2301#	1	mg/kg	44	46	23	27
Silicon	DETSC 2301*	10	mg/kg	34000	3200	25000	500000
Vanadium	DETSC 2301#	0.8	mg/kg	55	250	33	51
Zinc	DETSC 2301#	1	mg/kg	23000	3800	17000	21000
Inorganics							
pH	DETSC 2008#			8.6	9.6	8.4	9.1
Cyanide, Total	DETSC 2130#	0.1	mg/kg	10	5.0	140	3.1
Organic matter	DETSC 2002#	0.1	%	4.6	5.0	8.3	4.4
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	720	440	400	310
Petroleum Hydrocarbons							
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.10	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.10	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	0.26	0.11	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	58	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 76.3	59	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.10	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.10	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.10	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	1.6
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	15
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	52

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Summary of Chemical Analysis
Soil Samples

Our Ref 18-08351-2
Client Ref 4154A
Contract Title SLEMS Landfill Investigation

Test	Method	LOD	Units				
			Lab No	1322681	1322682	1322683	1327120
			Sample ID	TP108	TP109	TP106	TP104
			Depth	5.00	3.80	2.50	1.00
			Other ID	2	1	2	1
			Sample Type	ES	ES	ES	ES
			Sampling Date	27/03/18	27/03/18	27/03/18	27/03/18
			Sampling Time	n/s	n/s	n/s	n/s
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 34.3	< 10	70
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	110	59	70
PAHs							
Naphthalene	DETSC 3303#	0.03	mg/kg	0.39	1.4	0.37	0.17
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	1.1	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	0.13	0.38	0.11	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.59	0.36	0.55	0.20
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	0.06	< 0.03	0.06
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.14	0.23	0.14	0.15
Pyrene	DETSC 3303#	0.03	mg/kg	0.24	0.21	0.23	0.19
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	0.06	< 0.03	0.08
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	0.11	< 0.03	0.14
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.06
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	1.5	3.9	1.4	1.1
Phenols							
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Asbestos Analysis
Soil Samples

Our Ref 18-08351-2
Client Ref 4154A
Contract Title SLEMS Landfill Investigation

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1322675	TP101 1 2.00	SOIL	NAD	none	Michael Rutherford
1322676	TP102 1 2.50	SOIL	NAD	none	Michael Rutherford
1322677	TP103 2 1.00	SOIL	NAD	none	Michael Rutherford
1322678	TP105 3 3.00	SOIL	NAD	none	Michael Rutherford
1322679	TP107 3 1.00	SOIL	NAD	none	Michael Rutherford
1322680	TP110 2 4.50	SOIL	NAD	none	Michael Rutherford
1322681	TP108 2 5.00	SOIL	NAD	none	Michael Rutherford
1322682	TP109 1 3.80	SOIL	NAD	none	Michael Rutherford
1322683	TP106 2 2.50	SOIL	NAD	none	Michael Rutherford
1327120	TP104 1 1.00	SOIL	NAD	none	A Christodoulou

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 18-08351-2
Client Ref 4154A
Contract SLEMS Landfill Investigation

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1322675	TP101 2.00 SOIL	28/03/18	GJ 250ml x2, GV x2, PT 1L		
1322676	TP102 2.50 SOIL	28/03/18	GJ 250ml, GV		
1322677	TP103 1.00 SOIL	28/03/18	GJ 250ml, GV, PT 1L		
1322678	TP105 3.00 SOIL	28/03/18	PG		
1322679	TP107 1.00 SOIL	28/03/18	PG		
1322680	TP110 4.50 SOIL	28/03/18	PG		
1322681	TP108 5.00 SOIL	27/03/18	GJ 250ml x2, GJ 60ml x2, PT 1L		
1322682	TP109 3.80 SOIL	27/03/18	GJ 250ml x2, GJ 60ml x2, PT 1L		
1322683	TP106 2.50 SOIL	27/03/18	GJ 250ml x2, GJ 60ml x2, PT 1L		
1327120	TP104 1.00 SOIL		GJ 250ml x2, GJ 60ml x2, PT 1L		

Key: G-Glass P-Plastic J-Jar V-Vial T-Tub G-Bag

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 2002	Organic matter	%	0.1	Air Dried	No	Yes	Yes
DETSC 2003	Loss on ignition	%	0.01	Air Dried	No	Yes	Yes
DETSC 2008	pH	pH Units	1	Air Dried	No	Yes	Yes
DETSC 2024	Sulphide	mg/kg	10	Air Dried	No	Yes	Yes
DETSC 2076	Sulphate Aqueous Extract as SO4	mg/l	10	Air Dried	No	Yes	Yes
DETSC 2084	Total Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2084	Total Organic Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2119	Ammoniacal Nitrogen as N	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide free	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide total	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Phenol - Monohydric	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC 2130	Thiocyanate	mg/kg	0.6	Air Dried	No	Yes	Yes
DETSC 2321	Total Sulphate as SO4	%	0.01	Air Dried	No	Yes	Yes
DETSC 2325	Mercury	mg/kg	0.05	Air Dried	No	Yes	Yes
DETSC 3049	Sulphur (free)	mg/kg	0.75	Air Dried	No	Yes	Yes
DETSC2123	Boron (water soluble)	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Arsenic	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Barium	mg/kg	1.5	Air Dried	No	Yes	Yes
DETSC2301	Beryllium	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Cadmium Available	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cadmium	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cobalt	mg/kg	0.7	Air Dried	No	Yes	Yes
DETSC2301	Chromium	mg/kg	0.15	Air Dried	No	Yes	Yes
DETSC2301	Copper	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Manganese	mg/kg	20	Air Dried	No	Yes	Yes
DETSC2301	Molybdenum	mg/kg	0.4	Air Dried	No	Yes	Yes
DETSC2301	Nickel	mg/kg	1	Air Dried	No	Yes	Yes
DETSC2301	Lead	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC2301	Selenium	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC2301	Zinc	mg/kg	1	Air Dried	No	Yes	Yes
DETSC 3072	Ali/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETS 062	Benzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Ethylbenzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Toluene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	m+p Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	o Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3311	C10-C24 Diesel Range Organics (DRO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	C24-C40 Lube Oil Range Organics (LORO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	EPH (C10-C40)	mg/kg	10	As Received	No	Yes	Yes

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 3303	Acenaphthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Acenaphthylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(b)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(k)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(g,h,i)perylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Dibenzo(a,h)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Indeno(1,2,3-c,d)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Naphthalene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Phenanthrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3401	PCB 28 + PCB 31	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 52	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 101	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 118	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 153	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 138	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 180	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB Total	mg/kg	0.01	As Received	No	Yes	Yes

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS. No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.

Sample ID	MDL	Units	TP101	TP102	TP103	TP104	TP105	TP106	TP107	TP108	TP109	TP110	BH03TP	BH03TP	BH04TP	BH04TP	BH05TP	TP01	TP01	TP02	TP02	TP05	TP05	BH01TP	BH01TP	BH04	BH05	BH05	BH06	BH06	BH06	BH09	BH09	BH09	TP03	TP04	TP04	BH01 (TP)	BH08	BH08	BH08	BH08	BH08	BH08
Depth			2	2.5	1	1	3	2.5	1	5	3.8	4.5	2	5	2	3.5	4.5	0.5	2.5	1.5	2.5	2.5	0.00-1.50	1	2	1.2	1	4	1	2.5	5.5	2.2	5.4	8.2	1	3	1.00-2.00	1.5	8	12	15	1	3	5
Sampling Date			28/03/18	28/03/18	28/03/18	27/03/18	28/03/18	27/03/18	28/03/18	27/03/18	27/03/18	28/03/18	20/12/17	20/12/17	20/12/17	20/12/17	20/12/17	20/12/17	20/12/17	20/12/17	20/12/17	20/12/17	20/12/17	18/12/17	18/12/17	18/12/17	18/12/17	18/12/17	18/12/17	18/12/17	18/12/17	18/12/17	18/12/17	18/12/17	18/12/17	18/12/17	18/12/17	18/12/17	06/12/17	13/12/17	13/12/17	30/11/17	01/12/17	01/12/17
Metals																																												
Aluminium	1	mg/kg	14000	8400	2900	2100	1800	6200	1800	8200	920	6400	8300	9800	3900	5500	10000	540	3100	1100	10000	8400	11000	9600	8000	1600	14000	16000	2000	6000	8600	14000	5500	11000	5500	790	1700		2200	6100	4900	2400	1400	890
Antimony	1	mg/kg	6.1	4.6	15	15	14	6.7	13	11	14	9.2	3.9	3.5	5	5.2	3.5	7.2	6	19	10	16	8.1	8.1	6.8	14	1.5	5.4	15	8.5	7.3	5.6	6.1	6.1	9.1	13	20		17	5.7	11	19	20	19
Arsenic	0.2	mg/kg	2	6.6	7.8	14	11	28	11	43	13	2.1	3.1	7	0.7	0.9	1.9	5.7	0.6	19	46	54	9.6	3.7	15	13	8.6	1.3	13	1.6	7.7	2.9	3.7	4.6	43	7.6	17	3.9	9.9	9.8	17	16	14	12
Barium	1.5	mg/kg	460	120	86	68	50	120	51	72	44	110	140	230	38	65	210	18	58	59	250	390	140	290	170	110	250	130	62	91	230	800	180	350	240	50	140		85	120	120	110	120	72
Beryllium	0.2	mg/kg	0.6	1	< 0.2	< 0.2	< 0.2	0.7	< 0.2	0.9	< 0.2	< 0.2	0.5	0.6	< 0.2	0.3	0.2	< 0.2	< 0.2	< 0.2	1.6	0.9	0.4	0.4	0.4	< 0.2	1	0.4	< 0.2	< 0.2	0.6	0.8	0.5	0.7	0.8	< 0.2	< 0.2		< 0.2	0.7	0.4	0.2	< 0.2	< 0.2
Boron, Water Soluble	0.2	mg/kg	0.9	7	0.9	1.6	2.6	1.6	1.2	6	2.9	3.2	13	14	5	4.8	11	1.3	5.2	1.7	15	11	6.5	5.4	3.4	1.7	2.5	7.8	1.8	4.8	7.2	43	9	6.6	2	1.2	1	5.7	2.3	2.9	2.9	1.1	1.1	1
Cadmium	0.1	mg/kg	0.4	26	25	94	58	28	31	75	37	3.1	0.5	0.5	0.6	2.8	1.4	12	< 0.1	76	19	43	7.3	3.9	9.7	66	1.3	3.8	52	0.6	4.3	0.6	5.7	1.1	87	21	73	3.7	34	25	27	47	48	29
Chromium	0.15	mg/kg	390	40	110	120	140	40	130	34	170	610	240	200	330	330	200	71	460	130	140	130	370	530	200	100	33	320	120	640	320	420	340	450	28	110	110	190	170	48	74	88	91	120
Chromium, Hexavalent	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	0.2	mg/kg	20	20	94	140	170	42	130	26	160	22	13	220	17	14	16	45	7.4	160	92	190	51	35	150	120	36	23	140	16	100	18	33	28	23	160	150	50	170	26	75	99	110	160
Iron	25	mg/kg	130000	270000	470000	21000	620000	220000	520000	240000	560000	200000	55000	45000	83000	100000	81000	180000	74000	400000	170000	230000	160000	160000	130000	460000	55000	120000	450000	170000	170000	110000	160000	150000	210000	420000	510000		420000	200000	280000	290000	440000	480000
Lead	0.3	mg/kg	36	1500	1000	1600	1200	2500	1100	3100	830	93	41	50	25	92	100	720	6.2	1700	3600	2100	720	140	920	1200	100	110	1200	17	210	28	400	64	7900	1700	1600	270	1800	2500	2400	1400	1200	1800
Magnesium	1	mg/kg	31000	11000	5300	4700	4900	6500	4600	7300	6700	31000																																
Manganese	20	mg/kg	33000	1200	5900	4500	6600	830	5800	1600	9300	18000	14000	21000	7400	7300	10000	3400	7400	6600	6100	13000	9500	18000	6800	3600	840	11000	7100	16000	17000	42000	22000	38000	780	5200	4200		8000	1200	2500	3900	5600	8900
Mercury	0.05	mg/kg	< 0.05	0.42	0.13	0.35	0.1	0.54	0.15	0.29	0.1	< 0.05	< 0.05	0.05	< 0.05	< 0.05	0.1	< 0.05	< 0.05	0.26	3.1	1.2	0.58	< 0.05	0.94	0.27	0.07	< 0.05	0.19	< 0.05	< 0.05	< 0.05	0.07	< 0.05	1.4	0.1	0.19	0.15	0.07	0.28	0.24	0.19	0.13	0.15
Molybdenum	0.4	mg/kg	3	1.4	5.7	6.3	11	3.9	9	2.7	6.8	4.6	1.8	2	2.2	2	2.4	5.2	1.7	8.3	2.4	5.6	3.2	4.4	8	5.4	1.2	2.6	8	2.9	5.9	2.6	3.1	2.7	2.1	7.9	5.1		7.2	1.6	4.3	5.1	4.9	6.8
Nickel	1	mg/kg	8.8	23	34	27	54	23	47	44	46	60	7.2	9.3	9.7	6.4	6.8	23	17	33	32	42	19	16	90	25	36	8.1	38	3.7	22	8.8	8.2	10	22	39	27	38	42	18	26	23	23	43
Silicon	10	mg/kg	30000	36000	22000	500000	9200	25000	12000	34000	3200	45000																																
Vanadium	0.8	mg/kg	400	46	61	51	60	33	56	55	250	530	460	950	210	240	180	27	260	47	180	160	240	460	200	65	34	270	61	500	780	390	2800	3300	58	75	47		140	43	53	49	48	49
Zinc	1	mg/kg	190	9300	8700	21000	5500	17000	5800	23000	3800	440	170	160	150	640	440	4800	27	18000	8400	11000	2500	1000	2400	17000	310	780	14000	110	1400	180	2300	280	33000	8900	37000	960	11000	10000	12000	14000	22000	11000
Inorganics																																							11	10.3	10.3	9.1	9.5	9.6
pH			12.6	8.5	9.2	9.1	10.6	8.4	9.3	8.6	9.6	12.6	12.6	12.6	12.7	12.7	12.5	10.4	12.7	9.2	9.7	8.7	12.5	12.4	11.9	10	9.2	12.6	9.7	12.6	12.5	12.6	12.5	12.5	6.9	10.2	9.1	11.8						
Cyanide, Total	0.1	mg/kg	0.2	75	2	3.1	< 0.1	140	1.5	10	5	0.5													170													47						
Organic matter	0.1	%	0.7	5.2	5.2	4.4	1	8.3	4.3	4.6	5	1.5													13													3.7						
Sulphate Aqueous Extract as SO4	10	mg/l	15	1100	860	310	650	400	290	720	440	17													740													110						
Sulphur Free	0.75	mg/kg											< 0.75	1.6	< 0.75	1.4	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	100	< 0.75	< 0.75	870	6.9	< 0.75	< 0.75	< 0.75	< 0.75	< 0.75	1.7	< 0.75	2.4	220	< 0.75	3		< 0.75	36	28	1.6	1	< 0.75
Petroleum Hydrocarbons																																												
Aliphatic C5-C6	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.10	< 0.01													< 0.01													< 0.01						
Aliphatic C6-C8	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.10	< 0.01													< 0.01													0.15						
Aliphatic C8-C10	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.11	< 0.01	< 0.01	0.26	< 0.01													2.2													1.1						
Aliphatic C10-C12	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5													220													< 50.0						
Aliphatic C12-C16	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	2.7													1700													380						
Aliphatic C16-C21	1.5	mg/kg	2.2	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	5.6													4700													1100						
Aliphatic C21-C35	3.4	mg/kg	14	< 3.4	< 3.4	< 3.4	< 3.4	58	< 3.4	< 3.4	< 3.4	29													22000													6200						
Aliphatic C5-C35	10	mg/kg	17	< 10	< 10	< 10	< 10	59	< 10	< 10	< 76.3	38													28000													7700						
Aromatic C5-C7	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.10	< 0.01													14													4						
Aromatic C7-C8	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.10	< 0.01													7.9													3.8						
Aromatic C8-C10	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.10	< 0.01													6.6													4.1						
Aromatic C10-C12	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9													3400													460						
Aromatic C12-C16	0.5	mg/kg	< 0.5	< 0.5	< 0.5	1.6	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	9.8													12000													1800						
Aromatic C16-C21	0.6	mg/kg	1.3	< 0.6	< 0.6	15	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	25													6200													1300						
Aromatic C21-C35	1.4	mg/kg	5.7	< 1.4	< 1.4	52	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	80													11000													2600						
Aromatic C5-C35	10	mg/kg	< 10	< 10	< 10	70	< 10	< 10	< 10	< 10	< 34.3	120													33000													6200						
TPH Ali/Aro Total	10	mg/kg	25	< 10	< 10	70	< 10	59	< 10	< 10	110	150													61000													14000						
PAHs																																												
Naphthalene	0.03	mg/kg	< 0.03	0.22	0.07	0.17	< 0.03	0.37	< 0.03	0.39	1.4	< 0.03	0.11	0.14	< 0.03	0.05	< 0.03	0.19	0.04	0.12	97	0.93	0.06	< 0.03	3600	0.06	0.05	< 0.03	0.07	0.03	35	< 0.03	< 0.03	< 0.03	4.1	0.03	0.04	410	< 0.03	0.1	0.13	0.06	0.04	< 0.03
Acenaphthylene	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.07	0.05	0.13	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	11	0.25	< 0.03	< 0.03	370	0.05	< 0.03	< 0.03	< 0.03	< 0.03	10	< 0.03	< 0.03	< 0.03	0.07	< 0.03	< 0.03	62	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	0.03	mg/kg	< 0.03	0.1	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	1.1	0.51	0.04	0.08	< 0.03	< 0.03	< 0.03	< 0.03	0.08	< 0.03	120	2.4	0.06	0.04	3400	0.06	0.05	< 0.03	< 0.03	< 0.03	1	< 0.03	< 0.03	0.07	0.66	< 0.03	< 0.03	560	< 0.03	< 0.03	0.05	< 0.03	< 0.03	< 0.03
Fluorene	0.03	mg/kg	< 0.03	0.38	< 0.03	< 0.03	< 0.03	0.11	< 0.03	0.13	0.38	0.22	< 0.03	0.08	< 0.03	< 0.03	< 0.03	< 0.03	0.4	< 0.03	68	1.3	0.03	< 0.03	2100	0.1	0.07	< 0.03	< 0.03	< 0.03	8.9	< 0.03	< 0.03	0.11	1.2	< 0.03	< 0.03	330	< 0.03	0.09	0.16	< 0.03	< 0.03	< 0.03
Phenanthrene	0.03	mg/kg	0.13	1.3	0.16	0.2	< 0.03	0.55	0.05	0.59	0.36	0.97	1.7	3.3	0.07	0.19	0.24	0.16	7.7	0.29	100	1.3	0.16	0.14	1300	0.16	0.06	0.07	0.12	0.04	28	< 0.03	< 0.03	0.54	3.4	0.06	0.1	230	0.08	0.21	0.37	0.27	0.19	< 0.03
Anthracene	0.03	mg/kg	< 0.03	0.12	< 0.03	0.06	< 0.03	< 0.03	< 0.03	< 0.03	0.06	0.15	0.18	0.32	< 0.03	0.03	< 0.03	0.04	3.7	0.12	24	0.51	0.03	0.03	330	0.04	< 0.03	< 0.03	< 0.03	< 0.03	6.4	< 0.03	< 0.03	0.06	0.41	< 0.03	< 0.03	64	< 0.03	< 0.03	0.05	< 0.03	< 0.03	< 0.03
Fluoranthene	0.03	mg/kg	0.14	0.37	0.11	0.15	< 0.03	0.14	0.05	0.14	0.23	1.3	2.4	3.5	0.12	0.27	0.2	0.19	3.9	0.18	48	1.9	0.11	0.19	570	0.27	< 0.03	0.04	0.1	0.12	18	0.03	< 0.03	0.51	1.4	0.06	0.07	150	0.08	0.05	0.14	0.31	0.19	< 0.03
Pyrene	0.03	mg/kg	0.1	0.44	0.16	0.19	< 0.03	0.23	0.11	0.24	0.21	1.2	1.6	2.3	0.13	0.28	0.24	0.31	2.3	0.22	36	1.2	0.12	0.17	400	0.24	< 0.03	0.07	0.19	0.11	14	0.03	0.03	0.36	2.8	0.06	0.09	120	0.1	0.14	0.35	0.24	0.18	< 0.03
Benzo(a)anthracene	0.03	mg/kg	0.04	< 0.03	< 0.03	0.08	< 0.03	< 0.03	< 0.03	< 0.03	0.06	0.48	0.66	0.93	0.03	0.08	0.12	< 0.03	0.66	0.17	14	0.44	0.04	0.09	180	0.12	< 0.03	< 0.03	0.04	0.04	5.2	< 0.03	< 0.03	0.15	0.06	< 0.03	< 0.03	46	< 0.03	< 0.03	< 0.03	0.04	0.04	< 0.03
Chrysene	0.03	mg/kg	0.05	< 0.03	< 0.03	0.14	< 0.03	< 0.03	< 0.03	< 0.03	0.11	0.54	0.85	1.2	0.05	0.15	0.16	0.04	0.73	0.18	15	0.51	0.05	0.11	160	0.39	< 0.03	< 0.03	0.05	0.04	4.8	< 0.03	< 0.03	0.16	0.17	< 0.03	< 0.03	38	0.05	< 0.03	< 0.03	0.09	0.09	< 0.03
Benzo(b)fluoranthene	0.03	mg/kg	0.03	< 0.03	< 0.03	0.06	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.59	0.97	1.3	0.04	0.1	0.27	< 0.03	0.47	0.59	13	0.35	0.08	0.1	200	0.06	< 0.03	< 0.03	0.04	0.04	4.9	< 0.03	< 0.03	0.15	0.04	< 0.03	< 0.03	52	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.21	0.34	0.5	< 0.03	0.03	0.1	< 0.03	0.18	0.15	4.3	0.1	< 0.03	0.03	78	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	1.8	< 0.03	< 0.03	0.05	< 0.03	< 0.03	< 0.03	20	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.41	0.41	0.55	< 0.03	0.03	0.16	< 0.03	0.18	0.28	7.7	0.19	< 0.03	0.04	150	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	3.7	< 0.03	< 0.03	0.06	< 0.03	< 0.03	< 0.03	42	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.29	0.29	0.44	< 0.03	< 0.03	0.14	< 0.03	0.1	0.14	2.7	0.07	< 0.03	0.06	83	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	1.7	< 0.03	< 0.03	0.05	< 0.03	< 0.03	< 0.03	20	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.04	0.1	0.14	< 0.03	< 0.03	0.04	< 0.03	0.04	0.06	0.83	< 0.03	< 0.03	< 0.03	20	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.57	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	5.1	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.31	0.36	0.52	< 0.03	< 0.03	0.19	< 0.03	0.12	0.22	3.6	0.09	< 0.03	0.08	110	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	2.1	< 0.03	< 0.03	0.06	< 0.03	< 0.03	< 0.03	24	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	0.1	mg/kg	0.49	2.9	0.5	1.1	< 0.10	1.4	0.21	1.5	3.9	7.2	10	15	0.44	1.2	1.9	0.92	21	2.7	570	11	0.75	1.1	13000	1.5	0.23	0.18	0.61	0.43	150	< 0.10	< 0.10	2.4	14	0.18	0.31	2200	0.31	0.6	1.3	1	0.72	< 0.10
VOC and SVOC																																												
Phenol - Monohydric	0.3	mg/kg	0.4	0.4	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3													11													4.6						
Vinyl Chloride	0.01	mg/kg																							0.12													< 0.10						
Cis-1,2-dichloroethylene	0.01	mg/kg																							0.33													0.21						
Benzene	0.01	mg/kg																							120													6.2						
Trichloroethylene	0.01	mg/kg																							0.24													0.12						
Toluene	0.01	mg/kg																							140													13						
Ethylbenzene	0.01	mg/kg																							4.4													3.6						
m+p-Xylene	0.01	mg/kg																							20													17						
o-Xylene	0.01	mg/kg																							4.3													3.9						
Styrene	0.01	mg/kg																							7.3													6.5						
Isopropylbenzene	0.01	mg/kg																							0.44													0.27						
n-propylbenzene	0.01	mg/kg																							0.24													0.26						
1,3,5-trimethylbenzene	0.01	mg/kg																							4.2													4.9						
1,2,4-trimethylbenzene	0.01	mg/kg																							8.3													8.6						
1,4-dichlorobenzene	0.01	mg/kg																							0.32													0.31						
n-butylbenzene	0.01	mg/kg																							0.47													0.36						
1,2-dichlorobenzene	0.01	mg/kg																							0.22													0.2						
1,2,4-trichlorobenzene	0.01	mg/kg																							0.27													0.42						
1,2,3-trichlorobenzene	0.01	mg/kg																							< 0.10													0.18						
Phenol	0.1	mg/kg																							< 1.0													0.1						
2-Methylnaphthalene	0.1	mg/kg																							1300													14						
4-Nitrophenol	0.1	mg/kg																							< 1.0													1.3						
Dibenzofuran	0.1	mg/kg																							2400													32						
4-Nitroaniline	0.1	mg/kg																							190													2.9						
1,4-Dinitrobenzene	0.1	mg/kg																							84													< 0.1						
Azobenzene	0.1	mg/kg																							8													0.4						
Carbazole	0.1	mg/kg																							91													0.9						

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Appendix H5: The Former SSI Steelworks, Redcar: Replacement CLE3/8 Landfill Boreholes, CQA Validation Report

THE FORMER SSI STEELWORKS, REDCAR: REPLACEMENT CLE3/8 LANDFILL BOREHOLES

CQA Validation Report

South Tees Site Company Limited

Document Ref: 3777410007_01

JANUARY 2018

Incorporating

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The Former SSI Steelworks, Redcar: Replacement CLE3/8 Landfill Boreholes
CQA Validation Report

Author	Tom Costema
Checker	Jonny Aykroyd
Approver	Pamela Welburn
Report No	3777410007_01
Date	JANUARY 2018

VERSION CONTROL

Version	Date	Author	Changes
1	January 2018	T. Costema	

This report dated January 2018 has been prepared for South Tees Site Company (the "Client") in accordance with the terms and conditions of appointment dated 14 September 2017(the "Appointment") between the Client and **Arcadis (UK) Limited** ("Arcadis") for the purposes specified in the Appointment. For avoidance of doubt, no other person(s) may use or rely upon this report or its contents, and Arcadis accepts no responsibility for any such use or reliance thereon by any other third party.

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1 INTRODUCTION

1.1 Appointment

Arcadis was instructed by South Tees Site Company (STSC), ‘the Client’, to supervise the replacement of three monitoring wells that were identified as being destroyed or buried at the former SSI steelworks, Redcar (the Site).

In order to fulfil monitoring requirements, STSC are obliged to re-drill these positions and install new monitoring wells as per the original specification (or as close as reasonably practicable).

The work was carried out in accordance with the instruction from STSC dated 4th December 2017, with Arcadis acting as Principal Designer and Allied Exploration and Geotechnics (AEG) as Principal Contractor.

The scope of the ground investigation was determined by Arcadis, following review of the available existing information.

This ground investigation report provides a factual account of the fieldwork undertaken, the strata encountered, any variation from the original plan including justifications for changes or deviations and records of any non-compliance and the solution applied.

1.2 Existing Information

The scope for this investigation was developed after reviewing the original borehole logs and monitoring well installation details from J.B. Site Investigations (boreholes BHD and BHF, 2003) and Hymas GeoEnvironmental Ltd. (borehole BH4R, 2001). The details of these boreholes and the monitoring wells installed in them are summarised in the table below:

Location ID	Target Depth (mbgl)	Depth to Water (mbgl)	Ground Conditions	Installation Details
BH4R	10	0.3 3.2	Slag dominant Made Ground to 3.0m Sand to 6.0m Firm sandy clay to 7.5m Stiff sandy gravelly clay to 10m	HDPE 50mm Ø Plain well pipe to 4.0m Slotted well pipe to 6.0m Gravel pack to 0.2m above slots Bentonite seal 3.0-4.0 mbgl Unknown backfill to surface
BHD	7.5	7.5	Made Ground (ash & slag) to 4.8m Slag dominant Made Ground to 7.5m	HDPE 50mm Ø Plain well pipe to 1.0m Slotted well pipe to 7.5m Gravel pack to top of slotted Bentonite seal to surface
BHF	15	8.2	Made Ground (ash & slag) to 5.0m Slag dominant Made Ground to 10.5m Sand to 12m Sandy gravelly clay to 13.5m Mudstone to 15m	HDPE 50mm Ø Plain well pipe to 1.0m Slotted well pipe to 10.5m Gravel pack to top of slotted Bentonite seal to surface

1.3 Objectives and Scope of Works

The main objective of the intrusive investigation was to replace the destroyed or buried monitoring wells.

To achieve the objectives, the following scope of works was fulfilled:

- Utility clearance of all intrusive locations using GPR and electromagnetic methods (CAT and Genny) including active UXO clearance (down-hole magnetometer) within natural ground;
- Drilling of 3no. boreholes using Cable-Percussive drilling techniques; and
- Installation of 2no. groundwater monitoring wells (BH4R, BHF), and 1no. combined groundwater / ground gas monitoring well (BHD).

1.4 Reliability of Information / Limitations

A complete list of Arcadis’ Study Limitations is presented as Appendix A.

1.5 Reliance

This report has been prepared for the use of the STSC. The contents of this report may not be used or relied upon by any person other than this party without the express written consent and authorisation of Arcadis.

2 SITE SETTING

2.1 Site Location

The area identified for the replacement boreholes is located in the south-western part of the larger Former SSI Steelworks Facility, and slightly northwest of the CLE 3/8 Landfill Site. The centre of the site is approximately located at Ordnance Survey (OS) National Grid Reference: 453967, 522229.

A site location plan is presented as Figure 1.

2.2 Site Description

The site area is primarily occupied by an access track running southwest to northeast (known locally as Yellow 4 or Y4), and utilised by both STSC and CRH plc (Tarmac). A large stockpile of crushed and powdered slag material is present in the north of the site on land occupied and worked by Tarmac. The CLE 3/8 Landfill Site is located to the southeast and comprises a large area of worked and built-up ground which extends to the southeast. An area of cleared and levelled ground is located in the southwest which is an area that formerly contained stockpiles of slag material and was owned by TATA Steel Limited. BHF is located on a raised bank of material on the edge of the Tarmac land, BH4R is located on a sloping, unused access track to the CLE 3/8 Landfill Site, and BHD is located in the cleared and levelled area owned by TATA Steel. The surrounding areas comprise uneven and rough ground with banks and stockpiles of slag material. Grasses and scrubland also exist within these areas. The original positions of the boreholes are presented below, and the positions of the newly installed replacement boreholes are presented as Figure 2.

2.3 Rationale

During a recent audit, three monitoring wells that surround landfill CLE3/8 were identified as having been destroyed or buried. In order to fulfil monitoring requirements, STSC are obliged to re-drill these positions and install new monitoring wells as close to the original specifications as reasonably practicable.

The previous investigations have identified that made ground is likely to be present across the whole of the site and noted to be up to 10m thick in some areas. The made ground predominantly comprised slag deposits with fragments of slag material ranging from gravel to boulder size.

Review of the British Geological Survey (BGS) and previous investigation data suggests that the majority of the site is underlain by the following sequence of superficial deposits:

- **Tidal Flat Deposits** predominantly comprising sand and silt with layers of gravel and clay; and
- **Glacial Till** predominantly comprising slightly gravelly clay.

In some areas the following superficial deposits are anticipated:

- **Glaciolacustrine Deposits** predominantly comprising laminated clays and silt may be present overlying, or potentially within, the Glacial Till.

The BGS GeoIndex indicates that bedrock is likely to comprise:

- **Mercia Mudstone Group** (approximately 200m in thickness) comprising predominantly red mudstones and subordinate siltstones with thick halite-bearing units.

The table below specifies the recommended depths, monitoring well installation details and rationale for the changes from the original positions:

Location ID	Target Depth (mbgl)	Expected DTW (mbgl)	Recommended Installation Details	Rationale for Change
BH4R	10 (or proof of glacial till)	0.3 3.2	HDPE 50mm Ø Plain well pipe to ~3.0m Slotted well pipe to 6.0m Gravel pack to 0.2m above slots Bentonite seal to 0.3mbgl Concrete seal to surface	Original well screened sand immediately below the slag dominant made ground, in what appears to be natural ground.
BHD	12	7.5	HDPE 50mm Ø Plain well pipe to 1.0m Slotted well pipe to ~12m Gravel pack to 0.2m above slots Bentonite seal to 0.3mbgl Concrete seal to surface	Target depth extended to prove natural deposits. Slotted well pipe to ≈12m or resting on top of natural deposits to capture water content in any permeable strata above.
BHF	10.5	8.2	HDPE 50mm Ø Plain well pipe to 1.0m Slotted well pipe to ~10.5m Gravel pack to 0.2m above slots Bentonite seal to 0.3mbgl Concrete seal to surface	Original well screened within Made Ground. Target depth reduced to prove base of Made Ground only.

The replacement locations were positioned as close to the original positions as possible using the coordinates below:

- BH4R: NZ 54063 22382;
- BHD: NZ 53936 22097; and
- BHF: NZ 53804 22213.

3 SITE INVESTIGATION – METHODOLOGY

3.1 Borehole Formation

3.1.1 Investigation Locations

The following methods and techniques were undertaken to construct the exploratory holes at the Site:

- Three boreholes (BH4R, BHD and BHF) were progressed by AEG via cable percussive sampling techniques using a Dando 2000 drilling rig to depths of between 9m and 20m bgl.

The generated exploratory hole records are presented in Appendix B and the raw data is presented in the drillers records in Appendix C.

3.1.2 Variations from Scope

The historical log for BH4R shows that made ground (slag fill) was encountered to a maximum depth of 3m bgl with this material being underlain by sand, followed by firm to stiff sandy and gravelly clays; the replacement borehole was scoped to be progressed to 10m bgl or until Glacial Till was proven. However, during the progression of the replacement borehole the slag material was observed to be much thicker and was encountered to a maximum depth of 14.4m bgl. This was underlain by sand (Tidal Flat Deposits) to 15.5m bgl, soft to firm laminated clay (Glaciolacustrine Deposits) to 19.4m bgl and firm to stiff clay to 20m bgl (Glacial Till). As such, the monitoring well installation was required to be deepened to screen out the made ground and was installed to 15.5m bgl with a response zone between 14.5-15.5m bgl.

BHD was originally scoped to be progressed to 12m bgl with the aim of installing a monitoring well to screen groundwater present within the Made Ground. Soft to firm laminated clay was encountered between 8.5 and 9.0m bgl (Glaciolacustrine Deposits); as such, the borehole was terminated shallower and a monitoring well installed to the 9m bgl instead of 12m bgl.

The original scope for BHF was to progress the location to the base of the made ground, this was expected to be around 10.5m bgl. At 11m bgl the driller noted that clay was encountered, and the borehole was terminated at this depth. The monitoring well installed was as per the original depth scoped (10.5m bgl).

3.1.3 Cable Percussive Boring

Cable percussive boring was completed using Dando D2000 drilling rig equipped with 250mm and 200mm diameter casing and tools. Boreholes were logged in accordance with BS5930:2015 by a qualified geologist.

3.1.4 Monitoring Well Installations

Combined permanent ground gas and groundwater monitoring wells were installed in all boreholes to enable long term monitoring of the gas and groundwater conditions at the Site. The details of installed wells are provided on the relevant borehole logs within Appendix B.

Location ID	Final Depth (m bgl)	Monitoring Well Screening Depth (m bgl)	Material Screened
BH4R	20.0	14.5-15.5	Tidal Flat Deposits (sand)
BHD	9.0	1.0-9.0	Made Ground (tip of well in natural deposits)
BHF	11.0	10.5	Made Ground

4 SITE INVESTIGATION – FINDINGS

4.1 Ground Conditions

Full details of the ground conditions encountered are included in the exploratory hole logs presented as Appendix B, and are summarised below.

Made Ground

Made Ground was encountered in all three exploratory holes progressed and ranged in thickness from 8.5-14.4m bgl. This material generally comprised sandy gravel with cobbles and boulders of slag, concrete and brick.

Superficial Deposits

Tidal Flat Deposits – encountered in BH4R between 14.4 and 15.5m bgl and comprised silty sand.

Glaciolacustrine Deposits – encountered in BH4R and BHD between 8.5 and 15.5m bgl, proved to a maximum depth of 19.4m bgl in BH4R, and comprised soft to firm laminated clays.

Glacial Till – encountered in BH4R between 19.4 and 20.0m bgl and comprised firm to stiff, slightly sandy, slightly gravelly clay.

Bedrock

Not encountered during this investigation.

4.2 On-Site Environmental Screening, Visual and Olfactory Evidence

No visual or olfactory evidence of hydrocarbon contamination was observed during the intrusive works.

4.3 Groundwater Strikes

No definitive groundwater strikes were recorded during drilling, however, standing water was noted within boreholes BH4R at 19m bgl and 7m bgl in BHD upon completion.

FIGURE 1

Site Location Plan

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CONTACT ARCADIS UK IN CASE ANY QUERY

LEGEND

● SITE LOCATION

NOTES

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.

0 0.2 0.4 0.8 1.2 1.6 2 Kilometres

N

TITLE:
SITE LOCATION PLAN

SITE :
REDCAR STEELWORKS

CLIENT :
SOUTH TEES SITE COMPANY

PROJECT : **37774100**	**FIGURE 1**
DATE : 18/12/17	DRAWN BY : BNB
DRG No. : 3777410008 GIS	
SCALE : **1 : 50,000**	PRINT : **A4**

ARCADIS Design & Consultancy for natural and built assets

FIGURE 2

Site Layout and Borehole Location Plan

Key

⊕ Borehole Location

Notes:

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CONTACT ARCADIS IN CASE OF ANY QUERIES.

N

Title:
Replacement Landfill Boreholes - Location Plan

Site:
Redcar Steelworks

Client:
South Tees Site Company

Project: **37774100**	**Figure 2**

Date: 15/12/2017
Drawn By: TC
DRG No: 3777410001_01 GIS

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APPENDIX A

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) Limited (Arcadis), with all reasonable skill, care and diligence within the terms of the Appointment and with the resources and manpower agreed with South Tees Site Company (STSC) (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 correct 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 been 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 issue

APPENDIX B

Exploratory Hole Logs

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20, Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

BOREHOLE RECORD

Status:- PRELIM1

Project: The Former SSI Steelworks, Redcar - Priority Areas Within SSI Landholdings Contract 3			**Exploratory Hole No.** BH4R
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E: N:		
Method (Equipment): Cable Percussion (Dando 2000)	**Ground Level (m(AOD)):**	**Start Date:** 14/11/2017	**Sheet:** 1 of 3

SAMPLES & TESTS				STRATA				
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument/ Backfill
0.30	J1				▨	(12.20)	MADE GROUND (Black brown sandy gravel and cobbles. Sand is fine to coarse. Gravel is fine to coarse subangular and includes slag and concrete. Cobbles are subangular and include slag). (Engineer notes chiseled to smaller pieces).	

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
14/11/2017	0.00	0.00		
14/11/2017	4.00	4.00	250	Dry
15/11/2017	4.00	4.00	200	Dry
15/11/2017	8.00	8.00	200	Dry

Chiselling / Water Added

Chiselling			Water Added	
From	To	Hours (hh:mm)	From	To
1.30	1.80	01:00		
2.50	3.00	01:30		
3.50	4.00	00:30		
4.00	8.00	06:30		
8.00	9.00	04:00		

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) 50mm diameter slotted standpipe installed to 15.50m BGL.

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4155A**

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20, Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

BOREHOLE RECORD

Status:- PRELIM1

Project: The Former SSI Steelworks, Redcar - Priority Areas Within SSI Landholdings Contract 3			**Exploratory Hole No.** BH4R
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E: N:		
Method (Equipment): Cable Percussion (Dando 2000)	**Ground Level (m(AOD)):**	**Start Date:** 14/11/2017	**Sheet:** 2 of 3

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
11.00-11.45	SJ2	1/3.00				12.20	*(Continued...)* MADE GROUND (Black brown sandy gravel and cobbles. Sand is fine to coarse. Gravel is fine to coarse subangular and includes slag and concrete. Cobbles are subangular and include slag). (Engineer notes chiseled to smaller pieces).	
						(2.20) 14.40	MADE GROUND (Black grey sandy gravel. Sand is fine to coarse. Gravel is fine to medium subangular and includes slag, concrete and brick).	
14.40	J4					(1.10) 15.50	Black brown slightly silty SAND. Sand is fine to medium.	
15.50	J5						Soft to firm brown slightly sandy laminated CLAY. (Engineer notes silt dustings on laminae).	

Boring Progress and Water Observations				
Date	Depth	Casing	Casing Dia (mm)	Water Standing
16/11/2017	8.00	8.00	250	Dry
16/11/2017	10.20	10.00	250	Dry
17/11/2017	10.20	10.00	200	Dry
17/11/2017	10.20	10.00	200	Dry
20/11/2017	10.20	10.00	200	Dry
20/11/2017	10.20	10.00	200	Dry
21/11/2017	10.20	10.00	200	Dry
21/11/2017	12.50	12.50	200	12.20
22/11/2017	12.50	12.50	200	9.50

Chiselling			Water Added	
From	To	Hours (hh:mm)	From	To
9.00	10.20	03:00		
10.20	10.20	07:30		
10.20	11.00	02:30		
11.00	12.20	02:50		
12.50	14.40	02:00		

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) 50mm diameter slotted standpipe installed to 15.50m BGL.

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4155A**

Print Date and Time: 04/12/2017 11:40:37

BOREHOLE RECORD

Status:- **PRELIM1**

Project: The Former SSI Steelworks, Redcar - Priority Areas Within SSI Landholdings Contract 3			**Exploratory Hole No.** **BH4R**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E: N:		
Method (Equipment): Cable Percussion (Dando 2000)	**Ground Level (m(AOD)):**	**Start Date:** 14/11/2017	**Sheet:** 3 of 3

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
						(3.90) 19.40	*(Continued...)* Soft to firm brown slightly sandy laminated CLAY.	
19.50	J6					(0.60) 20.00	Firm to stiff red brown slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine to medium subangular and includes sandstone and mudstone).	
							Borehole complete at 20.00m BGL.	

Boring Progress and Water Observations					Chiselling			Water Added	
Date	Depth	Casing	Casing Dia (mm)	Water Standing	From	To	Hours (hh:mm)	From	To
22/11/2017	20.00	20.00	200	19.00					

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) 50mm diameter slotted standpipe installed to 15.50m BGL.

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4155A**

Print Date and Time: 04/12/2017 11:40:37

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20, Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

BOREHOLE RECORD

Status:- PRELIM1

Project: The Former SSI Steelworks, Redcar - Priority Areas Within SSI Landholdings Contract 3			**Exploratory Hole No.** BHD
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E: N:		
Method (Equipment): Cable Percussion (Dando 2000)	**Ground Level (m(AOD)):**	**Start Date:** 27/11/2017	**Sheet:** 1 of 2

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
0.30	J1					(8.50)	MADE GROUND (Black grey sandy gravel with cobbles noted. Sand is fine to coarse. Gravel is fine to coarse subangular and includes concrete, slag and clinker. Cobbles are subrounded and include slag and concrete). (Engineer notes gravel and cobbles are chiseled to smaller fractions).	
2.30	J2							

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
27/11/2017	0.00	0.00		
27/11/2017	1.20	1.00	250	Dry
28/11/2017	1.20	1.00	250	Dry
28/11/2017	4.50	4.50	200	
28/11/2017	6.50	6.50	200	Dry
29/11/2017	6.50	6.50	200	Dry

Chiselling			Water Added	
From	To	Hours (hh:mm)	From	To
0.00	1.00	03:00		
1.00	3.00	03:30		
3.00	6.50	03:00		
6.50	8.50	03:00		

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) 50mm diameter slotted standpipe installed to 9.00m BGL.

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4155A**

Print Date and Time: 04/12/2017 11:40:40

BOREHOLE RECORD

Status:- PRELIM1

Project: The Former SSI Steelworks, Redcar - Priority Areas Within SSI Landholdings Contract 3				**Exploratory Hole No.** BHD
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E: N:			
Method (Equipment): Cable Percussion (Dando 2000)		**Ground Level (m(AOD)):**	**Start Date:** 27/11/2017	**Sheet:** 2 of 2

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
					▨	8.50	*(Continued...)* MADE GROUND (Black grey sandy gravel with cobbles noted. Sand is fine to coarse. Gravel is fine to coarse subangular and includes concrete, slag and clinker. Cobbles are subrounded and include slag and concrete). (Engineer notes gravel and cobbles are chiseled to smaller fractions).	▤
8.70	J3				▤	(0.50) 9.00	Soft to firm brown laminated CLAY. (Engineer notes silt/fine sand dustings on laminae).	▤
							Borehole complete at 9.00m BGL	

Boring Progress and Water Observations				
Date	Depth	Casing	Casing Dia (mm)	Water Standing
29/11/2017	9.00	9.00	200	7.00

Chiselling			Water Added	
From	To	Hours (hh:mm)	From	To

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) 50mm diameter slotted standpipe installed to 9.00m BGL.

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4155A**

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BOREHOLE RECORD

Status:- **PRELIM1**

Project: The Former SSI Steelworks, Redcar - Priority Areas Within SSI Landholdings Contract 3			**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E: N:		**BHF**
Method (Equipment): Cable Percussion (Dando 2000)	**Ground Level (m(AOD)):**	**Start Date:** 14/11/2017	**Sheet:** 1 of 2

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
1.00	J1				▨	(1.40) 1.40	MADE GROUND (Brown clayey sandy gravel. Sand is fine to coarse. Gravel is fine to medium subangular and includes sandstone, concrete, slag and brick).	
2.50	J2				▨	(1.70) 3.10	MADE GROUND (Black brown sandy gravel. Sand is fine to coarse. Gravel is fine to coarse subangular and includes slag, concrete and brick) (Engineer notes chiseled to smaller pieces of gravel).	
3.50	J3				▨	(1.10) 4.20	MADE GROUND (Black brown red sandy gravel. Sand is fine to coarse. Gravel is fine to coarse subangular and includes slag, concrete and brick). (Engineer notes chiseled to smaller pieces of gravel).	
7.00	J4				▨	(5.80)	MADE GROUND (Black brown sandy gravel and cobbles. Sand is fine to coarse. Gravel is fine to coarse subangular and includes concrete, slag and brick. Cobbles are subrounded and include slag and concrete). (Engineer notes chiseled to smaller pieces).	

Boring Progress and Water Observations					Chiselling			Water Added	
Date	Depth	Casing	Casing Dia (mm)	Water Standing	From	To	Hours (hh:mm)	From	To
14/11/2017	0.00	0.00			3.60	3.80	00:30		
14/11/2017	4.20	4.20	250	Dry	4.10	4.20	00:30		
15/11/2017	4.20	4.20	200	Dry	4.20	4.60	01:00		
					4.60	4.90	01:00		
					6.40	6.70	00:30		

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) 50mm diameter slotted standpipe installed to 10.50m BGL.

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4155A**

Print Date and Time: 23/11/2017 09:13:37

BOREHOLE RECORD

Status:- **PRELIM1**

Project: The Former SSI Steelworks, Redcar - Priority Areas Within SSI Landholdings Contract 3				**Exploratory Hole No.**
Client: South Tees Site Company Ltd	**Location:** Redcar Steel Works E: N:			**BHF**
Method (Equipment): Cable Percussion (Dando 2000)	**Ground Level (m(AOD)):**	**Start Date:** 14/11/2017		**Sheet:** 2 of 2

SAMPLES & TESTS				STRATA				
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument/ Backfill
					▨	10.00	*(Continued...)* MADE GROUND (Black brown sandy gravel and cobbles. Sand is fine to coarse. Gravel is fine to coarse subangular and includes concrete, slag and brick. Cobbles are subrounded and include slag and concrete). (Engineer notes chiseled to smaller pieces).	
					▨	(1.00) 11.00	(1) MADE GROUND (Slag).	
							Borehole complete at 11.00m BGL.	

Boring Progress and Water Observations				
Date	Depth	Casing	Casing Dia (mm)	Water Standing
15/11/2017	11.00	8.51	200	Dry

Chiselling			Water Added	
From	To	Hours (hh:mm)	From	To
8.90	9.20	00:30		
9.20	9.60	00:30		

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) 50mm diameter slotted standpipe installed to 10.50m BGL.

All dimensions in metres Scale 1:50	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4155A**

Print Date and Time: 23/11/2017 09:13:37

APPENDIX C

Copies of Drillers Logs & Volumes of Backfill

Volumes of Backfill

Location ID	Bentonite (m^3)	Gravel Filter Pack (m^3)
BH4R	0.90	0.05
BHD	0.05	0.38
BHF	0.07	0.45

Allied Exploration & Geotechnics Limited

DRILLERS DAILY REPORT: CABLE PERCUSSION

Head Office: Unit 25, Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, County Durham, DH2 2RG. Tel: 01913874700 Fax: 01913874710
Regional Office: Unit B2 Anchorage Business Park, Chain Caul Way, Riverside Docklands, Preston, PR2 2YL. Tel: 01772735300 Fax: 01772735999

Contract Title:	Redcar Steel				**Contract No:**	4155A	**BH No:**	BH4R
Start / Finish Time:	**Hole (m)**	**Water (m)**	**Casing (m)**	**BH Moves**	**Date:**	14/11/17	**Day:**	TUSE
0800	GL		GL	From	**Rig:**	SA13	**Type:**	dando
1800	400	Dry	400	To	**Weather:**	Fine		

Strata Details			Samples & Tests			Depth		Undisturbed		Casing & Water	
From (mBGL)	To (mBGL)	Soil/Rock Description	No	Type	In-Situ Test	From	To	Blows	Rec	Casing (mBGL)	Water (mBGL)
		Slag	1	J		030					
GL	4.00										
Shift Total	400 m										

Groundwater Information (Inflow Terms: Slight, Slow, Moderate, Heavy, Artesian)

Time	Depth (mBGL)	Casing (mBGL)	Inflow	5 min	10 min	15 min	20 min	Sealed (mBGL)

Casing / Hole Details

Casing (C) Hole (H)	Diameter (mm)	From (mBGL)	To (mBGL)
C	250	GL	400
H	250	GL	400

Chiselling

From (mBGL)	To (mBGL)	Time Start (HH:mm)	Duration (HH:mm)
1.30	1.80	1300	~~1400~~ 1hr
1.50	2.00	1415	~~[illegible]~~ 1.5hr
3.50	4.00	1545	0.5hr

Water Added

From (mBGL)	To (mBGL)	Amount

Backfill Details

Type	From (mBGL)	To (mBGL)

From Time	Duration (HH: mm)	Details of Delays & Dayworks or Other Remarks
0800	3HR	Standing Waiting on BH location
1130	30min	Setup Rig

Additional Information

Inspection Pit:	[✓ Yes] / No	Depth 120	Time 1HR30
Permit-to-Work	[✓ Yes] / No	**SSWP Read**	[✓ Yes] / No
NVQ	Tick If Applies ✓	**CSCS**	Tick If Applies ✓

J = Jar B = Bulk P = Piston U = Undisturbed ES = Environmental (Soil) EW = Environmental (Water) K = Permeability Test V = Borehole Vane
SPT(S) = Standard Penetration Test (Open Shoe) SPT(C) =Solid Cone: Data Provided On A Separate Sheet NR = No Recovery

Signatures	**Crew**	**Hours**	**Signed**	**Supervisor**	**Client**	**Sheet**
	Marc Stephen Rob	9½	Mc			1 / 1

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Regional Office: Unit B2 Anchorage Business Park, Chain Caul Way, Riverside Docklands, Preston, PR2 2YL. Tel: 01772735300 Fax: 01772735999

Contract Title:	Redcar Steel				**Contract No:**	G155A	**BH No:**	4R
Start / Finish Time:	**Hole (m)**	**Water (m)**	**Casing (m)**	**BH Moves**	**Date:**	15/11/17	**Day:**	Week
0800	400	Dry	400	From	**Rig:**	SA13	**Type:**	dando
1800	800	Dry	800	To	**Weather:**	Fine		

Strata Details			Samples & Tests			Depth		Undisturbed		Casing & Water	
From (mBGL)	To (mBGL)	Soil/Rock Description	No	Type	In-Situ Test	From	To	Blows	Rec	Casing (mBGL)	Water (mBGL)
400	800	Slag									
Shift Total	400 m										

Groundwater Information (Inflow Terms: Slight, Slow, Moderate, Heavy, Artesian)

Time	Depth (mBGL)	Casing (mBGL)	Inflow	5 min	10 min	15 min	20 min	Sealed (mBGL)

Casing / Hole Details

Casing (C) Hole (H)	Diameter (mm)	From (mBGL)	To (mBGL)

Chiselling

From (mBGL)	To (mBGL)	Time Start (HH:mm)	Duration (HH:mm)
4.00	800	800	8.5 HR

Water Added

From (mBGL)	To (mBGL)	Amount

Backfill Details

Type	From (mBGL)	To (mBGL)

From Time	Duration (HH: mm)	Details of Delays & Dayworks or Other Remarks
1500	1 HR	Standing Due to Snapping 3 Seism Pins

Additional Information

Inspection Pit:	Yes / No	Depth	Time
Permit-to-Work	Yes / No	**SSWP Read**	Yes / No
NVQ	Tick If Applies	**CSCS**	Tick If Applies

J = Jar B = Bulk P = Piston U = Undisturbed ES = Environmental (Soil) EW = Environmental (Water) K = Permeability Test V = Borehole Vane
SPT(S) = Standard Penetration Test (Open Shoe) SPT(C) =Solid Cone: Data Provided On A Separate Sheet NR = No Recovery

Signatures	Crew	Hours	Signed	Supervisor	Client	Sheet
	Mark Stephen Rob	9½	M			1 / 1

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Contract Title:	Redcar Steel				**Contract No:**	4155A	**BH No:**	4R
Start / Finish Time:	**Hole (m)**	**Water (m)**	**Casing (m)**	**BH Moves**	**Date:**	16/11/17	**Day:**	Thurs
0800	8.00	Dry	800	From	**Rig:**	SA13	**Type:**	Dando
1800	1020	Dry	10.00	To	**Weather:**	Cold		

Strata Details			Samples & Tests			Depth		Undisturbed		Casing & Water	
From (mBGL)	To (mBGL)	Soil/Rock Description	No	Type	In-Situ Test	From	To	Blows	Rec	Casing (mBGL)	Water (mBGL)
800	1020	Slag									
Shift Total	2.20 m										

Groundwater Information (Inflow Terms: Slight, Slow, Moderate, Heavy, Artesian)

Time	Depth (mBGL)	Casing (mBGL)	Inflow	5 min	10 min	15 min	20 min	Sealed (mBGL)

Casing / Hole Details

Casing (C) Hole (H)	Diameter (mm)	From (mBGL)	To (mBGL)
C	250	800	1000
H	250	800	1020

Chiselling

From (mBGL)	To (mBGL)	Time Start (HH:mm)	Duration (HH:mm)
800	900	800	4 HR
9.00	1020	1300	3 HR

Water Added

From (mBGL)	To (mBGL)	Amount

Backfill Details

Type	From (mBGL)	To (mBGL)

From Time	Duration (HH: mm)	Details of Delays & Dayworks or Other Remarks
12.30	30min	Collect 10" cutter as one split on weld

Additional Information

Inspection Pit:	Yes / No	Depth	Time
Permit-to-Work	Yes / No	**SSWP Read**	Yes / No
NVQ	Tick If Applies	**CSCS**	Tick If Applies

J = Jar B = Bulk P = Piston U = Undisturbed ES = Environmental (Soil) EW = Environmental (Water) K = Permeability Test V = Borehole Vane SPT(S) = Standard Penetration Test (Open Shoe) SPT(C) =Solid Cone: Data Provided On A Separate Sheet NR = No Recovery

Signatures	**Crew**	**Hours**	**Signed**	**Supervisor**	**Client**	**Sheet**
	Marc Rob Stephen	9½				1 / 1

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AEG

Contract Title:	Redcar Steel	**Contract No:**	4154A	**BH No:**	4R
		Date:	17/11/17	**Day:**	Fri
		Rig:	SA13	**Type:**	dando
		Weather:	COLD		

Start / Finish Time:	Hole (m)	Water (m)	Casing (m)	BH Moves
				From
0800	1020	Dry		
				To
1800	1020	Dry		

Strata Details			Samples & Tests			Depth		Undisturbed		Casing & Water	
From (mBGL)	To (mBGL)	Soil/Rock Description	No	Type	In-Situ Test	From	To	Blows	Rec	Casing (mBGL)	Water (mBGL)
1020	1020	Stay									
Shift Total	0 m										

Groundwater Information (Inflow Terms: Slight, Slow, Moderate, Heavy, Artesian)

Time	Depth (mBGL)	Casing (mBGL)	Inflow	5 min	10 min	15 min	20 min	Sealed (mBGL)

Casing / Hole Details

Casing (C) Hole (H)	Diameter (mm)	From (mBGL)	To (mBGL)
C	200	GL	1020
H	200	1020	1020

Chiselling

From (mBGL)	To (mBGL)	Time Start (HH:mm)	Duration (HH:mm)
~~800~~1020	1020	830	2HR
1020	1020	1230	3.5HR

Water Added

From (mBGL)	To (mBGL)	Amount

Backfill Details

Type	From (mBGL)	To (mBGL)

From Time	Duration (HH: mm)	Details of Delays & Dayworks or Other Remarks
9.00	2HR	Recovering Tool as Rope Snaped

Additional Information

Inspection Pit:	Yes / No	Depth	Time
Permit-to-Work	Yes / No	**SSWP Read**	Yes / No
NVQ	Tick If Applies	**CSCS**	Tick If Applies

J = Jar B = Bulk P = Piston U = Undisturbed ES = Environmental (Soil) EW = Environmental (Water) K = Permeability Test V = Borehole Vane
SPT(S) = Standard Penetration Test (Open Shoe) SPT(C) =Solid Cone: Data Provided On A Separate Sheet NR = No Recovery

Signatures	Crew	Hours	Signed	Supervisor	Client	Sheet
	Marc Stephen	9½				1 / 1

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Contract Title:	Redcar Steel				**Contract No:** 4155A	**BH No:**	4R
Start / Finish Time:	**Hole (m)**	**Water (m)**	**Casing (m)**	**BH Moves**	**Date:** 20/11/17	**Day:**	Mon
0800	1020			From	**Rig:** SA13	**Type:**	dando
1800	1020			To	**Weather:** Fine		

Strata Details			Samples & Tests			Depth		Undisturbed		Casing & Water	
From (mBGL)	To (mBGL)	Soil/Rock Description	No	Type	In-Situ Test	From	To	Blows	Rec	Casing (mBGL)	Water (mBGL)
10.20	10.20	Slag ✓									
		Stainless steel casing length + shoe - 1.68m damaged due to extended MG depth >10m. Removed stainless steel casing to exchange for standard casing + shoe.									
Shift Total	0 m										

Groundwater Information (Inflow Terms: Slight, Slow, Moderate, Heavy, Artesian)

Time	Depth (mBGL)	Casing (mBGL)	Inflow	5 min	10 min	15 min	20 min	Sealed (mBGL)

Casing / Hole Details

Casing (C) Hole (H)	Diameter (mm)	From (mBGL)	To (mBGL)
C	200	1000	1000
H	200	1000	1000

Chiselling

From (mBGL)	To (mBGL)	Time Start (HH:mm)	Duration (HH:mm)
1020	1020	1300	2HR

Water Added

From (mBGL)	To (mBGL)	Amount

Backfill Details

Type	From (mBGL)	To (mBGL)

From Time	Duration (HH: mm)	Details of Delays & Dayworks or Other Remarks
0830	3HR30	Rig Breakdown
1500	1HR	Pull 8" casing as casing shoe was Dammaged - stainless steel shoe and length damaged due to extended MG.

Additional Information

Inspection Pit:	Yes / No	Depth	Time
Permit-to-Work	Yes / No	SSWP Read	Yes / No
NVQ	Tick If Applies	CSCS	Tick If Applies

J = Jar B = Bulk P = Piston U = Undisturbed ES = Environmental (Soil) EW = Environmental (Water) K = Permeability Test V = Borehole Vane
SPT(S) = Standard Penetration Test (Open Shoe) SPT(C) =Solid Cone: Data Provided On A Separate Sheet NR = No Recovery

Signatures	Crew	Hours	Signed	Supervisor	Client	Sheet
	Marc Stephen	9½				1 / 1

AEG FORM: DRILLCP01/V1.0

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Regional Office: Unit B2 Anchorage Business Park, Chain Caul Way, Riverside Docklands, Preston, PR2 2YL. Tel: 01772735300 Fax: 01772735999

AEG

Contract Title:	Redcar Steel				**Contract No:** 4155A	**BH No:** 4R
Start / Finish Time:	**Hole (m)**	**Water (m)**	**Casing (m)**	**BH Moves**	**Date:** 21/11/17	**Day:** Tuse
0800	1020	Dry	~~1020~~ GL	From	**Rig:** SA13	**Type:** Anelo
1800	1250	1220	1220	To	**Weather:** Fine	

Strata Details

From (mBGL)	To (mBGL)	Soil/Rock Description
1020	1220	Slag
1220	1250	Dence Black Sand With Slag
		Water Strike @ 12.20

Shift Total 2.30 m

Samples & Tests No	Type	In-Situ Test	Depth From	Depth To	Undisturbed Blows	Undisturbed Rec	Casing & Water Casing (mBGL)	Casing & Water Water (mBGL)
2	SJ		1100	1145			1100	Dry

Groundwater Information (Inflow Terms: Slight, Slow, Moderate, Heavy, Artesian)

Time	Depth (mBGL)	Casing (mBGL)	Inflow	5 min	10 min	15 min	20 min	Sealed (mBGL)

Casing / Hole Details

Casing (C) Hole (H)	Diameter (mm)	From (mBGL)	To (mBGL)
C	200	GL	1240
H	200	1020	1250

Chiselling

From (mBGL)	To (mBGL)	Time Start (HH:mm)	Duration (HH:mm)
1020	11.00	930	2HR30
11.00	1220	1300	2HR50

Water Added

From (mBGL)	To (mBGL)	Amount

Backfill Details

Type	From (mBGL)	To (mBGL)

From Time	Duration (HH: mm)	Details of Delays & Dayworks or Other Remarks
800	1HR30	Drop Steel 8" casing in

Additional Information

Inspection Pit:	Yes / No	Depth	Time	
Permit-to-Work	Yes / No	**SSWP Read**	Yes / No	
NVQ	Tick If Applies	**CSCS**	Tick If Applies	

J = Jar B = Bulk P = Piston U = Undisturbed ES = Environmental (Soil) EW = Environmental (Water) K = Permeability Test V = Borehole Vane SPT(S) = Standard Penetration Test (Open Shoe) SPT(C) =Solid Cone: Data Provided On A Separate Sheet NR = No Recovery

	Crew	Hours	Signed	Supervisor	Client	Sheet
Signatures	Marc Stephen	9½	M			1 / 1

AEG FORM: DRILLCP01/V1.0

Deakin Printers Ltd.

Allied Exploration & Geotechnics Limited

DRILLERS DAILY REPORT: CABLE PERCUSSION

Head Office: Unit 25, Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, County Durham, DH2 2RG. Tel: 01913874700 Fax: 01913874710
Regional Office: Unit B2 Anchorage Business Park, Chain Caul Way, Riverside Docklands, Preston, PR2 2YL. Tel: 01772735300 Fax: 01772735999

Contract Title:	Redcar Steel			
Contract No:	4155A	**BH No:**	4R	
Date:	22/11/17	**Day:**	Wed	
Rig:	SA13	**Type:**	dando	
Weather:	Fine			

Start / Finish Time:	Hole (m)	Water (m)	Casing (m)	BH Moves
0800	12.50	9.50	12.50	From
1800	20.00	19.00	20.00	To

Strata Details

From (mBGL)	To (mBGL)	Soil/Rock Description
12.50	14.40	Sandy Silty
14.40	15.50	Black Sand
15.50	19.40	Firm Brown Sandy laminated Clay
19.40	20.00	Stiff Red Stony Clay

Shift Total 7.50 m

Samples & Tests

No	Type	In-Situ Test	Depth From	Depth To	Undisturbed Blows	Undisturbed Rec	Casing (mBGL)	Water (mBGL)
4	J		14.40					
5	J		15.50					
6	J		19.50					

Groundwater Information (Inflow Terms: Slight, Slow, Moderate, Heavy, Artesian)

Time	Depth (mBGL)	Casing (mBGL)	Inflow	5 min	10 min	15 min	20 min	Sealed (mBGL)

Casing / Hole Details

Casing (C) Hole (H)	Diameter (mm)	From (mBGL)	To (mBGL)
C	200	12.50	20.00
H	200	12.50	20.00

Chiselling

From (mBGL)	To (mBGL)	Time Start (HH:mm)	Duration (HH:mm)
12.50	14.40	900	2HR

Water Added

From (mBGL)	To (mBGL)	Amount

Backfill Details

Type	From (mBGL)	To (mBGL)

From Time	Duration (HH: mm)	Details of Delays & Dayworks or Other Remarks
11.00	1HR	Pull 8" Casing
13.00	1HR30	Drop Stainless Casing in

Additional Information

Inspection Pit:	Yes / No	Depth	Time
Permit-to-Work	Yes / No	**SSWP Read**	Yes / No
NVQ	Tick If Applies	**CSCS**	Tick If Applies

J = Jar B = Bulk P = Piston U = Undisturbed ES = Environmental (Soil) EW = Environmental (Water) K = Permeability Test V = Borehole Vane
SPT(S) = Standard Penetration Test (Open Shoe) SPT(C) =Solid Cone: Data Provided On A Separate Sheet NR = No Recovery

Signatures	Crew	Hours	Signed	Supervisor	Client	Sheet
	Mave Stephen	9½	M			1 / 1

AEG FORM: DRILLCP01/V1.0

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Regional Office: Unit B2 Anchorage Business Park, Chain Caul Way, Riverside Docklands, Preston, PR2 2YL. Tel: 01772735300 Fax: 01772735999

Contract Title:	Redcar Steel				**Contract No:** 4155A	**BH No:** GR	
Start / Finish Time:	**Hole (m)**	**Water (m)**	**Casing (m)**	**BH Moves**	**Date:** 23/11/17	**Day:** Thurs	
0800				From	**Rig:** SA13	**Type:** Dando	
1800				To	**Weather:** Fine		

Strata Details			Samples & Tests			Depth		Undisturbed		Casing & Water	
From (mBGL)	**To (mBGL)**	**Soil/Rock Description**	**No**	**Type**	**In-Situ Test**	**From**	**To**	**Blows**	**Rec**	**Casing (mBGL)**	**Water (mBGL)**
		Remarks									
0800	1HR	Waiting on install Details									
9.00	~~[illegible]~~ 5HR	Pull 8" install Pipe Trying To free 10" Casing									
11:00	2HR	Standing as 10" Casing Head Snaped									
Shift Total		m									

Groundwater Information (Inflow Terms: Slight, Slow, Moderate, Heavy, Artesian)

Time	Depth (mBGL)	Casing (mBGL)	Inflow	5 min	10 min	15 min	20 min	Sealed (mBGL)

Casing / Hole Details

Casing (C) Hole (H)	Diameter (mm)	From (mBGL)	To (mBGL)

Chiselling

From (mBGL)	To (mBGL)	Time Start (HH:mm)	Duration (HH:mm)

Water Added

From (mBGL)	To (mBGL)	Amount

Backfill Details

Type	From (mBGL)	To (mBGL)

From Time	Duration (HH: mm)	Details of Delays & Dayworks or Other Remarks

Additional Information

Inspection Pit:	Yes / No	Depth	Time
Permit-to-Work	Yes / No	**SSWP Read**	Yes / No
NVQ	Tick If Applies	**CSCS**	Tick If Applies

J = Jar B = Bulk P = Piston U = Undisturbed ES = Environmental (Soil) EW = Environmental (Water) K = Permeability Test V = Borehole Vane SPT(S) = Standard Penetration Test (Open Shoe) SPT(C) =Solid Cone: Data Provided On A Separate Sheet NR = No Recovery

	Crew	Hours	Signed	Supervisor	Client	Sheet
Signatures	Marc Stephen	9½	M			1 / 1

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Contract Title:	Redcar Steel			
Start / Finish Time:	**Hole (m)**	**Water (m)**	**Casing (m)**	**BH Moves**
0800				From
1800				To

Contract No:	4155A	**BH No:**	4R
Date:	24/11/17	**Day:**	Fri
Rig:	SA13	**Type:**	Dando
Weather:	Fine		

Strata Details			Samples & Tests			Depth		Undisturbed		Casing & Water	
From (mBGL)	To (mBGL)	Soil/Rock Description	No	Type	In-Situ Test	From	To	Blows	Rec	Casing (mBGL)	Water (mBGL)
		Remarks									
800	1HR	Waiting for fitter to grind threads out of 10" casing									
0900	2HR	Pull 10" casing									
11-	1HR	Finish install									
1300	2HR	Drop rig + move to BHD									
1500	1HR	Clean BH									
Shift Total		m									

Groundwater Information (Inflow Terms: Slight, Slow, Moderate, Heavy, Artesian)

Time	Depth (mBGL)	Casing (mBGL)	Inflow	5 min	10 min	15 min	20 min	Sealed (mBGL)

Casing / Hole Details

Casing (C) Hole (H)	Diameter (mm)	From (mBGL)	To (mBGL)

Chiselling

From (mBGL)	To (mBGL)	Time Start (HH:mm)	Duration (HH:mm)

Water Added

From (mBGL)	To (mBGL)	Amount

Backfill Details

Type	From (mBGL)	To (mBGL)

From Time	Duration (HH: mm)	Details of Delays & Dayworks or Other Remarks

Additional Information

Inspection Pit:	Yes / No	Depth	Time
Permit-to-Work	Yes / No	**SSWP Read**	Yes / No
NVQ	Tick If Applies	**CSCS**	Tick If Applies

J = Jar B = Bulk P = Piston U = Undisturbed ES = Environmental (Soil) EW = Environmental (Water) K = Permeability Test V = Borehole Vane SPT(S) = Standard Penetration Test (Open Shoe) SPT(C) =Solid Cone: Data Provided On A Separate Sheet NR = No Recovery

	Crew	Hours	Signed	Supervisor	Client	Sheet
Signatures	Marc Stephen	9½	M			2 / 1

AEG FORM: DRILLCP01/V1.0

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STANDARD PENETRATION TEST SITE CERTIFICATE

BS EN ISO 22476-3: 2005

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Initial Test Information							Seating Information			Test Drive					Additional Details
Exploratory Hole No	Test No.	Date	Depth of Test (mBGL)	Water Level (mBGL)	Borehole Diameter (mm)	Rod Type/Size	Penetration Under Static Weight (mm)	75 mm	75 mm	75 mm	75 mm	75 mm	75 mm	Split Spoon or Solid Cone (S/C)	Comments including interruptions with time duration and change of rod
4R	2	21/11/17	11.00	Dry	200	NWY	0	5	13	25	25			S	

General Information: For exploratory hole data please refer to the corresponding **Drillers Daily Report Form**
Please use a new form if there is a change in Automatic Trip Hammer (ATH) during the course of the site operations.

AEG FORM: DRILLCP02/V1.0

Contract Number	Contract Title	Operator	Signature of Test Operator	Equipment Number	Energy Ratio E_r	Sheet Number
4155A	Rekerstreel	mare		ATH 3	%	1 OF 1

UKAS TESTING 1367

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DRILLERS DAILY REPORT: INSTALLATION RECORD

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Regional Office: Unit B2 Anchorage Business Park, Chain Caul Way, Riverside Docklands, Preston, PR2 2YL. Tel: 01772735300 Fax: 01772735999

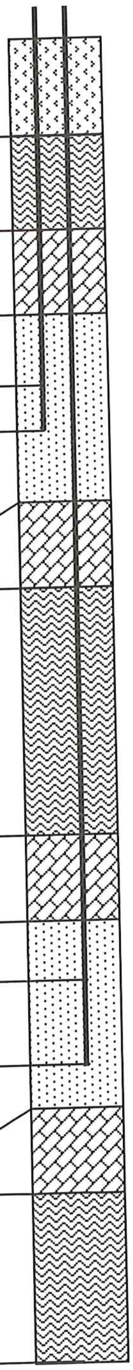
AEG

General Site Details

Contract Number:	4155A	**Contract Title:**	Redcar Steel		
Operator (s)	Marc Stephen	**Date:**	23/11/17	**BH No:**	4R

Twin Groundwater/Gas Piezometer/Standpipe Installation

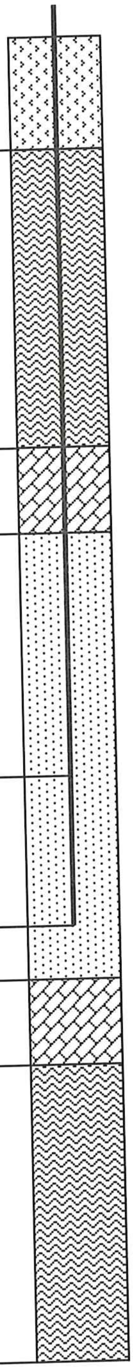
COVER: FLUSH / RAISED GAS VALVE / CAP
CONCRETE: mBGL
GROUT / ARISINGS: mBGL
SEAL (BP): mBGL
PIPE ID:
SLOTTED: mBGL
GEOSOCK: YES / NO
PIPE TIP: mBGL
RZ BASE: mBGL
FILTER TYPE: GRAVEL / SAND / OTHER
SEAL (BP): mBGL
GROUT / ARISINGS: mBGL
SEAL (BP): mBGL
PIPE ID:
SLOTTED: mBGL
GEOSOCK: YES / NO
PIPE TIP: mBGL
RZ BASE: mBGL
FILTER TYPE: GRAVEL / SAND / OTHER
SEAL (BP): mBGL
GROUT / ARISINGS mBGL
BASE OF HOLE: mBGL



WATER LEVEL AFTER INSTALLATION : S: D: mBGL

Single Groundwater/Gas Piezometer/Standpipe Installation

COVER: FLUSH / [✓ RAISED] / [✓ GAS VALVE] / CAP
CONCRETE: 050 mBGL
GROUT / ARISINGS: mBGL
SEAL (BP): 14.50 mBGL
PIPE ID: 50mm
SLOTTED: 15.50 mBGL
GEOSOCK: [✓ YES] / NO
PIPE TIP: mBGL
RZ BASE / BASE OF HOLE: mBGL
FILTER TYPE: GRAVEL / SAND / OTHER
SEAL (BP) / BASE OF HOLE: 15.50 mBGL
GROUT / ARISINGS: mBGL
BASE OF HOLE: 20.00 mBGL



WATER LEVEL AFTER INSTALLATION : GL mBGL

PLEASE DELETE THE APPROPRIATE CONSTRUCTION MATERIALS ON THE INSTALLATION DRAWINGS i.e. GROUT / ARISINGS

	Operator	**Client**	**Time Taken To Complete Installation**
Signatures	M		4HR

AEG FORM: DRILLCP03/V1.0

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Regional Office: Unit B2 Anchorage Business Park, Chain Caul Way, Riverside Docklands, Preston, PR2 2YL. Tel: 01772735300 Fax: 01772735999

AEG

Contract Title:	REDCAR TARMAC				**Contract No:** 4155A	**BH No:**	F
Start / Finish Time:	**Hole (m)**	**Water (m)**	**Casing (m)**	**BH Moves**	**Date:** 14 11 17	**Day:**	TUESDAY
0800	—			From DRAFT	**Rig:** 12	**Type:**	CP
18.00	4.20	DRY	4.20	To F	**Weather:** DRY		

Strata Details			Samples & Tests			Depth		Undisturbed		Casing & Water	
From (mBGL)	To (mBGL)	Soil/Rock Description	No	Type	In-Situ Test	From	To	Blows	Rec	Casing (mBGL)	Water (mBGL)
GL	1.40	Clay Slag fill	1	J		1.00					
1.40	3.10	Slag fill	2	J		2.50					
3.10	4.20	Black Red Slag.	3	J		3.50					

Shift Total 4.20 m

Groundwater Information (Inflow Terms: Slight, Slow, Moderate, Heavy, Artesian)

Time	Depth (mBGL)	Casing (mBGL)	Inflow	5 min	10 min	15 min	20 min	Sealed (mBGL)
NIL								

Casing / Hole Details

Casing (C) Hole (H)	Diameter (mm)	From (mBGL)	To (mBGL)
250	GL		
C	250	GL	420

Chiselling

From (mBGL)	To (mBGL)	Time Start (HH:mm)	Duration (HH:mm)
3.60	3.80	1445	1/2
4.10	4.20	1530	1/2

Water Added

From (mBGL)	To (mBGL)	Amount
NIL		

Backfill Details

Type	From (mBGL)	To (mBGL)
NIL		

From Time	Duration (HH: mm)	Details of Delays & Dayworks or Other Remarks
0800	4	INDUCTION, WAIT CLEAR SERVICES
13.00	1	PIT

Additional Information

Inspection Pit:	Yes / No	Depth	Time
Permit-to-Work	Yes / No	**SSWP Read**	Yes / No
NVQ	Tick If Applies	**CSCS**	Tick If Applies

J = Jar B = Bulk P = Piston U = Undisturbed ES = Environmental (Soil) EW = Environmental (Water) K = Permeability Test V = Borehole Vane SPT(S) = Standard Penetration Test (Open Shoe) SPT(C) =Solid Cone: Data Provided On A Separate Sheet NR = No Recovery

Signatures	Crew	Hours	Signed	Supervisor	Client	Sheet
	GB SC		GB			

AEG FORM: DRILLCP01/V1.

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Regional Office: Unit B2 Anchorage Business Park, Chain Caul Way, Riverside Docklands, Preston, PR2 2YL. Tel: 01772735300 Fax: 01772735999

Contract Title:	Redcar Tarmac				**Contract No:**	4155 A	**BH No:**	F
Start / Finish Time:	**Hole (m)**	**Water (m)**	**Casing (m)**	**BH Moves**	**Date:**	15 11 17	**Day:**	WED
0800	420	DRY	420	From	**Rig:**	12	**Type:**	CP
1800	11.00	"	8.51	To	**Weather:**	DRY		

Strata Details

From (mBGL)	To (mBGL)	Soil/Rock Description
420	1000	Slag fill
1000	1100	BASE Slag.
		Casing Stuck AT 8.51
		CHBL
4.20	460	8-9 1 HR
460	4.90	9 - 10 1 HR
6.40	6.70	11.30 1/2 3½ CH
8.90	920	14.00 1/2 hr
920	960	1500 1/2 hr
Shift Total		6.80 m

Samples & Tests			Depth		Undisturbed		Casing & Water	
No	**Type**	**In-Situ Test**	**From**	**To**	**Blows**	**Rec**	**Casing (mBGL)**	**Water (mBGL)**
4	J		7.00					

Groundwater Information (Inflow Terms: Slight, Slow, Moderate, Heavy, Artesian)

Time	Depth (mBGL)	Casing (mBGL)	Inflow	5 min	10 min	15 min	20 min	Sealed (mBGL)
il								

Casing / Hole Details

Casing (C) Hole (H)	Diameter (mm)	From (mBGL)	To (mBGL)
C	200	420	850
H	"	"	1100

Chiselling

From (mBGL)	To (mBGL)	Time Start (HH:mm)	Duration (HH:mm)
AS	ABOVE		

Water Added

From (mBGL)	To (mBGL)	Amount
Nil		

Backfill Details

Type	From (mBGL)	To (mBGL)
Nil		

From Time	Duration (HH: mm)	Details of Delays & Dayworks or Other Remarks

Additional Information

Inspection Pit:	Yes / No	Depth	Time
Permit-to-Work	Yes / No	**SSWP Read**	Yes / No
NVQ	Tick If Applies	**CSCS**	Tick If Applies

J = Jar B = Bulk P = Piston U = Undisturbed ES = Environmental (Soil) EW = Environmental (Water) K = Permeability Test V = Borehole Vane SPT(S) = Standard Penetration Test (Open Shoe) SPT(C) =Solid Cone: Data Provided On A Separate Sheet NR = No Recovery

Signatures	Crew	Hours	Signed	Supervisor	Client	Sheet
	EB SC	9½	GBoo			

AEG FORM: DRILLCP01/V1.0

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DRILLERS DAILY REPORT: INSTALLATION RECORD

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AEG

General Site Details

Contract Number:	4155 A	**Contract Title:**	REDCAR - TARMAC		
Operator (s)	GB	**Date:**	16.11.17	**BH No:**	F

Twin Groundwater/Gas Piezometer/Standpipe Installation

COVER: FLUSH / RAISED
GAS VALVE / CAP
CONCRETE: mBGL

GROUT / ARISINGS: mBGL

SEAL (BP): mBGL

PIPE ID:
SLOTTED:
mBGL
GEOSOCK: YES / NO

PIPE TIP: mBGL

RZ BASE: mBGL
FILTER TYPE:
GRAVEL / SAND / OTHER

SEAL (BP): mBGL

GROUT / ARISINGS: mBGL

SEAL (BP): mBGL

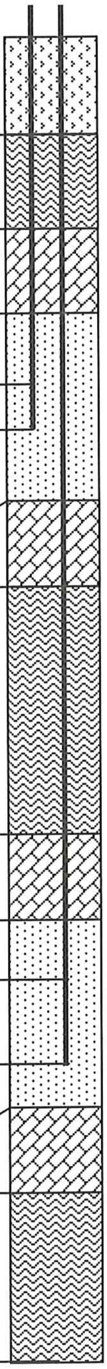
PIPE ID:
SLOTTED:
mBGL
GEOSOCK: YES / NO

PIPE TIP: mBGL

RZ BASE: mBGL
FILTER TYPE:
GRAVEL / SAND / OTHER

SEAL (BP): mBGL

GROUT / ARISINGS: mBGL
BASE OF HOLE: mBGL



S:
WATER LEVEL AFTER INSTALLATION : D: mBGL

Single Groundwater/Gas Piezometer/Standpipe Installation

COVER: FLUSH / [✓ RAISED]
[✓ GAS VALVE] / CAP
CONCRETE: .50 mBGL

40 Bags gravel
2 Pallets.

GROUT / ARISINGS: mBGL

SEAL (BP): 100 mBGL

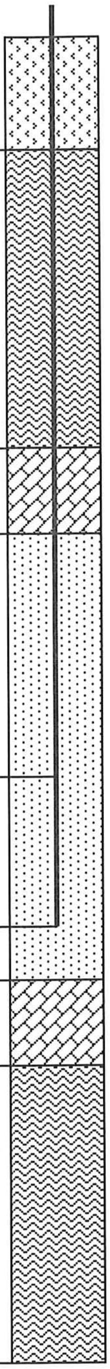
PIPE ID: 50
SLOTTED: 10 mtrs
mBGL
GEOSOCK: [✓ YES] / NO

PIPE TIP: mBGL

RZ BASE / BASE OF HOLE: 10.50 mBGL
FILTER TYPE:
[✓ GRAVEL] / SAND / OTHER

SEAL (BP) / BASE OF HOLE: 11.00 mBGL

GROUT / ARISINGS: mBGL
BASE OF HOLE: 11.00 mBGL



WATER LEVEL AFTER INSTALLATION : DRY mBGL

PLEASE DELETE THE APPROPRIATE CONSTRUCTION MATERIALS ON THE INSTALLATION DRAWINGS i.e. GROUT / ARISINGS

	Operator	Client	Time Taken To Complete Installation
Signatures	GB.		

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Contract Title:	Redcar Steel			
Start / Finish Time:	**Hole (m)**	**Water (m)**	**Casing (m)**	**BH Moves**
0800	GL		GL	From
1800	1.00	Dry	1.000	To

Contract No:	4155A	**BH No:**	D
Date:	27/11/17	**Day:**	Mon
Rig:	SA13	**Type:**	Dando
Weather:	Fine		

Strata Details			Samples & Tests			Depth		Undisturbed		Casing & Water	
From (mBGL)	To (mBGL)	Soil/Rock Description	No	Type	In-Situ Test	From	To	Blows	Rec	Casing (mBGL)	Water (mBGL)
GL	1.20	Slag with Sandy gravel	1	J		030					
Shift Total	1.20 m										

Groundwater Information (Inflow Terms: Slight, Slow, Moderate, Heavy, Artesian)

Time	Depth (mBGL)	Casing (mBGL)	Inflow	5 min	10 min	15 min	20 min	Sealed (mBGL)

Casing / Hole Details

Casing (C) Hole (H)	Diameter (mm)	From (mBGL)	To (mBGL)
C	250	GL	1.00
H	250	GL	1.00

Chiselling

From (mBGL)	To (mBGL)	Time Start (HH:mm)	Duration (HH:mm)
GL	1.00	800	3.HR

Water Added

From (mBGL)	To (mBGL)	Amount

Backfill Details

Type	From (mBGL)	To (mBGL)

From Time	Duration (HH: mm)	Details of Delays & Dayworks or Other Remarks
08.00	1HR	Collect 10" leader 10" cutter and 10" chisel from BH4R
12.00		Half Day Holliday

Additional Information

Inspection Pit:	[✓ Yes] / No	1 20	3HR
Permit-to-Work	[✓ Yes] / No	SSWP Read	[✓ Yes] / No
NVQ	✓	CSCS	✓

J = Jar B = Bulk P = Piston U = Undisturbed ES = Environmental (Soil) EW = Environmental (Water) K = Permeability Test V = Borehole Vane
SPT(S) = Standard Penetration Test (Open Shoe) SPT(C) =Solid Cone: Data Provided On A Separate Sheet NR = No Recovery

Signatures	Crew	Hours	Signed	Supervisor	Client	Sheet
	Mark Stephen	9½				1 / 1

AEG FORM: DRILLCP01/V1.0

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Regional Office: Unit B2 Anchorage Business Park, Chain Caul Way, Riverside Docklands, Preston, PR2 2YL. Tel: 01772735300 Fax: 01772735999

Contract Title:	Redcar Steel				**Contract No:**	4155A	**BH No:**	D
Start / Finish Time:	**Hole (m)**	**Water (m)**	**Casing (m)**	**BH Moves**	**Date:**	28/11/17	**Day:**	Tuse
0800	1.20	Dry	1.00	From	**Rig:**	SA13	**Type:**	[illegible]
1800	650	Dry	650	To	**Weather:**	Fine		

Strata Details			Samples & Tests			Depth		Undisturbed		Casing & Water	
From (mBGL)	To (mBGL)	Soil/Rock Description	No	Type	In-Situ Test	From	To	Blows	Rec	Casing (mBGL)	Water (mBGL)
120	650	Sandygravel with Sky and Boulders	2	J		230					
Shift Total	4.30 m										

Groundwater Information (Inflow Terms: Slight, Slow, Moderate, Heavy, Artesian)

Time	Depth (mBGL)	Casing (mBGL)	Inflow	5 min	10 min	15 min	20 min	Sealed (mBGL)

Casing / Hole Details

Casing (C) Hole (H)	Diameter (mm)	From (mBGL)	To (mBGL)
C	250	1.00	450
H	200	100	650
C	200	~~650~~ [illegible]	650

Chiselling

From (mBGL)	To (mBGL)	Time Start (HH:mm)	Duration (HH:mm)
1.00	800	830	3.5 HR
3.00	650	1300	3 HR

Water Added

From (mBGL)	To (mBGL)	Amount

Backfill Details

Type	From (mBGL)	To (mBGL)

From Time	Duration (HH: mm)	Details of Delays & Dayworks or Other Remarks
1400	1HR	Pull 8" out as casing Parted

Additional Information

Inspection Pit:	Yes / No	Depth	Time
Permit-to-Work	Yes / No	**SSWP Read**	Yes / No
NVQ	Tick If Applies	**CSCS**	Tick If Applies

J = Jar B = Bulk P = Piston U = Undisturbed ES = Environmental (Soil) EW = Environmental (Water) K = Permeability Test V = Borehole Vane
SPT(S) = Standard Penetration Test (Open Shoe) SPT(C) =Solid Cone: Data Provided On A Separate Sheet NR = No Recovery

	Crew	Hours	Signed	Supervisor	Client	Sheet
Signatures	Marc Stephen	9½				1 / 1

AEG FORM: DRILLCP01/V1.0

Deakin Printers Ltd.

Allied Exploration & Geotechnics Limited

DRILLERS DAILY REPORT: CABLE PERCUSSION

Head Office: Unit 25, Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, County Durham, DH2 2RG. Tel: 01913874700 Fax: 01913874710
Regional Office: Unit B2 Anchorage Business Park, Chain Caul Way, Riverside Docklands, Preston, PR2 2YL. Tel: 01772735300 Fax: 01772735999

AEG

Contract Title:	Redcar Steel			**Contract No:** 4155A	**BH No:**	D
Start / Finish Time:	**Hole (m)**	**Water (m)**	**Casing (m)**	**BH Moves**		
0800	6.50	Dry	6.50	From		
1800	9.00	7.00	9.00	To		

Date:	29/11/17	**Day:**	Wed
Rig:	SA13	**Type:**	Dando
Weather:	wet		

Strata Details

From (mBGL)	To (mBGL)	Soil/Rock Description
6.50	8.00	Sandy gravel with Slag and Boulders
8.00	8.50	Black Sandy gravel
8.50	9.00	Soft Brown laminated Sandy Clay
Shift Total	2.5 m	

Samples & Tests

No	Type	In-Situ Test	Depth From	Depth To	Undisturbed Blows	Undisturbed Rec	Casing (mBGL)	Water (mBGL)
3	J		8.20					

Groundwater Information (Inflow Terms: Slight, Slow, Moderate, Heavy, Artesian)

Time	Depth (mBGL)	Casing (mBGL)	Inflow	5 min	10 min	15 min	20 min	Sealed (mBGL)

Casing / Hole Details

Casing (C) Hole (H)	Diameter (mm)	From (mBGL)	To (mBGL)
C	200	6.50	9.00
H	200	6.50	9.00

Chiselling

From (mBGL)	To (mBGL)	Time Start (HH:mm)	Duration (HH:mm)
6.50	8.50	8.30	3HR

Water Added

From (mBGL)	To (mBGL)	Amount

Backfill Details

Type	From (mBGL)	To (mBGL)

From Time	Duration (HH: mm)	Details of Delays & Dayworks or Other Remarks
13.00	1H30	install Pipe + Pull 8" and 10"
1430	30min	DropT Pack Rig
1500	2HR	Standing waiting on site induction

Additional Information

Inspection Pit:	Yes / No	Depth	Time
Permit-to-Work	Yes / No	**SSWP Read**	Yes / No
NVQ	Tick If Applies	**CSCS**	Tick If Applies

J = Jar B = Bulk P = Piston U = Undisturbed ES = Environmental (Soil) EW = Environmental (Water) K = Permeability Test V = Borehole Vane
SPT(S) = Standard Penetration Test (Open Shoe) SPT(C) =Solid Cone: Data Provided On A Separate Sheet NR = No Recovery

	Crew	Hours	Signed	Supervisor	Client	Sheet
Signatures	Marc Stephen	9½				1/1

AEG FORM: DRILLCP01/V1.0

Allied Exploration & Geotechnics Limited

DRILLERS DAILY REPORT: INSTALLATION RECORD

Head Office:	Unit 25, Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, County Durham, DH2 2RG.	Tel: 01913874700	Fax: 01913874710
Regional Office:	Unit B2 Anchorage Business Park, Chain Caul Way, Riverside Docklands, Preston, PR2 2YL.	Tel: 01772735300	Fax: 01772735999

General Site Details

Contract Number:	4155A	**Contract Title:**	Redcar Steel		
Operator (s)	Marc Stephen	**Date:**	29/11/17	**BH No:**	D

Twin Groundwater/Gas Piezometer/Standpipe Installation

COVER: FLUSH / RAISED
GAS VALVE / CAP
CONCRETE: mBGL

GROUT / ARISINGS: mBGL

SEAL (BP): mBGL

PIPE ID:
SLOTTED: mBGL
GEOSOCK: YES / NO

PIPE TIP: mBGL

RZ BASE: mBGL
FILTER TYPE:
GRAVEL / SAND / OTHER

SEAL (BP): mBGL

GROUT / ARISINGS: mBGL

SEAL (BP): mBGL

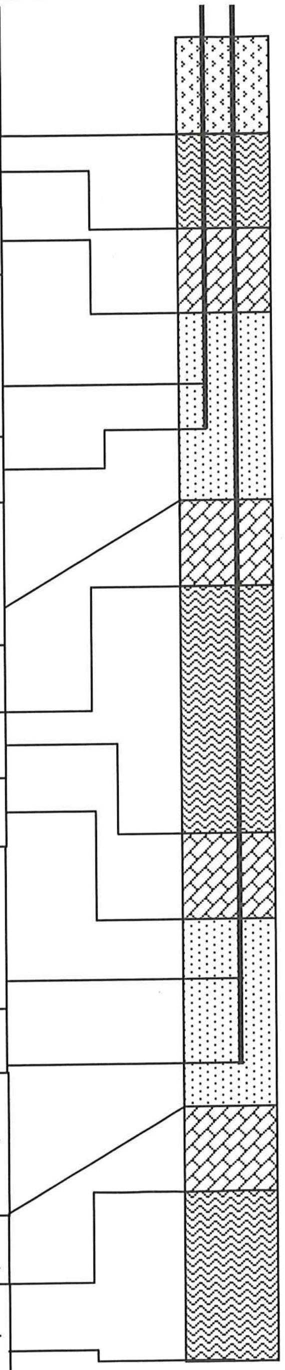
PIPE ID:
SLOTTED: mBGL
GEOSOCK: YES / NO

PIPE TIP: mBGL

RZ BASE: mBGL
FILTER TYPE:
GRAVEL / SAND / OTHER

SEAL (BP): mBGL

GROUT / ARISINGS mBGL
BASE OF HOLE: mBGL



WATER LEVEL AFTER INSTALLATION : S: D: mBGL

Single Groundwater/Gas Piezometer/Standpipe Installation

COVER: FLUSH / [✓ RAISED]
[✓ GAS VALVE] / CAP
CONCRETE: 0.50 mBGL

GROUT / ARISINGS: mBGL

SEAL (BP): 1.00 mBGL

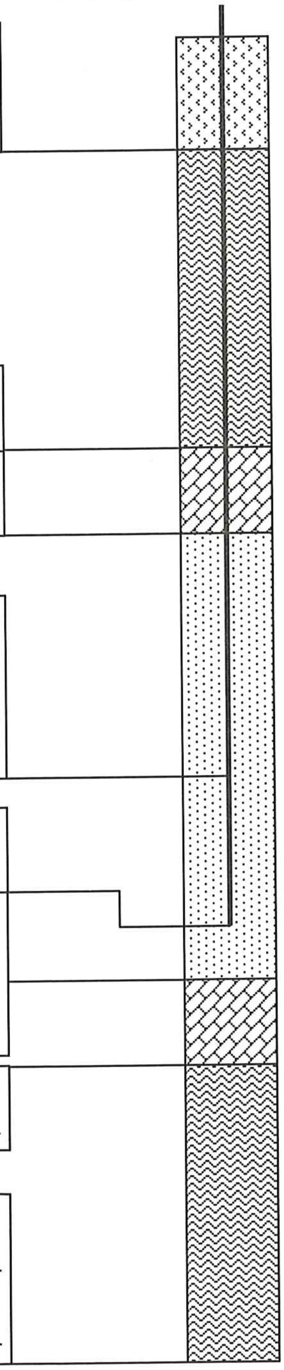
PIPE ID: 50mm
SLOTTED: 9.00 mBGL
GEOSOCK: [✓ YES] / NO

PIPE TIP: mBGL

RZ BASE / BASE OF HOLE: mBGL
FILTER TYPE:
GRAVEL / SAND / OTHER

SEAL (BP) / BASE OF HOLE: mBGL

GROUT / ARISINGS: mBGL
BASE OF HOLE: mBGL



WATER LEVEL AFTER INSTALLATION : 0 mBGL

PLEASE DELETE THE APPROPRIATE CONSTRUCTION MATERIALS ON THE INSTALLATION DRAWINGS i.e. GROUT / ARISINGS

	Operator	Client	Time Taken To Complete Installation
Signatures			1HR30

AEG FORM: DRILLCP03/V1.0

Deakin Printers Ltd.

APPENDIX D

Site Photographs

Plate 01 – Borehole BH4R Progression.

CLIENT:	South Tees Site Company	**DATE:**	January 2017
REFERENCE:	37774100	**SITE NAME:**	CQA Validation Report

ARCADIS Design & Consultancy for natural and built assets

10th Floor
Three Piccadilly Place
Manchester M1 3BN

T: 0161 245 8700
F: 0161 245 8701

Plate 02 – Slag and ash dominant Made Ground encountered during borehole progression.

CLIENT:	South Tees Site Company	**DATE:**	January 2017	Design & Consultancy for natural and built assets
REFERENCE:	37774100	**SITE NAME:**	CQA Validation Report	10th Floor Three Piccadilly Place Manchester M1 3BN T: 0161 245 8700 F: 0161 245 8701

Plate 03 – Installation of monitoring well BHD.

Arcadis (UK) Limited

1 Whitehall Riverside
Leeds
LS1 4BN
United Kingdom

T: +44 (0) 113 24 5300

arcadis.com

Appendix H6: TS4 South Bank – Phase 1 Environmental Desk Study

DATA REVIEW

TS4 South Bank – Phase 1 Geo-Environmental Desk Study

Prepared for

Homes and Communities Agency

31/08/2017

CH2M HILL United Kingdom
Dunedin House, Teesdale Business Park
Stockton-on-Tees, TS17 6BJ

Document History

Reference No: 678079_TS4_001

Client Name: Homes and Communities Agency

This document has been issued and amended as follows:

Version	Date	Description	Created by	Verified by	Approved by
1.0	31/08/2017	Final	Fiona Moore	Nathan Cummins	Ian Kirkpatrick

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Acronyms and Abbreviations

AOD	Above Ordnance Datum
BOC	British Oxygen Company, formerly Brin's Oxygen Company Ltd
BOS	Basic Oxygen Steelmaking
Bgl	Below Ground Level
BGS	British Geological Survey
CA	Coal Authority
CATS	Central Area Transmission System
DEFRA	Department for Rural Affairs
DoE	Department of the Environment
EA	Environment Agency
GIS	Geographic Information System
IPPC	Integrated Pollution Prevention and Control
LAAPC	Local Authority Air Pollution Control
LAPPC	Local Authority Pollution Prevention Control
LAIPPC	Local Authority Integrated Pollution Prevention and Control
MAGIC	Multi-Agency Geographic Information for the Countryside
NGR	National Grid Reference
OD	Ordnance Datum
PAH	Poly-aromatic hydrocarbon
PCBs	Polychlorinated biphenyls
PRoW	Public Right of Way
RCBC	Redcar and Cleveland Borough Council
SBCO	South Bank Coke Ovens
SLEMS	South Lackenby Environmental Management Site
SSI-UK	Sahaviriya Steel Industries UK
STSC	South Tees Site Company
SVOC	Semi-Volatile Organic Compound
TPH	Total Petroleum Hydrocarbons
UXB	Unexploded Bomb
VOC	Volatile Organic Compound

Executive Summary

TS4 is part of the former Redcar Steelworks site and is approximately 132 hectares in size. The Ordnance Survey (OS) National Grid Reference for the centre of the site is 453550E, 521975N (ref. Figure 1). To the north is the River Tees, with the Darlington to Saltburn railway line to the south. Smiths Dock Road broadly forms the western perimeter, with the Teesport area and SSI Tip, Impetus Tip and the South Lackenby Environmental Management Site to the east. The site is divided into two areas (ref. Figure 2), hereafter referred to as the main area and the northeast quadrant.

The northern to central areas were originally mudflats, whilst the southern comprised the south bank of the River Tees. Here South Bank Iron Works and Antonien (phosphate) Works were located. The site was reclaimed during the late 1890's, with Cleveland Salt Works located in the southern area of TS4. During the early 20th century industries including slag processing works, Concrete Works and a Galvanising Works were built on site, with tar processing and manufacturing built adjacent to the sites western boundary. By 1915 the Iron Works and many of the slag processing works had been demolished; replaced by Ore Grading Plants and Sinter Plant. This was followed by the construction of the original South Bank Coke Ovens (SBCO) and present-day By-Products Plant; the former replacing the Concrete Works. A Ferro-Manganese and Pig Casting Works were also built towards the eastern boundary of the main area of TS4, with much of the central to northern areas of the site comprised ore and coal stocking areas, linked by railway tracks and conveyors to the various plants. The original SBCO were demolished by 1978, having been replaced by the present-day Coke Ovens. Presently the northeast quadrant, and much of the eastern half of the main area of TS4 are used as stoking grounds by the Tarmac Group of Companies, which operates out of the northeast quadrant.

During WWI and WWII the manufacturing and industrial sites in Middlesbrough and around Teesside Port made the area a strategic target. The Zetica Regional Unexploded Bomb (UXB) Risk map which covers this area classifies the UXB risk to be 'moderate'; based on a "bomb density of 11 to 50 bombs per 1000 acres" and potential WWII targets. Further investigation is required to determine the site risk.

Historical investigations have encountered Made Ground of variable thickness across TS4. This is predominantly described as comprising sand, gravel, cobbles and boulders of slag, clinker, brick, concrete and ash as well as other materials, including relic foundations. The slag is sometimes referred to as pellite or granulated blast furnace, with fused slag also recorded. Deposits typically range from 1m to 7.8m thick, although deposits more than 10m thick have been encountered. Generally, the base of the Made Ground has not been proven. The underlying superficials are predominantly Tidal Flat deposits of sands and silts, with glaciolacustrine clays and silt towards the south. These may be laminated, very soft and contain traces of peat. In turn these are underlain by glacial till, which overlies bedrock of the Mercia Mudstone Formation. At considerable depth are Permian evaporate deposits which include the 25m thick Boulby Halite horizon. This has historically been exploited by brine extraction within TS4.

Although bedrock is classified as a Secondary (undifferentiated) aquifer; superficials are classified to be a Secondary A aquifer. Mill Stream flows beneath the site largely in culvert, outfalling into the River Tees. Given the origins of TS4, the potential for other culverted historical watercourses cannot be discounted.

The SSI site holds a COMAH Upper Tier Establishment classification associated with the large quantities of PAH contained within the Coke Oven Gas Main which also applies to TS4. Other COMAH products include Heavy Fuel Oil for combustion, By-Product Plant products and waste containing coal tar ('jallop') stockpiled in the former Breeze Stocking Area. Several active and inactive landfills border, or are in close proximity. This include sites accepting Special Waste, the closest being 95m east of the main area of TS4.

The features of concern include made ground, chimneys and furnaces, docklands, water treatment plants, electrical substation, transformers and oil-filled cables, garages and workshops, general

buildings, stocking ground and highway and railway infrastructure. Also of concern are the former Cleveland Salt Works, Sinter Plant, slag processing works and the various iron and steel making and galvanising sites. These may be potential sources of contamination; and include asbestos, heavy metals, PCBs, hydrocarbons, organic and inorganic compounds and soil gases.

Asbestos should be presumed to be within all Made Ground deposits, and therefore will need to be included in piling risk assessment should piles be proposed. Heavy metals, sulphates, hydrocarbons and coal tar are also present throughout the Made Ground. However, a variety of proven and established technologies are available to deal with these contaminants. Potential options include the use of clean cover systems, bioremediation and thermal desorption. The type of remediation will depend on the type, concentration and extent of contamination, and risk to potential receptors.

Certain types of slag may pose a risk to future buildings and structures due to their potential to exhibit volumetric instability. It can also weather resulting creating tufa (calcium hydroxide and calcium carbonate precipitates), which can be mobilised in surface and groundwater leading to damage to drainage infrastructure and unsightly deposits in watercourses. Slags are also characterised by elevated sulphate content, which will need to be considered when specifying concrete. Characterising the slag will enable the most problematic materials to be identified and if necessary removed; with the remaining material, mainly free of expansive slag. This slag can then be processed by crushing and blending to homogenise it, creating a usable fill. Processing the slag in this way will allow any discrete pockets of expansive materials to become disseminated with the fill. The processed slag is then allowed to hydrate over a period of months to promote any expansive reactions, before being placed in layers to distribute any remaining problem materials laterally.

By the nature of their deposition the underlying superficial Tidal Flat deposits are highly susceptible to compression resulting in excessive settlement, whilst their high organic content would also likely lead to long term secondary compression. This will need to be considered within the design of any future developments on site.

Introduction

CH2M was commissioned in May 2016 by the Homes and Communities Agency to undertake a Development Viability Assessment, largely comprising desk top technical studies, on the former Redcar (Sahaviriya Steel Industry (SSI)) Steelworks, following the site closure in October 2015. The SSI assets are currently in the hands of the Official Receiver, and permission to access the land and the information database held on site was granted in November 2016. The scope of the DVA was subsequently widened to include land in the ownership of TATA Steel, which is situated within the proposed South Tees Development Corporation (STDC) area, to inform the emerging Masterplan.

This document reports on a Phase 1 geo-environmental desk study, including site walkover surveys undertaken in March 2017, which aimed to review all information available pertaining to ground conditions and contaminated industry indicators, giving an overview of the existing ground conditions, including consideration of asbestos, and making recommendations for further studies and physical ground investigation works to inform future development of the wider STDC area.

1.1 Terms of Reference

This report is based on the information that has been acquired and/or made available to us via the various searches and consultations undertaken as part of the Desk Study exercise. In some cases anecdotal information has been relied upon, where documented evidence has been lacking.

The conclusions drawn in the report are considered correct although any subsequent additional information may allow refinement of the conclusions. It should be noted that:

- The report has been prepared in accordance with the instructions of our client, the Homes and Communities Agency, for their sole and specific use, or, by prior agreement, any party to whom the client is permitted to assign or transfer its rights under its contract with CH2M. Any other persons who use any information contained herein do so at their own risk.
- All work carried out in preparing this report has utilised and is based upon CH2M's current professional knowledge and understanding of current relevant UK standards and codes, technology and legislation. Changes in this legislation and guidance may occur at any time in the future and cause any conclusions to become inappropriate or incorrect. CH2M does not accept responsibility for advising the Homes and Communities Agency or other interested parties of the facts or implications of any such changes.
- This report has been prepared using factual information contained in maps and documents prepared by others. CH2M can accept no responsibility for the accuracy of such information.

This site forms part of the wider South Tees Development Corporation area, covering some 4,500 acres, and this report refers only to the area designated as TS4, referred to from now on as "the site".

1.2 Site Location and Description

TS4 is part of the former Redcar Iron Works site and comprises approximately 132 hectares of mixed use industrial land. The site has a long industrial history, including iron and steel making, metal galvanising, concrete manufacturing and slag processing. The National Grid Reference (NGR) for the centre of the site is approximately 453550E, 521975N, and its location is shown on Figure 1. The site is located south of the River Tees and north of the Tees Valley railway line (also known as the Darlington to Saltburn line). Smiths Dock Road broadly forms the western perimeter with the area of Teesport and the landfill sites of SSI Tip, Impetus Tip and the South Lackenby Environmental Management Site (SLEMS) bordering TS4 to the east. The site is irregular in shape with the main area broadly rectangular in form and comprising approximately 90hectares. This is subsequently referred to as the main area of TS4. An approximately rectangular area of land of around 42hectares extends out from the northeast corner of the main area of TS4 and is subsequently referred to hereafter as the northeast quadrant; ref Figure 2. Although largely derelict, the site is cross-cut by a number of roads, rough tracks and stockpiles. The Tarmac Group of Companies (Tarmac) occupies the northeast quadrant, as well as a Fuel Oil Depot located on the northern boundary. Stockpiles associated with Tarmac dominate the western section of the main area of TS4.

North of the River Tees is the industrial area of Seal Sands, with light industrial and residential areas of South Bank and the A66 Trunk Road located south of the Tees Valley railway line. Teesport Commerce Park and docklands are located west of Smiths Dock Road.

Sources of Information

The following sources of information have been consulted in the preparation of this report.

2.1 Landmark

Environmental data from government agencies was provided by Landmark Group Ltd in GIS format order ref 90671997.

2.2 Environment Agency

Information on flood risk, hydrology and hydrogeology and landfills was obtained from the Environment Agency (EA) at: http://apps.environment-agency.gov.uk/wiyby/default.aspx.

2.3 Multi-Agency Geographic Information for the Countryside

Multi-Agency Geographic Information for the Countryside (MAGIC) is a partnership project involving the Department for Environment, Food and Rural Affairs (DEFRA), Historic England, Natural England, Environment Agency, Forestry Commission and Marine Management Organisation. The MAGIC website http://magic.defra.gov.uk/MagicMap.aspx provides geographic information about the natural environment from across government. The information covers rural, urban, coastal and marine environments across Great Britain. It is presented in an interactive map which can be explored using various mapping tools that are included. Users do not require specialist software and can access maps using a standard web browser.

2.4 British Geological Survey (BGS)

Geological mapping and published exploratory hole logs have been reviewed via the British Geological Survey (BGS), via the online GeoIndex database. The data is listed in the following table:

Table 2-1 – British Geological Survey references

Title	Information
BGS Sheet 33: Solid and Drift (Stockton)	Geological information, solid and drift at 1:50,000 scale (1987)
BGS 1:50,000 scale GeoIndex Onshore (online resource)	Superficial and solid geology, faults and other linear features.
Historical boreholes within or adjacent to the site A number of logs are confidential or not available for review.	1973 – Tees Crossing NZ52SW15054/AS10, NZ52SW15054/AS8, NZ52SW15054/AS6, NZ52SW15054/AS4, NZ52SW15054/AS2; 1992 – Reclamation NZ52SW633, NZ52SW634, NZ52SW640, NZ52SW641; 1996 – Coke Ovens NZ52SW965, NZ52SW966, NZ52SW967, NZ52SW968, NZ52SW969, NZ52SW970, NZ52SW971, NZ52SW972. Other NZ52SW143/A, NZ52SW143/B, NZ52SW143/C; NZ52SW136/A, NZ52SW136/B, NZ52SW136/D, NZ52SW136/E.

Historical logs NZ52SW143/A, NZ52SW143/B and NZ52SW143/C, sunk along the channel of the River Tees and NZ52SW143/A, NZ52SW143/B, NZ52SW143/D and NZ52SW143/E located around the northern boundary have been discounted from this review. This is due to the poor quality of the logs/information provided. The locations of the historical exploratory holes are shown on Figure 3.

2.5 Redcar and Cleveland Borough Council

High resolution aerial photography was provided by Redcar and Cleveland Borough Council (RCBC). Aerial photography dated 2000 and 2012 covers the area of TS4 and was provided by RCBC as a GIS database.

2.6 SSI (UK)

Historical site information and site plans were obtained from the Sahaviriya Steel Industries UK (SSI UK) ‘Cabinet’ site records; (SSI UK, formerly Corus, formerly British Steel). Where other previous reports have been obtained, these are listed in Section 2.9. Drawings used in this report are listed in the following table.

Table 2-2 – Site plans referring to TS4

Drawing name	Drawing Ref.	Author/Company	Date	Data
General				
General Layout of Services and Buildings for Planning Permission	1X-5952	British Steel Corporation	Dec 1966	General layout of buildings and services
Cleveland – SBCO – Layout and Plans – Ovens/By-Products – Layout of SBCO & By-Products Plant	W116952 (Rev. A)	Corus Teesside Works	Apr 1968 (Rev. A May 1998)	Detailed building layout of the SBCO and By-Products Plant

Drawing name	Drawing Ref.	Author/Company	Date	Data
Dockside Road Phase 2 Route alignment Details	F/M-63581	County of Cleveland	Jan 1989	Plan identifies key features of the wider, former BSC site including pipelines and sewers.
Buildings - General				
South Bank – Coke Ovens – Buildings – Battery Welfare Block Wash/Shower Room Refurb	A109672 (Rev. A)	BSC General Steels – Teesside Works	Feb 1989 (Rev. A Mar 1994)	General layout of Battery Welfare Block, including details of removal of Asbestolux ceiling tiles.
Cleveland – SBCO – miscellaneous Buildings – Car Jet Washing Facilities – Civil works for New Car Jet Wash Facility	A117132	British Steel Teesside Works	Oct 1998	Location of temporary Contractor Village, associated utilities, car wash facilities and areas of hard standing
Chimneys				
General Works and Plans - Location of Chimneys and Stacks	X-97498 Rev. B	Corus Teesside Works (British Steel plc)	Jan 1981, revised Aug 1998	Location of Chimneys and Stacks referenced as CCS26 to 30 Layout of the site as of 1998
Proposed Layout of New Boiler House for South Bank Coke Ovens	CO10782	Forge House Engineering	Oct 1995	Layout details of Boiler House including details of Water Treatment Plant and Oil Fuel Storage Tank.
Conveyors				
South Bank coke Ovens – 88 Wilputte Ovens – Coal Handling Plant – Con. W1 & W2 GTU Trestles Design	CO8297 (Rev. A)	Birtley Engineering Limited Chesterfield Derbyshire England	Oct 1969	Details of gravity take-up trestles for conveyors
Cleveland – SBCO – Coal Conveyors – Wilputte Ovens – Foundations – Layout of Bases and Pile Caps for Conveyors W1, W2 and W3	A38513 (Rev. C)	Dorman Long (Steel) Ltd – Central Engineering Department - Middlesbrough	Dec 1969 (Rev. C Jan 1970)	Details of the conveyors and foundations transporting coal to SBCO
Cleveland – SBCO – Coal Conveyors – Wilputte Ovens – Foundations – Pile Bases T4, T5 and T6 for Conveyors W1, W2 and W3	A38645 (Rev. F)		Dec 1969 (Rev. F Aug 1972)	

Drawing name	Drawing Ref.	Author/Company	Date	Data
South Bank – Details of Junction House No. 2	CO2034	Simon-Carves Ltd Stockport – Coke Oven and Washer Department	Oct 1955	Details of junction houses of conveyors
South Bank – Coke Oven Plant – Coke Handling Plant – General Arrangement of No. 1 Junction House	CO3871			
South Bank – Coke Oven Plant – Coke Handling Plant – General Arrangement of No. 2 Junction House	CO3876 CO3877		Nov 1955	
Docklands – Dolphins, Jetties and Wharfs				
South Bank Wharf – Ore Handling – Lay-by No.6 Berth – Mooring facilities and limits for fuel oil importation	A97435 Rev. C	British Steel Corporation	Jan 1981 Revised Nov 1982 and May 1983	As-built drawing
General Arrangement of Mooring Dolphin and Location Plan	7A-12816 Rev. K	Dorman Long (Steel) Ltd Middlesbrough Central Engineering and Plant Construction Dept.	Dec 1960	Cross-section of construction of Dolphin at South Bank Wharf, including ground model based on boreholes drilled by Cementation & Co Limited; July 1958.
South Bank Wharf – Details of Mooring Dolphin	7A-12817 Rev. H	Dorman Long (Steel) Ltd	Jan 1959 Revised Jul 1981	Construction details of Dolphins associated with South Bank Wharf
General arrangement of skid dolphin and walkway to no.5 berth extension	7A-13420 Rev. A		Nov 1959	Construction details of Dolphins associated with South Bank Wharf
Details of skid dolphin – sheet 1 of 2	7A-13421 Rev. A		Dec 1959	Construction details of skid dolphin on South Bank Wharf
Details of skid dolphin – sheet 2 of 2	7A-13422 Rev. B		Dec 1959	Construction details of skid dolphin on South Bank Wharf
Arrangement and details of walkway between skid dolphin and no.5 berth extension – sheet 1 of 2	7A-13423 Rev. A		Dec 1959 Revised Jul 1971	Construction details for South Bank Wharf
Arrangement and details of walkway between skid dolphin and no.5 berth extension – sheet 2 of 2	7A-13424 Rev. A		Dec 1959 Revised Jul 1971	Construction details for South Bank Wharf

Drawing name	Drawing Ref.	Author/Company	Date	Data
General Plan of Wharf – South Bank Wharf	7A-17661 Rev. B		Jan 1966	Layout details of South Bank Wharf.
Electrical Sub-stations				
8511 Teesside Works – 136 Redcar Primary Processes – Services – 5002 Electricity Distribution	5002-E7221	British Steel	Sept 2016	Location of electrical Sub-stations within TS4 and the wider SSI site.
Teesside – South Bank Coke Ovens By-Products – Davenport Cooler Fan No's 1-8 Indication Interface	EA37551	British Steel SP and CS Teesside Works	Oct 1994	Details of Davenport Sub-station
Teesside – South Bank Coke Ovens By-Products – Davenport Cooler Fan No's 9-10 Bunker Water Signal Interface (Salt House Sub-station)	EA37552		Oct 1994	
Lackenby – Central Wroskhops – Workshops and Stores Compex – Main sub-station at new electric Shop	EA2703	British Steel Corporation – Teesside Division – Development Department	<Aug 1976	
Davenport Motor Control Centre One Line Diagram	ECO3876 (Rev. 1)	John Brown Engineering Ltd – Panels and Systems	Feb 1997	Details of Davenport Sub-station
Davenport 440v Motor Control Centre – General Arrangement	ECO3880 (Rev. 3)		Dec 1996 (Rev. 3 May 1998)	
Main Sub-station – General Arrangement of Extension	15903	Skinningrove Iron Co. Limited	Jun 1961	Details of layout of extension to the Main 11kV Sub-station.
Main Sub-station of Steelwork for Extension	15920 15923		Jul 1961	Details of foundations and piles to extension of Main 11kV Sub-station
Exploratory Hole Location Plans				
Dockside Road Phase 2 Preliminary Site Investigation Details location of Boreholes and Trial Pits	F/M-63263	County of Cleveland	January 1988	Plan identifies key features of the wider, former BSC site
Exploratory Hole Location Plan – Site C	SS/EPST/042	Halcrow (One North East)	July 1999	Location of exploratory holes sunk for the 1999 investigation.

Drawing name	Drawing Ref.	Author/Company	Date	Data
Fuel				
Area 1 - Potentially polluting substances and relevant activities	A119581	Corus Teesside Works	-	Includes Diesel Storage areas.
South Bank – coke Ovens – Arrangement and Details of Petrol Store at SBCO Works Entrance	9A389	Dorman Long (Steel) Ltd Middlesbrough – Central Engineering and Plant Construction Department	Jul 1966	Details of petrol store near entrance
Hazardous Substances				
Cleveland – General – Works Plan – Plans and Works Layout – SBCO Hazardous Substances	A124443	Sahaviriya Steel Industries	July 2012	Location of SBCO hazardous substances
Garages and Workshops				
South Bank – Coke Ovens – SBCO – Arrangement and Details of Foundation for 3CWT Steam Hammer in Wagon Repair Shop	9A299 (Rev. F)	Dorman Long (Steel) Ltd Middlesbrough - Central Engineering and Plant Construction Department	Mar 1963 (Rev. F Feb 1972)	Details of the foundations of the Wagon Repair Shop
Highways				
Setting Out of Roads Near Riverside Pump House	7A-10898	Dorman Long (Steel) LTD Middlesbrough	Sep 1957	Plan identified road layout and buildings around Riverside Pump House on the south bank of the River Tees, as well as the pipes running to and from the pump house.
General Works Layout – SSI-TATA Transaction – SBCO future Development and Land Transfer Plan	A-123842	TATA Steel	Feb 2011	Base map showing building outlines and roadways
Iron and Steel Making – SBCO – By-Products Plant				
Connections for Schematic Arrangement for South Bank Coal Handling Plant	ECO513 (Rev. 4)	Allen West and Co Ltd, Brighton	Jul 1956 (Rev. 4 May 1983)	Limited details of the layout of the Coal Handling Plant
Cleveland – SBCO – External Works – Scrubber Square – Civil Engineering Works – Road Slabs	A117919	British Steel – Sections Plates and Commercial Steels – Teesside Works	Feb 2000	Layout details of the gas scrubbers and washers of the By-Products Plant
Redcar – Coke Ovens – Tar and Liquor	A96466 (Rev. B)	British Steel Corporation – Teesside Division	July 1980 (Rev. B Sept 1981)	Details of Tar Decanter

Drawing name	Drawing Ref.	Author/Company	Date	Data
Separation – Secondary Tar Decanters – Arrangement of Tar Decanter Skip and Lorry				
Cleveland – SBCO – Layout – By-Products – ATEX Classification Area	A119195	Corus Teesside Works	Jul 2002	Detailed layout and list of the plant equipment located within the By-Products Plant; including storage tanks containing contaminative materials.
GA of modification to Existing By-products plat at South Bank Middlesbrough - Plan	CO9879	Gibbons Brothers Ltd	Mar 1971	Layout details of Secondary Cooler located east of the By-Products Plant
South Bank Coke Ovens Refurbishment of the Gas Exhauster House	CO10799 (Rev. A)	Harkin Associates – Construction Consultants	Nov 1994 (Rev. A Dec 1994)	Layout details of the building
BSC South Bank	CO10057	Otto-Simon Carves Ltd	Mar 1966	Layout of plant drainage and roadways
Proposed Layout of New Tar Decant System	CO10216		Jan 1977	Details of Tar Decanter Plant
Cleveland – SBCO – Services – Gas Holder – Gas Holder – General Arrangement	A125272	Sahaviriya Steel Industries	Jun 2015	Details of Gas Holder
South Bank - 2No. Tar Storage Tanks	CO11782 (Rev. C)	Service Welding Limited	Jan 2000 (Rev. C Feb 2000)	Details of Tar Storage Tanks within the Tar Decanter Plant
Dorman Long South Bank Coke Oven Plant (By-Plant) – General Arrangement of Exhauster	CO165 (Rev. E)	Simon-Carves Ltd Stockport – Coke Oven and Washer Department	Jun 1953 (Rev. E Jun 1956)	General arrangement of the Exhauster House.
Dorman Long south Bank Coke Works By products – Concrete formwork For Scrubber Pumps in Secondary Condenser Pumphouse	CO4741		Jul 1953	Cross-section and plan view of Secondary Condenser Pump House, including tranches leading to and beneath the structure.
Dorman Long south Bank Coke Works By products - Arrangement of Benzol Scrubber Pumps Delivery Lines Sec Cond. P/H	CO739 (Rev. C)		Aug 1953	Arrangement of Benzol Scrubber Pumps and delivery lines within the By-Products Plant

Drawing name	Drawing Ref.	Author/Company	Date	Data
Dorman Long – South Bank – Arrangement of Drains and Water Services Entering By-products Plant Pipe Reservation	CO1721		Jun 1954	Arrangement of drains and water services entering By-products plant, including details of service bunkers.
Dorman Long south Bank Coke Works By products – concrete foundations for Crude Benzol Pumphouse	CO4607		Sep 1954	Details of the Crude Benzol Pumphouse within the By-Products Plant
Dorman Long south Bank Coke Works By products – Arrangement of Benzol Pumphouse	CO4619		Mar 1955	
Dorman Long south Bank Coke Works By products – Arrangement of Benzol Pumphouse Drains	CO4620		Apr 1955	
Dorman Long – South Bank Coke Works By-products – Arrangement of Pipe Trenches – electric Trenches and Drain at By-Products Plant.	CO5969		Nov 1954	Layout of the central area of the By-products Plant, including details of drains and tanks.
Dorman Long – South Bank Coke Works By-products – Detail of Drainage to Plant	CO879 (Rev D)		Mar 1955 (Rev. D)	Details of drainage of the By-products Plant including details of vale pits, deep manhole chambers and trenches
	CO880 (Rev. H)		Apr 1955 (Rev. H July 1957)	Layout of By-Products drainage system
Dorman Long – South Bank Coke Works By-products – Arrangement of Foul Effluent Drains	CO4535		Dec 1956	Layout of By-Products foul water effluent drainage system
Iron and Steel Making – Ferro-Manganese Plant				
Bessemer Ironworks – No.5 Blas Furnace – Pig Casting Machine	F/C53178 Rev. A	Ashmore, Benson, Pease and Co. Ltd (BSC Teesside)	Mar 1971 Revised May 1972	As built drawings of Bessemer Ironworks detailing the arrangement of the Ferro-Manganese Plant and Pig Casting Machine

Drawing name	Drawing Ref.	Author/Company	Date	Data
Bessemer Iron Works - No 5 furnace Reconstruction – Hot Metal and Slag Runners – Layout of Rail Tracks and H.M. runners	A-37718 Rev. D	Dorman Long (Steel) LTD Central Engineering Department Middlesbrough	Sep 1969	Layout of the Bessemer Ferro-Manganese Plant
Iron and Steel Making – South Bank Coke Ovens				
Cleveland – South Bank coke Ovens – Oven Battery – Under Firing Gas Main – Arrangement of East Battery	CO11800 CO11801 (West battery)	British Steel General Steels – Teesside Works	Dec 2000	As-built drawings of the arrangement of the under firing gas main beneath the east and west batteries of the SBCO
Cleveland – SBCO – Layout – Ovens Battery – ATEX Area Classification	A119193	Corus Teesside Works	Jul 2002	Layout of the Ovens Battery of South Bank Coke Ovens, including basement level
GA and Details of Hot Coke Car Track	CO8399 Rev. E	Gibbons Brothers Ltd	Mar 1970 (Rev. E Mar 1971)	Layout of Coke Car Tracks - SBCO
Cross Section through Batteries of Wilputte Coke ovens	CO8590 (Rev. B)	Gibbons Bros Ltd	Sep 1969 (Rev. B Mar 1970)	Cross- section through SBCO
Coke Works – Middlesbrough – GA to Coke Car Track Foundations	CO8618 Rev. G	Holst and Co Ltd	Mar 1970 Rev. G Aug 1970	Layout of Coke Car Tracks - SBCO
BS Southbank coke Ovens Coke Side Emissions Control System Elevation and Plan of Battery	CO11013 Rev. P3	John M Henderson and Co Ltd	Mar 1995 Rev. P3 Nov 1997	
Dorman Long South Bank – General Arrangement of Coke Car Track	CO5486 Rev. D	Simon-Carves Ltd Stockport – Building Department	Feb 1954 (Rev. D Nov 1954)	Layout of Coke Car Tracks of original coke Ovens which were retained as part of the SBCO infrastructure
Cleveland – SBCO – Drainage – Detailed arrangement of surface water drainage for Wilputte Ovens Plant	A39456 (Rev. D)	-	May 1970 (Rev. D Sep 1970)	Drawings details surface drainage arrangement and details of underground chambers, including the waste heat flue and culvert for gas main,
Dorman Long Steel Ltd Cleveland – South Bank Coke Oven Plant – Details of foul Gas Main at Wilputte Plant	CO8220 (Rev. B)	Teesside Bridge and Engineering Limited, Middlesbrough	Nov 1969 (Rev. B Feb 1970)	Details of Foul Gas Main of south Bank Coke Ovens

Drawing name	Drawing Ref.	Author/Company	Date	Data
Cross-section thru Battery	CO7804 Rev. F	Wilputte Coke Oven Division – Allied Chemical Corporation	- Rev. F Sep 1968	Cross-section through the original Coke Ovens on site.
Gas Main and Pipe Bridges				
Cleveland – SBCO – Layout – Pipebridge – ATEX Area Classification	A119194	Corus Teesside Works	Jul 2002	Pipebridge locations and arrangement north of the SBCO.
Cleveland – SBCO – Buildings – Main Water Pump House – Arrangement of Extension to Main Water Pump House	A92297 Rev. D	British Steel Corporation – Teesside Division – Development Department	Jun 1978 (Rev. D)	Layout details of Main Water Pump House within the By-Products House.
Layout of Riverside Pump House	2C-928	DL and Co. Central Engineering Department	Feb 1954	Layout details of Riverside Pumping Station on the south bank of the River Tees
General Layout of Services and Buildings for Planning Permission	1X-5952	British Steel Corporation	Dec 1966	General layout of buildings and services
South Bank Wharf – Ore Handling – Lay-by No.6 Berth – Mooring facilities and limits for fuel oil importation	A97435 Rev. C	Shell UK LTD Teesport	Jan 1981 Revised Nov 1982 and May 1983	As-built drawing
Railway Lines				
Layout of Cleveland Works North of British Railways (Sheet 1)	7A-13164	Dorman Long (Steel) LTD Middlesbrough	June 1958	Layout of the buildings and sidings associated with SBCO
Layout of Cleveland Works North of British Railways (Sheet 2)	7A-13165		June 1958	Layout of the buildings and sidings associated with SBCO
Layout of Cleveland Works North of British Railways (Sheet 3)	7A-13166		August 1958	Layout of the buildings and sidings associated with SBCO By-Products Plant
Layout of Cleveland Works North of British Railways (Sheet 4)	7A-13167		August 1958	Layout of the buildings and sidings associated with the Blending Plant of the SBCO
Layout of Cleveland Works North of British Railways (Sheet 5)	7A-13168		August 1958	Layout of the buildings and sidings associated with the northern end of the SBCO By-Products Plant

Drawing name	Drawing Ref.	Author/Company	Date	Data
Layout of Cleveland Works North of British Railways (Sheet 6)	7A-13169		August 1958	Layout of the coal Stocking area associated with the SBCO
Layout of Cleveland Works North of British Railways (Sheet 7)	7A-13170		August 1958	Layout of the coal Stocking area associated with the SBCO
Layout of Cleveland Works North of British Railways (Sheet 7)	7A-13172		August 1958	Layout of the area around South Bank Wharf
Layout of Cleveland Works North of British Railways (Sheet 8)	7A-13173		August 1958	Layout of the northwest area of the site
South Bank – Coke Oven – MDO – Setting Out Details for Railways – South Bank Coke Oven Plant – Section 1	7A5543 (Rev. D)	Dorman Long (Steel) Ltd Middlesbrough – Plant Construction Department	- (Rev. D May 1958)	Layout of railway lines and sidings
Ordnance Survey				
Ordnance Survey 1:1,250 scale	NZ 5321 SW	Ordnance Survey	June 1952	Historical map partially covering the southwest corner of the site showing the Concrete Works and adjacent Tar Distillation Works ad Basic Slag Works west of Smiths Dock Road
Ordnance Survey 1:1,250 scale	NZ 5321 NW		April 1958	Historical map partially covering the SBCO By-Products Plant and coal Stocking Area
Ordnance Survey 1:1,250 scale	NZ 5321 NE		July 1952	Historical map partially covering the former Sinter Plant and Ore Grading Plant
Ordnance Survey 1:1,250 scale	NZ 5321 NE		April 1958	Historical map partially covering the former Sinter Plant
Ordnance Survey 1:1,250 scale	NZ 5321 NE		February 1977	Historical map partially covering the former Sinter Plant and SBCO By-Products Plant
Ordnance Survey 1:1,250 scale	NZ 5322 SW		December 1967	Historical map partially covering South Bank Wharf, Riverside Pump house and the former Benzole Plant

Drawing name	Drawing Ref.	Author/Company	Date	Data
Utilities				
Surface Drainage at By-Products Plant	A-85879	British Steel Corporation	May 1975	Details of surface drainage around the By-Products Plant
300 NS Fuel Oil Line from Shell Oil (UK) Teesport to BSC Oil Depot – Layout through Tarmac area to BSC	OH10120 Rev. B	Shell UK LTD Teesport	Dec 1979 Revised June 1980 and September 1980	Details of Tarmac Wharf located east of South Bank Wharf and fuel oil pipelines
Services Distribution – Teesside Site	NZ 530 220	Corus	September 2006	Services distribution
Services Distribution – Teesside Site	NZ 530 225		September 2006	Services distribution – South Bank Wharf and adjacent Dolphin Wharf
Services Distribution – Teesside Site	NZ 535 220		September 2006	Services distribution – Ferro-Manganese Plant and Pig Casting Machine area
Services Distribution – Teesside Site	NZ 535 225		September 2006	Services distribution – Fuel Oil Storage Tanks and Tarmac area
Services Distribution – Teesside Site	NZ 535 230		September 2006	Services distribution – Tarmac Wharf
Site condition Report - Area 2 – Potentially polluting substances and relevant activities	A119582 D1.2		-	Identification of potential sources of contamination – Eastern end of south Bank Wharf and Dolphin Wharf

2.7 Coal Authority

The Coal Authority database http://mapapps2.bgs.ac.uk/coalauthority/home.html was reviewed to identify risks from historical coal mining at the site.

2.8 Zetica

An indicative Unexploded Bomb (UXB) risk map has been obtained from Zetica. This was a preliminary assessment of risk based on historical site uses. No further information is available at this time pertaining to UXO risk at the site.

2.9 Previous Studies

Table 2.3 outlines the previous studies which have been made available for the site.

Table 2-3 – Previous studies undertaken within TS4

Document title and date	Author (client)	Information summary	Document reference in this report.
Misc. Logs – 1958 to 1966	Cementation & Co Limited	Borehole logs from ground investigation for construction of South Bank Wharf; south bank of River Tees. Borehole sunk off-shore from the river bank	BGS logs Other historical logs are available for this period, however no location plan or co-ordinates have been made available
"South Tees Industrial Area – Site C – Ground Investigation Report" July 1999	Allied Exploration and Geotechnics Limited (English Partnerships)	Borehole logs and geotechnical and geo-environmental laboratory testing for the north west quadrant of the site.	1999 investigation
"Soil and Groundwater Baseline Characterisation Study Teesside Works" June 2004	Enviros (Corus UK Ltd)	Factual report of a ground investigation of the Teesside Works which includes the area of Cleveland Works within which TS4 is located.	2004 investigation
"Soil and Groundwater Baseline Characterisation Study Teesside Works" June 2004	Enviros (Corus UK Ltd)	Interpretative report on the ground investigation of the Teesside Works which includes the area of Cleveland Works within which TS4 is located.	2004 interpretative report
Report into the condition of South Bank Coke Ovens in preparation for keeping it safe.	SSI UK Ltd	The report provides a brief history and function of the plant and how it operated and the legacy following closure.	SSI UK SBCO 2016
Report into the condition of the Electrical Infrastructure in preparation for keeping it safe.	SSI UK Ltd	The report provides a brief history and function of the electrical infrastructure various workshops around the site and the legacy following closure.	SSI UK EI 2016

The list may not be definitive, but includes all data that was available at the time of writing.

Site Information

3.1 Introduction

The following information has been obtained from the data sources listed in Section 2.

3.2 Historical Development

The historical development of the site is detailed in Table 3.1. The main historical features associated with TS4 are highlighted on Figure 4.

Table 3-1 – Historical development of TS4

Mapping Date	Map Scale	Site Use
1894-95	1:2,500	The northern to central areas of the site are mudflats, cross-cut by numerous small channels which flow north towards the River Tees. The High Water Mark crosses the central to southern half of the site, marking the southern limits of the flats. A large sand bank extends across the far north-eastern quadrant of the site. Eston Jetty and Clay Lane Jetty (railways lines) cross the mudflats in the western area of the site, serving Eston Wharf and Clay Lane Wharf on the south bank of the Tees. Tracks from both jetties run south, connecting with Clay Lane Iron Works and Clay Lane Slag Works, south of the site. Numerous east/west aligned railway lines and sidings cross the southern area of the main area of the site, connecting South Bank Iron Works in the south-eastern corner of TS4, with other areas in the site. Two reservoirs and a sluice are recorded east of the iron works, and a clay pit 130m northwest of the works. The area around the pit is classified as mudflats, however locally material has been placed creating embankments. Adjacent to the eastern boundary, north of the iron works is Antonien Works (phosphate), from which a series of north/south aligned railway lines connect with those within the far south of the site. Undeveloped mudflats are to the east of TS4, crossed by occasional railway lines and sidings. The NER Darlington and Saltburn line borders the southern boundary, with the area of South Bank beyond. This includes Clay Lane Iron Works, Clay Lane Slag Works (100m to 200m to the south) referred to above; and Cleveland Iron Works and Cleveland Steel Works (located 120m south to southeast).
1899-1915	1:2,500	The northern to central area of the site have been reclaimed, whilst the rest remaining as mudflats. Clay Lane and Eston wharfs have been replaced by South Bank Wharf, which extends from the northwest corner to the centre of the northern boundary. Railway tracks run along the wharf, connecting to the bank at the centre and either end. A Travelling Crane runs along the wharf. Eston and Clay Lane jetties are not shown, with a new railway line crossing the western part of the main area of the site and connecting to sidings in the northwest corner of the site. At the east end of the wharf the railway line continues southwest towards two new travelling cranes located in the central to northern part of the site. Many north/south aligned sidings are located in the eastern part of the main area of the site. Riverside Pumping Station is located northeast of South Bank Wharf on the south bank of the river, beyond which and continuing along the bank are a series of dolphins. A large, undefined building and chimney are located immediately south of the pumping station. East is an undefined channel which extends south-eastwards from the River Tees and towards the eastern boundary. Antonien Works is now a Basic Slag Works.

		The reservoir south of South Bank Iron Works has been infilled, and the second extended eastwards. Cleveland Salt Works is shown adjacent to the southern boundary, immediately west of South Bank Iron Works. The buildings occupied by the Salt Works are shown on earlier maps but have not previously been defined. A shaft is recorded between the Salt Works and the Iron Works, with others recorded 70-120m south of the site. Brine Tanks and Brine Wells are recorded approximately 200m north of the Salt Works; and are served by a single track which connects to the railway sidings in the south. A new railway line runs sub-parallel with the south-western boundary. A pond is located in the far south-western corner of the site, east of which is a Concrete Works. This is also connected to the railway line running across the southern part of the site Smiths Dock Road has been constructed as per its present day alignment; forming the south-western site boundary. A Basic Slag Works and Slag Wool Works are located west of the southwest corner, beyond which (approximately 210m from the site) there is a 1899. The area east of the main site, although reclaimed is largely undeveloped, with the exception South Bank Works (slag); located 375m to the east, and its associated railway lines and sidings which connect it with TS4.
1915-29	1:2,500	Previously undefined buildings along the northwest border, south of South Bank Wharf are now shown as Eston Sheet and Galvanising Works. Two chimneys associated with the works border the site. A number of jetties have been built along the south bank of the River tees. The two, large, rectangular reservoirs located within the western area of the site are no longer shown. A new north/south aligned Travelling Crane Gantry and associated railway line cross the centre of the site, connecting the Brine Wells with South Bank Wharf. A Travelling Crane and two Metal Breakers are shown amongst the railway sidings in the eastern area of the site. The Basic Slag Works, formerly Antonien Works has increased in size. Although the Brine Tanks remain, the adjacent Brine Wells are now inactive, Cleveland Salt Works is disused and the shafts are no longer shown. A Travelling Crane, Tanks and Chimneys are noted around South Bank Iron Works. A Slag Brick Works has been built in the southwest of the site, northeast of the Concrete Works. Tanks are shown in the Slag Brick Works, with a new crane shown in the Concrete Works site. Several buildings defined as Teesport have been built adjacent to the northeast boundary. South Bank (slag) Works east of the site and its associated railways lines are no longer shown, although a new Slag Reduction Works and associated railway lines has been built 200m east of the site. Clay Lane Iron Works south of the site and the Slag Wool Works west of the Concrete Works are now disused. The Slag and Tar Macadam Works west of the site has been redeveloped by a new Tar Manufactory, which includes numerous tanks located approximately 90m west of the Concrete Works on site. River Tees Dockyard has been built approximately 90m from the site and west of Smith Docks Road. This comprises a Saw Mill and Timber Yard, numerous undefined buildings, dry docks, shipbuilding berths, travelling cranes and a wharf.
1953	1:2,500	A new Electrical Sub Station has been constructed southwest of Riverside Pumping Station, south of which are two large, and a third smaller, circular buildings. The undefined channel east of the pumping station is Mill Stream, east of which a series of tanks have been constructed. A number of pipelines extend from the tanks, connecting to South Bank Wharf. Others extend north from the pumping station.

		A Coal Track runs across the north-eastern quadrant of the site, connecting the adjacent Teesport area (which has undergone significant expansion and redevelopment) with the railway sidings located within the eastern site area. The Concrete Works on site has expanded northwards, and the adjacent pond to the west infilled. New tanks and an Electric Sub-Station are recorded within the area north of the Basic Slag Works bordering the eastern boundary. Two Ore Grading plants connected by a Conveyor, and a Sinter Plant have been built immediately north of South Bank Iron Works. These are connected via a network of railway lines to the Travelling Crane which traverses the centre of the site and a second, new crane constructed to the west. A series of Electrical Sub-Stations have been built adjacent to the west of the first Travelling Crane. Conveyors are also located east of the Sinter Plant and west of the western-most Ore Grading Plant. A Weighbridge is located 160m northeast of the western-most Ore Grading Plant, with an undefined building and chimney 50m to the north of the Weighbridge. The former Brine Wells previously located here are no longer shown, with the wider area appearing to be used to stockpile material. A number of tanks and pipes are denoted within the area of South Bank Iron Works, with a new Boiler Plant and associated chimneys recorded in the eastern area of the works. A new Electric Sub Station is 50m north of the Boiler Plant. An Incinerator is located 200m east of the Concrete Works and 260m west of South Bank Iron Works. The Concrete Works has expanded northwards with a Travelling Crane built adjacent to the east which connects to the railway line and sidings to the north. Eston Sheet and Galvanising Works has been redeveloped into Eston (Iron) Refinery with a new Electrical Sub Station to the east. A second has been built on the western boundary, 280m northwest of the Concrete Works. Clay Lane Iron Works south of the site has been demolished along with the associated railway sidings. The former Slag Wool Works adjacent to the southwest corner of the site has been redeveloped into a Tar Distillation Works, encompassing the adjacent former Tar Manufactory site.
1958-74	Partial coverage 1:1,250 1:2,500	A new Electrical Sub Station and large circular tank have been constructed 30m to 40m southeast-south of South Bank Wharf Custom House. A second Sub-station is located 55m south of Riverside Pumping Station with a second Pumping Station constructed east of the first. The tanks on the east bank of Mill Stream are no longer shown. A series of pipelines run parallel with the channel along its eastern bank, connecting to a new pumping Station located 130m from the western boundary and 300m northwest of the Basic Slag Works. A second pipeline runs parallel to the west bank. An Oil Depot has been built on the south bank of the Tees, 210m northeast of Riverside Pumping Station, with new Dolphins on the adjacent river front. A large Slag Crushing Works is located to the east, with an associated Jetty on the river bank. Railway lines and sidings are associated with the works site, and run off-site to connect with the large Slag Heap bordering the eastern boundary. An Ore Crushing Plant and associated Conveyor and railway lines/sidings has been constructed 170m south of Riverside Pumping Station. The tracks east of the plant connect with the sidings located within the eastern area of the site. The Basic Slag Works adjacent to the eastern boundary is no longer defined, although the buildings and associated infrastructure remains. Two large, undefined buildings have been built 180m to the northwest, with two other 50m to 130m to the west and a third adjacent to the south. These replace a number of railway sidings. The South Bank Iron Works is no longer shown with the site having been cleared in the process of being re-developed. West of the former South Bank Iron Works site a new long, narrow rectangular building has been constructed, replacing many of the railway lines and sidings within the far southern part of the site (original South Bank Coke Ovens). Immediately to the

		north of these are a series of undefined buildings and tanks. These occupy the area of the former Concrete Works and Slag Brick Works dominantly the southwestern to western area of the site. A large number of north/south aligned tracks run sub-parallel with the western boundary, east of Smiths Dock Road, connecting with the remaining east/west aligned tracks running along the southern boundary and South Bank Wharf. Although not defined, the Ore Grading plants remain, with the Sinter Plant building having expanded northwards. Eston (Iron) Refinery has been redeveloped into an undefined works. The area of Teesport bordering the north-eastern boundary has expanded and comprises many large tanks defined as Depot. The area to the east of the main part of the site is defined as a Slag Heap. The site of Cleveland Iron Works has been redeveloped and has expanded westwards into the former Clay Lane Iron Works site.
Dec 1966	Drawing 1X-5952	The circular tank 30m to 40m southeast-south of South Bank Wharf Custom House is a disused Benzole Plant. A Chlorination House is located south of Riverside Pump House. A Pump House and Oil Loading Bay are recorded adjacent northeast of the Oil Depot located on the south bank, with the Slag Crushing Works to the east now a Tarmac Plant. An Ore Crushing Plant 170m south of Riverside Pumping Station is now a Ferro-Manganese Plant with an adjacent stocking ground to the west. To the south a Pig Casting Machine works is proposed, with associated adjacent Welfare block and Maintenance workshops. The Basic Slag Works adjacent to the eastern boundary is now a Joiners Shop with the large building to the south Maintenance Shops. The two large buildings 180m northwest are defined as a Garage and Mobile Tool Shop, with the adjacent area to the west a Pig Casting Stocking Area. The buildings west of the Joiners and Maintenance shops are part of the Sinter Plant and include an Ore Handling Plant, Sinter Bench, Fan House and Domestic Coke Ovens. To the south, north of the former South Bank Iron Works site are the Blending, Screening and Crushing Houses associated with the Sinter Plant. Garages are recorded within the far south-western corner of TS4. West of the former South Bank Iron Works are the original South Bank Coke Ovens and associated Coke Wharf and Quencher. The buildings occupying the former Cement Works include the Blending Bunkers, Klonne Gas Holder, a Wagon Repair Shop and Coal Stocking Area. A By-Products Plant is also located here which includes Booster and Exhaust houses, Condensers and De-Tarrers, Gas Washers, Scrubbers, a Rack Cooler, Acid Storage Tanks, Benzole Storage Tanks and Tar Pump House as well as miscellaneous tanks and sub-stations. East of the plant is the Domestic Coke Stocking Area, with the two large ore stocking areas to the north. Various mineral and coal sidings are defined along the western boundary.
1974	Partial Coverage	A new wharf (Tarmac Wharf) has been built on the south bank of the River Tees at the north east corner of the north-eastern quadrant of the site. An overhead conveyor connects the wharf to the site.
1978	Partial coverage	The site and the surrounding area largely remain unchanged. The northeast quadrant it referred to as Teesside Works Cleveland. New buildings shown within the area of the Slag Crushing Works, now referred to as South Teesside Works, Cleveland. Overhead power lines enter the south from the south and cross the area of the Slag Crushing Works before crossing the River Tees. The works occupying the southern half of the site are collectively defined as South Teesside Works Cleveland. Numerous tanks and chimneys are scattered throughout this area, with many of the works buildings connected by conveyors. Many of the railway lines and sidings within the western area have also been removed.

		The original South Bank Coke Ovens have been demolished, with the current South Bank Coke Ovens constructed to the east on the site of the former south Bank Iron Works. The former Tar Distillation Works adjacent to the west of the site have been redeveloped and are predominantly covered by slag and spoil heaps. Collectively referred to as Cargo Fleet Works.
1987-88	Partial coverage	Site not covered by mapping. Former Cleveland Steel Works located adjacent to the southwest of the site is undergoing redevelopment. The former Tar Distillation Works, located adjacent to the west of the site redeveloped into a Training Centre and Laboratory.
2000	Aerial photography	The railway lines and sidings running parallel to the western and southern boundaries have been removed. Two undefined buildings located north of the former South Bank Iron Works have been demolished. The railway liens associated with South Bank Wharf also appear to have been removed.
2012	Aerial photography	Stockpiles occupy the central area of the site, with a second located within the western area, north of the former Concrete Works.

3.3 Utility Apparatus

Figure 5 shows the location of existing utility apparatus within TS4 or adjacent to the boundary. This does not include the location of local services for which further investigation is required. The following utilities are recorded:

- BT Openreach Underground cables
- BOC Oxygen Pipeline
- BOC Nitrogen Pipeline
- BOC Hydrogen Pipeline
- Northern Gas Network – Medium Pressure
- Northern Gas Network – Low Pressure
- National Grid Overhead Electricity
- Northumbria Water Limited - Clean water
- Northumbria Water Limited - Sewer
- Northern Power Grid – underground electricity
- Coke Oven Gas Main – Above ground
- Coke Oven Gas Main – Underground
- Industrial Water
- Fuel Oil Pipeline

Figure 5 shows the location of these utilities, but does not included details regarding local distributions and local supplies to and within buildings on site. Furthermore, there is a possibility that temporary utilities routes may also exist on site which may or may not be redundant. These are associated with temporary contractor compounds which were established as and when required. Although not included within the list above pipework transporting gas from the SBCO to the By-Products Plant will also exist, and may be above ground as well as below ground level.

3.4 Site Inspection

Based on a walkover of the site in March 2017 the site is generally flat, with occasional waste mounds scattered across the northern area. A narrow area of raised ground runs between the western boundary and the western access road, with the former site of the Sinter Plant significantly higher than the surrounding area. This is approximately 5m to 6m high. A narrow strip of raised ground runs parallel with the southern boundary of the main area of TS4, along which railway lines run, associated with the Coke Wharf of South Bank Coke Ovens (SBCO). This is approximately 1.5m to 2m high. A low bund runs parallel with the south bank of the River Tees within the northeast quadrant of the site, along which pipework was noted.

A derelict railway embankment runs parallel to the western access road, increasing in height towards the River Tees. It is estimated that this embankment reaches a height of approximately 5m. Also within the northern section of the main area of TS4 are two earthworks supported by concrete retaining walls. These are approximately 4m high and were loading ramps for the former railway located in this area. An underground loading bay is located within the north-western section of the main area of TS4. This is approximately 6m deep and is reached from the surface via a gentle ramp. A shallow cutting, associated with a dismantled railway runs parallel with the eastern boundary of the main area of TS4.

A recent topographic survey of the site has not been undertaken. As-built drawings of Tarmac Wharf dated 1971 indicate that the south bank of the River Tees to have an elevation of between 6.0m and 6.2mAOD. The historical plans don’t suggest any significant changes to the wharf since its construction.

3.5 Geology & Ground Conditions

3.5.1 Made Ground

The BGS 1:50,000 scale Solid and Drift map (Sheet 33 - 1987) identifies the site as being covered entirely by Made Ground. As the site and the wider area are known to comprise reclaimed mudflat and marshland it is likely that this is what is referred to as Made Ground by the BGS mapping.

Made Ground is predominantly granular, comprising deposits described as loose black gravelly silty fine to coarse sand or black to grey sandy gravel and loose to dense dark grey to black sandy gravel to sandy gravelly cobbles and boulders. Sand is typically ash, slag or coal dust, with gravel to cobble-sized fragments of predominantly slag, clinker and brick (furnace, occasionally house); occasionally rubble, timber (including sleepers), coal, coke, metal and concrete and boulder-sized fragments of slag. The looser material typically overlies denser deposits and given their composition and thickness represent the stockpiled raw materials associated with the iron and steel making process.

Slag is sometimes referred to as pellite or granulated blast furnace slag, with fused slag also recorded within a select number of holes. This is described as green-white-yellow fused slag, fused slag boulders or fused bluish grey slag pellite with patches of loose grey coarse slag granulate. Horizons range from 0.7m (1AT7) to in excess of 3.7m thick (EDT6). Occasionally horizons of concrete and tarmac have also been encountered, consistent with relic infrastructure/foundations, with the large metal plates recorded at <1.5mbgl (DBT26 and EDT24) possibly indicative of underground services.

Historical records indicate that the Made Ground increases in thickness southwards from the River Tees towards the centre of the site. Deposits typically range between 1m and 7.8m thick, although deposits in excess of 10m thick (to -2.5mOD) have been encountered. Generally the base of the Made Ground has not been proven, but where encountered is typically below 0mAOD, consistent with the material having been used to raise site levels.

3.5.2 Superficial Geology

The BGS 1:50,000 scale map shows the superficial deposits as comprising post-glacial estuarine and marine alluvium, consistent with the BGS GeoIndex which describes Tidal Flat deposits of sand, silt and clay. The BGS Lexicon of Name Rock Units describes the area as intertidal and the lithology *"normally a consolidated soft silty clay with layers of sand, gravel and peat".* Along the southern site border glacial laminated clay is recorded described by the BGS as a Glaciolacustrine deposit of clay and silt. Given the mapping scale it is possible these deposits extend beneath the site; beneath the tidal flat deposits.

The historical logs describe the natural superficial deposits as a mix of granular and cohesive deposits. Granular materials comprise loose to dense sometimes laminated grey to black fine sand to silty fine sand with shell fragments; and occasionally contain lenses/layers of clayey silt, very clayey/silty slightly gravelly to gravelly sand and gravelly sand to sandy gravel. Locally these are underlain by soft to firm fissured red-brown silty clay with fine gravel. Together these deposits most likely represent Tidal Flat deposits and have a thickness of between 2m to 7.5m.

Granular superficial deposits are not recorded within holes sunk within the central to southern area of TS4. Here laminated clays is recorded, indicating that the boundary between the Glaciolacustrine and Tidal Flat deposits is located beneath the northern half of TS4, further north than suggested by BGS mapping. Laminated clay is described as very soft to stiff dark brown/grey brown to orange brown thinly laminated clay to silty slightly sandy laminated clay, mottled slightly sandy clay of high plasticity with silt dustings on laminae and very soft to stiff laminated clays/silts. The deposits are between 3.5m to 11m thick, increasing eastwards and are occasionally described as being slightly weathered.

The Tidal Flat and Glaciolacustrine deposits are underlain by deposits of Glacial Till, which is firm to very stiff reddish brown to dark brown silty sandy to sandy gravelly clay of low plasticity with occasional to many cobbles; and stiff to hard fissured red-brown to dark brown sandy silty clay with fine to medium gravel. Gravel is fine to coarse, subangular to subrounded of sandstone, quartzite and mudstone. Occasional reference is made to thin bands of medium dense silty sand or silty clayey sand and gravel which have been inferred as localised glaciofluvial channels. The glacial till ranges between 2.5m to 9m thick, overlying bedrock.

3.5.3 Solid Geology

BGS mapping identifies the bedrock to be Mercia Mudstone of the Triassic Mercia Mudstone Group. This is described by the BGS Lexicon as *"dominantly red, less commonly green-grey, mudstone and subordinate siltstones with thick halite-bearing units in some basinal areas. Thin beds of gypsum /anhydrite widespread; sandstones are also present"*. The BGS 1:50,000 scale map also identifies that site is underlain at depth by the Boulby Halite deposit.

Where encountered bedrock has been described as being very weak to weak, highly weathered. The rock has been recovered as stiff to hard sometimes laminated, fissured red-brown to grey-green silty clay/clayey silt, grey and brown clay with bands of mudstone and gypsum and silty very sandy clay with gravel-sized fragments of weathered mudstone or limestone and silt partings. Other descriptions describe bedrock as bedded and jointed grey-green and red-brown bands of weathered limestone and mudstone, with veins of gypsum, hard brown clay marl and very weak brown and grey mudstone with bands of gypsum.

Rockhead has typically been encountered between 16m (AS04) and 21mbgl (BH-C03); correlating with an elevation of around -11m (AS04) to -15mOD (AS02). Occasionally it appears shallower at around 11m to 12.5mbgl (-5.5m to -7mAOD), and has been proven to an elevation of -19mOD.

3.5.4 Geological Hazards

The site is identified by the BGS as being at very low risk from shrink swell, running sand and landslide hazards. It is also identified as being at very low risk from compressible ground hazards, despite the natural superficial deposits comprising Tidal Flat deposits. This is considered unlikely, particularly as peat deposits may be present within this material. The southern area of the site is identified as being underlain by evaporate mining.

With reference to the Coal Authority Interactive Map, TS4 is not within a Coal Mining Reporting Area. This is consistent with BGS mapping and as such coal mining is not discussed further within this report.

3.6 Hydrology and Hydrogeology

3.6.1 Hydrology

The south bank of the River Tees forms the northern boundary of the site and is classified by the EA as a Main River.

Mill Stream enters the site (in culvert) via the southern boundary, beneath the footprint of the former South Bank Steel Works. It continues northwards for approximately 560m, appearing at the surface 60m west of the eastern boundary and 750m southeast of the River Tees. It continues northwest for approximately 660m, before turning northwards and continuing in culvert as it passes beneath the access road parallel to the south bank of the Tees, outfalling into the river towards the eastern end of South Bank Wharf. The stream is classified by the EA as a secondary river.

A culverted, unnamed drainage cut is located 340m east of the site. It flows towards the northwest, outfalling into the River tees.

Given the history of the TS4, the possible presence of other culverts on site should be considered.

3.6.2 Flood Risk

With the exception of the northern boundary the EA Flood Map for Planning (Rivers and Sea) indicates that the site is not within a flood zone. The south bank of the River Tees forms the northern site boundary and as such is predominantly classified as Flood Zone 2. This classification is assessed as *"between 1 in 100 and 1 in 1,000 (1%-0.1%) annual probability of river flooding …or between 1 in 200 and 1 in 1,000 (0.5%-0.1%) annual probability of sea flooding"*, again ignoring the presence of any defences.

There are no areas benefitting from flood defences within 250m of the site.

3.6.3 Hydrogeology

The EA Interactive mapping indicates that bedrock beneath the site is classified as a Secondary B Aquifer with the overlying superficial deposits classified as a Secondary Undifferentiated Aquifer. The EA describe a Secondary B Aquifer as *"predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering"*. A Secondary Undifferentiated is defined as *"assigned in cases where it has not been possible to attribute either category A or B"*. This generally means that the horizon has variable characteristics allowing it to function as both a minor and non-aquifer in different locations.

The site is not located within a Groundwater Source Protection Zone, nor within a surface water, groundwater or eutrophic Nitrate Vulnerable Area. The site has a Groundwater Vulnerability Classification of "*minor aquifer high"*

3.6.4 Groundwater

Groundwater was recorded within a number of historical boreholes sunk across the site. The information is presented within the table below.

Table 3-2 – Groundwater strike observations

Borehole reference	Strike		Rise	Geology	Strata
	Borehole depth mbgl (mOD)	***Water depth mbgl (mOD)***			
BGS boreholes					
NZ52SW15054/AS02	4.6 (1.55mAOD)	4.35 (1.8mAOD)	0.25m	Cobbles and boulders of blast furnace slag	Made Ground
	20.2 (-14.05mOD)	18.4 (-12.25mOD)	2.2m	Interface between superficials and weathered bedrock	
NZ52SW15054/AS04	6.3 (0.85mAOD)	-	-	Dense slag fill with some bricks and occasional loose ash pockets.	Made Ground
	17.8 (-10.65mOD)	5.6 (1.55mAOD)	12.2m	Brown slightly sand fine to medium gravel	Weathered bedrock
NZ52SW15054/AS06	9.0 (-1.3mOD)	6 (1.7mAOD)	3m	Occasionally jointed boules or blast furnace slag.	Made Ground
	17 (-9.3mOD)	9 (-1.3mOD)	8m	Clayey silty very fine sand with occasional coarse sand and gravel.	Glacio-fluvial band within glacial till
NZ52SW15054/AS08	4.2	-	-		
	15.8				
NZ52SW15054/AS10	7.5 (0.45mAOD)	5.2 (2.75mAOD)	2.3m	Occasionally jointed boules or blast furnace slag.	Made Ground
	22 (-14.05mOD)	16.6 (-8.65mOD)	5.4m	Stiff to hard laminated and fissured grey-green clayey silt with gravel.	Weathered bedrock
NZ52SW633	6 (3.32mAOD)	4.93 (4.39mAOD)	1.07m	Soft to firm laminated slightly sandy clay	Glaciolacustrine
NZ52SW634	2.0(7.85mAOD)	1.6 (8.25mAOD)	0.53m	Dense slightly ashy sand to cobbles sized brick and concrete fragments.	Made Ground
	14.05 (-4.21mOD)	12.9	1.15m	Very stiff sandy clay with gravel and cobbles.	Glacial till
NZ52SW640	3.05 (6.56mAOD)	-	Seepage	Slightly weathered slightly sandy clay	Glaciolacustrine
NZ52SW641	2.55 (6.84mAOD)	-	Seepage	Slightly weathered slightly sandy clay	Glaciolacustrine
1999 investigation					
BH-C01	7.0 (-0.03mOD)	5.67 (1.3mAOD)	1.33m	Very clayey gravelly sand	Granular alluvium

Borehole reference	Strike		Rise	Geology	Strata
	Borehole depth mbgl (mOD)	***Water depth mbgl (mOD)***			
BH-C02	8.0 (-0.16mOD)	6.3 (1.56mAOD)	1.7m	Clayey sandy gravel	Granular alluvium
	13.5 (-5.66mOD)	8.75 (-0.91mOD)	4.75m	Sandy gravelly clay	Glacial till
	21.6 (-13.76mOD)	17.4 (-9.56mOD)	4.2m	Highly weathered mudstone	Bedrock
BH-C03	8.2 (-0.21mOD)	6.3 (1.69mAOD)	1.9m	Clayey sand	Granular alluvium
	14.0 (-6.01mOD)	6.4 (1.59mAOD)	7.6m	Sandy gravelly clay	Glacial till
	19.5 (-11.51mOD)	6.8 (1.19mAOD)	12.7m	Sandy gravelly clay	Glacial till
	22.2 (-14.01mOD)	8.9 (-0.91mOD)	13.3m	Highly weathered mudstone	Bedrock
BH-C04	15.5 (-7.59mOD)	5.6 (1.81mAOD)	9.9m	Interface between superficials and weathered bedrock	
	18.7 (-11.29mOD)	8.9 (-1.49mOD)	9.8m	Interface between weathered bedrock and bedrock	
BH-C05	11.5 (-3.26mOD)	4.3 (3.94mAOD)	7.2m	Thinly laminated sandy clay	Glacio-fluvial
	16.0 (-7.76mOD)	8.3 (-0.06mOD)	7.7m	Sandy gravelly clay	Glacial till
	21.7 (-13.46mOD)	14.4 (-6.61mOD)	7.3m	Highly weathered mudstone	Bedrock
BH-C06	15.5 (-7.44mOD)	13 (-4.94mOD)	2.5m	Sandy gravelly clay	Glacial till
	21.5 (-13.44mOD)	16.3 (-8.24mOD)	5.2m	Highly weathered mudstone	Bedrock
TP-BHC01	5.3 (1.67mAOD)	-	-	Sandy gravelly angular cobbles and boulders of slag	Made Ground
TP-BHC02	6.1 (1.74mAOD)	-	-	Sandy gravelly angular cobbles and boulders of slag	Made Ground
TP-BHC03	7.1 (0.89mAOD)	-	-	Sandy gravel with some cobbles of slag	Made Ground
TP-BHC04	5.4 (2.01mAOD)	-	-	Gravelly angular cobbles and boulders of slag	Made Ground
TP-BHC05	6.1 (2.14mAOD)	-	-	Sandy gravel with many cobbles and boulders of slag	Made Ground

Borehole reference	Strike		Rise	Geology	Strata
	Borehole depth mbgl (mOD)	***Water depth mbgl (mOD)***			
TP-BHC06	5.8 (2.26mAOD)	-	-	Angular cobbles and boulders of slag	Made Ground
2004 investigation					
1AB1	-	5.0mbgl (2.41mAOD)	-	Clayey sandy angular to subangular fine to coarse gravel.	Made Ground
2AB2	-	3.8mbgl (4.49mAOD)	-	Interface between granular Made Ground and underlying very clayey Made Ground	Made Ground
2AB3	-	5.0mbgl (2.53mAOD)	-	Dark brown silty very gravelled fine to coarse sand.	Made Ground
2AT12	-	0.5mbgl (unknown)	-0.15m	Interface between grey slag gravel and wet, black tar-like material	Made Ground
3AB2	-	7.5mbgl (1.23mAOD)	-	Interface between two different sandy gravels.	Made Ground
DAB1B	-	6.0mbgl	-	Unknown	Unknown
EAT2	-	2.8mbgl	-	Loose silty gravel and cobbles of slag	Made Ground
EDT40	-	0.9mbgl (unknown)	-	Gravel, cobbles and boulders of mixed slag	Made Ground
Notes - No information available					

No groundwater monitoring was undertaken as part of the 1999 investigation. Table 3.3 summarises the groundwater monitoring undertaken as part of the 2004 investigation.

Table 3-3 – Summary of 2004 investigations groundwater monitoring in TS4

Location	Groundwater mbgl	Groundwater mAOD	Response zone geology
2AB1	4.8	4.459	Made Ground
2AB2	3.4	4.891	Made Ground
2AB3	4.45	3.082	Made Ground and Tidal Flat
3AB2	7.56	1.174	Made Ground
3AB3	4.45	5.206	Made Ground
DAB1	4.45	3.806	Made Ground

Given the granular nature of the Made Ground and the location of the site it logical that groundwater strikes within this material could be associated with the tidal influence of the River Tees, as demonstrated by the 1.4m variation in groundwater elevation. The same is also likely for strike recorded within the granular natural superficial deposits, although this will depend upon elevation. Strikes recorded within the glacial till are likely to be attributed to granular horizons, with significant rises due to confinement by the overlying deposits. Those strikes recorded within the bedrock are likely to be variable in terms of the volume of groundwater encountered, as given the bedrock material permeability will be linked to the extent of fracturing within the rock.

The 2004 interpretative report concluded that groundwater levels across TS4 do not conform to any consistent flow patterns, with groundwater typically only found within deeper monitoring boreholes. Generally the direction of flow was broadly towards the River Tees, with groundwater appearing to be shallower towards the east.

Due to the arrangement and variation in boreholes across the site the 2004 interpretative report concluded that local flow conditions are complex and possibly localised which may be attributed to variations in the composition and thickness of the Made Ground and variations in the permeability of the underlying natural superficials.

3.7 Man-made Features

This section covers the existing man made features and those which are associated with the current land use but have recently been removed. The following information has been obtained from historical mapping, available as-built drawings and from observations made during walkover of TS4 in March 2017. The location of these features are shown on Figure 4, which details the historical development of the site. Drawing W116952 is a detailed drawing of the buildings within the area of SBCO and By-Products Plant.

3.7.1 BOC Pipelines

An underground 250mm diameter oxygen pipeline (ref. 75NB 02) runs sub-parallel with the eastern edge of Smith Dock Road. The pipe runs from beneath the bridge in the far southwest corner of the site, joining an east/west aligned underground pipe which runs parallel to the Tees Valley Railway Line and southern boundary. The pipe continues north until 290m south of the River Tees where it turns 90° to the west, crossing under smiths Dock Road to connect to an oxygen Distribution Centre located 95m west of the site boundary. An above ground 200mm diameter hydrogen pipe and two above ground 100mm diameter nitrogen pipelines run parallel with the north-eastern boundary of the northeast quadrant of TS4. The pipes enter the site via a tunnel which carries them beneath the river. The central nitrogen pipeline terminates 110m southeast of the river bank. The remaining two continue a further 140m before turning 90° east and continuing along an unnamed service road and beyond the limits of the site.

All four pipelines operate up to a pressure of 42 Bar (600 psi) and are operational; maintained by BOC.

3.7.2 BOS Grit

BOS grit a waste product from the BOS Plant and is described as a black fine gravel, and identified by the sparkle reflecting from its surface in bright sunlight. It is believed to be stockpiled within the far south-eastern corner of TS4, east of the SBCO and within the former Ferro-Manganese Plant.

3.7.3 Buildings – General including Welfare, Offices and Stores

With reference to Drawing 1X-5259, the aerial photographs contained within the GIS dataset and the findings of the walkover survey it should be assumed that the foundations and any basements of all former buildings and structures on site remain, until proven otherwise. The is particularly important when considering the potential foundations and areas of hard standing currently obscured by the raw material stockpiles (former Sinter Plant area).

The SBCO offices located within the southwest corner of TS4 are currently operational, although the adjacent Battery Welfare Block is not. Drawings A109672 details the layout of the Battery Welfare. This includes reference to the removal of ‘Asbestolux’ ceiling tiles within the shower room and replacement with ‘Supalux’ tiles. Similarly the small Welfare Block east of the By-Products Plant, and the large block associated with the former Sinter Plant remain but are unused, the latter being in a derelict state.

With reference to Drawing W116952, a combined Site Office and Welfare Block is located north of the Boiler house, west of the By-Products Plant.

3.7.4 Car Parks and Highways

A small area of car parking is located adjacent to the SBCO Offices, south of the Wagon Repair Shop and west of Coke Handling. Other areas include adjacent to the north of the former Cleveland Coke Ovens (see Section 3.7.18), west of SBCO and around the perimeter of a small Welfare Building, north of the Boiler House.

Details of the road layout throughout the By-Products Plant are shown on Drawing CO10057.

3.7.5 Chimneys

The location of some of the chimneys within TS4 are shown on Drawings X-97498. Others are located across the site.

Drawing W116952 shows the Boiler House located east of the By-products Plant. Drawing CO10782 details the layout of the building, which makes reference to Water Treatment Plant, including a bunded Caustic Tank within the southern end of the Boiler House; with an adjacent Oil Fuel Storage Tank (30,000 gal capacity).

3.7.6 Contractors Site Village

Drawing W116952 shows the location of a temporary Contractors Site Village to the far west of SBCO. Details of the layout of the village, including utilities and Car Wash facilities are shown on Drawing A117132. The Car Wash facilities still remain, however the village no longer exists. Despite this there is a possibility that buried utilities and areas of concrete hard standing remain which may pose a constraint to future works.

3.7.7 Culverts

See section 3.6.1 for details of known culverts beneath the site.

3.7.8 Earthworks

Numerous low bunds and small waste piles of considerable age are located across the site, both comprising similar materials which include slag, brick, concrete, metal beams and track; as well as fly-tipped materials.

3.7.9 Electrical Sub-stations, Transformers and Oil-Filled Cables

A number of derelict electrical Sub-stations are located within the northern area of TS4, between 60m and 260m southeast of the River Tees. Some of these buildings may include a basement or sub-basement level. Drawing 1X-5952 identifies these as buildings as a Switch House and Sub-stations with transformer pens for the former adjacent Ore Stocking Ground to the west. A derelict Sub-station is located adjacent to the southwest of Riverside Pump House on the south bank of the River Tees. 2.75kV Derelict Riverside Sub-station, including transformer pens is also located 30m southwest of Riverside Pump House, with the 11kV Riverside Sub-station (ref. 69 Table 3.4), located 40m south of 2.75kV Riverside Sub-station. Drawing F/M-63581 details a 2.75kV and 11kV electric cables running parallel to the west of the access road running the length of the eastern boundary of the main area of TS4. These are most likely to be associated with the 2.75kV and 11kV sub-stations. An emergency 11kV electric cable is detailed running between the former Domestic Coke Stocking Area east of the By-Products Plant and the Emergency Coke Storage Area, west of the former Ferro-Manganese Plant. It is not known if these are still live.

An Electrical Switch House is located north of the Pipe Bridge; 135m west of eastern boundary of main area of TS4.

An multi-story Electrical Sub-station is located 80m west of the eastern boundary of the main area of TS4, and east of the former Pig Casting Stocking Area (see Section 3.7.10).

A number of live sub-stations are located within the area of the SBCO By-Products Plant (see Table 3.4 below). These are identified on Drawing X-97498.

Until proven otherwise electrical sub-stations, transformer pens and switch houses should be considered live and potential areas of PCB impacted ground. Details of the electrical infrastructure are given in the SSI reports ref. SSI UK IL EI 2016 and SSI UK SBCO 2016.

Drawing 5002-E7221 details some of the sub-stations located within TS4 and the wider SSI site circa September 2016. These are summarised in Table 3.4 below

Table 3-4 – Electrical Sub-stations recorded in TS4 based on SSI records (Drawing 5002-E7221)

Ref. no.	Location	Sub-station	Ownership	Comment
17	Far south-eastern corner of the site, east of SBCO	Holmebeck 11kV	SSI	
68	Between Offices and By-Products Plant	SBCO 11/2.75kV	SSI	
69	South bank of River Tees – Riverside Pumphouse	Riverside Pumphouse 11kV	TATA	Third party ownership
77	Engineering Workshops	Main 11kV Sub	SSI	
78	Southern end of By-Products Plant	By Products Plant 440v Switchboard	SSI	
79	Northern end of By-Products Plant, west of Brick Shed	Davenport Sub-Station	SSI	
80	West of SBCO	Screenhouse Sub	SSI	
81	Western end of SBCO	Battery Sub-station	SSI	
82	Eastern end of SBCO	Quencher	SSI	
83	Adjacent to south of SBCO	Plough Sub-station	SSI	

Details of the Davenport Sub-station are given on drawings EA37551, EA37552, ECO876 and ECO880. Drawings 15903, 15920, 15923, 15935, 15974 and EA2703 detail the layout and arrangement of the Main 11kV Sub-station, including the piled foundations (ref. drawings 15920 and 15923).

Details of the SBCO 11/2.75kV sub-station are given on Drawings 7A5762 which shows a box basement level 2m deep exists beneath the main area of the sub-station.

With reference to the SSI UK commissioned report (ref. SSI UK EI 2016) electricity is transmitted around the wider SSI site at 66kV, entering the SSI site at two Grid Supply Points (GSPs) located outside the boundary of SSI3. Transformers located at each GSP transform the voltage down from 275kV to 66kV. Once stepped down to 66kV the power connects to the SSI UK site network at two Sub-stations located outside the boundary of SSI3. From these Sub-stations electricity is distributed around the SSI UK site. Within the network there are a 9No. Sub-stations; each of which is interconnected by underground cables or ‘feeders’, to which there are 20No. 66kV transformers, 4No. of which are mothballed (Ladel Furnace, T64, TA3 and TA4). The 66kV distribution network is transmitted around site through oil filled cables; with the oil acting as an insulator. Historically leaks have been reported from these cables. The cables are buried underground and are located in specifically denoted reservations protected by ARMCO barriers where possible. With reference to the report SSI UK EI 2016 there are 301No. Transformers across the SSI UK site. 163No. are owned by SSI UK and have been isolated.

Battery systems are used as backup systems within the Sub-stations. Many are nickel cadmium, although a small number are lead acid. The 66kV cables on site all have a lead paper wrap beneath the insulator.

Until proven otherwise electrical sub-stations, transformer pens and switch houses should be considered live and potential areas of PCB impacted ground.

Further detailed information is given in report ref. SSI UK EI 2016.

3.7.10 Ferro-Manganese Plant and Pig Casting Machine (Bessemer Works)

South of the River Tees, towards the eastern boundary of the main area of TS4 is the former Ferro-Manganese Plant; now a derelict warehouse previously used to store pig iron. The structure currently stores BOS grit, a waste product from the BOS plant. A large area of hard standing is located to the west and south of the structure most likely remnants of the Manganese Ore Stocking Ground and the Pig Casting Machine Works. Details of the Pig Casting Machine are shown on Drawing F/C-53178 and show a basement level within the Control House for loading lime and shot (raw materials) into the bogies (railway carts). Drawing A-37718 shows the layout of the former Ferro-Manganese Plant, must of which has been demolished.

3.7.11 Fuel Oil Storage

Five large fuel oil storage tanks, and ancillary buildings are located within the northeast quadrant of TS4, close to the northern boundary. The tanks are contained within a concrete bunker and are connected via a series of pipes. Drawing OH10120, dated 1980 shows that the storage tanks are fed via a pipe which runs parallel to the river, south of the access road. The pipe originates from Shell Oil (UK) Teesport, but its exact route is unclear. A Pump House and Oil Loading Bay are associated with the store.

Drawing F/M-63581 details a Fuel Oil Pipeline running along the length of the eastern boundary of the main area of TS4.

A Petrol Store is reported to have been located near to the SBCO works entrance, as detailed in Drawing 9A389.

3.7.12 Garages and Workshops

The office block and garage for Mobile Tools located towards the eastern boundary of the main area of TS4 remain but are derelict (ref. Drawing 1X-5952). The area surrounding these structures is currently used by the Tarmac Group of Companies to stockpile raw materials. Plant, referred to as Stackers are located within the stocking ground and are used to create the stockpiles. South-west of the Mobile Tool Garage and Office is the former Pig Casting Stocking Area. This may have included areas of hardstanding, but is currently obscured by stockpiles. The railway tracks associated with the stocking area appear to have been removed.

The Engineering Workshops are located between SBCO and the By-Products Plant; with the Wagon Repair Shop and a garage are located north of the SBCO Offices (ref. Drawing W116952). Details of the foundations of the Wagon Repair Shop are given on Drawing 9A299.

3.7.13 Gas Main and Pipe Bridge

Many of the pipes located within the area of SBCO and the By-products Plant are elevated, running above ground level via pipe bridges. Details of the arrangement of the pipes running parallel to the north of the Coke Oven and connecting to the By-products Plant are given on Drawing A119194.

Details of the Coke Oven Gas Main are given on drawings 7A5792 to A75794 and E86863,

3.7.14 High Voltage Overhead Power Lines and Pylons

Overhead high voltage power lines cross-cut the western area of the TS4. These are supported on high pylons. Overhead lines also run along the eastern perimeter of the northeast quadrant of TS4 as shown on drawings OH10120, F/M-63263 and F/M63581.

3.7.15 Miscellaneous Tanks and Pipelines

Drawing A124443 details the location and hazardous substances stored within the SBCO area circa July 2012. This includes the following:

- 3No. Benzole storage tanks
- 2No. Creosote Oil tank
- 2No. Coal Tar tanks
- Coke Oven Gasholder
- Gasholder Sealant storage
- Liquid Oxygen Storage Vessel

The location of Diesel Storage areas is shown on drawing A119581 and drawing A120096, with the latter also listing the contents and capacity of the tanks.

3.7.16 Pumping Stations and Pipes

The derelict Riverside Pump House is located on the south bank of the River Tees. Details of the pump house are given in drawings 2C-928, F/M-63581 and 7A-10898. The pumping station provided the SBCO with water from the Tees. Drawing 7A-10892 identifies two pipes which connect to a Valve Pit south of the pump house. Drawing F/M-63581 and 1X-5952 identifies these as a 42” diameter Salt Water Delivery Main and a 30” Saltwater Delivery Main. East of the watercourse, along which circulating water is discharged there is a 48” Supply water Main and an adjacent Fuel Oil Pipeline (see Section 3.7.9) These run above ground and along the eastern boundary of the main area of TS4. To the south-west the former Chlorination House also remains within this area. A 42” diameter sewer and industrial water main are also detailed running northwest/southeast through the western area of TS4 to outfall into the River Tees as the SBCO Main Drain Outfall. A 36” diameter sewer flows northeast from the SBCO and beneath the former Coke Stocking Areas to outfall near Riverside Pump house as Eston UDC Sewer.

Details of water mains and sewers within the areas of the By-Products Plant and SBCO are detailed on Drawing 1X-5952. Most of the water mains appear to be either 4” or 6” in diameter. It is unknown if these are redundant. Details of surface water drainage are given on Drawing A-85879.

A derelict pump house and adjacent water tank are located in the northern area of TS4, approximately 60m south east of the River Tees.

A pump house is associated with the Fuel Oil Storage area (ref. drawing 1X-5952).

The location of pump houses within the area of the By-Products Plant are detailed on Drawing X-97498. The Main Water Pump House is located towards the northern end of the By-Products Plant. Details of the structure and its including foundations are shown on Drawing A9229, as well as the location of Caustic and Acid tanks and a Chlorinator Room,

3.7.17 Road and Rail Bridges

Road bridge over former railway lines (now dismantled), located 80m west of eastern boundary of main area of TS4, east of the former Pig Casting Stocking Ground.

A disused railway bridge crosses over the access road running parallel to the western boundary, in the northwest corner of the site.

The main access road runs parallel with the southern, western and northern boundary of the site. A second road runs parallel to the southern boundary, formerly providing access to the Coke Wharf of SBCO.

3.7.18 Railway Infrastructure – Tracks, cuttings, embankments and loading areas

A disused railway embankment runs parallel to the western boundary, west of the By-Products Plant. On approaching the river it heads eastwards and is cross-cut by an overbridge before ending sharply. The track have been removed and the embankment is in poor conditions.

Cutting to a dismantled railway line is located 40m to 80m west of the eastern boundary of the main area of TS4; running sub-parallel to the boundary.

Part of the tracks of Port Clarence Crane Sidings remain within the northwest section of the main area of TS4. This includes a deep underground loading bay and above ground loading ramp. A second above-ground loading ramp associated with former Goliath Ore Stocking Gantry, which ran through the centre of the main area of TS4 also remains, approximately 80m south east of the river and 230m west of the Ferro-Manganese Plant (see Section 3.7.8). Some derelict tracks and redundant infrastructure remain within the northern area of TS4, close to South Bank Wharf.

Details of the layout of the railway lines and sidings around the By-Product Plant are given on drawings 7A5543 to 7A5550, 7A5552 to 7A5562, 7A5658, 7A5660 and 7A5661.

3.7.19 South Bank Coke Ovens (SBCO) and By-products Plant

3.7.19.1 South Bank Coke Ovens

The derelict South Bank Coke Ovens run parallel with the southern boundary of the main area of TS4. Drawing A119193 details the layout of the Coke Ovens, which shows a basement level 2.15m deep. Reference is made a combustion air duct and CO gas under firing, indicating that the ovens were designed to allow for the collection of coke oven gas for domestic use. Further details are given on drawings C011800 and CO11801. The SBCO occupy the site of the earlier South Bank Iron Works which was demolished during the late 1950’s. Drawing A39456 details the drainage of the SBCO including details of the Waste Heat Flue and culvert for the 5’0” diameter gas main. Further details of the gas main are given on Drawing CO8220.

The original coke ovens on TS4, Cleveland Coke Ovens were located to the west of SBCO. These were demolished during the 1970’s. Drawings CO7804 shows a cross-section through a Coke Oven Battery, however the drawing dates from before September 1968 and therefore is of the earlier Cleveland Coke Ovens and not SBCO. The drawing shows a basement level beneath the original oven batteries. It is possible that this was not demolished, and if so poses a potential obstruction to any future works. Further details of the SBCO sub-structures are given on drawings CO5487 and CO5496.

Drawing CO8590 shows a cross section through the South Bank Coke Ovens (also referred to as Wilputte Ovens on some drawings). This also has a basement level, housing the underground conveyor system of the coke wharf. A 2m high bunker is also shown beneath the Battery, as well as the underground Coke Oven Gas Main and Waste Gas Flue. Details of the bunker; including foundations, reinforced concrete areas, as well as associated structures are given on drawings CO8066, CO8067, CO8075, CO8076, CO8078, CO8078, and CO8367 to CO8370. The foundations of the bunker are supported on piles, details of which are given on Drawing CO7917. Drawings 8X238 shows the layout of bunkers and conveyors. Further reference should be made to report ref. SSI UK IL SBCO 2016.

The Coal Hopper located between the batteries of the original coke ovens was retained following their demolition and was used to house the water tank for the firefighting system for the SBCO and By-Products Plant. Drawing CO11013 includes a longitudinal view of the current SBCOs. In order to reduce the high temperature of the coke it was transported in coke cars to Quenchers located at either end of the ovens. Here water was used to cool the coke, before returning it to the coke wharf on the southern side of SBCO. The coke was sprayed with more water, before being transported via underground conveyors from the ovens. Details of the bunker beneath the Coke Wharf are given on drawings

Drawing A39456 shows a settling pond adjacent to the north of the eastern Quencher where waste water from the process was stored. In addition of the Coal Hopper the railway lines associated with the Coke Wharf of the earlier coke ovens were also retained and extended to join the SBCO Coke Wharf. The tracks run along a low embankment, parallel with the southern boundary, which is constructed of slag. Details of these are given on Drawing CO5486 with details of tracks for the existing SBCO given on drawings CO8399 and CO8618.

Coal which supplied the Coke Ovens was stored within the stocking grounds west of the By-Products Plant. It was loaded onto a conveyors and transported south to the SBCO. Some details of the layout of the Coal Handling Plant are given on Drawing ECO513. Details of some of the conveyors and their foundations are given on drawings A38513, A38645 and CO8297.

North of the SBCO is the site of the former Sinter Plant and the associated ore Handling Plant and Crusher House. The buildings have been demolished and the area is currently used to stockpile materials for the Tarmac Group of Companies. Amongst the stockpile some of the foundation can still be seen. East of the former Sinter Plant are the now derelict Maintenance Shops and Welfare block. Whilst some of the roads remain in this area, the railways tracks and sidings associated with the plants have been removed.

West of the By-Products Plant and within the south-west corner of TS4 is the Klonne Gas Holder and Sample House, Blending Bunker, Coke Handling Plant and Pulveriser House. A large sub-station also remains. Details of the gas holder are given on Drawing A125272. East of the By-Products Plant the Silica Brick Shed, and Cooling Tower Pond also remain.

The SBCO is connected to the Coal Stocking Area and Coke Handling Plant by overhead conveyors. Numerous overhead pipes connect the By-Products Plant to the SBCO. Drawing A-85879 details the surface drainage around the plant, and shows that some of the drainage system and cables run underground via chambers between 0.7m and 0.9m deep. Tank pits also extend underground to an unknown depth.

Details drawings of the layout of the SBCO and By-Product Plant are given in drawings 7A-13164 to 7A-13168.

3.7.19.2 Coke Oven Gas Main

The Coke Oven Gas main runs east/west through the area of the SBCO. As the gas cools moisture condensates, precipitating from the gas. This is periodically released from the pipeline at designated points along its length; referred to as Condensate Pits. Localised contamination may be present within these areas and is likely to comprise organic compounds such as benzene and naphthalene

3.7.19.3 By-Products Plant

Northwest of the SBCO, west of the former Sinter Plant is the By-Products Plant associated with SBCO. Drawing 1X-5259 details the original layout of the plant, which when compared with Drawing A119195 does not appear to have changed significantly save for the Salt Plant which has been demolished. Those buildings of note include:

- Booster House, Exhauster House, Condensers and De-tarrers
- Gas Washers and Scrubbers and Rack coolers,
- Acid Storage Tanks and Benzole Storage Tanks,
- Tar Pump House.

Drawing A119195 list the plant equipment of the By-Products Plant; which including a number of tanks and sumps containing materials such as tar, liquor, naphthalene and benzol; all of which are potential sources of contamination and fall under the COMAH regulations. The COMAH product inventory for SBCO is given in Appendix 20 of the SSI UK (IL) report ref. SSI UK (IL) SBCO 2016.

Details of the Exhauster House, located within the southern area of the By-Products Plant are given on drawings 9A294, CO165 and CO10799. The Exhauster House pre-dates SBCO and was originally attached to the now demolished Cleveland Coke Ovens.

Details of the layout of the Washers and Scrubbers are given on Drawing A117919, which refers to Napthalene Gas Washers, Benzole Scrubbers and Ammonia Scrubbers. The associated pumps and delivery lines are detailed on Drawing CO739, with details of drains and water services and service bunkers on Drawing CO1721. The Secondary Cooling Plant is attached to this section of the plant, as detailed in Drawing CO9879.

Drawing CO4607 details the Crude Benzole Pump House, the cross-sections of which shows details of a sub-basement level 0.7m deep; and two trenches 0.7m deep and between 0.45m to 0.7m wide. Further details of the pipework arrangement are given in drawings CO4619 and CO4620. Drawing CO4747 details the Secondary Condenser Pumphouse, and shows 1m deep pipe trenches beneath the structure.

Drawing CO5969 details the layout of the central area, including drainage and electricity trenches, of the By-products Plant which includes the following:

- Napthalene Scrubbers
- Napthalene Stripping Plant
- Crude Benzol Tank Farm,
- Crude Benzol Plant
- Acid Storage Tanks

Drawings CO879, CO880, CO10057 and CO4535 detail the drainage associated with the By-products plant, including details of valve pits, trenches and deep manhole chambers.

With reference to Drawing W116952 the Tar Decant Facility is located west of the Engineering Workshops and south of the Boiler House. Details are given on drawings CO10216, CO11782 and A96466.

Further detailed information is given in report ref. SSI UK IL SBCO 2016.

3.7.20 South Bank Wharf, Dolphin Wharf and Tarmac Wharf

The wharf runs parallel with the southern bank of the River Tees. It of wooden and metal girder construction and is in a derelict. The associated railway lines, sidings and travelling crane have been removed, however it still can be accessed from the bank at either end and towards the centre. Dolphin Wharf and Tarmac Wharf are located downstream of South Bank Wharf, respectively. Details of the Dolphin Wharf and associated berths and infrastructure are given on drawings 7A-12816, 7A-12817, 7A-13420 to 7A-13424 and A-97435. Drawing 7A-17661 is a general plan of South Bank Wharf. Tarmac Wharf is shown on Drawing OH10120.

Details of the former tracks and sidings associated with South Bank Wharf are show on drawings 7A-13172 and 7A-13173.

3.7.21 Stocking Grounds

The former site of the Sinter Plant, north of the SBCO is currently used to store raw materials for the Tarmac Group of Companies which operate within the northeast quadrant of the site. The stockpiles include slag and other materials. The Sinter Plant was located on a large raised area of ground which remains, as does some of the concrete foundations of the plant. The location and layout of the former sinter Plant is shown on drawings 1X-5952, NZ5321 NE; 1952, 1958 and 1977 editions.

West of the By-Products Plant is the former Coal and Breeze stocking areas, both of which comprise large areas of concrete hard-standing. The layout of the former stocking areas is shown on drawings 7A-13169 and 7A-13170. The Breeze Stocking Area currently stockpiles 'Jallop', which contains coal tar as well as other materials. This is classified as a COMAH Hazardous Substance. Further details of this and other COMAH and COMAH Substances are given in the SSI UK (IL) report ref. SSI UK SBCO 2016.

The conveyor between the two stocking areas has been removed but derelict foundations of the loading areas and Crush House remain.

3.7.22 Tarmac Group of Companies

This company is located within the northeast quadrant of TS4, and largely comprises a number of large stockpiles of slag and aggregates for use within the construction industry. A number of ancillary buildings and plant are located within this area, including conveyors for moving and stockpiling materials. An overhead conveyor system connects the works site with a small wharf located on the south bank of the river.

3.7.23 Travelling Cranes and Railway Lines

Based on the aerial photography dated 2012 it appears that the railway lines and sidings across the site, including those associated with the Travelling Cranes, have been removed. Some tracks may remain along South Bank Wharf, located on the edge of the River Tees.

3.7.24 Trade Directory Points

The Tarmac Group of Companies, located within the northeast quadrant is identified as being active within the Trade Directory. It is associated with the storage and supply of sand, gravel and other aggregates. Slag was identified as also being stockpiled within this area during the site walkover, and may pose a constraint.

An inactive Trade Directory is also recorded within the northeast quadrant, 40m west of the main area of TS4 and 200m southeast of the River Tees. It is also associated with Tarmac; described to be an asphalt and coated macadam laying contractor. Although listed to be active, should the company have operated before the mid 1980's and stockpiled raw materials and/or old road planings there is a risk that materials containing coal tar may present within this area, posing a constraint.

Nine Trade Directory entries are recorded up to 250m west of the site. With 2No. exceptions these are inactive, and relate to haulage, boat construction, light industrial manufacturing and fertiliser manufacturing. The two active entries refer to crane hire and chemical recycling and disposal hire services.

With the exception of the fertiliser manufacturing site, located 100m west of TS4, the Trade Directory points located west of the site area considered unlikely to pose a constraint. Two other entries are located northeast of TS4, and therefore downstream of the site.

3.8 Unexploded Ordnance

Middlesbrough and the Teesside Port area were home to many iron, steel and manufacturing plants during World War II; and the strategic significance of these sites made these areas a target for bombing.

The Zetica Regional Unexploded Bomb Risk map for the Teesside-Durham-Stockton area classify the Unexploded Bomb risk (UXB) of TS4 as being *'moderate'*. This classification is derived based on a *"bomb density of between 11 and 50 bombs per 1000 acres and that may contain potential WWII targets"*.

With reference to Section 3.2 (historical development), TS4 was reclaimed from the mud flats of the River Tees prior to the start of WWII, however areas of the site have been extensively redeveloped since the war. Given TS4’s location adjacent to the River Tees and the density of industrial sites both on site and within the immediate surrounding area it is recommended that further investigation be undertaken to determine the UXB risk on site.

3.9 Landfill and Waste Management Facilities

With reference to the Landmark Envirocheck database and EA Interactive Map there are no Registered Landfill, Registered Waste Transfer or Registered Waste Treatment sites recorded within TS4. Two inactive landfill sites encroach the eastern boundary of TS4, and are part of much larger landfill sites located within the area east of the main body of TS4. Details of these are given in table 3-5 below.

Table 3-5 – Inactive landfill sites encroaching into the main area of TS4

Name	Location	Operator	Licence type	Waste	Dates
ICI No 3 Teesport ID 64473079	Encroaches the eastern boundary of the main area of TS4	North Tees Waste Management Limited	Waste landfilling; >10T/D with capacity >25,000 T	Excluding Inert Waste	
BS Cleveland Works ID 9833600	Encroaches the eastern boundary of the main area of TS4	Corus Construction and Industrial (British Steel Plc)	A2: Other landfill site taking special waste	Special waste	
Notes * - data sourced from Landmark GIS Dataset ^ - data from EA Interactive Map viewer (What’s in your backyard?)					

Given the extent to which these encroach the site it is unlikely that waste associated with these sites is located within TS4. Instead their outlines more likely represent the footprint of the entire landfill site, rather than the area where waste was deposited. As such these site are unlikely to pose a constraint and are not discussed further.

Several historical and active waste sites border, or are located within close proximity to the site. These are detailed in the tables below.

Table 3-6 – Active waste sites within 500m of the boundary of TS4

Name	Approximate distance to site boundary and direction	Operator	Licence type	Waste received
Active				
ICI No 3 Teesport ID 129419784 (EPR/BP3730VD)^	330m east of the main area of TS4 and 30m southeast of the southern boundary of the northeast quadrant.	North Tees Waste Management* Green North East Trading Bidco Limited^	Waste landfilling; >10T/D with capacity >25,000 T Excluding Inert Waste	-
ICI No 2 Teesport Epr/Bv 1984ih* ID 9833601 (EPR/SP3130VB)^	435m east of the main area of TS4 and 390m southeast	North Tees Waste Management* Green North East Trading Bidco Limited^	Waste landfilling; >10T/D with capacity >25,000 T Excluding Inert Waste	-
CLE 3/8 Landfill Site EPR/Rp3434hp ID 102696275	50m east of the main area of TS4 and 30m southeast of the northeast quadrant	Sahaviriya Steel Industries UK Limited	Waste landfilling; >10T/D with capacity >25,000 T Excluding Inert Waste	
Notes * - data sourced from Landmark GIS Dataset ^ - data from EA Interactive Map viewer (What's in your backyard?)				

Based on a walkover of the site it is believed that ICI No. 3 Teesport (ID 129419784) is the only active landfill site. The remaining three are believed to have become inactive before or following the closure of the Redcar Iron Works Site.

The sites listed above are located south of the northeast quadrant of TS4 and are of considerable size. It is anticipated that given the age of these sites and the nature of the materials contained within them that liners and leachate collection systems were installed before in filling began. However should this not be the case, or should liners and/or leachate systems no longer be effective; (and given that the anticipated groundwater flow is northwards towards the River Tees), there is a risk that contaminative materials could be leaching beneath TS4. Further details regarding the design of the landfills and monitoring data; supplemented by further ground investigation, testing and monitoring would assist in establishing whether these landfill sites pose a constraint to the development of TS4.

Table 3-7 – Inactive waste sites within 500m of the boundary of TS4

Name	Approximate distance to site boundary and direction	Operator	Licence type	Waste received
British Steel CLE 3/8 Landfill Site ID 10745031	50m east of the main area of TS4 and 80m southeast of the northeast quadrant	Sahaviriya Steel Industries UK Limited	Waste landfilling; >10T/D with capacity >25,000 T Excluding Inert Waste	Only waste produced on site
B S Cleveland Landfill ID 9833603	95m east of the main area of TS4 and 30m southeast of northeast quadrant.	Corus Construction and Industrial (British Steel Plc)	A2: Other landfill site taking special waste	Special waste
ICI Chemicals and Polymers ID 10733809 (CLE 170/6)	330m east of the main area of TS4 and 185m southeast of the northeast quadrant.	ICI	Small (Equal to or greater than 10,000 and less than 25,000 tonnes per year)	Only waste produced on site
B S Cleveland Landfill ID 64473073	330m east of the main area of TS4 and 185m southeast of the northeast quadrant.	Corus Construction and Industrial (British Steel Plc)	A2: Other landfill site taking special waste	Special waste
ICI No2 Teesport *^ ID 127234167	220m east of the main area of TS4 and 40m south of the northeast quadrant.	Imperial Chemical Industries Plc	-	Included Industrial and Commercial waste
Cargo Fleet Wharf Area ID 127241878	0m adjacent to the west of Smiths Dock Road	County Council of Cleveland	-	Included inert
Clay Lane Steelworks Ref ID 127229981	45m south	Langbaurgh DC^	Large (Equal to or greater than 75,000 and less than 250,000 tonnes per year)	Included inert*^ No known restriction on source of waste *

Notes

* - data sourced from Landmark GIS Dataset

^ - data from EA Interactive Map viewer (What's in your backyard?)

Four of the sites listed above are located south of the northeast quadrant of TS4, with Clay Lane Steel Works and Cargo Fleet Wharf area located upstream of the main area of TS4. All are of considerable size. As discussed above it is anticipated that given their age and the type of waste accepted that liners and leachate collection systems were installed before in filling began. However they pose a constraint to TS4 until details regarding their design etc. are established. This may also be supplemented by further ground investigation, testing and monitoring to establish if they do pose a constraint. Due to their location

In addition to the sites listed above an inactive Registered Waste Treatment Site is recorded 720m southeast of the northeast quadrant of TS4. This is the site of the SLEMS (ID 10709423); South Lackenby Environmental Management Site which was licensed to accept waste produced on site equal to or greater than 250,000 tonnes per year. The site is closed to new material, but waste material was still being transferred from the site at the time of the site walkover. Given its distance from TS4, it is unlikely to pose a constraint.

3.10 Designations

MAGIC (Multi-Agency Geographic Information for the Countryside) is a partnership project of bodies who have responsibilities for rural policy-making and management involving DEFRA (Department for Environment, Food and Rural Affairs), English Heritage, the Environment Agency, Forestry Commission and Local Government. Its website http://magic.defra.gov.uk/ - MAGIC, 2017) provides information on UK designated Sites of Special Scientific Interest (SSSI), internationally important sites (including World Heritage Sites) and biodiversity sites.

The mudflats along the northern bank of the River Tees, 200m northwest of the site are identified as being a Site of Special Scientific Interest (SSSI); and a RAMSAR site and Special Area of Protection (SPA).

A Public right of Way (PRoW) runs parallel to the south of the Darlington to Saltburn Railway Line, located adjacent to the south of the site.

3.11 Potential Hazards and Permits

With reference to the information provided by the Landmark dataset the following designations, hazards and permits detailed in the table below, have been identified as potentially impacting the site.

Table 3-8 – Hazards and Permits on site and located within 250 of the boundary of TS4

Name and/or reference number	Status	Location	Comment
Hazards			
Misc historical tanks and sub-station facilities	Unknown	On site Numerous undefined tanks located across TS4, specific concentrations noted within the southeast, southwest and northern areas. Occasional tanks along the eastern boundary.	Unknown contents
Misc historical tanks and sub-station facilities	Unknown	Off-site Located between 20m to 400m east of the north-eastern quadrant of TS4	Unknown contents
Hazardous Substances Consent – ammonium nitrate based fertilisers and composite fertilisers containing phosphate and/or potash Ref. R/2004/0759/Hd	Consent Granted 25/06/2004	Off-site Tees Offshore Base, dockside Road - 240m west of TS4	Operator: Iaws Fertilisers Ltd
Hazardous Substances Consent – ammonium nitrate based fertilisers and composite fertilisers containing phosphate and/or potash Ref. R/2007/1136/Hd	Unknown	Off-site South Tees Freight Park, Puddlers Road – 240m south of TS4	Operator: Fertiliser Solutions Ltd
Permits – Discharge consents			
Discharge consent – Sewage discharges – final/treated effluent	Revoked 30/09/1996	On site	Operator: Corus Construction Industrial Receiving water – River Tees

Name and/or reference number	Status	Location	Comment
Ref. 254/B/0158		Sewage Disposal Works; South Bank Wharf - 120m south of River Tees & 130m east of west boundary.	
Discharge consent – unknown discharge Ref. 254/X/0647	Transferred from COPA 1974	On site British Steel; Cleveland Works C2 - south bank of River Tees, 485m northeast of northwest corner of TS4	Operator: British Steel Receiving water – River Tees
Discharge consent – trade discharges – cooling water Ref. 25/04/1598	Revoked 26/11/2008	On site Cement and Lime Plaster Manufacturer - 125m south of River Tees and 530m southwest of northeast corner of TS4	Operator – Civil and Marine Limited Discharged to land/soakaway
Discharge consent – trade effluent from sewage disposal works – other Ref. 254/B/0255	Unknown	On site Central Oil Storage & Water Treatment Plant - Northeast quadrant 60m south of River Tees	Operator: British Steel Plc Receiving water – River Tees
Discharge consent – trade effluent from sewage disposal works – other Ref. AR0241	Revoked 14/09/1995	On site Sewage Disposal Works Eston Jetty, Cleveland Works - Northeast quadrant 60m, south of River Tees	Operator: British Steel Plc Receiving water – River Tees
Discharge Consent – sewage discharges – storm water overflow – water company Ref. Qc.25/04/1590	Active	Off-site Cso at Smiths Dock Road – 145m west of site	Operator: Northumbrian Water Limited Receiving water – River Tees
Discharge Consent – sewage discharges – final/treated effluent – not water company Ref. 254/0592	Transferred from COPA 1974	Off-site Tees & Hartlepool Port Authority Sewage Disposal Works – 40m southwest of northwest corner of TS4	Operator: PD Teesport Limited Receiving water – River Tees
Discharge Consent – trade discharges – cooling water Ref. 254/1217	Revoked 14/06/1993	Off-site British Steel, Cleveland Works – 50m north of TS4	Operator: Corus Construction Industrial Receiving water – River Tees
Discharge Consent – unknown Ref. 254/X/0646	Transferred from COPA 1974	Off-site British Steel, Cleveland Works – 50m north of TS4	Operator: British Steel Plc Receiving water – River Tees
Discharge Consent – sewage discharge – sewage and trade combined - unspecified Ref. 254/1172	Revoked 10/01/2000	Off-site Sewage Disposal Works, Clay Lane Outfall – 25m north of TS4	Operator: Northumbrian Water Ltd Receiving water – River Tees
Discharge Consent – unknown Ref. 254/X/0627	Transferred from COPA 1974	Off-site Sewage Disposal Works, Clay Lane Outfall – 25m north of TS4	Operator: Northumbrian Water Ltd Receiving water – River Tees
Discharge consent – trade discharges – site drainage Ref. 254/1941	Modified Effective 06/03/2007	Off-site Sabic UK Petrochemicals Teesport Compound – 160m northeast of northeast quadrant of TS4	Operator: Sabic UK Petrochemicals Receiving water – River Tees

Name and/or reference number	Status	Location	Comment
Discharge consent – unknown Ref. 254/x/0645	Transferred from COPA 1974	Off-site Tarmac Roadstone (Sewage Disposal Works) – 180m northeast of northeast quadrant of TS4	Operator: A Mccaskie (Hauliers) Ltd Receiving water – River Tees
Permits - IPPC			
IPPC Ref. PP3336KL	Valid	On site ICI No3 Teesport – northeast corner of northeast quadrant.	Operator: Impetus Waste Management Ltd
IPPC Ref. BP3730VD	Valid	On site ICI No 3 Teesport (Landfill) – northeast corner of northeast quadrant, adjacent to River tees	Operator: North Tees Waste Management Limited
IPCC Ref. JP3534VK	Effective	Off-site Waste Treatment Facility at ICI (Teesport) No 3 Landfill – 200m southeast of northeast quadrant of TS4	Operator: Green North East Trading Bidco Limited
IPPC Ref.FP3436AT/UP3530RG	Effective	Off-site Teesside Integrated Iron and Steelworks (Cleveland Works) – 200m east of main area of TS4	Operator: Longs Steel UK limited
IPPC Ref.RP3434hp	Effective	Off-site Cle 3/8 Landfill Site (Cleveland Works) - 200m east of main area of TS4	Operator: Sahaviriya Steel Industries UK Limited
IPPC Ref. Bv1984ih/SP3130VB	Valid	Off-site ICI No 2 Teesport – 200m east of main area of TS4	Operator: North Tees Waste Management Limited
Permits – LAIPPC/LAPPC/LAAPC			
LAIPPC Ref.A-CAM-302	Revoked	On site Located within northwest area of northeast quadrant of TS4	Operator: Civil and Marine (Gbbs) Plant
LAIPPC Ref. -	Issued	Off-site Cement Production - 210m southwest of main area of TS4	Operator: Ready Mixed Concrete (North) Ltd
LAPPC Ref. 109121213	Permitted	On site Teesside Coating Plant – northeast corner of northeast quadrant of TS4	Operator: Lafarge Tarmac Limited PG3/15 mineral drying and roadstone coating process
LAAPC Ref. B/3.5/048/RO	Authorised	On site Teesside Works – northeast corner of northeast quadrant of TS4	Operator: Tarmac Northern Ltd PG3/8 Quarry processes including roadstone plants and the size reduction of bricks, tiles and concrete

Name and/or reference number	Status	Location	Comment
LAAPC Ref. A-CAM-302	Transferred to LAIPPC	On site GGBS plant - Located within northwest area of northeast quadrant of TS4	Operator: Civil and Marine (Ggbs Plant) PG3/8 Quarry processes including roadstone plants and the size reduction of bricks, tiles and concrete
LAPPC Ref. 104775693	Permitted	On site Civil and Marine (Teeside Works) – located within southwest area of northeast quadrant of TS4	Operator: Hanson Premix PG3/1 Blending, packing, loading and use of bulk cement
LAAPC Ref. 2306976	Revoked	On site Ggbs Plant – located within the southwest area of northeast quadrant of TS4	Operator: North East Slag Cement Ltd PG3/8 Quarry processes including roadstone plants and the size reduction of bricks, tiles and concrete
LAPPC Ref. RMT-301-MP	Permitted	Off-site Puddles Road, Southbank – 220m south of the main area of TS4	Operator: Ready Mix Tees Valley Ltd PG3/1 Blending, packing, loading and use of bulk cement
Planning Consents			
Application for Hazardous Substances Consent Ref. R/2011/0210/HD	Expired: 08/06/12	On site in area of SBCO	Redcar Blast Furnace and Coke Ovens
Continuation of Hazardous Substances Consent Ref. R/2011/0211/HD	Withdrawn: 08/06/12	On site in area of SBCO	Redcar Blast Furnace and Coke Ovens
Application for Hazardous Substances Consent Ref. R/2011/0208/HD	Expired: 08/06/12	Off-site Landfill adjacent to the east	Landfill adjacent to the east
Continuation of Hazardous Substances Consent Ref. R/2011/0209/HD	Withdrawn: 08/06/12	On site in area of SBCO	Redcar Blast Furnace and Coke Ovens
Application Under S96A of the Act to Vary Planning Condition (1) of Planning Permission R/2010/0789/VC To Extend the Term of the Planning Permission for Mobile Concrete Batching Plant Ref. R/2012/0796/NM	Expired: 20/11/12	On site Hanson Concrete Civil and Marine Teesside Works Grangetown	Northeast quadrant
Application Under S96A of the Act to Vary Planning Condition (1) of Planning Permission R/2010/0789/VC To Extend the Term of the Planning Permission for	Expired: 07/12/15	On site Hanson Concrete Civil and Marine Teesside Works Grangetown	Northeast quadrant

Name and/or reference number	Status	Location	Comment
Mobile Concrete Batching Plant Ref. R/2015/0681/NM			
Notes:			
IPPC – Integrated Pollution Prevention and Control LAIPPC – Local Authority Integrated Pollution Prevention and Control LAPPC – Local Authority Pollution Prevention and Control LAAPC – Local Authority Air Pollution Control			

The SSI site holds a COMAH Upper Tier Establishment classification associated with the large quantities of PAH contained within the Coke Oven Gas Main. This classification also applies to the TS4 site.

The presence of numerous tanks on the site is considered to pose a potential constraint. This is due to the fact that the condition and contents of these tanks is unknown. Similarly those located adjacent to the west and south are also considered to pose a potential constraint because they are located upstream of the site, therefore should any leaks have occurred contamination will have flowed towards the River Tees and consequently TS4. The potential risk will depend on the materials stored within tanks and their distance from TS4, as the greater the distance the greater the dispersal of contaminates by groundwater flow. Polychlorinated biphenly's (PCBs) were once widely used as coolant and dielectric fluids within electrical equipment and as such may be found within electrical Sub-station, particularly dating before the 1980's. Where PCBS have been replaced by other substances there is a risk that residue may remain within the component. As the condition and date of the sub-stations are unknown it is considered that those on site, and those located upstream of TS4 pose a potential constraint.

The Hazardous Substances consents relate to the off-site use and storage of ammonium nitrate and phosphate based fertilisers. Although off-site, the consents are associated with industries located upstream TS4. As such groundwater contaminated by these industries will flow towards the site. However given their distance from the site it is considered likely that concentrations will be sufficiently dispersed by the time they reach TS4 and therefore any risk is likely to be low.

Whilst many of the discharge consents relating to the site have been revoked, the associated pipes will have passes beneath the site. These may have become damaged over time result in leaks. However given the nature of the material transported it is unlikely that these will have posed a risk to the site. Furthermore concentrations are likely to have been dispersed given the granular nature of the Made Ground and the high water table associated with the River Tees.

Consents located offsite to the south, west and north of the site (assumed that the pipes pass beneath TS4 to discharge north of the site boundary), both active and revoked, are typically associated with surplus storm water or treated effluent and therefore are unlikely to pose a risk. Those located east of the site are located downstream and therefore do not pose a constraint.

The IPPC, LAIPPC and LAAPC permits identify historical and current activities that have the potential to cause harm and as such are monitored and have conditions put in place to prevent pollution incidents from occurring. Those identify within TS4 highlight areas of potential contamination and therefore pose a potential constraint. Those located off-site to the south, and particularly to the east of the main area of the site also pose a potential constraint. Given the proximity of the River Tees any contaminants from these activities are likely to be carried beneath the site by groundwater flow on its way toward the river. The impact from activities associated with LAAPC permits are likely to be concentrated around the footprint of the activity, with airborne dust and contaminants readily dispersed by the wind.

The closest Fuel Station entry to the site is located 240m south of the main area of TS4. This is a non-retail site associated within Les Woolstone HGV. A second is located 330m southwest of the main area of TS4 and is associated with a retail fuel station. Both of the sites are located upstream of TS4, therefore should any leaks have occurred contamination will have flowed towards the site. However, given the distance of these sites from TS4 it is likely that any contaminants will have been dispersed by groundwater flow before entering the site. As such the risk of contamination associated with the fuel station is considered to be low.

The closest Pollution Incident is located 120m south of the site, and dates from 2003. Although the incident resulted in a Category 2 – Significant Incident to water, given the age of the incident it is unlikely to pose a constraint. A Category 3 – Minor Incident to water, associated with the release of oils is recorded is recorded pollution Incident 40m northeast of the northeast quadrant. The incident dates from 1993 and is located downstream, therefore it does not pose a constraint.

Geo-environmental and Contamination

4.1 Processes on site

The following sections describe the processes which have occurred on site and the potential contaminants that may be present as a result of these activities.

4.1.1 General Made Ground – Including Backfilled Reservoirs

Historical mapping identifies two backfilled reservoirs within the western part of the main area of TS4. It is unknown what materials were used to backfill the reservoirs, which may be significantly different to the surrounding area. A variety of contaminants may be located within this area associated with the materials used to backfill; including waste from the local iron and steel making industries. Possible contaminants may include:

- Asbestos
- Heavy metals and metalloids
- Hydrocarbons – TPH and PAH
- Inorganic compounds – phosphate, sulphates/sulphides
- Transformer oils – PCBs
- Decaying organic matter – generating soil gases and elevated pH

4.1.2 Made Ground - Slag

Slag produced as a waste from the iron and steel making industry has been imported to site in order to raise site levels. The composition will depend on the quality of the raw materials used and if any metal reclamation was undertaken. Deposits of slag are likely to be sulphate rich, with an alkali pH and contain a variety of heavy metals such as arsenic, iron, nickel and zinc as well as cyanide, antimony.

Potential contaminants are expected to comprise:

- Asbestos
- Elevated pH
- Heavy metals and metalloids
- Sulphates/sulphides

4.1.3 Brine Wells and Salt Works - Cleveland Salt Works

Brine wells were sunk to extract the halite beneath the site as part of the areas early chemical industry. Fresh water was pumped down boreholes into the salt bed, dissolving it. The resulting brine was then pumped out and evaporated in large pans to drive off the water. The Cleveland Salt Works were initially fuels by gas from the adjacent blast furnaces, but were later converted to coal (ref. www.hidden-teesside.co.uk). Leaks from the brine wells and pipework and tanks used to transfer and store the brine water will have resulted in hypersaline conditions, with hydrocarbon contamination from accidental spills and leaks of oils and lubricants. Similar contamination would also be anticipated within workshop area and include solvents for degreasing.

Contamination is also likely around the area of the salt pans where coal was burnt to generate heat, producing ash which would require disposal. Coal storage areas are also likely to be contaminated with heavy metals and sulphates. Given the age of the Cleveland Salt Works it is likely that asbestos was used for insulation and fire/heat protection, and therefore although the works has long since been demolished, may be present within any remaining rubble. PCBs may have also been present within Sub-stations and electrical equipment and are discussed in Section 4.1.9.

Possible contaminants are therefore likely to include:

- Asbestos
- Elevated pH
- Hydrocarbons – PAH
- Heavy metals and metalloids
- Organic solvents - solvents
- Brine – Salts; sodium chloride
- Sulphates/sulphides

4.1.4 Buildings – general including Welfare and Offices

Based on the history of the site, most of the buildings that remain were most likely built before 2000 and as such are likely to contain asbestos. Areas where asbestos is present or assumed to be present will be recorded within the site's Asbestos Register. Other source of contamination area likely to be located with leaks and spillages associated with fuel storage tanks, hydrocarbons from oils and grease used for general maintenance; and lead within paint and water pipes.

Possible contaminants are therefore likely to include:

- Asbestos
- Hydrocarbons – TPH and PAH
- Heavy metals - Lead

4.1.5 Car Parks and Highways

Localised contamination by hydrocarbons and organic compounds is also likely within car parking areas as a result of leaks and spillages of hydrocarbons from oils, fuels, and grease.

4.1.6 Chimneys, Furnaces, Incinerators and Boiler Houses

Drawing ref. X97498B identifies four chimney stacks within the southern area of the site, ref CCS27 to CCS30, broadly correlating with the aerial photography of 2012. The historical maps identify numerous chimneys across TS4 throughout the industrial history of the site. Contamination will most likely be associated with leaks and spillages of fuel during storage and transfer and therefore the potential contaminants will depend on the fuel source. This will also influence the chemical composition of any waste products produced i.e. ash.

Asbestos may have been used for insulation and fire/heat protection, and therefore may even persist within the ground where structures have been demolished. Similarly localised hydrocarbon contamination may be found where oils and grease were stored and used for general plant maintenance.

Possible contaminants are therefore likely to include:

- Asbestos
- Elevated pH

- Hydrocarbons - TPH and PAH
- Heavy metals and metalloids
- Sulphates/sulphides

4.1.7 Concrete Works

Concrete is formed by mixing cement with aggregate. With reference to the DoE profile (ref. DoE Industry Profile – Ceramics, cement and asphalt manufacturing works) cement is highly alkaline, derived by mixing limestone/chalk and clay or shale together with other minor materials. This may include alumina, iron oxide, sulphur trioxide, manganese oxide, bauxite, slag, pigments and plasticisers. The mix is burned in a kiln to make a cement clinker, which is ground together with gypsum/anhydrite. It is unknown if the cement used at these within these works was made on site or imported.

These works will have also included ancillary activities such as workshops, maintenance areas and fuel storage for plant, vehicles and heating. Manufacturing concrete uses a lot of electricity, thus there may have been on-site sub-stations and associated transformers or capacitors (see Section 4.1.9).

Contamination is also likely around the area of the kiln associated with fuels and ash. Fuel sources may potentially include high calorific wastes (e.g. solvents) from other industries. Leaks and spillages during transfer and storage may have resulted in contamination, particularly from underground tanks. Localised contamination within storage facilities, transfer and production areas may also be present as a result of accidental spillages of metal oxides, inorganic compounds and other additives. On-site disposal of waste products, including kiln ash and workshop wastes also pose a potential risk.

Given the operational periods of these works, asbestos may have been used as pipe insulation, cladding etc. As the older of the two works was redeveloped during the late 1950's it is possible that asbestos may have been disposed on site, and may be within any remaining demolition rubble.

Potential contaminants are therefore likely to include:

- Asbestos
- Elevated pH - acids and alkalis
- Hydrocarbons - TPH and PAH
- Heavy metals and metalloids
- Organic solvents
- Phenols
- Sulphates and sulphides
- PCBs

4.1.8 Docklands - Dolphins, Jetties and Wharfs

Located along the south bank of the River Tees these structures were used as loading and off-loading points for the raw materials required and products produced by the site. These structures have been served by railway lines and travelling cranes allowing for the bulk transfer of cargo (see Section 4.1.15). The early wharfs were located within the mudflats, however the reclamation of the site raised ground levels by several meters, extending the mainland northwards to the south bank of the river. Potential contamination may exist as a result of the materials used in the reclamation. Not all of the materials may have been moved by mobile plant, increasing the likelihood for possible spillage and the spread of wind blow dust (ref. DOE profile – Dockyards and dockland). Whilst the presence of pipes suggests slurry systems may have also been employed, these may have suffered from leaks and spillages.

Ancillary operations are likely to have been present including but not limited to the maintenance areas, the storage of raw materials, cargo and fuels including associated fuelling areas for dockside vehicles; and on-site waste disposal facilities to accommodate wastes from ancillary activities and spilled cargo. Due to the sites location there is also a risk that dredging’s which may have been used to reclaim the site, could contain contaminants that originated in discharges from industries upstream.

Potential contaminants are expected to comprise:

- Elevated pH
- Hydrocarbons – TPH and PAH
- Heavy metals and metalloids
- Organic compounds
- Sulphates and sulphides

4.1.9 Electrical Sub-stations, Transformers and Oil-filled Cables

Prior to the 1980s, Polychlorinated Biphenyls (PCBs) were routinely used as an insulator in electrical Sub-stations. Either during maintenance or disassembly, PCBs were often spilled on to the surrounding ground. The PCBs used in Sub-stations were generally of high viscosity and low leaching potential, so contamination can be expected to be localised.

While the exact dates of installation are unclear, it is safe to assume that some or all of the Sub-stations on site contained PCBs. Asbestos may also be present where fire-protection measures were required. Additional potential contaminant sources include the batteries used in the sub-stations (lead acid and nickel cadmium) and the lead wrap used in 66kV cable coatings.

The 66kV distribution network is transmitted around site through oil filled cables; with the oil acting as an insulator. Historically leaks have been reported from these cables.

Potential contaminants are expected to comprise:

- Asbestos
- Elevated pH - acids
- Heavy metals – Cadmium, Leak, Nickel
- Hydrocarbons - PAH
- Transformer oils - PCBs

4.1.10 Fuel Oil Depot

Contamination may occur as a result of spillages during the transfer of materials and from undetected leaks, particularly from underground storage tanks and pipelines. Numerous tanks have been identified across the site and these most likely stored fuels, solvents and by-products of the iron and steel making industries such as benzol and tar. Contamination may also be attributed to maintenance activities such as cleaning and painting. Asbestos may also be present where fire protection or insulating measures were required. It should be noted that Heavy Fuel Oil for Combustion is a COMAH product.

Potential contaminants are expected to include:

- Asbestos
- Hydrocarbons - TPH and PAH
- Phenols

- Volatile Organic Compounds

4.1.11 Galvanising Works – Eston Sheet and Galvanising Works.

The site operated from the 1920's, and was redeveloped during the early 1950's into Eston (Iron) Refinery (see section 4.1.13). With reference to the DOE profile (Metal manufacturing, refining and finishing works – electroplating and other metal finishing works) hot-dip galvanising *'involves the immersion of iron or steal workpieces into a bath of molten zinc to form an adherent protective coating of zinc and zinc compounds'* Before immersion the metal is degreased, and acid pickled (hydrochloric acid) or shot blasted. A dry process involves immersing the metal into a zinc chloride/ammonium chloride flux solution and allowing it to dry before immersion into the molten zinc bath. Effluent contaminated with zinc cyanides is produced by this process. This is treated to allow oxidisation of the cyanides, the pH is then adjusted to allow heavy metal hydroxides to precipitate. This neutralised effluent is then clarified creating a sludge; and the remaining waste water discharged from the works. Historical effluent plants were designed on the gravity flow principle and were difficult to maintain and repair, and often suffered from leaks. Sludge and solid wastes may have been disposed of on site within designated landfills or used to backfilled basement levels of demolished buildings. Untreated liquid wastes may have also been disposed of on site by means of soakaway systems, therefore creating the potential for contamination.

The DOE profile suggests that contamination is most likely to have occurred as a result of leaks and spillages of raw materials, products and waste by-products from floor drains, tanks and sumps. This is likely to include acidic and/or alkaline solutions and effluents. High metal concentrations are likely to be associated with areas used to treat pre-treatment effluents and store and dispose post-treatment sludge's. Other potential sources of contamination include leakages and spillages of plating chemicals, solutions, and solvents and acids used for degreasing.

Ancillary processes will also have occurred at the works site, including but not limited to the storage and transfer of fuel for plant and vehicles. Oils may have leaked from electrical transformers, which may present a risk of PCB contamination. The buildings themselves may also pose a potential contaminative risk, not only from asbestos, but buildings materials impregnated with contaminates (e.g. from demolished tanks, floors and drains may release materials into the environment as a result of demolition and clearance works.

Potential contaminants are therefore likely to include:

- Asbestos
- Elevated pH - acids
- Hydrocarbons - PAH
- Heavy metals and metalloids
- Inorganic compounds
- PCBs
- Organic solvents

4.1.12 Garages and Maintenance Workshops

The Maintenance Workshops are generally associated with the repair and maintenance of railway engines and carriages and plant, with garages generally associated with other vehicles. Contamination is likely to be focused within storage areas as a result of leaks; and around area where repairs are carried out and vehicles serviced due to accidental spillages. Typical sources of contamination are likely to be associated with hydrocarbons from fuels, oils and grease, solvents for degreasing, metals from batteries and organic compounds from paints.

Localised contamination by hydrocarbons and organic compounds is also likely, as a result of leaks and spillages of oils, fuels, grease and anti-freeze products. Asbestos may also be present as lagging, cladding or insulation.

Potential contaminants are therefore likely to include:

- Asbestos
- Heavy metals – Lead, Nickel and Cadmium
- Hydrocarbons – TPH and PAH
- Organic compounds
- Organic solvents

4.1.13 Iron and Steel Works – Including the Bessemer Works (Ferro-manganese Works) and Pig Casting Machine

Iron oxide in the form or iron ore and other oxides ("gangue" minerals) are smelted in a blast furnace with coke and limestone to produce iron. The ore may be turned into pellets (bonding together very finely ground ore) or sinter (see section 4.1.17 Sinter Plant). The blast furnaces reduces the iron oxide to iron and in doing so becomes saturated with carbon from the coke (ref. DOE Industry Profile – Metal manufacturing, refining and finishing works – iron and steel works). Slag is a waste produce of the process, comprising the gangue minerals which are absorbed into the limestone-based flux. Gas produced in the blast furnace is cleaned and then reused as fuel, with the resulting waste slurry often high in metals and alkalis. The molten iron can then be purified to create steel.

Steel is an alloy of iron, produced by removing excess carbon, silicon, phosphorus and other elements. Depending on the end product aluminium, nickel and chromium may be added. Slag is produced as a by-product of the process, formed by adding lime as a flux and oxygen. It is separated from the steel and may undergo metal reclamation. Slurries generated by flume cleaning have high metal contents, but are unsuitable for reuse and therefore may be stored in lagoons on site. Similarly water used during the process is high in metals and fluoride. Scrap metal may be used as part of the process, and may result in localised contamination within the stocking grounds. The Bessemer process was an early method for mass-producing steel from pig iron; a carbon-rich iron. The introduction of manganese to the iron oxide reduced the melting point of the combined alloy. Water was used to cool the pig iron before being transported, therefore a water treatment plant was associated with the site. As such there may be localised contamination as a result of leaks and spills of untreated water and resulting slurry's. Gas generated by the blast furnace was collected by Electrostatic Precipitators and sent for cleaning. Areas of contamination are likely to include the blast furnace, electrostatic precipitators and the tracks used to transport the raw materials and resulting ferro-manganese.

Given the age of the buildings it is considered likely that asbestos may have been used for fire protection and insulation within the plants. Other uses may have included pipe lagging and building cladding. Although many of the structures no longer exist it is possible that asbestos materials may persist within demolition rubble. Localised hydrocarbon contamination may also be encountered as a result of accidental spills of oils and grease used in the general operation and maintenance of the works.

Potential contaminants are expected to include:

- Asbestos
- Elevated pH

- Heavy metals and metalloids
- Hydrocarbons – PAH
- Inorganic compounds
- PCBs
- Solvents from de-scaling
- Sulphates/sulphides

4.1.14 Miscellaneous Tanks and Pipelines – not water related

Contamination may occur as a result of spillages during the transfer of materials and from undetected leaks, particularly from underground storage tanks and pipelines. Numerous tanks have been identified across the site and these most likely stored fuels and chemicals used in the steel-making process. Table 3.5 list the chemicals used on site, and where they were stored on site. Given the volume of water required in the process these also include corrosion and scale inhibitors and therefore may have an elevated pH. Industrial grey water will be a source of heavy metals, inorganic compounds and elevated pH.

Contamination may also be attributed to maintenance activities such as cleaning and painting. Asbestos may also be present where fire protection or insulating measures were required.

Potential contaminants are expected to include:

- Asbestos
- Elevated pH
- Hydrocarbons – PAH
- Inorganic compounds – phosphate, sulphates, fluoride
- Organic compounds – Phenols, Napthalene
- Organic solvents – Volatile Organic Compounds

4.1.15 Phosphate Works

The earliest edition maps identify a Phosphate works within the site termed Antonien Works (phosphate). It has been assumed that this refers to the process described by the DoE profile (DOE Industry Profile - Chemical works: fertiliser manufacturing works) of producing phosphate fertiliser " *by the addition of acid to imported phosphate rock and bones to produce soluble phosphates"*'. The main ingredients are calcium sulphate (gypsum) and sulphuric acid, but phosphate fertilisers may also be produced by the *"ammoniation of phosphoric acid to produce ammonium phosphate".* After manufacture the fertilisers are either directly distributed to the consumer of sent to bulk blending plants for bagging or transfer into drums. The finished product may be in granular or liquid form.

The DOE profile lists ancillary activates associated with the manufacturing process as likely including *"on-site power generation, raw water purification and wastewater treatment plants".* Electrical Sub-stations may have been located on site to control the electricity being generated, therefore there may be the possibility of PCB impacted ground where sub-stations and transformers were located. Wastes that contain organic solvents were usually disposed of by incineration, with waste materials disposed via on-site landfill.

Later historical maps refer to the Antonien Works as a Basic Slag Works, suggesting that the phosphate may actually have been being derived from phosphate-rich (basic) slag rather than phosphate rock. Details of this process are given in sub-section 4.1.18.

Potential contaminants are expected to include:

- Asbestos
- Elevated pH
- Heavy metals
- Hydrocarbons - PAH
- Phenols
- Sulphates/sulphides

4.1.16 Railway Lines, Sidings and Travelling Cranes

Railway lines and sidings are shown from the earliest edition mapping. The areas with the greatest potential for contamination are typically sidings, maintenance depots and refuelling areas. 1950's mapping show several Travelling Cranes dominating the northern to central areas of the main TS4 site, which were served by railway lines and sidings. Railway embankments are likely formed from waste materials from the surrounding iron and steel industries of the time. Crushed slag is likely to have been used as ballast, however given the period stream locomotive ash may also have been used. Spent ballast may have been removed and replaced, resulting in localised stockpiles of this material alongside the tracks. Wooden sleepers will have been treated with preservatives, with older examples potentially further treated with decay inhibitors. Herbicides will have been used to prevent the growth of weeds, and may have included substances toxic to human health.

Early overhead cranes may have been steam driven, although historical mapping indicates that most appeared on the site after 1915 and therefore are likely to have been electric. As such early transformers will have contained PCBs and therefore there is a potential risk of PCB impacted ground as a result of accidental leaks and spillages.

Wastes derived from depots are likely to have comprised scrap metals and packaging materials, with combustible waste often burned on site or used as fuel for heating; generating ash. Fuels, lubricants and greases are likely at terminal stations and sidings where trains may have stood for significant periods of time, and within depots, workshop and fuelling areas as a results of spillages and leaks. General contamination across railway land may occur through wind dispersal of airborne contaminants such as coal dust from open waggons and steam locomotives.

Asbestos may be found within associated buildings or where buildings have been demolished as the material has historically been used for cladding, roofing and pipe lagging.

Potential contaminants are expected to include:

- Asbestos
- Elevated pH
- Hydrocarbons – TPH and PAH
- Heavy metals and metalloids
- Phenols
- Transformer oils - PCBs
- Sulphates/Sulphides

4.1.17 Riverside Pump House

Water intended for human consumption was steralised close to the source within the Chloride House, where contamination is likely to be linked to leaks and accidental spillages of organic compounds such as chloride and sodium chloride. Biocides may also have been used.

Drawing 2C-928 indicates that Albany Oil Pumps were used within the pump house, therefore localised contamination may be present as a result of leaks of stored fuels and accidental spills during transfer. Other sources of contamination are likely to include oils and greases used in maintenance and chlorine used to sterilise the water in the adjacent Chlorination House. Sub-stations and transformer pens are located adjacent to the pump house (see Section 4.1.9). Asbestos may also be present within the buildings construction.

Potential contaminants are expected to include:

- Asbestos
- Hydrocarbons – TPH and PAH
- Inorganic compounds – Chloride and sodium chloride
- PCB's

4.1.18 Sinter Plant

Sinter is a small, irregular nodule-shaped agglomerate of iron ore fines, limestone and coke. It is produced by mixing and blowing hot air through very fine grained material until liquefied and fused. The ingredients bond together while undergoing little chemical change. These nodules are they key metallic ingredient for the blast furnace. Sulphur dioxide and dust are produced by the process, with the latter generally captured by electrostatic precipitators and fed back into the plant.

Ancillary processes associated with the plant are likely to include storage and transfer of oils and lubricants. Oils may have leaked from electrical transformers, which may present a risk of PCB contamination. The buildings themselves may also pose a potential contaminative risk if asbestos was used as pipe lagging or cladding etc.

Potential contaminants are expected to include:

- Asbestos
- Elevated pH
- Heavy metals and metalloids
- Hydrocarbons - TPH and PAH
- Transformer oils - PCBs
- Sulphates/Sulphides

4.1.19 Slag Processing Works – Includes Basic Slag Works and Slag Crushing Works, Slag Brick Works and Slag Wool Works.

Slag is a by-product of iron and steel making; comprising gangue minerals from the ore which are absorbed into a limestone-based flux. Blast furnace slag differs from steel-making slag in that it contains no iron oxide or phosphorous (ref. DOE Industry Profile – Metal manufacturing, refining and finishing – iron and steel works), but may contain a very small amount of iron trapped within it which may be recoverable. The composition of the slag varies, depending on the quality of the raw materials used.

Basic slag is the name given to high-phosphate slag which was historically used as fertiliser. This material was produced by grinding the slag down to an appropriate size within the Slag Crushing Works.

Slag wool is produced by firing a jet of air through liquid slag, causing it to dry into long, thin strands which can then be spun and used for insulation.

Slag bricks are produced by pouring liquid slag into brick-shaped moulds, before baking them within a kiln. Their durability made them a popular choice for paving roads and alleyways before the invention of tarmac.

Contamination is likely to be associated with leaching of heavy metals from stockpiled slag and areas where slag accumulated during processing. Slag is high in sulphates and generally highly alkaline, and therefore may have produced aggressive ground conditions within such areas.

Ancillary activities associated with these slag processing plants are likely to include storage and transfer of fuels, oils and lubricants used to power and maintain equipment. Oils may have leaked from electrical transformers, which may present a risk of PCB contamination. The buildings themselves may also pose a potential contaminative risk if asbestos was used as pipe lagging or cladding etc.

Potential contaminants are expected to include:

- Asbestos
- Elevated pH
- Heavy metals and metalloids
- Hydrocarbons – PAH
- Inorganic compounds – phosphate
- Sulphates/sulphides
- PCBs

4.1.20 South Bank Coke Works, Coke Oven Gas Main and By-Products Plant – including Benzole Store

Coke, used in iron making, is formed by heating coal in the absence of air. By-products include coal gas, tar and ammoniacal liquors. The gas leaving the ovens is impure and therefore undergoes fractionation to remove ammonia, tar, hydrocarbon oils and sulphur compounds. With reference to report SSI UK IL SBCO 2016 the SBCO Coke Oven Gas system has a history of containing pyrophoric materials, caused by internal corrosion of the pipework by corrosive elements within the gas. This forms iron sulphide which will ignite spontaneously in air at or below 55°. Naphthalenene also build up within the pipe, and although not pyrophoric is it flammable. In order to remove this risk the system is maintained in an oxygen free environment by the application of a continuous blanket of nitrogen. Although not toxic or flammable nitrogen is an asphyxiant.

Based on the DOE profile (ref. DOE Industry Profile – Gas works, coke works and other coal carbonisation plants) the tar and water vapour is removed in condensers, with the tar separated by washers or electrostatic precipitators. Ammonia, hydrogen sulphide and hydrogen cyanide can be removed from the gas by scrubbing with weak ammoniacal liquor or water. Slaked lime was historically used to remove hydrogen sulphide, producing foul lime as a waste product which solidifies and weathers to emit hydrogen sulphide. Lime was later replaced by bog ore (iron oxide), producing ferric sulphide which was used in the manufacture of sulphuric acid and also to remove hydrogen cyanide from coal gas. Additional purification of the gas removed crude benzene and aromatic hydrocarbons, collectively referred to as benzol. These by-products were important to the early inorganic and organic chemical industries and will have been stored within tanks on site.

The fractionation and distillation of the by-products was often an ancillary process of the coke works, and in doing so often generated wastes and other by-products. The materials were stored in tanks, often underground which could be a potential source of contamination as a result of leaks and spills. If coal tar could not be used it may have been disposed of on site in ponds or lagoons. Spent oxide, foul lime and ammoniacal liquor may also have potentially bene disposed of in this way. These ponds and lagoons pose a potential contamination risk, and if not suitably lined may have resulted in contaminants leaching from the waste.

Further details of hazardous process materials and future waste considerations are covered in the SSI UK report ref. SSI UK (IL) SBCO 2016

Given the operational periods of these works, asbestos may have been used as pipe insulation or cladding. Where former coke ovens have been demolished it is possible that asbestos persists within any remaining demolition rubble.

Potential contaminants may include:

- Asbestos
- Elevated pH – acids and alkalis
- Hydrocarbons - PAH
- Heavy metals and metalloids
- Organic compounds – Ammoniacal liquor, naphthalene, benzene
- Phenols
- Sulphates/Sulphides

4.1.21 Stocking Grounds

Drawing 1X5952 shows the layout of the former stocking grounds. More recently the western half of the main area of TS4 has been used by the Tarmac Group of Companies to store slag, with large stockpiles of slag are also stored within the northeast quadrant of TS4. ‘Jallop’; a mixture of coal tar, coke and other products in a COMAH Substance, which is currently being stored on an area of hard standing west of the By-Products Plant, formerly the Breeze (fine coal) Stocking Area. During the site walkover fly-tipped waste materials were noted within the stocking areas, and as such asbestos products may be present.

Potential contaminants are expected to include:

- Asbestos
- Elevated pH
- Heavy metals and metalloids
- Hydrocarbons – TPH and PAH
- Organic compounds – Ammoniacal liquor
- Phenols
- Sulphates/Sulphides

4.1.22 Tidal Flat Deposits

Tidal Flat deposits often contain bands of organic matter and peat. As this material decays gases such as methane and carbon dioxide are released and the pH may become slightly acidic. The build-up of these gases poses a potential explosive and asphyxiant risk, whilst an acidic pH poses a potential risk to buried building materials.

4.2 Summary of Potential Contaminants

Based on the information available and what is known about the processes conducted on site, a summary of likely contaminants is listed Table 4.1

Table 4-1 – Summary of potential contaminants

Potential contaminant	**Processes**																						
	General Made Ground	**Made Ground - Slag**	**Brine wells & Salt Works**	**Buildings - general**	**Car parks & Highways**	**Chimneys, Furnaces & Incinerators**	**South Bank Coke Works, Coke Oven Gas Main & By-Products Plant**	**Concrete Works**	**Docklands**	**Electrical Sub-stations & Transformers**	**Oil-filled Electric Cables**	**Fuel Oil Depot**	**Galvanising Works**	**Garages & Workshops**	**Iron & Steel Making**	**Miscellaneous Tanks & Pipelines**	**Phosphate Works**	**Railway Lines & Sidings**	**Riverside Pump House**	**Sinter plant**	**Slag Processing Works**	**Stocking Grounds**	**Tidal Flat Deposits**
Asbestos	✓^	✓^	✓^	✓^		✓^	✓^	✓^		✓^	✓^	✓^	✓^	✓^	✓^	✓^	✓^	✓^	✓^	✓^	✓^	✓^	
Elevated pH	✓	✓	✓			✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓			✓	✓	✓
Heavy Metals & metalloids	✓	✓	✓#	✓		✓	✓	✓	✓	✓			✓	✓	✓		✓	✓		✓	✓	✓	
Other inorganic compounds							✓						✓		✓	✓		✓			✓		
Other organic compounds	✓		✓				✓	✓	✓					✓		✓			✓			✓	
PAH	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
TPH	✓*		✓	✓	✓	✓		✓	✓			✓		✓	✓		✓		✓	✓		✓	
PCBs								✓*		✓	✓		✓*		✓*			✓*	✓*	✓*	✓*		
Phenols	✓						✓	✓				✓					✓	✓				✓	
Sulphates/ sulphides	✓	✓	✓			✓	✓	✓	✓						✓	✓	✓	✓		✓	✓	✓	

Organic solvents – & VOCs	✓		✓					✓~				✓	✓	✓	✓	✓							
Soil gases	✓																					✓

Notes

* - Associated with sub-stations, transformers and capacitors on the works site and not the process itself

^ - Associated with buildings and infrastructure and not a product of the process itself

~ - As a high calorific fuel source and not a product of the process itself

- Associated with ancillary activities and works only i.e. burning fuels for power and heating

4.3 Summary of Previous Geo-environmental Testing

4.3.1 1999 Ground Investigation

As part of the 1999 ground investigation limited chemical and geo-environmental testing was undertaken on samples of Made Ground and from various stockpiles of slag located around the site. Table 4-2 below summarises the laboratory results, with the tests scheduled based on guidance current at the time of the investigation. The results in Table 4-2 have been assessed against current Land Quality Management (LQM) Suitable 4 Use Levels (S4UL) for a Commercial end use as this is perceived to be the most likely end use for the site.

Table 4-2 – Summary of geo-environmental testing undertaken as part of the 1999 ground investigation

Contaminant	S4UL (mg/kg)	Results					
	Commercial end use	No. of samples	Range		No. of samples	Range	
			Min mg/kg	Max mg/kg		Min mg/kg	Max mg/kg
Material		Made Ground			Stockpiles		
Arsenic	640	32	<1.0	342.6	3	15.9	45.3
Cadmium	190		<0.2	13.8		<0.2	1
Chromium (hexavalent)	33		<1	8.4		<1	<1
Chromium (total)	8600		7.8	628		27.4	106.4
Lead	2300		10.6	2952.3		73.3	377.1
Mercury	1100		<1.0	3.5		<1	1.2
Selenium	12000		<1.0	212.5		<1	<1
Boron (water soluble)	240000		<0.5	6.7		<1	0.6
Copper	68000		<0.2	3620		41.4	81.1
Nickel	980		2.7	143.9		20.4	33.3
Zinc	730000		19.3	21808		106.6	670
Phenols	440		<1.0	45.2		<1	<1
Total Cyanide	-		<2.0	55.9		<2	<2
Total Sulphate	-		453	51355		1816	10138
Sulphide	-		2.3	1464.2		7.6	262.1
Sulphur (free)	-		<100	1921		<100	355
TEM^	N/A		<100	3560		260	1410
Cyanide (free)	-	2	<2	<2	0	-	-
Mineral Oil^	N/A	19	<0.1	415.7	1	-	51.9
PAH (total)	N/A	15	<10	16	0	-	-

Contaminant	**S4UL (mg/kg)**	**Results**					
	Commercial end use	**No. of samples**	**Range**		**No. of samples**	**Range**	
			Min mg/kg	**Max mg/kg**		**Min mg/kg**	**Max mg/kg**
Material		**Made Ground**			**Stockpiles**		
pH	-	32	5.8	12.2	3	8.8	9.2
Water Soluble Sulphate as SO4 (g/l)	-	30	0.113	2.267	2	0.515	5.954
Notes ^ - tests are no longer relevant and are out of date							

The results of Table 4.2 show exceedances of Chromium (hexavalent) and Lead within the Made Ground, combined with elevated pH and Sulphate levels this suggests that the source is likely to be the slag within the Made Ground. Elevated levels of Lead are associated with samples taken from TPC13 located within the area of the former Galvanising Works, and TPC23 within the area of the former Ferro-Manganese and Pig Caster. Lead is used in both processes and therefore these activities are the most likely source of these results.

Table 4-3 summarises the results from water samples collected as part of the 1999 ground investigation. Again, the tests scheduled were based on guidance current at the time of the investigation. The results in Table 4-3 have been assessed against The Water Framework Directive (2015) for salt water. Note that many of the results are in mg/l which the guideline values are ug/l.

Table 4-3 – Summary of geo-environmental testing undertaken on groundwater samples

Contaminant	**Salt water – Long term (mean)**	**Unit**	**Results**				
			No. of samples	**Unit**	**Range**		**Average**
					Min	**Max**	
Water							
Arsenic	25	ug/l	4	ug/l	1.3	6.8	3.18
Cadmium	*			ug/l	<0.1	0.3	0.2
Chromium	*			**mg/l**	<0.01	<0.01	0.01
Chromium (hexavalent)	0.06	ug/l		**mg/l**	<0.01	<0.01	0.01
Lead	*			**mg/l**	<0.03	<0.03	0.03
Mercury	*			ug/l	<0.1	<0.1	0.1
Selenium	*			ug/l	<0.1	4.3	2.38
Copper	3.76	ug/l		**mg/l**	<0.01	<0.01	0.01
Nickel	*			**mg/l**	<0.01	<0.01	0.01

Contaminant	Salt water – Long term (mean)	Unit	Results				
			No. of samples	Unit	Range		Average
					Min	Max	
Water							
Zinc	6.8	ug/l		**mg/l**	<0.01	0.97	0.25
PAH (total)	*			**mg/l**	<0.01	46.18	12.38
Phenols	7.7	ug/l		**mg/l**	0.01	0.31	0.13
Cyanide (total)	1	ug/l		**mg/l**	<0.01	<0.01	0.01
Sulphate	*			**mg/l**	1529	1723	2025
Sulphide	*			**mg/l**	<0.1	<0.1	0.1
pH	-	n/a		-	7.5	8.4	7.9
Mineral Oils#		ug/l		**mg/l**	<0.01	880.26	220.1

Notes

* – no value available

- Test no longer relevant and are out of date

Those highlighted in yellow exceed current guidelines

With reference to Table 4.3 the detection limits of the laboratory exceed the current guidelines values for Chromium (Hexavalent), Copper and Cyanide (total) and as such cannot be relied upon to accurately determine their concentrations. Elevated pH and Sulphate are most likely the result of slag within the Made Ground.

Exceedances of Zinc levels are associated with a single sample recorded from BHC5, located towards the centre of the main area of TS4 and within an area formerly dominated by railway track, sidings and overhead travelling cranes. Zinc is a heavy metal in coal, and is also used in glavanising a process that has been linked to TS4. Elevated levels of PAH are also associated with BHC5. All four water samples recorded exceedances of Phenols, with the highest two associated with TPBHC5 (excavated ahead of sinking BHc5) and BHC5. Phenols are associated with waster water from iron and steel making as well as with coal tar, a by-product of Coke Manufacturing. The borehole is located northwest and downstream of the By-Products Plant and SBCO, which are the most likely sources of Phenol and PAH (total).

4.3.2 2004 Ground Investigation

Geo-environmental testing was undertaken as part of the 2004 ground investigation. The investigation divided TS4 into five areas as follows. The location of these is shown on Figure 3.

- Area 1 – By-Products Plant and Coke Ovens
- Area 2 – By-Products Plant
- Area 3 – Fuel Oil Storage Area next to Dolphin Wharf
- Area D – Western side of Pig Caster
- Area E – Tarmac and Wharf Area

Soil samples for geo-environmental analysis were taken from both the Made Ground and natural strata as part of the 2004 ground investigation. The following sub-sections summarise the results of these tests which were scheduled based on current guidelines at the time. The results were assessed against Soil Guideline Values (SGV) derived from the now obsolete Dutch Intervention Values, CLEA Industrial Guidance Limits and values derived for the site by Enviros a part of the 2004 Interpretative Report. The results in tables 4.4.1 and 4.4.2 have however been compared against the current Land Quality Management (LQM) Suitable 4 Use Levels (S4UL) for a Commercial end use as this is perceived to be the most likely end use for the site.

Table 4-4-1 – Summary of geo-environmental testing undertaken as part of the 2004 ground investigation – Areas 1, 2 and 3

Contaminant	S4UL (mg/kg)	Area 1				Area 2				Area 3			
	Commercial land use	No. of samples	Range		Mean mg/kg	No. of samples	Range		Mean mg/kg	No. of samples	Range		Mean mg/kg
			Min mg/kg	Max mg/kg			Min mg/kg	Max mg/kg			Min mg/kg	Max mg/kg	
Geology		Made Ground				Made Ground				Made Ground			
Arsenic	640	26	3.7	166.8	29.5	28	3.6	195.2	36.3	10	3.3	52.5	14.8
Cadmium	190		<0.1	6.3	0.8		<0.1	5	0.9		<0.1	1.4	0.3
Chromium	8600		10.3	632.1	84.1		6	502.1	54.9		10.2	69.7	32.1
Lead	2300		14.9	311.9	86.8		2	1930	193.9		2.9	82.5	31.1
Mercury	1100		<0.1	1.4	0.3		<0.1	4.2	0.4		<0.1	0.2	0.1
Selenium	12000		0.7	5.8	3.5		0.6	7.2	2.9		1.1	6.1	4
Copper	68000		1.4	42.9	13		<0.5	71.4	22.8		2.3	66.5	12.8
Nickel	980		2.8	88.8	13.7		0.8	43.4	16.8		1.4	46	9.1
Zinc	730000		8.1	2070	360.7		7.2	5260	553.1		13.3	729.8	127.5
Boron	240000		<0.5	2.8	1		<0.5	6.3	1.3		0.7	4.2	2.4
TPH (C8-C37)	2000		64	2864	480.3		85	266000	13013.4		19	90900	9189.7
GRO (C5-C10)	2000		<0.2	<0.5	0.3		<0.2	345	14.2		<0.2	1.5	0.3
Acid Soluble Sulphide	-		<5	3037	1150		6	9270	1358.1		11	2153	894.2
Total Cyanide	-		<1	13	5.1		<1	671	34.3		<1	29	5.2
Total Sulphur	-		2500	14800	7104		3200	13500	7521.4		3900	17400	9490
Free Cyanide	-		<1	2	1		<1	79	10.3		<1	<1	1
PAH Total EPA16	15		<16	<100	36.8		<16	145483	25534.86		<16	<400	65.2

Contaminant	S4UL (mg/kg)	Area 1				Area 2				Area 3			
	Commercial land use	No. of samples	Range		Mean mg/kg	No. of samples	Range		Mean mg/kg	No. of samples	Range		Mean mg/kg
			Min mg/kg	Max mg/kg			Min mg/kg	Max mg/kg			Min mg/kg	Max mg/kg	
Geology		**Made Ground**				**Made Ground**				**Made Ground**			
Benzene	27		<10	<25	14.6		<10	20700*	9582		<10	<25	11.5
Toluene	869		<10	<25	14.6		<10	58400*	17200.8		<10	<25	11.5
Ethylbenzene	518		<10	<25	14.6		<10	<5000*	716.7		<10	<25	11.5
Xylenes	478		<20	<50	29.2		<20	89000*	27174.8		<20	304	48.4
Phenol Index	440		<0.5	1.5	0.6		<0.5	12.3	4.2		<0.5	0.9	0.6
pH	-		8.4	12.7	10.2		8.4	12.8	9.8		8.7	11.4	10.6
Water Soluble Sulphate as SO4 (mg/lt)	-		16	2190	1050		75.6	2100	1000.9		158	3690	1247.2

Table 4-2-2 - Summary of geo-environmental testing undertaken as part of the 2004 ground investigation – Areas D and E

Contaminant	**S4UL (mg/kg)**	**Area D**								**Area E**			
	Commercial land use	**No. of samples**	**Range**		**Mean mg/kg**	**No. of samples**	**Range**		**Mean mg/kg**	**No. of samples**	**Range**		**Mean mg/kg**
			Min mg/kg	**Max mg/kg**			**Min mg/kg**	**Max mg/kg**			**Min mg/kg**	**Max mg/kg**	
Geology		**Made Ground**				**Natural Superficials**				**Made Ground**			
Arsenic	640	77	0.8	270.9	28.7	3	8.6	20.6	14	56	0.5	159.2	22.8
Cadmium	190		0.1	64.6	2.6		0.2	2.4	1.0		0.1	9.3	0.83
Chromium	8600		5	1550	104.5		26.2	37.5	29.8		6.2	1270	179
Lead	2300		1.4	11800	415.6		36.3	608.7	228		1.1	1848	117.2
Mercury	1100		<0.1	1.6	0.2		0.1	0.3	0.2		<0.1	2.2	0.2
Selenium	12000		<0.5	7.2	3.8		<0.5	1.7	0.9		1.3	6.3	3.9
Copper	68000		<0.5	493	24.4		12.1	28.6	19.5		<0.5	67.4	15.6
Nickel	980		<0.5	169.4	16.1		9.1	34.3	24.7		0.6	43.2	10.3
Zinc	730000		5.4	45700	1524.5		114.5	395.2	213.3		3	7160	481.1
Boron	240000		<0.5	4.9	1.5		0.8	6.6	3.3		1	15	3.7
TPH (C8-C37)#	2000		<10	1610	163.7		33	170	78.7		<10	1350	207
GRO (C5-C10) #	2000		<0.2	3.4	0.3		<0.2	0.6	0.3		<0.2	5.1	0.3
Acid Soluble Sulphide	-		<5	8262	1750.5		<5	245	85		5	7512	1504.2
Total Cyanide	-		<1	66	11.3		<1	1	1		<1	67	10.2
Total Sulphur	-		600	20400	8188.3		1300	7900	4300		1100	15800	8075
Free Cyanide	-		<1	4	1		<1	11	4.3		<1	2	1
PAH Total EPA16	15		<16	120	20.8		<16	34	22.7		<16	209	25.8

Contaminant	S4UL (mg/kg)	Area D								Area E			
	Commercial land use	No. of samples	Range		Mean mg/kg	No. of samples	Range		Mean mg/kg	No. of samples	Range		Mean mg/kg
			Min mg/kg	Max mg/kg			Min mg/kg	Max mg/kg			Min mg/kg	Max mg/kg	
Geology		Made Ground				Natural Superficials				Made Ground			
Benzene	27		-	<25	11.7		<10	206	75.3		<10	250	17.3
Toluene	869		<10	311	15.5		<10	32	17.3		<10	250	15.9
Ethylbenzene	518		<10	69	12.3		<10	11	10.3		<10	250	16.4
Xylenes	478		<20	50	23		<20	86	42		<10	500	34.7
Phenol Index	440		<0.5	4.1	0.7		<0.5	3.7	1.6		<0.5	3.1	0.8
pH	-		7.5	12.9	10.4		8.0	8.6	8.3		8.4	12.9	11.4
Water Soluble Sulphate as SO4 (mg/lt)	-		16	3890	1138.5		594	1050	797.7		13.6	2640	1094
# - Tests no longer represents current guidelines													

The results show exceedances of PAH Total EPA16 within Area 1 which is likely to be associated with the by products produced during the manufacture of coke.

The results for Area 2 show exceedances of Benzene, Toluene, Ethylbenzene and Xylenes, collectively known as BTEX, as well as PAH total EPA16 and TPH (C8-C37). Area 2 includes the By-Products Plant of SBCO and is where coal tar is extracted from the coke oven gas. BTEX, TPH and PAH are found in coal tar, coal and a variety of petroleum products. Given the processes within Area 2, coal tar is considered the most likely BTEX source.

Exceedances of TPH (C8-C37) and PAH total EPA16 were also recorded within Area 3 within which the Fuel Oil Storage Area and wharf are located. These contaminants are found in oil, coal and tar deposits, with PAH also associated as a by-product of fuel from burning. On closer review the results exceeding guideline values are attributed to a single borehole located adjacent to the northeast of the Fuel Oil Storage area within an area of hard standing. The sample is from a depth of 4mbgl suggesting that a leak may be a source of the exceedance.

An exceedance of Benzene was reported within the natural superficial deposits of Area D, specifically within exploratory hole DAB1 at a depth of 7mbgl. The boreholes are located within the footprint of a backfilled reservoir and adjacent to the north of the By-Products Plant and may indicate groundwater contamination. No deep exploratory holes are located north of DAB1 to confirm this. Elevated levels of Lead are also recorded within the Made Ground of Area D. These are associated with a single borehole, DBT39 located within the area of the former Ferro-Manganese and Pig Casting Plant. As discussed above, lead was used as an alloy within the Ferro-Manganese Plant, and therefore is the most likely source. Exceedances of PAH EPA total 16 are recorded throughout Area D at depths of between 0.2m and 4mbgl and therefore within the Made Ground and superficials. Whilst many of the exploratory holes recording exceedances are located downstream of the SBCO and By-Products plant, some are not and are located along the western boundary (DBT17, DBT19 and DBT22 for example). Historical mapping dating from 1899 records a former Slag and Tarmacadam Works, later a Tar Manufactory Works between 90m and 210m from the site boundary. This may therefore be a potential source of this contamination.

Elevated levels of Benzene were reported within Area E, specifically exploratory holes ECT28 and ECT34 located within the north-eastern area of TS4. Historical mapping shows railway lines previously crossing this area; which at present is used by Tarmac Group of companies as Stocking Grounds. Elevated levels of Xylenes were recorded within ECT17 located along the south boundary of the north-eastern quadrant of TS4 at 2mbgl. Xylenes are produced during the manufacture of coke. Given the history of TS4 this is the most likely source.

Table 4-5 summarises the results from water samples collected as part of the 2004 ground investigation. Again, the tests scheduled were based on guidance current at the time of the investigation. The results in Table 4-5 have been assessed against The Water Framework Directive (2015) for salt water. Note that many of the results are in mg/l which the guideline values are ug/l.

Table 4-5 – Summary of groundwater results taken as part of the 2004 investigation

Contaminant	**Salt water – Long term (mean) (ug/l)**	**Area 1**			**Area 2**			**Area 3**			**Area D**		
		No. of samples	**Range**		**No. of samples**	**Range**		**No. of samples**	**Range**		**No. of samples**	**Range**	
			Min ug/l	**Max ug/l**		**Min mg/l**	**Max mg/l**		**Min mg/l**	**Max mg/l**		**Min mg/l**	**Max mg/l**
Arsenic	25	1	-	4	3	2	12	1	-	4	1	-	12
Cadmium	*		-	<0.1		<0.1	<0.1		-	<0.1		-	0.0
Chromium	*		-	10		0.0	10		-	<1		-	0.0
Lead	*		-	<1		<1	<1		-	<1		-	<1
Mercury	*		-	<0.01		<0.1	<0.1		-	<0.1		-	0.2
Selenium	*		-	3		3	8		-	13		-	7
Copper	3.76		-	2		<1	2		-	<1		-	1
Nickel	*		-	0.00		0.00	10		-	0		-	0
Zinc	6.8		-	0		0.0	0.0		-	0		-	0
Boron	*		-	500		1,000	2,700		-	1,300		-	1,400
TPH GC	*		-	<100		<100	247,000		-	200		-	6,200
Gasoline Range Organics (C6-C12)	*		-	100		<100	7,300		-	<100		-	<100
Total Cyanide	1		-	<100		<100	14,600		-	<100		-	<100
Total Sulphur as SO4	*		-	856,000		1,030,000	2,910,000		-	22,700,000		-	1,390,000

Contaminant	Salt water – Long term (mean) (ug/l)	Area 1			Area 2			Area 3			Area D		
		No. of samples	Range		No. of samples	Range		No. of samples	Range		No. of samples	Range	
			Min ug/l	Max ug/l		Min mg/l	Max mg/l		Min mg/l	Max mg/l		Min mg/l	Max mg/l
Acid Soluble Sulphide	*		-	<200		<200	1,300			500		-	9,500
Free Cyanide	*		-	<100		-	<100		-	<100		-	<100
PAH Total EPA16	*		-	<170		<180	<83,5500		-	<210		-	<1,670
Benzene	*		-	<5		<5	7,150		-	<5		-	<5
Toluene	*		-	<5		<5	2,800		-	<5		-	<5
Ethylbenzene	*		-	<5		<5	108		-	<5		-	<5
Xylenes	*		-	<10		<10	1,837		-	<10		-	<10
Phenol Index	7.7		-	<50		0	<50		-	<50		-	<50
pH	-		-	7.6		6.9	7.6		-	7.6		-	7.3

Notes:-

Those highlighted in yellow exceed the current standards, those highlighted in orange refer to elevated values, relative to the other results

Table 4.5 records exceedances of Total Cyanide and Phenol within samples from within all four areas tested, however the detection limits of the laboratory used to undertake the testing, far exceed the current standards and as such the results are questionable. Elevated Total Sulphur as SO4 levels can most likely be attributed to slag within the Made Ground. Testing in Area 2, which includes the By-Products Plant reported elevated TPH GC, Gasoline Range Organic, PAH Total EPA 16 and BTEX are most likely from coal tar within the By-Products Plant. Testing in Area D recorded elevated TPH GC which may also be attributable to the adjacent By-Product Plant, however further testing would be required to confirm this given that testing of soil samples suggests a possible external source. Elevated levels of acid soluble sulphate suggest a possible pyrite presence on site.

No testing was undertaken within Area E.

Preliminary Conceptual Site Model

5.1 General

Sources and receptors have been established based on the findings of this Desk Study. Potential pathways have been based on reasonable scientific knowledge of contaminants properties and their behaviour in the ground.

A pollutant linkage does not exist unless a source can be linked by a pathway to a receptor; without any one of these pieces, a complete linkage does not exist.

5.2 Potential Sources of Contamination On-site

Table 5-1 below lists the potential sources of contamination on site based on the information reviewed as part of this report.

Table 5-1 - Potential Sources of Contamination

Site feature	**Contaminant group**	**Contaminant**	**Likelihood**	
			Likely	**Unlikely**
Made Ground – General - slag - ash - demolition rubble - backfilled water features - organic materials	Asbestos	Asbestos	✓	
	Waste materials – ash, slag, miscellaneous	Elevated pH	✓	
		Heavy metals and metalloids	✓	
	Inorganic compounds	Phosphate and sulphates	✓	
	Transformer oils	PCBs		X
	Soil gases	Carbon dioxide, methane and hydrogen sulphide	✓	
	Hydrocarbons – fuel, oils and grease	TPH	✓	
		PAH	✓	
Made Ground – Slag - to reclaim land from mudflats	Asbestos	Asbestos	✓	
	Slag	Alkali pH	✓	
		Heavy metals	✓	
		Sulphates/sulphides	✓	
Brine Wells and Salt Works: - asbestos for fire protection and insulation - brine extraction - evaporation of brine	Asbestos	Asbestos	✓	
	Coal and coal ash	Elevated pH	✓	
		Heavy metals and metalloids	✓	
		Sulphates/Sulphides	✓	
	Hydrocarbons – oil and grease	PAH	✓	
	Inorganic compounds	Sodium chloride	✓	

Site feature	Contaminant group	Contaminant	Likelihood	
			Likely	Unlikely
Buildings – general: - asbestos tiles, insulation etc - fuel for heating and subsequent ash - oils and grease from general maintenance - lead based paints	Asbestos	Asbestos	✓	
	Hydrocarbons - Fuels, oils and grease	TPH	✓	
		PAH	✓	
	Heavy metals	Lead	✓	
Car parks and highways: - fuels, oil and grease - anti-freeze and de-icer - gritting	Fuel, oils and grease	Hydrocarbons – TPH & PAH	✓	
Chimneys, furnaces, incinerators and boiler houses - asbestos for fire protection and insulation - fuels and subsequent ash - oils and grease from general maintenance	Asbestos	Asbestos	✓	
	Coal and coal ash	Heavy metals and metalloids	✓	
		Elevated pH	✓	
		Sulphates/sulphides	✓	
	Oils and grease	Hydrocarbons – TPH & PAH	✓	
South Bank Coke Works, Coke Oven Gas Main and By-Products Plant: - asbestos for insulation, fire protection etc - coal as raw material - coal gas, coal tar, acids and organic compounds as by-products - condenses products from coal gas	Asbestos	Asbestos	✓	
	Hydrocarbons - fuel	Elevated pH	✓	
		Heavy metals and metalloids	✓	
		Sulphates/sulphides	✓	
	Organic compounds	Phenols	✓	
	Inorganic compounds	Hydrogen sulphide, hydrogen cyanide, ferric sulphate, iron sulphide	✓	
		Napthalene, Benzene	✓	
		Ammonical liquor	✓	
	Hydrocarbons – oils and grease	PAH	✓	
	Hydrocarbons – coal tar	TPH	✓	
	Organic solvents – VOCs and SVOCs	BTEX	✓	
Concrete Works - asbestos for insulation, fire protection, cladding etc	Asbestos	Asbestos	✓	
	Coal and coal ash	Elevated pH	✓	
		Heavy metals	✓	

Site feature	**Contaminant group**	**Contaminant**	**Likelihood**	
			Likely	**Unlikely**
- fuels including solvents - ash from kilns		Sulphates/sulphides	✓	
	Hydrocarbons – oils and grease	PAH	✓	
	Transformer oils	PCBS	✓	
	Organic compounds	Phenol	✓	
	Organic solvents		✓	
Docklands: - oils and grease from leaks and spills - loading/unloading of raw materials and finished products - contaminated dredgings from off-site sources	Coal, raw materials, finished products and wastes	Elevated pH		X
		Heavy metals and metalloids	✓	
		Misc organic compounds	✓	
		Sulphates/sulphides	✓	
	Hydrocarbons – fuel, oils and grease	PAH	✓	
		TPH	✓	
Electrical sub-stations, Transformers and Oil-filled Cables: - asbestos for insulation and fire protection - insulator oils - batteries - cable coatings	Asbestos	Asbestos	✓	
	Elevated pH	Acidic pH	✓	
	Heavy metals	Cadmium, Nickel, Lead	✓	
	Hydrocarbons – oil and grease	PAH	✓	
	Transformer and insulator oils	PCBs	✓	
Oil-filled Electric Cables	Asbestos	Asbestos	✓	
	Insulator oils	PCBs	✓	
Fuel Oil Depot: - asbestos for pipe lagging - heavy fuel oil storage - oils and grease from general maintenance	Asbestos		✓	
	Hydrocarbons - fuel	TPH	✓	
		PAH	✓	
	Organic compounds	Phenols	✓	
	Organic solvents	VOCs	✓	
Galvanising Works: - asbestos for fire protection, insulations etc - raw materials - degreasing	Asbestos	Asbestos	✓	
	Elevated pH	Acids	✓	
	Heavy metals	Zinc	✓	
	Hydrocarbons – oils and grease	PAH	✓	
	Inorganic compounds		✓	
	Organic solvents		✓	
	Transformer oils	PCBs	✓	
	Asbestos	Asbestos	✓	

Site feature	**Contaminant group**	**Contaminant**	**Likelihood**	
			Likely	**Unlikely**
Garages and Maintenance Workshops: - asbestos for fire protection and insulation - fuels - oils and grease from general maintenance - solvents for degreasing and anti-freeze - paint -batteries	Hydrocarbons – fuel, oils and grease	TPH	✓	
		PAH	✓	
	Organic solvents	Acetates, glycols and acetone	✓	
	Organic compounds		✓	
	Heavy metals	Lead, Nickel, Cadmium	✓	
	Elevated pH	Acids		X
Iron and Steel Works – including Bessemer Works and Pig Casting: - asbestos for fire protection and insulation - slag as a waste product - BOS grit	Asbestos	Asbestos	✓	
	Slag	Elevated pH	✓	
		Heavy metals and metalloids - Arsenic, Cadmium, Nickel, Lead, Zinc	✓	
		Sulphates/sulphides	✓	
	Hydrocarbons – oils and grease	PAH	✓	
	Transformer oils	PCBs	✓	
	Inorganic compounds		✓	
	Organic solvents		✓	
Miscellaneous Tanks and Pipes – not water related	Asbestos	Asbestos	✓	
	Hydrocarbons – fuels, oils and grease	TPH	✓	
		PAH	✓	
	Inorganic compounds	Phosphate, sulphates and fluoride	✓	
	Organic compounds	Phenol, naphthalene	✓	
		Elevated pH	✓	
	Heavy metals		✓	
	Organic solvents	VOCs	✓	
Phosphate Works - fuels - oils and grease from maintenance	Asbestos	Asbestos	✓	
	Hydrocarbons – fuel, oils and grease	TPH	✓	
		PAH	✓	
	Coal, ash and slag	Heavy metals	✓	
		Elevated pH	✓	
		Sulphates/sulphides	✓	
Railway lines and sidings:	Asbestos	Asbestos		X

Site feature	Contaminant group	Contaminant	Likelihood	
			Likely	Unlikely
- asbestos in brakes - oils and grease from maintenance - transformers	Coal and coal ash	Elevated pH	✓	
		Heavy metals and metalloids	✓	
		Sulphates/sulphides	✓	
	Hydrocarbons – fuel, oils and grease	TPH	✓	
		PAH	✓	
	Organic compounds	Phenols	✓	
	Transformer oils	PCBs	✓	
Riverside Pump House - chlorine for sterilisation - sub-stations and transformer pens adjacent -motors for pumps	Asbestos	Asbestos	✓	
	Inorganic compounds	Chlorine, sodium chloride	✓	
	Transformer oils	PCBs	✓	
	Hydrocarbons – fuels, oils and grease	TPH	✓	
		PAH	✓	
Sinter Plant - Asbestos for insulation, fire protection etc. - contamination around storage areas	Asbestos	Asbestos	✓	
	Slag	Elevated pH	✓	
		Heavy metals and metalloids	✓	
		Sulphates/sulphides	✓	
		Phosphate	✓	
	Hydrocarbons – fuel, oil and grease	TPH	✓	
		PAH	✓	
	Transformer oils	PCBs	✓	
Slag Processing Works - Asbestos for insulation, fire protection etc. -slag	Asbestos	Asbestos	✓	
	Slag	Heavy metals and metalloids	✓	
		Elevated pH	✓	
		Sulphates/sulphides	✓	
	Hydrocarbons –oils and grease	PAH	✓	
	Inorganic compounds	Phosphate	✓	
	Transformer oils	PCBs	✓	
Stocking Grounds - raw material – coal, coke, lime and iron ore - slag	Slag, raw materials, fly tipped wastes	Asbestos	✓	
		Elevated pH	✓	
		Heavy metals and metalloids	✓	

Site feature	Contaminant group	Contaminant	Likelihood	
			Likely	Unlikely
- fly tipped wastes, could include asbestos		Sulphate/sulphides	✓	
	Jallop – contains coal tar	TPH	✓	
		PAH	✓	
		Phenols	✓	
		Ammoniacal liquor		X
Tidal Flat and Glaciolacustrine superficial deposits: – decay of peat and other organic materials	Soil gases	Carbon dioxide, methane hydrogen sulphide	✓	
	Elevated pH	Acidic pH		X

5.3 Potential Pathways

The following potential pathways have been identified for the site:

- Vertical migration through geological deposits
- Surface water runoff
- Migration via groundwater flows
- Inhalation
- Dermal contact
- Ingestion

5.4 Potential Receptors

The following potential receptors have been identified for the site:

- Human Health – Construction workers and site visitors
  - Inhalation
  - Ingestion
  - Dermal contact
- Human Health – Future/End users of the site
  - Inhalation
  - Ingestion
  - Dermal contact
- Human Health – Site neighbours and public
  - Inhalation
  - Ingestion
  - Dermal contact

- Controlled water – Groundwater
- Controlled water – Surface water
- Air quality
- Ecosystems
- Construction materials

5.5 Potential Pollutant Linkages

Appendix A presents a comprehensive catalogue of the potential linkages between the identified site features, potential receptors and the pathways by which they may be connected. Those linkages which are considered to be plausible are summarised in Table 5.2 below and their location highlighted on Figure 6. Where linkages are considered to be plausible, their probability and consequences are qualitatively evaluated in accordance with the tables in Appendix A.

Table 5-2 – Plausible Pollutant Linkages

Site feature	Contaminant group	Contaminant/s	Pathway	Receptor	Risk
General Made Ground	Asbestos	Asbestos	✓	✓	High
	Waste materials	Elevated pH	✓	✓	Moderate
		Heavy metals and metalloids	✓	✓	High
		Hydrocarbons – TPH and PAH	✓	✓	Moderate
		Inorganic compounds - phosphates	✓	✓	High
		Sulphates/Sulphides	✓	✓	Moderate
	Transformer oils	PCBS	✓	✓	High
	Decaying organic matter	Elevated pH	✓	✓	Moderate
		Soil gases – Carbon Dioxide, Methane and Hydrogen Sulphide	✓	✓	Moderate
Made Ground - Slag	Asbestos	Asbestos	✓	✓	High
	Slag	Elevated pH	✓	✓	Moderate
		Heavy metals and metalloids	✓	✓	High
		Sulphates/sulphides	✓	✓	Moderate
Brine Well and Salt Works	Asbestos	Asbestos	✓	✓	High
	Fuels, oils and grease, coal ash	Elevated pH	✓	✓	Moderate
		Heavy metals and metalloids	✓	✓	High
		Hydrocarbons - PAH	✓	✓	Moderate
		Sulphates/sulphides	✓	✓	Moderate

Site feature	Contaminant group	Contaminant/s	Pathway	Receptor	Risk
	Inorganic compounds	Brine; Sodium Chloride	✓	✓	High
Buildings - general	Asbestos	Asbestos	✓	✓	High
	Fuel, oils and grease	Hydrocarbons – TPH and PAH	✓	✓	Moderate
	Paint and water pipes	Lead	✓	✓	High
Car parks and highways	Fuels, oil and grease	Hydrocarbons – TPH and PAH	✓	✓	Moderate
Chimneys, furnaces, incinerators and boiler houses	Asbestos	Asbestos	✓	✓	High
	Ash and flue dust	Elevated pH	✓	✓	Moderate
		Heavy metals and metalloids	✓	✓	High
		Sulphates/sulphides	✓	✓	Moderate
	Fuels, oils and grease	Hydrocarbons – TPH and PAH	✓	✓	Moderate
Coke Works and By-Products Plant	Asbestos	Asbestos	✓	✓	High
	Fuel, coke and coal tar	Elevated pH	✓	✓	Moderate
		Heavy metals and metalloids	✓	✓	High
		Sulphates/Sulphides	✓	✓	Moderate
	Organic compounds – VOCs and SVOCs	BTEX	✓	✓	High
	Organic compounds	Phenols	✓	✓	High
		Ammonical liquor	✓	✓	High
	Inorganic compounds	Hydrogen sulphide, hydrogen cyanide and ferric sulphate	✓	✓	High
	Fuels oils and grease	Hydrocarbons – TPH & PAH	✓	✓	Moderate
Concrete Works	Asbestos	Asbestos	✓	✓	High

Site feature	Contaminant group	Contaminant/s	Pathway	Receptor	Risk
	Coal, raw materials and concrete	Elevated pH	✓	✓	Moderate
		Sulphates/sulphides	✓	✓	Moderate
		Heavy metals	✓	✓	High
	Fuel, oils and grease	Hydrocarbons – TPH and PAH	✓	✓	Moderate
		High calorific solvents	✓	✓	High
	Transformer oils	PCBs	✓	✓	High
	Organic compounds	Phenols	✓	✓	High
Docklands	Coal, raw materials and finished products, waste products	Elevated pH	✓	✓	Moderate
		Heavy metals and metalloids	✓	✓	High
		Sulphates/sulphides	✓	✓	Moderate
		Misc organic compounds	✓	✓	High
	Fuels, oils and grease	Hydrocarbons – TPH and PAH	✓	✓	Moderate
Electric sub-stations and transformers	Asbestos	Asbestos	✓	✓	High
	Batteries	Elevated pH	✓	✓	Moderate
		Heavy metals	✓	✓	High
	Transformer oils	PCB's	✓	✓	High
	Oils and grease	Hydrocarbons - PAH	✓	✓	Moderate
Oil-filled Electric Cables	Asbestos	Asbestos	✓	✓	High
	Insulator oils	PCBs	✓	✓	High
Fuel Oil depot	Asbestos	Asbestos	✓	✓	High
	Diesel fuel	Hydrocarbons – TPH and PAH	✓	✓	Moderate

Site feature	Contaminant group	Contaminant/s	Pathway	Receptor	Risk
	Organic compounds	Phenols	✓	✓	High
	Organic solvents	Volatile Organic Compounds	✓	✓	High
Galvanising Works	Asbestos	Asbestos	✓	✓	High
	De-greasing and cleaning metal	Elevated pH – acids	✓	✓	Moderate
		Organic solvents – Zinc Cyanide, Zinc Chloride and Ammonium Chloride	✓	✓	High
		Inorganic compounds	✓	✓	High
	Heavy metals	Zinc	✓	✓	High
	Oils and grease	Hydrocarbons - PAH	✓	✓	Moderate
	Inorganic compounds	Miscellaneous	✓	✓	High
	Organic compounds	Miscellaneous	✓	✓	High
	Transformer oils	PCBs	✓	✓	High
Garages and Maintenance	Asbestos	Asbestos	✓	✓	High
	Fuels, oils and grease	Hydrocarbons – TPH and PAH	✓	✓	Moderate
	Degreasers and solvents (VOCs & SVOCs)	Organic solvents – acetates, glycols and acetone	✓	✓	High
	Batteries	Elevated pH	✓	✓	Moderate
		Heavy metals – Nickle, Cadmium, Lead	✓	✓	High
	Paint	Organic compounds	✓	✓	High
Iron and Steel Works – including Bessemer Works and Pig Casting	Asbestos	Asbestos	✓	✓	High
		Heavy metals; including iron and magnesium	✓	✓	High
		Elevated pH – Alkali	✓	✓	Moderate

Site feature	Contaminant group	Contaminant/s	Pathway	Receptor	Risk
	Raw materials, finished products and wastes such as slag	Sulphates/Sulphides	✓	✓	Moderate
		Inorganic compounds	✓	✓	High
	Oils and grease	Hydrocarbons - PAH	✓	✓	Moderate
	Transformer oils	PCBs	✓	✓	High
	Solvents for descaling	Organic solvents	✓	✓	High
Miscellaneous tanks and pipelines – not water related	Asbestos	Asbestos	✓	✓	High
	Chemical precipitators and cleaning compounds. Industrial grey water By-products and wastes	Elevated pH	✓	✓	Moderate
		Heavy metals	✓	✓	High
		Inorganic compounds – phosphate, sulphates and fluoride	✓	✓	High
		Organic compounds – Phenol, Naphthalene	✓	✓	High
	Fuels, oils and grease	Hydrocarbons – TPH and PAH	✓	✓	Moderate
Phosphate Works	Asbestos	Asbestos	✓	✓	High
	Coal, ash and slag	Elevated pH	✓	✓	Moderate
		Heavy metals	✓	✓	High
		Sulphates/sulphides	✓	✓	Moderate
	Oils and grease	Hydrocarbons – PAH and TPH	✓	✓	Moderate
Railway Lines and Sidings	Asbestos	Asbestos	✓	✓	High
	Coal, dust and ash	Elevated pH	✓	✓	Moderate
		Heavy metals and metalloids	✓	✓	High
		Phenols	✓	✓	High
		Sulphates/Sulphides	✓	✓	Moderate

Site feature	Contaminant group	Contaminant/s	Pathway	Receptor	Risk
	Oils and grease	Hydrocarbons – PAH	✓	✓	Moderate
	Transformer oils	PCBs	✓	✓	High
Riverside Pump House	Asbestos	Asbestos	✓	✓	High
	Fuel, oils and grease	Hydrocarbons – TPH and PAH	✓	✓	Moderate
	Transformer oils	PCBs	✓	✓	High
	Water treatment	Inorganic compounds – Chloride and Sodium Chloride	✓	✓	High
Sinter Plant	Asbestos	Asbestos	✓	✓	High
	Raw materials, products and wastes	Elevated pH	✓	✓	Moderate
		Heavy metals and metalloids	✓	✓	High
		Sulphates/sulphides	✓	✓	Moderate
	Transformer oils	PCBs	✓	✓	High
	Oils and grease	Hydrocarbons - PAH	✓	✓	Moderate
Slag Processing Works	Asbestos	Asbestos	✓	✓	High
	Slag	Heavy metals and metalloids – arsenic, iron, magnesium, chromium, zinc	✓	✓	High
		Elevated pH	✓	✓	Moderate
		Sulphates/sulphides	✓	✓	Moderate
		Inorganic compounds - phosphate	✓	✓	High
	Oils and grease	Hydrocarbons – PAH	✓	✓	Moderate
Stocking Grounds	Slag and fly tipped wastes and raw materials	Asbestos	✓	✓	High
		Elevated pH	✓	✓	Moderate

Site feature	Contaminant group	Contaminant/s	Pathway	Receptor	Risk
	"Jallop" – COMAH Substance – Organic compounds	Heavy metals and metalloids	✓	✓	High
		Sulphates/sulphides	✓	✓	Moderate
		Hydrocarbons – TPH and PAH	✓	✓	Moderate
		Phenols	✓	✓	High
		Ammoniacal liquor	✓	✓	High
Tidal Flat and Glaciolacustrine deposits	Decaying organic matter	Elevated pH – acidic	✓	✓	Moderate
		Soil gases – Carbon dioxide, methane and hydrogen sulphide	✓	✓	Moderate

Geotechnical Constraints and Opportunities

6.1 Introduction

Although historical ground investigations have been undertaken at the site, the focus has primarily been towards geo-environmental testing and as such limited geotechnical testing is available, particularly with regards to the underlying superficial deposits. The following section therefore provides an overview of the geotechnical constraints and possible opportunities which are likely to be encountered at the site.

6.2 Ground Conditions

The walkover of TS4, undertaken in March 2017 identified a number of waste piles across the site which comprised a mixture of waste raw materials, process waste (i.e. slag and coke), demolition rubble, railway sleepers and general waste. In places this material has been used to create bunds, which in some places have been created to limit access. Given the source, varied composition of the material and history of TS4, it is possible that these areas of Made Ground are contaminated. Potential contaminants of concern include heavy metals, hydrocarbons, organic and inorganic compounds in addition to an elevated pH. The possible presence of asbestos should also be considered as well as the generation of ground gas.

6.2.1 Made Ground - Slag

Engineering fills which contain a significant proportion of certain types of slag may pose a risk to future buildings and structures due to their potential to exhibit volumetric instability (i.e. the potential to expand) resulting in differential ground movements and intolerable disruption to foundations (including piles) and services. Subject to the nature of the fill encountered on site, determination of the properties of these materials will be required. In addition slag bearing materials can contain ‘slag skulls’, which may comprise fused slag concretions may prove to be extremely difficult to excavate and break up.

Slag can also weather resulting in the creation of tufa (calcium hydroxide and calcium carbonate precipitates). This can be mobilised in surface and groundwater leading to damage to drainage infrastructure and unsightly deposits in watercourses.

Slags are also characterised by elevated sulphate content, which will need to be taken into consideration when specifying concrete

Material containing slag may be “conditioned”, by its excavation, crushing to a suitable grading, and subsequent processing by a long-term programme of hydrating and turning the material. The purpose of such a process would be to homogenise the materials, and to promote the occurrence of expansive behaviours within the material. The material would be subsequently used as an engineering fill, being placed and compacted in layers.

6.2.2 Compressible Soils

The site is underlain by Tidal Flat and Glaciolacustrine deposits, which by the nature of their depositional environment means that have the potential to contain significant deposits of peat and high plasticity clays. These materials are highly susceptible to compression, resulting in excessive settlement. Their high organic content would also likely lead to long term secondary compression.

Limited geotechnical testing undertaken as part of the 1999 ground investigation identified the laminated clay to be of intermediate to high plasticity with glacial till being of low plasticity.

6.2.3 Obstructions

The potential for buried service runs/culverts and basements cannot be discounted, particularly those associated with older parts of the site, which may not have been as accurately recorded as more recent developments.

Based on the available as-built drawings for TS4, service tunnels are known to exist within the footprint of the SBCO. Drawing FC-53178 shows a sub-basement level to the Ferro-Manganese Plant, along which raw material was transported to the Blast Furnace. Based on knowledge of other areas of the wider SSI site, the stocking areas may also contain basement levels from which raw materials and coke were loaded. Other obstructions also include the culverts which pass beneath the site.

Further as-built drawings are required covering the former and existing structures currently remaining on site to determine the presence and extent of underground structures.

6.2.4 Existing Foundations

A number of former buildings and hardstanding's and existing buildings and hardstanding's are present on site. Their foundations are largely unknown but could include significant foundation structures with groups of piles.

Reference to drawings RGEN8670 has indicated that, elsewhere on the SSI site, foundations comprised a composite pile design. A bored, cast-in-situ pile was constructed between the base of the Made Ground and the ultimate termination depth of the pile, with a steel "I-Beam" pile embedded into the concrete, and extending through the Made Ground, with a compressible void filling material installed. The purpose of this detail would be to mitigate the effects of lateral expansion of the slag within the Made Ground.

Several foundation slabs were noted during the site walkover, some partially obscured buried beneath stockpiles and vegetation (for example the former Sinter Plant). Until proven otherwise it should be assumed that the foundations and floor slabs of all structures identified on historical plans and as-built drawings, remain beneath the site. This includes former loading ramps, bays and platforms associated with the railway sidings and travelling cranes. These may cause obstructions to any further ground investigation and redevelopment.

A basement level is known to have existed beneath the former Cleveland Coke Ovens. The foundations may remain and therefore also pose a potential obstruction risk to future works. A 2m deep basement level also exists beneath the SBCO 11/2.75kV sub-station. Drawings show that a basement level exists beneath the SBCO in the form of a 2000 tonne coke bunker. Other underground structures include the Coke Oven Gas Main culvert, waste heat flue and conveyor beneath the coke wharf. Drawings also indicate that the basement of the SBCO was supported by piled foundations. Numerous sub-basement levels exist beneath the By-Products plant in the form of service trenches, valve pits and deep manholes.

In order to mitigate the risk of encountering obstructions a detailed review of as-built drawings should be undertaken ahead of any intrusive works. The potential location of buried structures can then be considered, and adjustments to works, undertaken accordingly. Given the history of TS4, it should be anticipated that existing foundations and floor slabs are reinforced and are of considerable thickness. It is anticipated that any significant structure would have been founded on piled foundations, likely to have been terminated within the underlying glacial till.

6.2.5 Ground Aggressivity

Given the nature of the site buried concrete is likely to be susceptible to sulphate attack that can lead to expansion/softening of the concrete.

Whilst decomposing organic matter within the underlying natural Tidal Flat deposits will generate acids, and thus may locally impact the pH of the surrounding material. Whilst such deposits will be at depth, any concrete which will come into contact with the alluvium will need to be designed accordingly.

6.3 Future Geotechnical considerations

Further geotechnical testing is required to determine the geo-environmental and geotechnical properties of the Made Ground and underlying superficial deposits. This will also determine the thickness of the Made Ground, groundwater conditions beneath the site; and allow parameter to be derived for design.

The possible presence of ground gas should also be investigated. Both gas generated from the natural decay of organic matter within the superficial deposits and that associated with solvents, hydrocarbons and organic compounds used and produced on site.

Site Development Considerations

7.1 Introduction

The table below describes the main risks highlighted by the conceptual site model and describes the likely risks associated with the site, and areas where further information is required.

Table 7-1 – Summary of risks and possible mitigation measures

Consideration	Detail	Possible mitigation measures
Geotechnical		
Soft and compressible ground	Likely disruption to shallow foundations Excessive settlement resulting in foundation failure	Intrusive ground investigation required to obtain samples for geotechnical analysis so as to assess the strength characteristics of the superficial deposits, and to inform the specification of appropriate foundation design.
Potentially expansive slag	Potential to disrupt foundations/hard standing as a result of expansion	Assessment of the expansive properties of Made Ground at the site as part of ground investigation and associated specialist testing. Dig out and replace shallow areas, with spoil retained on site and potentially used for landscaping and noise bunding. Consider possible engineering solutions including protecting piled foundations by the use of sleeves around piles. Use of non-compressible fills around foundations. Processing and hydration of slag-bearing Made Ground, to encourage the initiation of expansive reactions and thereby produce a useable aggregate for long-term future use at the site.
Potentially fused slag	Large bodies of fused slag may be difficult to break through or excavate using conventional plant, thereby creating an obstruction to development	Use of aggressive techniques to manage large bodies of fused slag, such as drilling and blasting. Consider alternative, shallow foundation designs. Adapt Masterplan to avoid development of areas of impenetrable fused slag. Take into account during detailed design stage and accommodate into the design.
Variable thickness of Made Ground	Potential for differential ground movements resulting in differential settlement and damage to foundations and associated structures	Intrusive ground investigation and associated geotechnical laboratory testing in order to determine the character of the Made Ground Dig out and replace shallow areas, with spoil retained on site for landscaping and noise bunding. If suitable excavate and re-lay materials in controlled layers to an engineered specification.
Shallow groundwater	Groundwater is likely to be at shallow depth beneath the site and could be affected by the tidal influence of the River Tees	Ground investigation and subsequent monitoring to establish ground water elevation. Monitoring to include piezometer wells and groundwater dataloggers.
Obstructions	Potential for time delays and associated additional costs	Review of available as-built drawings to determine likely location of buried obstructions,

		including remnant foundations and basement levels. Use a variety on non-intrusive geophysical methods to investigate unknown areas and to confirm as-built drawings.
Geo-environmental		
Asbestos in soil	Potential for unanticipated disposal costs	Geo-environmental testing undertaken as part of intrusive ground investigation to include for asbestos testing and if identified quantification. Potential options for impacted ground may be capping beneath areas of hard standing and foundations etc. subject to agreement with the local authority and recording the locations in the Health and Safety file.
Unknown, unrecorded asbestos within buildings as a risk to human health	Potential for unanticipated disposal costs	Review of asbestos registers to determine location of known asbestos products. Review of as-built drawings to identify areas where asbestos products have been specified. Identify areas which may potentially contain asbestos based on current knowledge to date.
Ground gas generation	Potential for ground gas to build up within existing and future developments; specifically confined spaces and basement levels; potentially an explosive and/or asphyxiant risk	Ground investigation to establish ground gas regime via installation of combined gas/groundwater monitoring wells. Include ground gas protection measures within the design of future developments which include underground areas.
Risk to human health and ecology	From contamination on site	Ground investigation to establish the extent of any contamination and the risk to human health and the environment.
Slag	Potential for the precipitation of tufa, leading to damage to drainage infrastructure and unsightly deposits in watercourses	Further investigation to confirm the extent and chemical composition of slag on site. Considered use of the slag in the earthwork, e.g. distal from watercourses. High phosphate slags may be economically viable for excavation and sale to third parties.
Ecological		
Ecology – rare/protected birds, plants, animals and insects	Potential for delays resulting is additional costs	Ecological surveys to be undertaken at an early stage to develop and ecological baseline for the site.

Proposals for further investigation

8.1 Introduction

Based on the preliminary risk evaluation and the Site Development Considerations, the following proposals for further studies are presented:

8.2 Desk-based Studies

- Undertake further research in to the structure of the Engineering Workshop to determine the full extent of basement levels and foundations.
- Undertaken further research into establishing the extent of former Sinter Plant, Bessemer Works, Galvanising Works, Basic Slag Works, Slag Brick Works and Slag Wool Works to determine the potential for and extent of any basement levels and foundations.
- Commission a UXO desk study for the site.
- Survey the existing groundwater and gas monitoring boreholes within the site
    - Investigate whether monitoring installations are still function before undertaking groundwater and gas monitoring as part of any future intrusive works.
- Review status with respect to COMAH designations relating to the site.

8.3 Intrusive Investigation

Reference should be made to Figure 4 which shows the location of each of the areas listed in Table 8.1 below.

Table 8-1 – Proposed investigation

Area	Location	Proposed investigation	Comments
A	Concrete Works and Railway Sidings	10No. Trial pits to 5mbgl 3No. Rotary corded boreholes within cable percussive follow on to rockhead or 20mbgl Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Investigation to focus on the footprint of the former Concrete Works, associated sidings and existing wash down area. Trial pit to sample of Made Ground and determine thickness. Boreholes to determine the thickness of the made ground and sample natural superficials. Installations to monitor and sample groundwater and establish whether potential off-site sources of contamination are leaching beneath the site.
B	Mineral Sidings	15No. Trial pits to 5mbgl 3No. Rotary corded boreholes within cable percussive follow on to rockhead or 20mbgl Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Investigation to focus on the area of former railway sidings Trial pits to sample of Made Ground and to determine thickness. Boreholes to determine the thickness of the Made Ground and sample natural superficials. Installations to monitor and sample groundwater and establish whether potential off-site sources of contamination are leaching beneath the site.

Area	Location	Proposed investigation	Comments
C	Iron Works, Galvanising Works and Railway Sidings	10No. Trial pits to 5mbgl 3No. Rotary cored boreholes within cable percussive follow on to rockhead or 20mbgl Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Investigation to focus on the railway sidings, electric sub-station and stockpiles associated with the former Iron Works and Galvanising Work site. Trial pits to sample Made Ground and determine thickness. Boreholes to target former sub-station, chimneys and stockpile area and for groundwater monitoring installations to be installed. Installations to monitor and sample groundwater and establish whether potential off-site sources of contamination are leaching beneath the site.
D	South Bank Wharf – docklands and railway sidings	10No. Trial pits to 5mbgl 3No. Rotary cored boreholes within cable percussive follow on to rockhead or 20mbgl Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Investigation to determine composition of Made Ground and allow for geo-environmental sampling around railway sidings. Trail pits for geo-environmental testing only. Groundwater monitoring and sampling to confirm that contaminants are not leaching through the wider site into the River Tees.
E	Railway Sidings, Travelling Cranes and Brine Wells	130No. Trial pits to 5mbgl 15No. Rotary cored boreholes with cable percussive follow-on to rockhead or 20mbgl. Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Investigation to focus on the railway embankments and former sidings, particularly where electrical sub-stations, tanks and loading areas were located. Also focus around former brine well area. Trial pits to establish composition and thickness of Made Ground and allow for sampling. Boreholes to determine thickness of Made Ground and allow for sampling of underlying superficials. Gas monitoring and groundwater sampling to establish whether contamination from By-Products Plant and SBCO is leaching beneath the site. Gas monitoring installations within footprint of backfilled reservoirs. Groundwater monitoring and sampling.
F	Coal Stocking Ground	20No. Trial pits to 5mbgl 3No. Rotary cored boreholes with cable percussive follow-on to rockhead or 20mbgl. Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Investigation to focus on the backfilled reservoir area and 'jallop' storage area. Trial pits to establish composition and thickness of Made Ground and allow for sampling. Boreholes to determine thickness of Made Ground and allow for sampling of underlying superficials. Gas monitoring and groundwater sampling prove contamination from By-Products Plant and SBCO not leaching beneath the site. Gas monitoring installations within footprint of backfilled reservoirs. Groundwater monitoring and sampling.

Area	Location	Proposed investigation	Comments
G	SBCO and By-Products Plant – also former Slag Wool and Slag Brick Works	30No. Hand dug pits up to 1.2m deep. 20No. Trial pits to 5mbgl 10No. Rotary cored boreholes with cable percussive follow-on to rockhead or 20mbgl. Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Investigation to focus on possible contamination risk from By-Products Plant and Coke Ovens, as well as the former site of the Cleveland Salt Works. Storage tank areas to be of primary focus as well as the Coke Oven Gas pipeline. Proposed shallow hand dug pits to allow for geo-environmental testing as part of preliminary investigation to inform further investigation. Trial pits to establish composition and thickness of Made Ground and allow for sampling. Boreholes to determine thickness of Made Ground and allow for sampling of underlying superficials. Gas monitoring and groundwater sampling prove contamination from By-Products Plant and SBCO not leaching beneath the site. Gas monitoring installations within footprint of backfilled reservoirs. Groundwater monitoring and sampling.
H	Cleveland Salt Works	To be included with proposals for SBCO and By-Products Plant	
I	Sinter Plant and Ore Processing Plant	10No. Trial pits to 5mbgl 4No. Rotary cored boreholes with cable percussive follow on to rockhead or 20mbgl Samples of geo-environmental and geotechnical testing. Gas and groundwater monitoring piezometers to be installed within the Made Ground and superficial deposits	Investigation to focus on the former Sinter Plant and Ore Processing Plants and the existing stockpile of BOS grit. Trial pits to establish composition and thickness of Made Ground and allow for sampling. Boreholes to determine thickness of Made Ground and allow for sampling of underlying superficials. Gas monitoring and groundwater sampling prove the absence of contamination
J	Coke and Ore Stocking Areas	40No Trial Pits to 5mbgl 6No. Rotary cored boreholes with cable percussive follow on to rockhead or 20mbgl Samples of geo-environmental and geotechnical testing. Gas monitoring and groundwater monitoring and sampling installations.	Investigation to focus on the former railway sidings associated with the stocking areas. Composition of Made Ground to be establish from trial pits. Boreholes to prove the thickness of Made Ground and allow for groundwater monitoring and sampling installations to be installed.
K	Basic Slag Works and Phosphate Works	20No. Trial pits to 5mbgl set at 50m intervals 5No. rotary cored boreholes with cable percussive follow-on Samples of geo-environmental and geotechnical testing. Gas and groundwater monitoring piezometers to be installed within the Made Ground and superficial deposits.	Investigation to focus on the footprint of the former Phosphate Works and Basic Slag Works and stockpile area to the south. Trial pits to establish composition and thickness of Made Ground Driller's logs and a daily site report are to be provided daily prior to the start of the next day's shift. The daily site report shall detail staff, equipment, weather and activities on site.

Area	Location	Proposed investigation	Comments
			Boreholes to determine thickness of Made Ground and allow for sampling of underlying superficials. Gas monitoring and groundwater sampling prove the absence of contamination and ground gas.
L	Bessemer Works (Ferro-Manganese Works) and Pig Casting Machine Works – including former Benzole Plant	30No. Trial pits to 5mbgl 8No. rotary cored boreholes with cable percussive follow-on Samples of geo-environmental and geotechnical testing. Groundwater monitoring and sampling installations.	Investigation to focus on the footprints of the former Bessemer Works and Pig Casting Machine works, as well as the stocking areas to the west and south and former Benzole Plant to the north. Exploratory holes to be located within the vicinity of the former Electrostatic Precipitators and Transformer House as well as the Dust Catcher, Blast Furnace and railway sidings. Composition of Made Ground to be establish from trial pits. Boreholes to prove the thickness of Made Ground and allow for groundwater monitoring and sampling installations to be installed. Samples to be taken from the underlying natural superficials.
M	Riverside Pump House	5No. hand dug pits to up to 1.2mbgl 10No. Trial pits to 5mbgl 3No. rotary cored boreholes with cable percussive follow-on to rockhead or 20mbgl. Samples of geo-environmental and geotechnical testing. Groundwater monitoring and sampling installations.	Investigation to focus around the electrical Sub-stations and transformers on site as well as the Chlorination House. Hand dug pits for shallow geo-environmental sampling. Boreholes to prove the thickness of Made Ground and allow for groundwater sampling, to establish whether contamination is leaching beneath the site and into the River Tees.
N	Waste Ground	40No. Trial pits to 5mbgl set at 50m intervals 5No. rotary cored boreholes with cable percussive follow-on Samples of geo-environmental and geotechnical testing. Groundwater monitoring and sampling installations.	Investigation to establish ground conditions Boreholes to prove the thickness of Made Ground and allow for groundwater monitoring and sampling installations to be installed.
O	Fuel Oil Storage Depot	5No. rotary cored boreholes with cable percussive follow-on to prove a minimum of 10m of natural ground or to bedrock 5No. Hand dug pits to up to 1.2m deep Samples of geo-environmental and geotechnical testing. Gas and groundwater monitoring installations	Rotary coring required to enable boreholes to progress through the slag. Hand dug pits for shallow geo-environmental sampling. Boreholes to allow installation of groundwater monitoring installations to confirm that fuels are not leaking from the depot.
P	Area of Tarmac Group of Companies site	100No. machine excavated trial pits to 5mbgl	Some of the cable percussive boreholes could be located where trial pits have been excavated. Here the slag will have already been

Area	Location	Proposed investigation	Comments
		15No. rotary cored boreholes with cable percussive follow-on to 20mbgl or rockhead Samples of geo-environmental and geotechnical testing. Gas and groundwater monitoring installations	excavated and broken up and therefore rotary coring would not be necessary.

References

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British Geological Survey Sheet 33 – Soil and Drift (Stockton) 1:50,000 (1987

Coal Authority - http://mapapps2.bgs.ac.uk/coalauthority/home.html

Department of the Environment Industry Profile – Gas works, coke works and other coal carbonisation plants - http://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/76-key-documents/198-doe-industry-profiles

Department of the Environment Industry Profile – Ceramics, cement and asphalt manufacturing works - http://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/76-key-documents/198-doe-industry-profiles

Department of the Environment industry Profile – Dockyards and docklands - http://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/76-key-documents/198-doe-industry-profiles

Department of the Environment Industry Profile – Metal manufacturing, refining and finishing works - http://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/76-key-documents/198-doe-industry-profiles

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Multi-Agency Geographic Information for the Countryside – https://magic.defra.gov.uk/MagicMap.aspx

SSI UK EI 2016 – Sahaviriya Steel Industries (In Liquidation) – Report in to the condition of the Electrical Infrastructure – Aug 2016

SSI UK SBCO 2016 – Sahavitiya Steel Industries (in liquidation) – Report into the condition of South Bank Coke Ovens in preparation for keeping it safe – July 2016

The Water Framework Directive (Standards and Classification) Direction (England and Wales) 2015

Zetica Regional Unexploded Bomb Risk Map (Teesside-Durham-Stockton) – http://www.zetica.com

Appendix A – Pollutant linkages

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
Asbestos	General Made Ground Made Ground - Slag Brine Wells and Salt Works Brine Wells and Salt Works Buildings – General (Welfare, Offices and Stores) Chimneys, Furnaces, Incinerators and Boiler Houses Concrete Works Coke Works and By-Products Plant Electrical Sub-stations and Transformers Oil-filled Electric Cables Fuel Oil Depot Galvanising Works Garages and Maintenance Workshops Iron and Steel Works Misc Tanks and Pipelines – not water related Phosphate Works	Vertical migration through geological deposits	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Migration via groundwater flow	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
	Railway Lines and Sidings Riverside Pump House Sinter Plant Slag Processing Works Stocking Grounds		Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Surface water run off	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood**	**Risk**	
		Dermal contact	Human Health - Site neighbours and public	X				
			Human Health - Site neighbours and public	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Inhalation	Human Health - Construction workers and site visitors	√	Severe	Moderate	High	Presence of asbestos assumed given the age of these works. Any asbestos will be in building rubble as these sites have been demolished, with some redeveloped. As such those at greatest risk are perceived to be Construction Workers and Maintenance Staff, particularly if excavations are undertaken. Areas where asbestos and asbestos containing materials are known to exist should be recorded within the site's Asbestos Register, which should be reviewed ahead of any future works. However, there is a risk that unrecorded asbestos may be
			Human health - Future/End users of the site	√	Severe	Low	Moderate	
			Human Health - Site neighbours and public	√	Severe	Low	Moderate	

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
								encountered and therefore those at greatest risk will again be Construction Workers and Maintenance Staff.
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Ingestion	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Construction materials	X				
Elevated pH	General Made Ground Made Ground - Slag Brine Wells and Salt Works Chimneys, Furnaces, Incinerators and Boiler Houses Coke Works and By-Products Plant Concrete Works Docklands Electrical Sub-stations and Transformers Galvanising Works Garages and Maintenance Workshops Iron and Steel Works Miscellaneous Tanks & Pipelines Phosphate Works Railway Lines and Sidings Sinter Plant Stocking Grounds Tidal Flat and Glaciolacustrine	Vertical migration through geological deposits	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	√	Medium	Low	Moderate/ Low	
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	√	Medium	Moderate	Moderate	pH attack of buried concrete structures
		Migration via groundwater flow	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	√	Mild	Low	Low	
			Controlled water - Surface Water	√	Mild	Low	Low	
			Air quality	X				
			Ecosystems	√	Mild	Low	Low	
			Construction materials	√	Medium	Moderate	Moderate	
		Surface water run off	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	√	Mild	Low	Low	
			Air quality	X				
			Ecosystems	√	Mild	Low	Low	

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Construction materials	√	Medium	Low	Moderate/ Low	
		Dermal contact	Human Health - Construction workers and site visitors	√	Mild	Moderate	Moderate/ Low	
			Human health - Future/End users of the site	√	Mild	Low	Low	
			Human Health - Site neighbours and public	√	Mild	Unlikely	Very Low	
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Inhalation	Human Health - Construction workers and site visitors	√	Mild	Moderate	Moderate/ Low	
			Human health - Future/End users of the site	√	Mild	Low	Low	
			Human Health - Site neighbours and public	√	Mild	Unlikely	Very Low	

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood**	**Risk**	
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Ingestion	Human Health - Construction workers and site visitors	√	Mild	Moderate	Moderate/ Low	
			Human health - Future/End users of the site	√	Mild	Low	Low	
			Human Health - Site neighbours and public	√	Mild	Unlikely	Very Low	
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	√	Mild	Low	Low	
			Construction materials	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
Hydrocarbons	Made Ground - General Brine Wells and Salt Works Buildings - General Car Parks and Highways Chimneys, Furnaces, Incinerators and Boiler Houses Coke Works and By-Products Plant Concrete Works Docklands Electrical Sub-stations and Transformers Fuel Oil Depot Galvanising Works Garages and Maintenance Workshops Iron and Steel Works Miscellaneous Tanks & Pipelines Phosphate Works Railway Lines and Sidings Riverside Pump House Sinter Plant Slag Processing Works Stocking Grounds	Vertical migration through geological deposits	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	√	Medium	Low	Moderate/ Low	
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Migration via groundwater flow	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	√	Medium	Low	Moderate /Low	

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Controlled water - Surface Water	X				
			Controlled water - Nearby estuary and sea	√	Medium	Low	Moderate /Low	
			Air quality	X				
			Ecosystems	√	Medium	Low	Moderate/ Low	
			Construction materials	X				
		Surface water run-off	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	√	Medium	Low	Moderate/ Low	
			Controlled water - Surface Water	√	Medium	Moderate	Moderate	
			Air Quality	X				
			Ecosystems	√	Mild	Low	Low	
			Construction materials	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
		Dermal contact	Human Health - Construction workers and site visitors	√	Severe	Low	Moderate	
			Human health - Future/End users of the site	√	Severe	Unlikely	Moderate/ Low	
			Human Health - Site neighbours and public	√	Severe	Low	Moderate	
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Inhalation	Human Health - Construction workers and site visitors	√	Severe	Moderate	High	
			Human health - Future/End users of the site	√	Severe	Low	Moderate	
			Human Health - Site neighbours and public	√	Severe	Unlikely	Moderate/ Low	
			Controlled water - Groundwater	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Ingestion	Human Health - Construction workers and site visitors	√	Severe	Unlikely	Moderate/ Low	
			Human health - Future/End users of the site	√	Severe	Unlikely	Moderate/ Low	
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	√	Medium	Low	Moderate/ Low	
			Construction materials	X				
Heavy metals and Metalloids	Made Ground - General Made Ground - Slag	Vertical migration through	Human Health - Construction workers and site visitors	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood**	**Risk**	
	Brine Wells and Salt Works Buildings - General Chimneys, Furnaces, Incinerators and Boiler Houses Coke Works and By-Products Plant Concrete Works Docklands Electrical Sub-stations and TransformersGalvanising Works Garages and Maintenance Workshops Iron and Steel Works Phosphate Works Railway Lines and Sidings Sinter Plant Slag Processing Works Stocking Grounds	geological deposits	Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	√	Minor	Unlikely	Very Low	
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Migration via groundwater flow	Human Health - Construction workers and site visitors	√	Severe	Low	Moderate	
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	√	Medium	Low	Moderate/ Low	
			Controlled water - Surface Water	√	Medium	Low	Moderate/ Low	
			Air quality	x				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Ecosystems	√	Medium	Low	Moderate/ Low	
			Construction materials	X				
		Surface water run-off	Human Health - Construction workers and site visitors	√	Mild	Low	Low	
			Human health - Future/End users of the site	√	Mild	Low	Low	
			Human Health - Site neighbours and public	√	Mild	Low	Low	
			Controlled water - Groundwater	√	Medium	Low	Moderate/ Low	
			Controlled water - Surface Water	√	Medium	Low	Moderate/ Low	
			Air quality	X				
			Ecosystems	√	Mild	Low	Low	
			Construction materials	X				
		Dermal contact	Human Health - Construction workers and site visitors	√	Medium	Low	Moderate/ Low	
			Human health - Future/End users of the site	√	Medium	Unlikely	Low	

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Inhalation	Human Health - Construction workers and site visitors	√	Severe	Moderate	High	
			Human health - Future/End users of the site	√	Severe	Low	Moderate	
			Human Health - Site neighbours and public	√	Severe	Unlikely	Moderate/ Low	
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Construction materials	X				
		Ingestion	Human Health - Construction workers and site visitors	√	Severe	Low	Moderate	
			Human health - Future/End users of the site	√	Severe	Low	Moderate	
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	√	Medium	Moderate	Moderate	
			Construction materials	X				
Sulphates/ Sulphides	General Made Ground Made Ground - Slag Brine Wells and Salt Works Chimneys, Furnaces, Incinerators and Boiler Houses	Vertical migration through geological deposits	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
	Coke Works and By-Products Plant Concrete Works Docklands Iron and Steel Works Miscellaneous Tanks and Pipelines – not water related Phosphate Works Railway Lines and Sidings Sinter Plant Slag Processing Works Stocking Grounds		Controlled water - Groundwater	√	Medium	Moderate	Moderate	
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	√	Mild	Moderate	Moderate/ Low	
		Migration via groundwater	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	√	Medium	High	Moderate	
			Controlled water - Surface Water	√	Medium	Low	Moderate/ Low	
			Air quality	X				
			Ecosystems	√	Medium	Low	Moderate /Low	
			Construction materials	√	Mild	Moderate	Moderate /Low	

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
		Surface water run off	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	√	Medium	Moderate	Moderate	
			Controlled water - Surface Water	√	Medium	High	High	
			Air quality	X				
			Ecosystems	√	Medium	Low	Moderate /Low	
			Construction materials	√	Mild	Moderate	Moderate/ Low	
		Dermal contact	Human Health - Construction workers and site visitors	√	Mild	Low	Low	
			Human health - Future/End users of the site	√	Mild	Unlikely	Very Low	
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Inhalation	Human Health - Construction workers and site visitors	√	Mild	Unlikely	Very Low	
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Ingestion	Human Health - Construction workers and site visitors	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood**	**Risk**	
			Human health - Future/End users of the site	√	Mild	Unlikely	Very Low	
			Human Health - Site neighbours and public	√	Mild	Low	Low	
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	√	Mild	Low	Low	
			Construction materials	X				
Other organic and inorganic compounds	General Made Ground Brine Wells and Salt Works Coke Works and By-Products Plant Concrete Works Docklands Garages and Maintenance Workshops Miscellaneous Tanks and Pipelines – not water related Railway Lines and Sidings Slag Processing Works	Vertical migration through geological deposits	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	√	Medium	Moderate	Moderate	
			Controlled water - Surface Water	X				
			Air quality	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
	Stocking Grounds		Ecosystems	X				
			Construction materials	√	Mild	Low	Low	
		Migration via groundwater flow	Human Health - Construction workers and site visitors	√	Severe	Low	Moderate	
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	√	Severe	Unlikely	Moderate/ Low	
			Controlled water - Groundwater	√	Medium	Low	Moderate/ Low	
			Controlled water - Surface Water	√	Medium	Unlikely	Low	
			Air quality	X				
			Ecosystems	√	Severe	Unlikely	Moderate/ Low	
			Construction materials	√	Mild	Low	Low	
		Surface water run off	Human Health - Construction workers and site visitors	√	Severe	Low	Moderate	
			Human health - Future/End users of the site	√	Severe	Unlikely	Moderate/ Low	

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Human Health - Site neighbours and public	√	Severe	Low	Moderate	
			Controlled water - Groundwater	√	Medium	Low	Moderate/ Low	
			Controlled water - Surface Water	√	Medium	Moderate	Moderate	
			Air quality	X				
			Ecosystems	√	Severe	Low	Moderate	
			Construction materials	√	Mild	Low	Low	
		Dermal contact	Human Health - Construction workers and site visitors	√	Severe	Moderate	High	Particularly around the site of the former Coke Ovens to the west of the current ovens.
			Human health - Future/End users of the site	√	Severe	Unlikely	Moderate/ Low	
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Construction materials	X				
		Inhalation	Human Health - Construction workers and site visitors	√	Severe	Low	Moderate	Particularly around the site of the former Coke Ovens to the west of the current ovens.
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	√	Severe	Unlikely	Moderate/ Low	
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Ingestion	Human Health - Construction workers and site visitors	√	Severe	Unlikely	Moderate/ Low	
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X	Severe	Unlikely	Moderate/ Low	

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	√	Severe	Low	Moderate	
			Construction materials	X				
PCB's	Concrete Works Electrical Sub-stations and Transformers Oil-filled Electric Cables Galvanising Works Iron and Steel Works Railway lines and Sidings Riverside Pump House Slag Processing Works	Vertical migration through geological deposits	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				PCB's are hydrophobic so not readily mobile when leached in aqueous solution
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	√	Severe	Unlikely	Moderate/ Low	
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood**	**Risk**	
		Migration via groundwater flow	Human Health - Construction workers and site visitors	X				PCB's are hydrophobic so not readily mobile when leached in aqueous solution
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				PCB's are hydrophobic so not readily mobile when leached in aqueous solution
			Controlled water - Groundwater	√	Severe	Low	Moderate	
			Controlled water - Surface Water	√	Severe	Unlikely	Moderate/ Low	
			Air quality	X				
			Ecosystems	√	Severe	Moderate	High	PCB's can readily persist within the environment
			Construction materials	X				
		Surface water run-off	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	√	Severe	Unlikely	Moderate/ Low	

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Controlled water - Surface Water	√	Severe	Low	Moderate	Although hydrophobic, some sub-stations and transformers are located on the edge of the River Tees.
			Air quality	X				
			Ecosystems	√	Severe	Moderate	High	PCB's can readily persist within the environment
			Construction materials	X				
		Dermal contact	Human Health - Construction workers and site visitors	√	Severe	Low	Moderate	Based on the age of these works sites PCBs will have been used within sub-stations and transformers prior to the current transformer oils in use.
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
		Inhalation	Human Health - Construction workers and site visitors	√	Severe	Unlikely	Moderate/ Low	
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Ingestion	Human Health - Construction workers and site visitors	√	Severe	Unlikely	Moderate/ Low	Based on the age of these works sites PCBs will have been used within sub-stations and transformers prior to the current transformer oils in use.
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	√	Severe	Moderate	High	PCB's can readily persist within the environment
			Construction materials	X				
Organic solvents – SVOCs and VOCs	Brine Wells and Salt Works Coke works and By-Products Plant Concrete Works Fuel Oil Depot Galvanising Works Garages and Maintenance Workshops Galvanising Works Iron and Steel Works Miscellaneous Tanks and Pipelines – not water related	Vertical migration through geological deposits	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Migration via	Human Health - Construction workers and site visitors	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
		groundwater flow	Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Surface water run-off	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water – Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Ecosystems	X				
			Construction materials	X				
		Dermal contact	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Build up of gases within confined spaces - inhalation/ asphyxiation	Human Health - Construction workers and site visitors	√	Severe	Low	Moderate	Most likely to be exposed during redevelopment of site
			Human health - Future/End users of the site	√	Severe	Moderate	High	Most likely to be exposed during redevelopment of site as a result of

Source		**Pathway**	**Receptor**	**Plausible**	**Initial assessment**			**Comment/data gap**
Contaminant	**Site feature**				**Consequence**	**Likelihood**	**Risk**	
			Human Health - Site neighbours and public	√	Severe	Moderate	High	the ground being disturbed, allowing for migration.
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Build up of gases within confined spaces - explosive risk	Human Health - Construction workers and site visitors	√	Severe	Low	Moderate	Most likely to be exposed during and/or following redevelopment of site as a result of the ground being disturbed, allowing for migration. Future/end users and neighbouring sites considered to be at greater risk as more likely to remain within a single area and for longer periods of time.
			Human health - Future/End users of the site	√	Severe	Moderate	High	
			Human Health - Site neighbours and public	√	Severe	Moderate	High	
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				

Source		**Pathway**	**Receptor**	**Plausible**	**Initial assessment**			**Comment/data gap**
Contaminant	**Site feature**				**Consequence**	**Likelihood**	**Risk**	
			Construction materials	√	Severe	Low	Moderate	
		Ingestion	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
Phenols	Coke Works and By-Products Plant Concrete Works Fuel Oil Depot Miscellaneous Tanks and Pipes – not water related	Vertical migration through geological deposits	Human Health - Construction workers and site visitors	X				
			Human Health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Controlled water - Groundwater	√	Medium	Moderate	Moderate	
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	√	Mild	Low	Low	
		Migration via groundwater flow	Human Health - Construction workers and site visitors	X				
			Human Health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	√	Medium	Low	Moderate/ Low	
			Controlled water - Surface Water	√	Medium	Unlikely	Low	
			Air quality	X				
			Ecosystems	√	Severe	Unlikely	Moderate/ Low	
			Construction materials	√	Mild	Low	Low	

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
		Surface water run-off	Human Health - Construction workers and site visitors	X				
			Human Health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	√	Medium	Low	Moderate/ Low	
			Controlled water - Surface Water	√	Medium	Moderate	Moderate	
			Air quality	X				
			Ecosystems	√	Severe	Low	Moderate	
			Construction materials	√	Mild	Low	Low	
		Dermal contact	Human Health - Construction workers and site visitors	√	Medium	Low	Moderate/ Low	
			Human Health - Future/End users of the site	√	Medium	Unlikely	Low	
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Inhalation	Human Health - Construction workers and site visitors	√	Severe	Low	Moderate	
			Human Health - Future/End users of the site	X				
			Human Health - Site neighbours and public	√	Severe	Unlikely	Moderate/ Low	
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Ingestion	Human Health - Construction workers and site visitors	√	Severe	Unlikely	Moderate/ Low	

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Human Health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
Soil gases	General Made Ground Tidal Flat and Glaciolacustrine superficial deposits	Vertical migration through geological deposits	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Ecosystems	X				
			Construction materials	X				
		Migration via groundwater flow	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Surface water run-off	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				
		Build up of gases within confined spaces - inhalation/ asphyxiation	Human Health - Construction workers and site visitors	√	Severe	Unlikely	Moderate /Low	Very little information about the underlying superficial deposits
			Human health - Future/End users of the site	√	Severe	Low	Moderate	Disturbing the ground could provide a pathway for off-site migration
			Human Health - Site neighbours and public	√	Severe	Low	Moderate	
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Construction materials	X				
		Build up of gases within confined spaces - explosive risk	Human Health - Construction workers and site visitors	√	Severe	Unlikely	Moderate /Low	
			Human health - Future/End users of the site	√	Severe	Low	Moderate	Very little information about the underlying superficial deposits.
			Human Health - Site neighbours and public	√	Severe	Low	Moderate	Disturbing the ground could provide a pathway for off-site migration
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	√	Severe	Low	Moderate	
		Ingestion	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	Site feature				Consequence	Likelihood	Risk	
			Controlled water - Groundwater	X				
			Controlled water - Surface Water	X				
			Air quality	X				
			Ecosystems	X				
			Construction materials	X				

Appendix B –Risk Classification

Classification of Consequence

Classification	Definition	Examples
Severe	Short term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem, or organism forming part of such ecosystem (note: the definitions of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000).	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse (can also equate to a short term human health risk if buildings are occupied).
Medium	Chronic damage to Human Health ("significant harm" as defined in the DETR, 2000). Pollution of sensitive water resources (note: Water Resources Act contains no scope for considering significance of pollution). A significant change in a particular ecosystem, or organism forming part of such ecosystem. (note: the definitions of ecological systems within Circular on Contaminated Land, DETR , 2000).	Concentrations of a contaminant from site exceed the generic, or site specific assessment criteria. Leaching of contaminants from a site to a major or minor aquifer. Death of a species within a designated nature reserve.
Mild	Pollution of non-sensitive water resources. Significant damage to buildings/structures and crops ("significant harm" as defined in the Draft Circular on Contaminated Land, DETR, 2000). Damage to sensitive buildings/structures or the environment.	Pollution of non-classified groundwater. Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).

Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as Personal Protective Clothing, etc). Easily repairable effects of damage to buildings/structures.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discolouration of concrete.

Classification of Likelihood

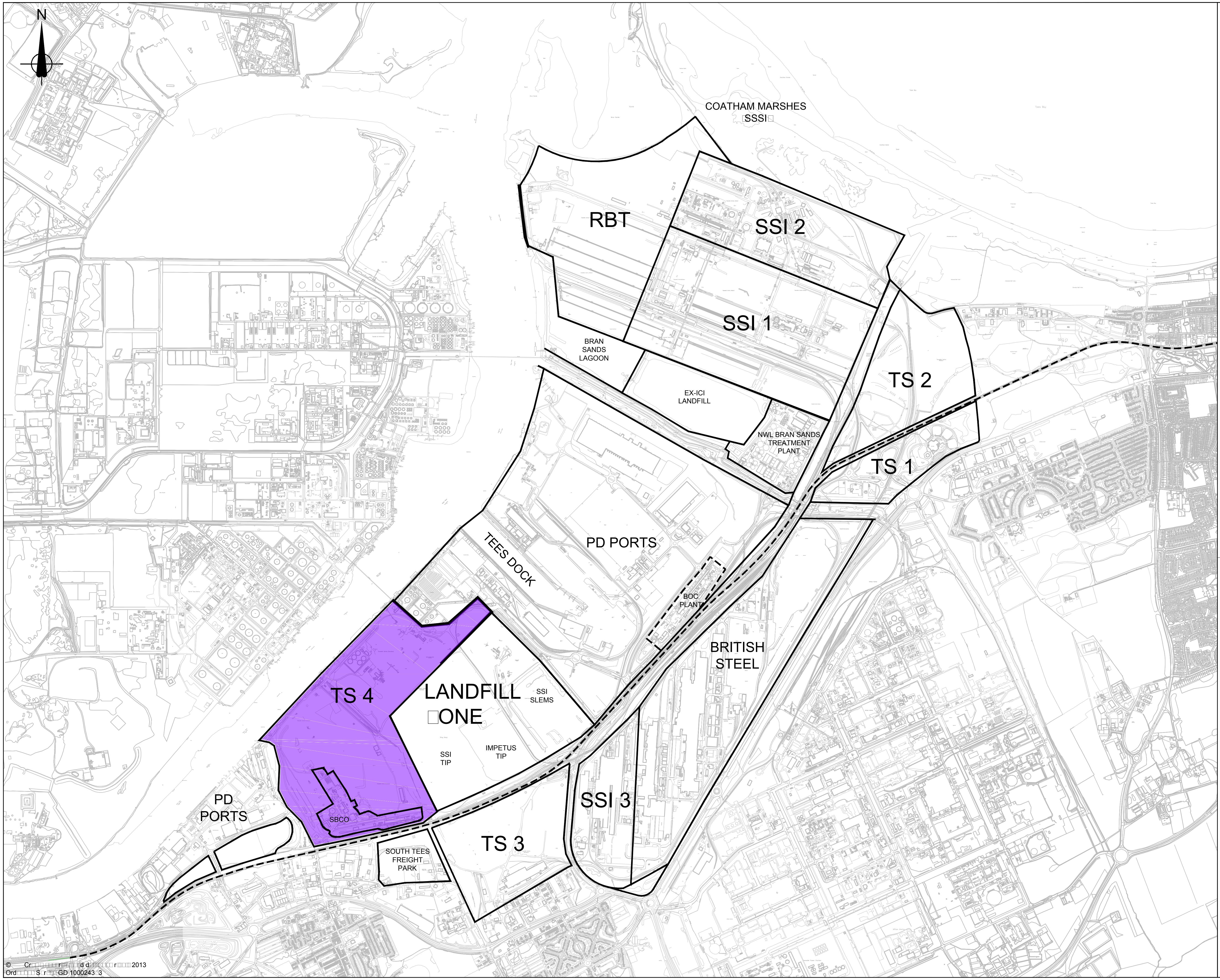
Classification	**Definition**
High	There is a pollution linkage and an event which would either appear very likely in the short term and almost inevitable over the long term, or, there is evidence at the receptor of harm or
Moderate	There is a pollution linkage and all the elements are present and in the right place which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

Risk evaluation of Consequence against Likelihood

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Likelihood	**High**	Very High Risk	High Risk	Moderate Risk	Moderate/ Low Risk
	Moderate	High Risk	Moderate Risk	Moderate/ Low Risk	Low Risk
	Low	Moderate Risk	Moderate/ Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/ Low Risk	Low Risk	Very Low Risk	Very Low Risk

Figures

Figure 1 – Site Location Plan



KEY

▨ TS4 LOCATION

Rev	By	Chkd	Apprvd	Date	Description
-	-	-	-	-	-

Client

Homes & Communities Agency

CH2M
D□□□d□ H□□□□□R□□r□d□□S□□□□□□-□□-T□□□
T□□□44 □0□1642 632800
□□□□CH2M□□□□

Project

SSI REDCAR

Drawing

TS 4
□INCLUDING SBCO□
SITE LOCATION PLAN

Drawn by: JT Date: 10/05/2017
Checked by: FM Date: 15/06/2017
Approved by: IDK Date: 15/06/2017

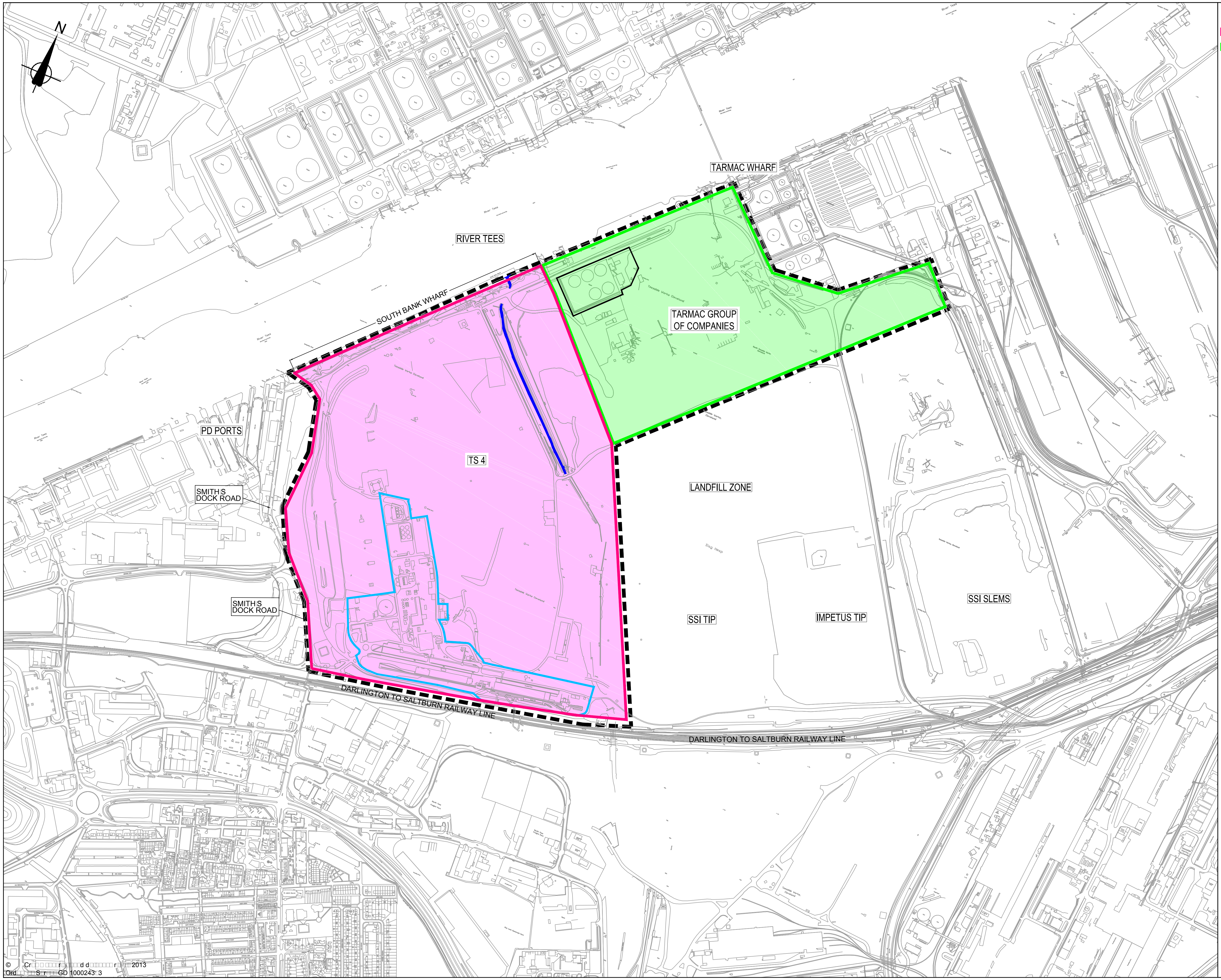
Drawing No.
FIGURE 1

Revision
-

Drawing Scale: 1:12500 @ A1; 1:25000 @A3

Drawing file path & name :
Xreference file path :
User and Plot Date :

Figure 2 – Site Setting



KEY

🟥 MAIN AREA OF TS4
🟩 NORTHEAST QUADRANT
— SBCO
— UNCULVERTED SECTION OF MILL STREAM
— FUEL OIL DEPOT
- - - TS 4 SITE AREA

-	-	-	-	-	-
Rev	By	Chkd	Apprvd	Date	Description

Client

Homes & Communities Agency

CH2M
[illegible]
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Project

SSI REDCAR

Drawing

TS4
SITE SETTING

Drawn by: KW Date: 10/04/2017
Checked by: FM Date: 15/06/2017
Approved by: IDK Date: 15/06/2017

Drawing No.

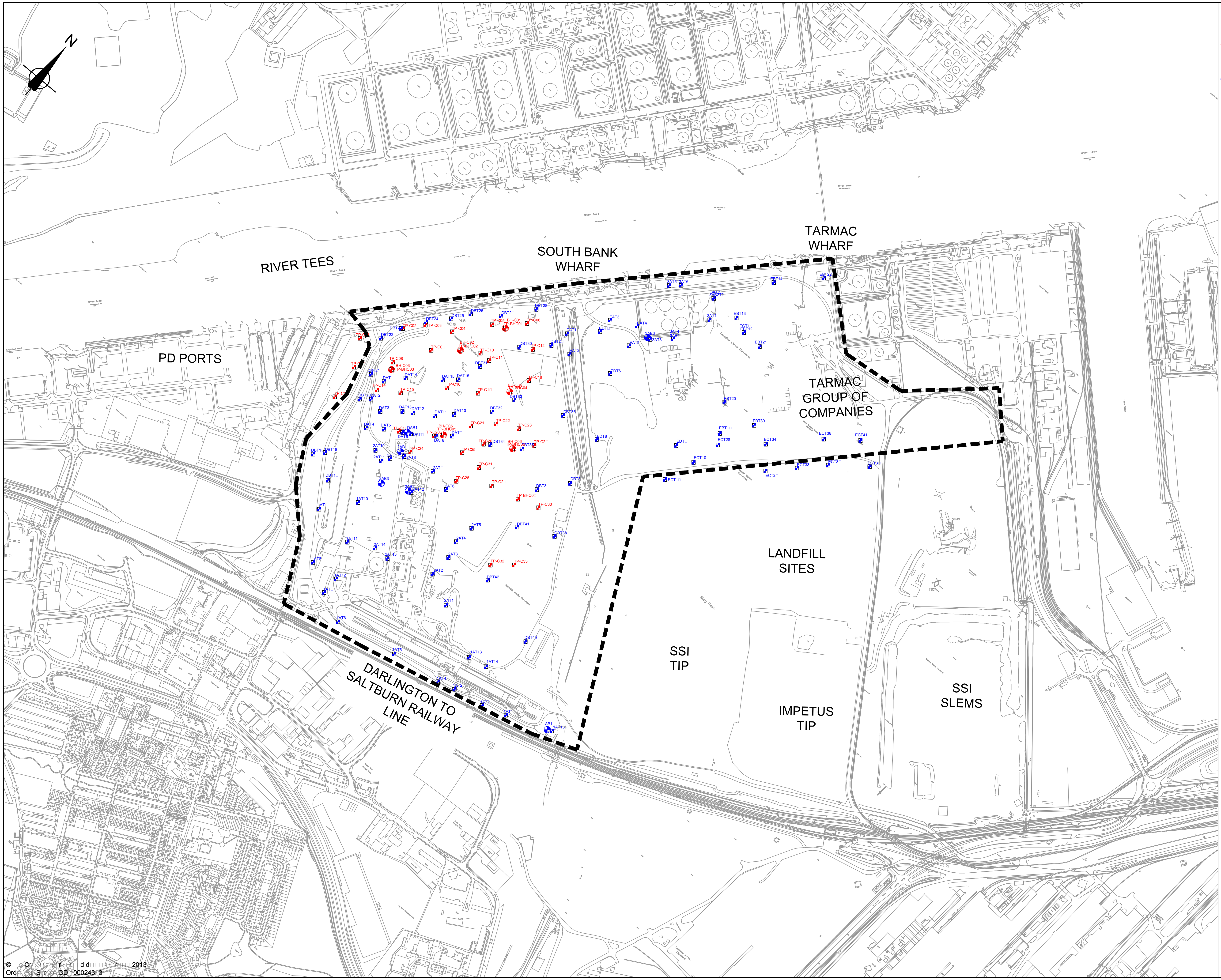
FIGURE 2

Revision
-

Drawing Scale: 1:5000 @ A1; 1:10000 @A3

Drawing file path & name :
Xreference file path :
User and Plot Date :

Figure 3 – Historical Exploratory Hole Location Plan



KEY

🟥	1999 TRIAL PITS
🔴	APPROXIMATE LOCATION OF BRITISH STEEL BOREHOLES 1981
🟦	2004 TRIAL PITS FROM ENVIROS SOIL & GROUND WATER STUDY REPORT
🔵	2004 BOREHOLES FROM ENVIROS SOIL & GROUND WATER STUDY REPORT
▬ ▬ ▬	TS 4 SITE AREA

SLEMS - SOUTH LACKENBY ENVIRONMENTAL MANAGEMENT SERVICE

Rev	By	Chkd	Apprvd	Date	Description
-	-	-	-	-	-

Client

Homes &
Communities
Agency

CH2M
D d H R r d S - -T
T 44 0 1642 632800
CH2M

Project

SSI REDCAR

Drawing

TS4
HISTORIC BOREHOLES
AND TRIAL PITS
LOCATION PLAN

Drawn by: KW Date: 12/04/2017
Checked by: FM Date: 15/06/2017
Approved by: IDK Date: 15/06/2017

Drawing No.

FIGURE 3

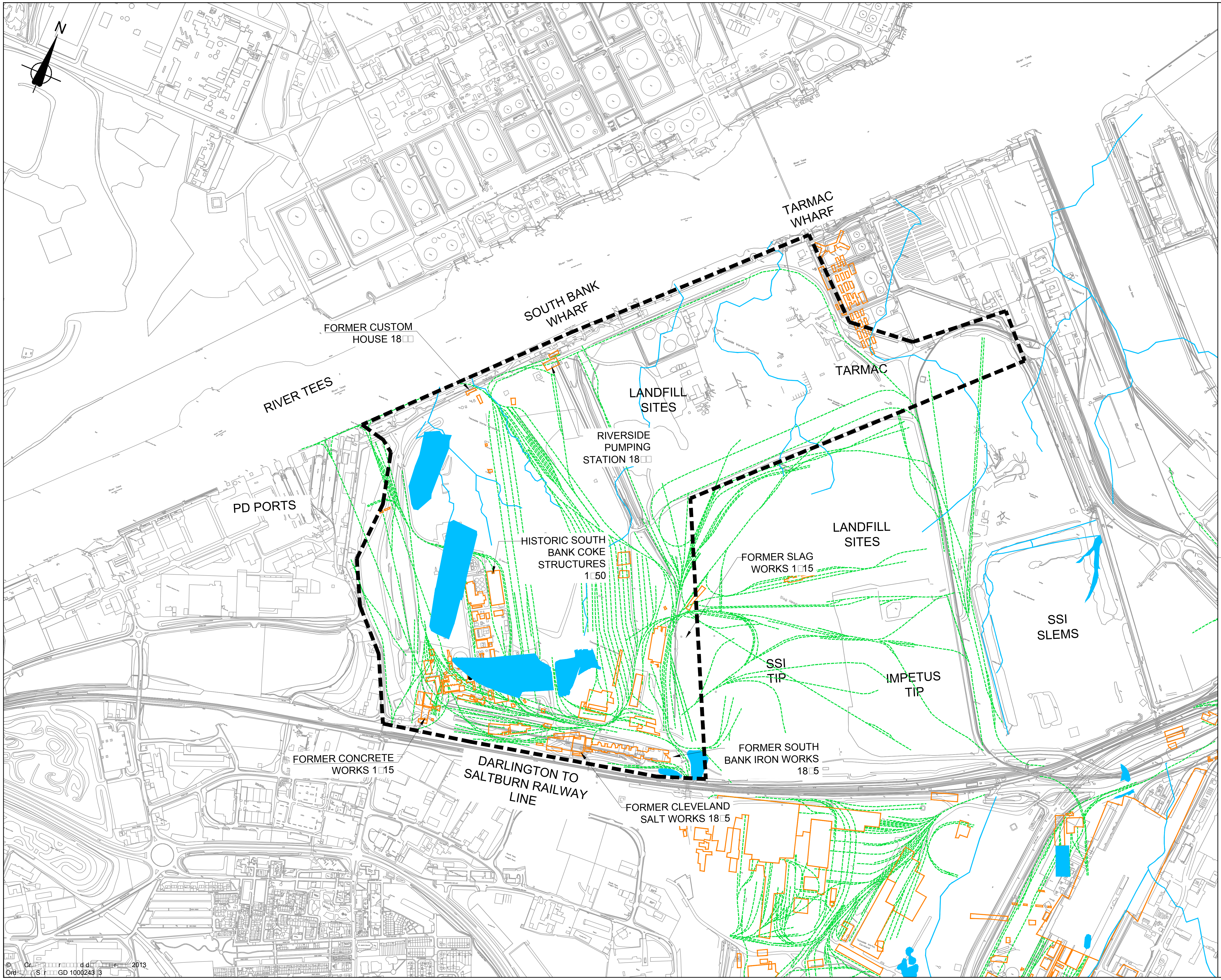
Revision

-

Drawing Scale: 1:5000 @ A1; 1:10000 @A3

Drawing file path & name :
Xreference file path :
User and Plot Date :

Figure 4 – Historical Site Layout



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Ord[illegible] S[illegible]r[illegible] GD 1000243[illegible]3

KEY

▬ ▬	TS 1 SITE AREA
- - -	HISTORICAL RAIL TRACKS
▭	HISTORICAL BUILDING FOOTPRINTS
—	HISTORICAL WATERCOURSE
■	HISTORICAL POND

Rev	By	Chkd	Apprvd	Date	Description
-	-	-	-	-	-

Client

Homes & Communities Agency

CH2M
D[illegible]d[illegible] H[illegible]R[illegible]r[illegible]d[illegible]S[illegible]-[illegible]-T[illegible]
T[illegible]44 [illegible]0[illegible]1642 632800
[illegible]CH2M[illegible]

Project

SSI REDCAR

Drawing

TS4
HISTORICAL SITE LAYOUT

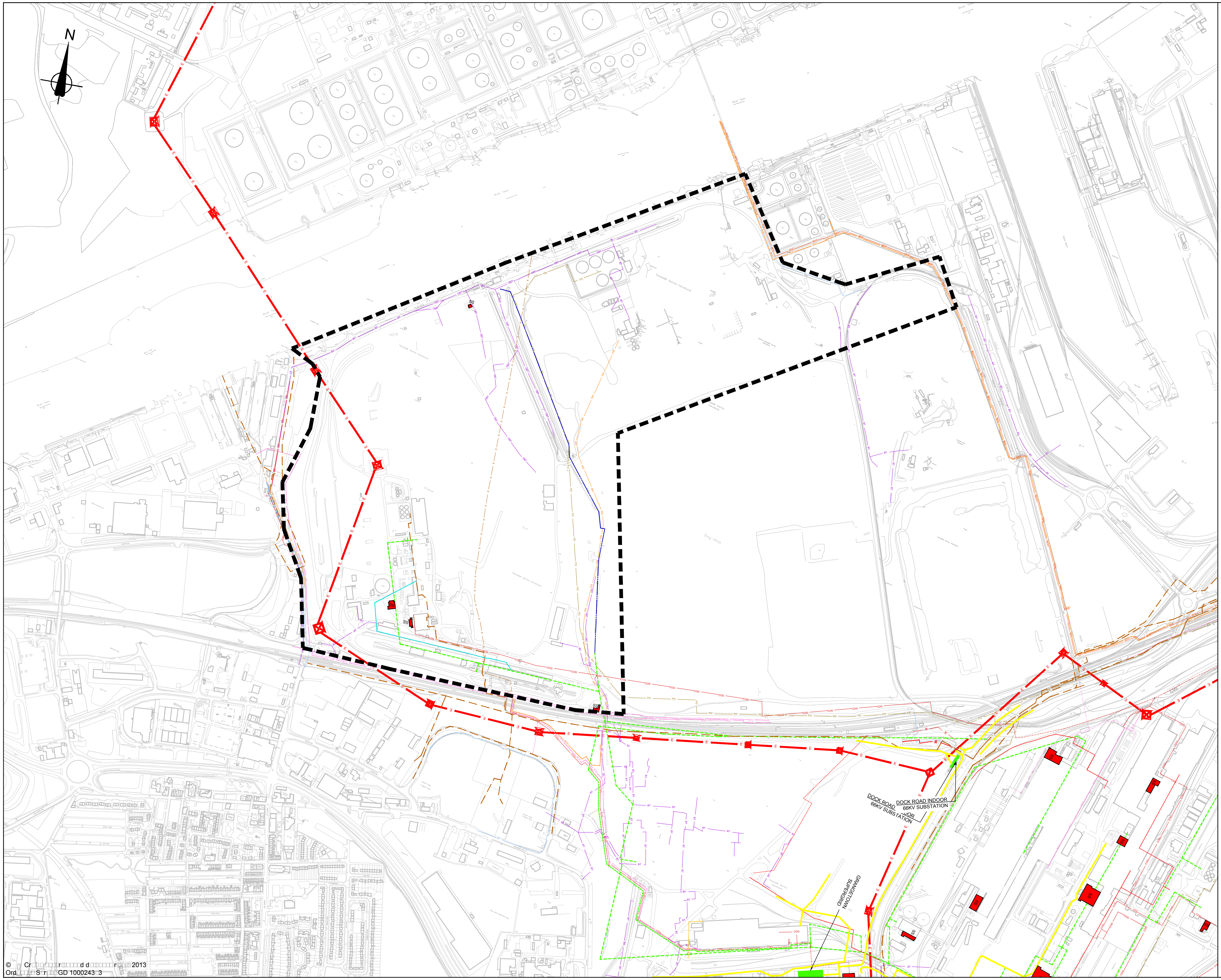
Drawn by: JT Date: 30/03/2017
Checked by: FM Date: 15/06/2017
Approved by: IDK Date: 15/06/2017

Drawing No.	Revision
FIGURE 4	-

Drawing Scale: 1:5000 @ A1; 1:10000 @A3

Drawing file path & name :
Xreference file path :
User and Plot Date :

Figure 5 – Existing Utilities Plan



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Ordnance Survey GD 1000243□3

NOTES
1. INDICATIVE ONLY.

KEY

BT	BT Openreach Underground
OBT	BT Openreach Overhead
BOC	BOC Oxygen Pipeline
BOC	BOC Nitrogen Pipeline
BOC	BOC Hydrogen Pipeline
X	Redundant BOC Oxygen Pipeline
MG	Northern Gas Networks Medium Pressure
LG	Northern Gas Networks Low Pressure
E	National Grid OH Electricity
☒	Electric Pylons
W	NWL Clean Water
	NWL Sewer
X	NWL Abandoned Sewer
NPG	Northern Power Grid
COG	Coke Oven Gas Main Above Ground
	Coke Oven Gas Main Under Ground
	Fibre Optic Cable
	Potable Water
	Industrial Water
FO	Fuel Oil Pipeline
	HV E□□□□r□□□□ R□□□r□□□□□□□
	Site Boundary
SS	11kV Substations

Rev	By	Chkd	Apprvd	Date	Description
-	-	-	-	-	-

Client

Homes & Communities Agency

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Tel +44 (0)1642 632800
www.CH2M.com

Project

SSI REDCAR

Drawing

Existing Utilities Plan
TS4

Drawn by: KW Date: 12/04/2017
Checked by: Date:
Approved by: Date:

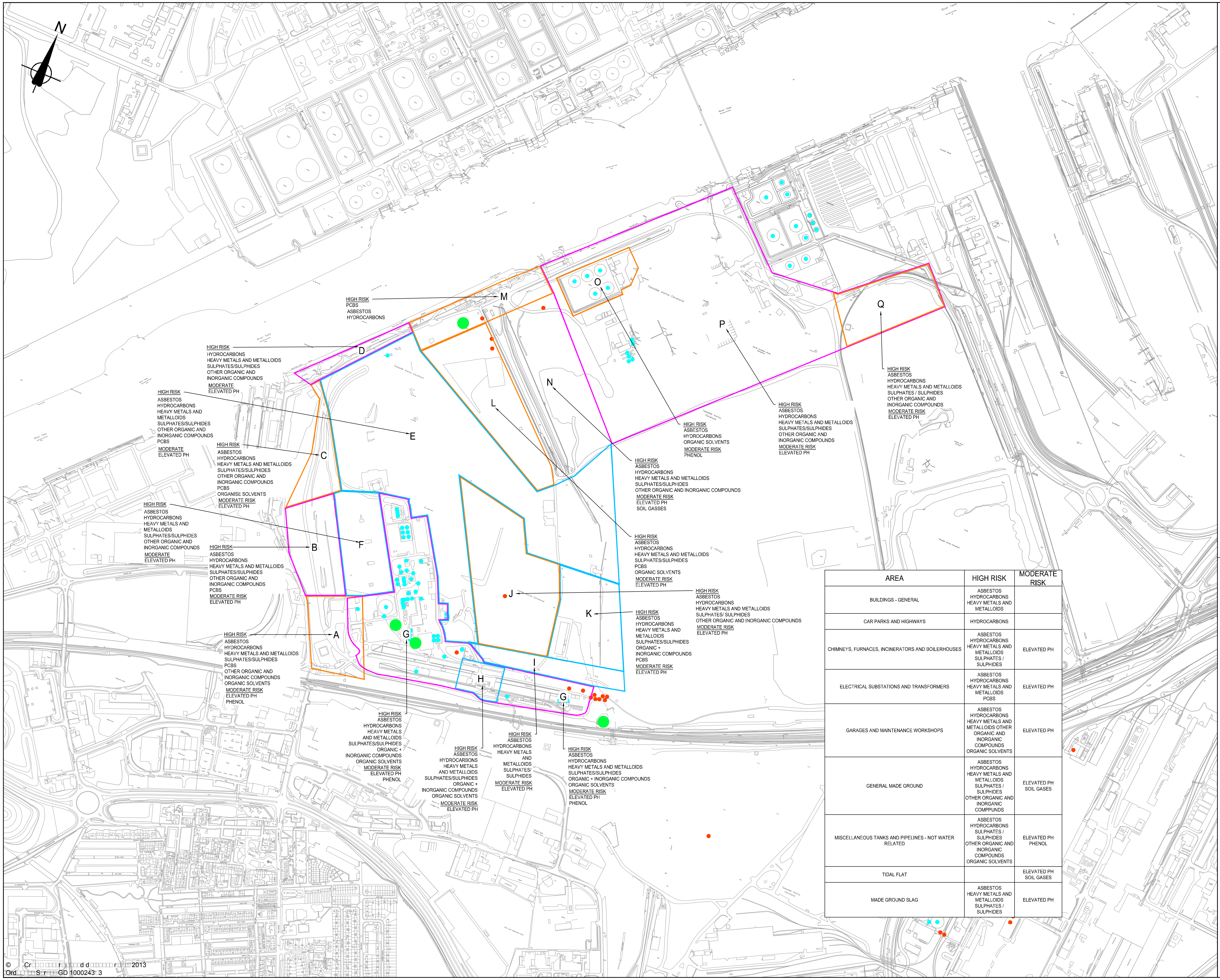
Drawing No.
FIGURE 5

Revision
-

Drawing Scale: 1:5000 @ A1; 1:10000 @A3

Drawing file path & name :
Xreference file path :
User and Plot Date :

Figure 6 –Site Constraints Plan



AREA	HIGH RISK	MODERATE RISK
BUILDINGS - GENERAL	ASBESTOS HYDROCARBONS HEAVY METALS AND METALLOIDS	
CAR PARKS AND HIGHWAYS	HYDROCARBONS	
CHIMNEYS, FURNACES, INCINERATORS AND BOILERHOUSES	ASBESTOS HYDROCARBONS HEAVY METALS AND METALLOIDS SULPHATES / SULPHIDES	ELEVATED PH
ELECTRICAL SUBSTATIONS AND TRANSFORMERS	ASBESTOS HYDROCARBONS HEAVY METALS AND METALLOIDS PCBS	ELEVATED PH
GARAGES AND MAINTENANCE WORKSHOPS	ASBESTOS HYDROCARBONS HEAVY METALS AND METALLOIDS OTHER ORGANIC AND INORGANIC COMPOUNDS ORGANIC SOLVENTS	ELEVATED PH
GENERAL MADE GROUND	ASBESTOS HYDROCARBONS HEAVY METALS AND METALLOIDS SULPHATES / SULPHIDES OTHER ORGANIC AND INORGANIC COMPPUNDS	ELEVATED PH SOIL GASES
MISCELLANEOUS TANKS AND PIPELINES - NOT WATER RELATED	ASBESTOS HYDROCARBONS SULPHATES / SULPHIDES OTHER ORGANIC AND INORGANIC COMPOUNDS ORGANIC SOLVENTS	ELEVATED PH PHENOL
TIDAL FLAT		ELEVATED PH SOIL GASES
MADE GROUND SLAG	ASBESTOS HEAVY METALS AND METALLOIDS SULPHATES / SULPHIDES	ELEVATED PH

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Ord S r GD 1000243 3

NOTES:

1. TO BE REVIEWED WITH FIGURE 5.

KEY

A	CONCRETE WORKS + RAILWAY SIDINGS
B	MINERAL SIDINGS
C	IRON WORKS + GALVANISING WORKS + SIDINGS
D	SOUTH BANK WHARF
E	RAILWAY SIDINGS + TRAVELLING CRANES
F	COAL STOKING GROUND (BREEZE)
G	SBCO AND BY-PRODUCTS PLANT
H	CLEVELAND SALT WORKS
I	SINTER PLANT + ORE PROCESSING
J	COKE + ORE STOCKING AREAS
K	BASIC SLAG WORKS + PHOSPHATE WORKS
L	BESSEMER, PIG CASTING + BENZOLE PLANT
M	RIVERSIDE PUMP HOUSE
N	WASTE GROUND
O	OIL FUEL DEPOT
P	TARMAC GROUP OF COMPANIES
Q	SCRAP METAL STOCKING AREA
●	HISTORICAL TANK
●	PRESENT TANK
●	11KV SUBSTATION

-	-	-	-	-	-
Rev	By	Chkd	Apprvd	Date	Description

Client

Homes & Communities Agency

CH2M
D d H R r d S - -T
T 44 0 1642 632800
CH2M

Project

SSI REDCAR

Drawing

TS4
SITE CONSTRAINTS

Drawn by: JT Date: 12/04/2017
Checked by: FM Date: 15/06/2017
Approved by: IDK Date: 15/06/2017

Drawing No.
FIGURE 6

Revision
-

Drawing Scale: 1:5000 @ A1; 1:10000 @A3

Drawing file path & name :
Xreference file path :
User and Plot Date :

Appendix H7: First Phase Reporting of the Site Protection and Monitoring Programme

Reference Source no.	136323
Project number	7129.19
Date of issue	31 January 2008
Security Code	R: all CRD&T staff; named Corus staff; named non-Corus staff

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First Phase Reporting of the Site Protection and Monitoring Programme

For Teesside Works, Corus Construction and Industrial

WHERE REFERENCE DATA IS REQUIRED

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Security Code R: all CRD&T staff; named Corus staff; named non-Corus staff

Contents **Page**

Summary

First Phase Reporting of the Site Protection and Monitoring Programme

For Teesside Works, Corus Construction and Industrial

Author(s): Mr R J Hardeman

Reviewer(s): Mr A Griffin
Date of issue: 31 January 2008
Version no:
Security Code: R: all CRD&T staff; named Corus staff; named non-Corus staff

This document represents the first phase reporting of reference data for the Teesside Works Site Protection and Monitoring Programme ('SPMP'). Reference Data has been collected for Cleveland and Redcar where there is likelihood for potential pollution to land. The potential polluting substances that may cause pollution to land are:

- Source S^3 Heavy Fuel Oil Storage Tanks, South Bank Oil Farm (Area 2), Cleveland Works.
- Source $S6^3$ Ammoniacal Liquor Storage Tanks, Redcar Coke Ovens and By-Products Plant (Area 12), Redcar Works.

This first phase reporting was undertaken by Mr Richard Hardeman, Environmental Geologist, Corus Research, Development and Technology, Rotherham.

3 Boreholes, BH2B1 to BH2B3, were excavated at south bank oil farm. 8 trial pits TP1T1 to 1T8 and 3 boreholes BH12B1 to BH12B3 were excavated at Area 12, Redcar Coke Ovens and By-Products Plant. Groundwater monitoring wells were installed in each borehole to a maximum depth of 13m depending on the ground conditions encountered.

The analytical suites agreed in the Design SPMP were used in the analysis of samples from the investigation to collect reference data.

Reference Data for the two locations have been collected by this report and are presented in Summary as Appendix F. Elevated levels of pollutants have not been found where reference data has been collected. The reference data collected shows no difference between upgradient and downgradient sampling locations. Therefore, it is proven that the sources are not responsible for the low level concentrations seen in soil and groundwater.

The Infrastructure monitoring programme ahs remained unchanged from the design SPMP. As a result of collecting this Reference Data, an environmental monitoring programme has

Corus Research, Development & Technology
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Environment
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Rotherham
South Yorkshire S60 3AR
United Kingdom

been proposed to monitor the groundwater boreholes to identify any loss of containment at the two sources.

In order to determine any breaches of containment, downgradient groundwater monitoring results will be directly compared to those upgradient. If results downgradient significantly increase in comparison to the baseline data recorded, and this increase is not reflected in the analysis of the upgradient boreholes, then more intensive monitoring will be undertaken until assurances can be made that changes in concentrations cannot be attributed to the storage tanks that reference data has been collected for.

Results from groundwater monitoring will be recorded within the EMS and reported to the Agency annually.

Customer: P. Boydell
Programme manager:

Approved by: P. Boydell

First Phase Reporting of the Site Protection and Monitoring Programme

1. Introduction

This document represents the first phase reporting of reference data for the Teesside Works Site Protection and Monitoring Programme ('SPMP'). The design SPMP's (Ref. 1, 2 and 3) for Cleveland, Lackenby and Redcar and were submitted to the Environment Agency (the 'Agency') in pursuance of condition 4.1.7 of PPC Permit No.BK0493 (Ref. 4) on the 25th October 2004, 19th April 2005 and 19th June 2005 respectively. This document is provided as an addendum to the design SPMP documents.

A supplementary Application Site Report (Ref.5) was submitted to the Agency in March 2004. This assessed the potential for pollution to land at Cleveland, Lackenby and Redcar. This document represents the collection of reference data for Cleveland and Redcar where there is likelihood for potential pollution to land. The potential polluting substances that may cause pollution to land are:

- Source S^3 Heavy Fuel Oil Storage Tanks, South Bank Oil Farm (Area 2), Cleveland Works.
- Source $S6^3$ Ammoniacal Liquor Storage Tanks, Redcar Coke Ovens and By-Products Plant (Area 12), Redcar Works.

This first phase reporting was undertaken by Mr Richard Hardeman, Environmental Geologist, Corus Research, Development and Technology, Rotherham.

1.1 Site Location

The installation is located at Teesside Integrated Iron and Steelworks, Corus UK Ltd, Redcar, Cleveland TS10 5QW. The centre of the site is at National Grid Reference NZ5400 2240. The site location can be seen in Figure 1 in Appendix A. Highlighted on this drawing are both the South Bank Oil Farm (Area 2) and Redcar Coke Ovens and By-Products Plant (Area 12) for which reference data are required.

2. Intrusive Investigations

2.1 Investigation and Sampling Strategy

The investigation and sampling strategy undertaken at the site varied from the design SPMP. These variations were discussed with the Agency on 4th May 2006 where the revised SPMP was discussed and confirmed as being acceptable. The details of this meeting and final details of the requirements are set out in a letter sent to the Agency on the 4th August 2006 by Miss K E Liddle (Ref.6).

The following sections detail the variations to and deviations from the design SPMP.

2.1.1 General

The investigation was conducted from 11th June 2007 to the 5th July 2007. Trial pit investigations were undertaken under the supervision of Mr Richard Hardeman, Environmental Geologist, and Mr Shaun McKenna, Senior Environmental Engineer, of Corus Research, Development and Technology, Rotherham. Trial Pit Logs are provided in Appendix B1. Boreholes were installed by J.B.Site Investigation, a sub-contractor of Soil mechanics, under the supervision of Mr Richard Hardeman. Boreholes 2B2, 2B3, 12B2 and 12B3 were completed in this period. Rotary boreholes using a symmetrix technique were excavated to a minimum depth of 10 metres and subsequently installed with groundwater monitoring standpipes, as detailed in the borehole logs given in Appendix B2.

Due to difficulties in reaching the desired depths with traditional rotary techniques, two final boreholes had to be installed using a Sonic Drilling Technique. BH2B1 and BH12B1 were completed on the 3rd and 4th December 2007 to depths of 12 m and 10 m respectively. These were installed with groundwater monitoring standpipes, as detailed in the borehole logs given in Appendix B2.

Soil and groundwater investigation and sampling techniques have not significantly changed to those agreed in the design SPMP. The sections are reproduced below with any minor changes reported.

2.1.2 Constraints on Investigations

The main constraint on the investigation, as mentioned above, was the suitability of the drilling technique. Rotary drilling was thought to be the most suited technique for the site due to the nature of the fused slag ground conditions. However, problems were encountered throughout the investigation with the casing used during the drilling ‘jamming’ within the Made Ground. This led to the abandonment of two boreholes, and a new sonic drilling technique was used to excavate the boreholes to the desired depth. This change in drilling technique and contractors led to delays in the installation of boreholes, and therefore the submission of reference data has been significantly delayed.

Significant delays also occurred due to concerns from site safety personnel about how the working at heights regulations affected the excavation of trial pits. As such, new working methods had to be sought so the excavation of trial pits could be performed safely, and the commencement of the site investigation was delayed several months.

Other constraints on the investigation, as discussed and documented previously with the Agency, primarily include the drilling works undertaken at Area 12 within the vicinity of the by-products plant. The by-products plant is classified as an intrinsically safe area, and therefore drilling works had to take place outside the boundaries of the plant.

2.1.3 Soil Investigation and Sampling Techniques and Protocols

Soil investigation techniques have been revised from that within the Design SPMP, with agreement with the Agency.

Trial pits were advanced at all exploratory locations, including the pre-excavation of borehole locations. Trial pits will be excavated using a 20 tonne excavator to a maximum depth of 4m.

Boreholes were installed to provide groundwater Reference Data and allow for continued environmental monitoring at the installation. Due to the nature of the slag made ground, the drilling technique has been revised. The installation of groundwater monitoring boreholes at the internal landfill site at Cleveland, encountered significant problems when drilling the made ground. Consequently, boreholes will be advanced using rotary drilling techniques that will crush the steel slag and therefore it will not be possible to obtain soil samples. The boreholes will be advanced through the trial pits and logged from 4m to a maximum depth of 10m. Due to difficulties in reaching the desired depths with traditional rotary techniques, two final boreholes had to be installed using a Sonic Drilling Technique. BH2B1 and 12B1 were completed on the 3rd and 4th December 2007 to depths of 12 m and 10 m respectively. These were installed with groundwater monitoring standpipes, as detailed in the borehole logs given in Appendix B2.

Intrusive investigation and sampling will be performed in accordance with BS 5930:1999 and BS 10175:2001. In addition, rotary drilling operatives will be required to have British Drilling Association accreditation and all materials encountered will be logged in accordance with BS 5930:1999 by an experienced Engineer / Geologist / Environmental Scientist. Health and safety policy at Teesside Works prohibits work above an open excavation, unless harnesses are used and an appropriate ground anchor is available. This is the interpretation of the Working at Height Regulations. Consequently it will not be possible to accurately log the depth from which soil samples are collected. Samples will be taken from the excavator bucket as it arises, with the experienced excavator operator providing an indication of depth.

At exploratory locations the presence of any visual and/or olfactory contamination will be noted. Sample selection will be made on the basis of this information and on the depth of the investigation and the nature of the strata. Samples will be taken using stainless steel sampling equipment and clean nitrile/disposable gloves at each location. All sampling equipment will be cleaned between each location to minimise possible cross contamination. Samples will be taken at 1m intervals, or where changes in strata are recorded (not anticipated due to the known thickness of made ground). Samples will comprise 1 x 500g plastic tub, 1 x 500g amber glass jar and 1 x 125g amber glass jar. All samples will be labelled to identify the nature, depth, date and sample ID, and a full chain of custody established prior to collection at site by the contracted external chemical laboratory.

Trial pit and borehole installation methodologies are reproduced in Appendix C.

2.1.4 Groundwater Investigation and Sampling Techniques and protocols

Groundwater monitoring wells were installed in each borehole to a maximum depth of 13m depending on the ground conditions encountered. Given the thickness of made ground at the site, it is not anticipated to encounter natural deposits. Where this is the case, care will be taken to ensure that vertical contaminant pathways are not created. This will be achieved, where necessary, by the use of bentonite seals in boreholes. Where contamination is encountered drilling equipment will be pressure washed to minimise possible cross contamination. Installation of groundwater monitoring instruments will be conducted in accordance with BS 5930:1999 and BS 10175:2001 and all materials are approved prior to installation. Where more than one groundwater strike is recorded, the instrumentation will be designed to allow discrete groundwater sampling.

Groundwater sampling was undertaken upon completion of drilling works. At each location water levels and depth to the base of the monitoring well will be measured and recorded. Sampling of groundwater from the boreholes will be undertaken in accordance with BS 6068-6.11:1993, with three well volumes purged using dedicated Wattera inertial pumping equipment. The determination of successful borehole development shall be either when the pumped water is visually clear and when the field measurements of electrical conductivity and pH stabilise, or if the borehole has purged dry prior to stabilisation. One sample per installation will be taken, and the sample stored in a cool box to be dispatched to the external chemical laboratory on the same day. Groundwater samples will be taken using Waterra tubing, dedicated to each well to prevent cross contamination between wells and to minimise the loss of volatile contaminations from water samples. Samples will be stored in 1 x 1litre plastic bottle, 2 x 1litre amber glass bottles (for TPH and PAH) and 1 x 40ml glass vial (for VOCs). Samples will be labelled and a full chain of custody established prior to collection at site by the external chemical laboratory.

2.2 Sample Locations

The number and location of samples has changed from the design SPMP. These variations were discussed with the Agency on 4th May 2006 where the revised SPMP was discussed and confirmed as being acceptable. The details of this meeting and final details of the requirements are set out in a letter sent to the Agency on the 4th August 2005 by Miss K E Liddle (Ref.6).

Sample locations were located using differential GPS and have a horizontal accuracy of less than one metre, and a vertical accuracy of one metre. Sample locations for Area 2 and Area 12 are shown on figures 2 and 3 within Appendix A. Discussion for the selection; justification and design for the revised sampling strategy with respect to individual areas are given in the following sections. Samples have been referenced using the classification system proposed in the design SPMP.

The findings are discussed in Section 2.4 below and all physical ground results (borehole and trial pit logs) are reproduced in Appendix B.

2.2.1 Area 2 South Bank Oil Farm

The SPMP for Cleveland Works proposed two trial pits (2T1 and 2T2) and one borehole (2B1) with a combined gas and groundwater monitoring instrument at Source S3 (5x100,000 litre heavy fuel oil storage tanks), as shown in Figure A3.1 of Appendix A3 of the SPMP.

The Agency's concern that the proposed sampling strategy would bias the Reference Data has been considered, and it is now proposed to advance three boreholes (2B1 to 2B3) through the made ground to a depth of 10m. The boreholes will be positioned to the south and east of the heavy fuel oil tanks to establish up-gradient soil and groundwater conditions, with the remaining borehole positioned to the west at the down-gradient location between the tanks and the River Tees. Given that the borehole locations will be pre-excavated to 4m depth, it is no longer considered necessary to excavate the two previously proposed trial pits along the river bank. The location of the down gradient borehole (BH2B2) has been relocated to this position due to access restraints along a raised bank at its originally proposed location. The revised locations are shown in Figure 2 within Appendix A.

2.2.2 Area 12 Redcar Coke Ovens and By-product Plant

The SPMP for Redcar Works proposed nine trial pits (12T1 and 12T9) and three boreholes (12B1 to 12B3) with a combined gas and groundwater monitoring instrument at Source $S6^3$ (2 x ammoniacal liquor tanks), as shown in Figure A3.1 of Appendix A3 of the SPMP.

The Agency's concern that the proposed sampling strategy would bias the Reference Data has been considered, and it is now proposed to advance three boreholes (12B1 to 12B3) and eight trial pits (12T1 to 12T8) through the made ground to a depth of 10m and 4m respectively.

A site walkover on 19th July 2006 confirmed that it is not possible to undertake any ground investigation within the confines of the By-products Plant. This is because the By-Products Plant is designated as an 'intrinsically safe' area, due to the high volatility and low flash point of the substances stored. The purpose of the assessment is not considered to be proportional to the level of risk involved in working within this designated area.

The boreholes will be positioned to provide one to the south of the ammoniacal liquor tanks to establish up-gradient soil and groundwater conditions, with the remaining two boreholes positioned to the north, at down-gradient locations in the direction of groundwater flow. Seven of the eight trial pits are located down-gradient of Source $S6^3$ and they have been repositioned closer to the ammoniacal liquor tanks to allow adequate Reference Data to be collected.

2.3 Analytical Strategy

2.3.1 Justification of the Analytical Suites

The analytical suites agreed in the Design SPMP were used in the analysis of samples from the investigation to collect reference data. Justification of the analytical strategy is given in Appendix D.

2.3.2 Justification of the Analytical / Field Technique and Detection Limits

The laboratory analytical techniques and detection limits for each analysis were as agreed in the design SPMP.

2.3.3 Laboratory Accreditation / Quality Assurance and Quality Control

All laboratory analytical techniques undertaken are within UKAS Accreditation with MCERTS accreditation where applicable.

Quality control is expected from the external chemical laboratory contracted to undertake all analysis of soil and water samples. This is not just required to ensure a robust CSM, but is also a prerequisite in approval of third party contractors. The analytical quality assurance and quality control plan expected of a contracted laboratory is reproduced below.

The laboratory's confidence in the quality of the data produced should be supported by the preparation and analysis of a range of analytical quality control (AQC) samples with each batch of unknown samples. These AQC samples shall be drawn from the following sources depending upon the type of matrix and nature of the analysis being performed:

- Certified Reference Materials.
- Secondary reference materials produced In-House.
- Replicate testing.
- Blank Spikes.
- Matrix Spikes.
- Blank Samples.
- Surrogate recoveries.

AQC samples will normally be required for analysis at the rate of 1 in every batch of twenty unknown samples.

The data obtained from the analysis of the associated AQC samples should be examined by a Senior Analyst and released only where the results are within acceptable limits. AQC data should also be examined for adverse trends.

The AQC regime is to be applied to all routine analyses regardless of their accredited status.

At an instrument level performance is to be verified by the use of:

- Instrument Blanks
- Continuing calibration checks
- Independent calibration verification samples
- System suitability checks

2.4 Findings of the Ground Investigation

2.4.1 Area 2 South Bank Oil Farm

3 Boreholes, BH2B1 to BH2B3, were excavated at south bank oil farm. Borehole logs are provided in Appendix B2. The ground conditions encountered were consistent across the site:

- Made Ground of slag was encountered in all three locations to between 8.50 metres and 10 metres below ground level (bgl).
- Silty sand was encountered in all three locations underlying the Made Ground to the base of the boreholes at 13 metres. The thickness of this silty sand is unknown. This silty sand is considered to be the natural estuarine alluvial deposits shown on published geological maps.

Groundwater was encountered within the estuarine alluvium at the base of the boreholes, which flows northwards and is in hydraulic continuity with the River Tees. Perched groundwater was not encountered within any of the boreholes. Groundwater monitoring installations were screened within the alluvial deposits as shown on the borehole logs.

Prior to excavation of boreholes, trial pits were excavated within the made ground to a maximum of 4 metres to allow soil sampling to take place. 12 samples were taken from the three locations within the Made Ground. Appendix E1.1 contains a summary of the results and full certificates of analysis.

Groundwater samples were taken from the three boreholes in order to define baseline groundwater quality. Appendix E1.2 contains a summary of the results and full certificates of analysis.

2.4.2 Area 12 Redcar Coke Ovens and By-Products Plant

8 trial pits TP1T1 to 1T8 and 3 boreholes BH12B1 to BH12B3 were excavated at Area 12, Redcar Coke Ovens and By-Products Plant. Borehole logs and trial pit logs are provided within Appendix B1 and B2. The ground conditions across the area were consistent:

- Made Ground of slag was encountered in all locations to depths between 5.5 and 6.0 metres bgl.
- Silty sand was encountered below the Made Ground to the base of the boreholes. The full thickness of this sand is unknown. This silty sand is considered to be the natural estuarine alluvial deposits shown on published geological maps.

Perched groundwater was encountered within the Made Ground. The alluvial sand appeared to be dry, and so groundwater monitoring installations were screened within the Made Ground in order to monitor perched groundwater.

8 trial pits were excavated within the area, and the three borehole locations were pre-excavated so soil samples could be taken. 48 soil samples in total were taken from the Made Ground. Appendix E2.1 contains a summary of the results and full certificates of analysis.

During borehole excavation at 12B1 traces of hydrocarbon contamination within the Made Ground between 5.0 and 5.50 metres were discovered, but this has no impact on the reference data, as the potentially polluting substances that the reference data is required for, do not contain hydrocarbons.

Groundwater samples were taken from the three boreholes in order to define baseline groundwater quality. Appendix E2.2 contains a summary of the results and full certificates of analysis.

2.5 Data Interpretation

The data presented above is to act as Reference Data for two potentially polluting sources within the installation that had insufficient secondary containment and so a likelihood of land pollution or leaks to land will occur during the life of the permit. The collection of reference data established baseline conditions for land and groundwater from permit issue. It also defined up and down-water gradient conditions in relation to the sources of potentially polluting substances that require reference data.

2.5.1 Statistical Analysis of Data

The collection of Reference Data was set for specific tanks that have a likelihood of causing land pollution or leaks to land within specific areas. No hotspots of pollution are identified and the soil results act as a baseline to measure further deterioration against. No statistical analysis of the data has been undertaken.

2.5.2 Confirmed sources of Identified Elevated Levels of Pollutants

Elevated levels of pollutants have not been found where reference data has been collected. The reference data collected shows no difference between upgradient and downgradient sampling locations. Therefore, it is proven that the sources are not responsible for the low level concentrations seen in soil and groundwater.

2.5.3 Unknown source of Identified Levels of Pollutants

Concentrations detected within the soil and groundwater across both Area 2 and Area 12 are not considered polluting.

3. Statement of Reference Data

Reference Data for the following locations have been collected by this report and are presented in Summary as Appendix F.

- Source S^3 Heavy Fuel Oil Storage Tanks, South Bank Oil Farm (Area 2), Cleveland Works (Appendix F1).
- Source S6^3 Ammoniacal Liquor Storage Tanks, Redcar Coke Ovens and By-Products Plant (Area 12), Redcar Works (Appendix F2).

4. Inspection and Monitoring Programme

As a result of the investigations to collect reference data and install environmental monitoring infrastructure the Monitoring Programme for the Reference Data is proposed as follows.

4.1 Objectives of the Monitoring Programme

4.1.1 Objectives of the Environmental Monitoring Programme

The objectives of the monitoring plan at Area 2 Source S^3 and Area 12 Source S6^3 is to:

- Monitor the effectiveness of infrastructure and management procedures and provide a warning loss of containment.
- Assist at permit surrender by:
    - Determining the movement of pollutants onto or off of the locations of the sources of potentially polluting substances.
    - Determining the movement of pollutants relating to the sources.

- Providing data on long term trends.

4.1.2 Objectives of the Infrastructure Monitoring Programme

The objectives of the infrastructure monitoring programme have not changed since the design SPMP.

4.2 Environmental Monitoring Infrastructure

4.2.1 Location

The environmental monitoring infrastructure has been agreed with the Agency prior to the collection of Reference Data. The locations of the boreholes for groundwater monitoring are shown on figures 2 and 3 within appendix A.

4.2.2 Groundwater Monitoring

The log and completion details of each groundwater monitoring installation are contained in Appendix B2. Each monitoring point is finished with a lockable cover and is designed to prevent the ingress of surface water.

4.2.3 Soil Vapour Monitoring

No soil vapour monitoring will occur at the installation during the life of the permit.

4.2.4 Soil Monitoring

No on going soil monitoring will occur at the installation during the life of the permit.

4.2.5 Procedure for the Inspection and Maintenance of Monitoring Infrastructure

Monitoring infrastructure will be inspected at the time of monitoring. A monitoring infrastructure checklist is provided in Appendix G. Each borehole will have a documented monitoring infrastructure record. Any deficits found in the monitoring infrastructure will be improved before monitoring is undertaken.

4.3 Monitoring Programme

4.3.1 Monitoring Frequency

Groundwater will be monitored at all boreholes installed for the collection of Reference data on an annual basis. This will be to determine if there has been any deterioration on groundwater quality due to the permitted activities that Reference Data is required for. Leaks from tanks will be identified under this monitoring regime, as will any changes in background groundwater quality that may influence future monitoring rounds.

4.3.2 Sampling and Analysis Protocols

The protocols for analysis remain the same as those used for the investigations to determine baseline conditions detailed in Section 2.3 above.

4.3.3 Personnel Issues

Personnel responsible for the sampling and analysis are trained to an appropriate level to ensure compliance with the existing Infrastructure Monitoring Programme. Roles and responsibilities for undertaking the Programme (including reporting) and ensuring adequate competence of staff are as required under the EMS.

4.4 Infrastructure Monitoring Programme

The infrastructure monitoring programme meets the objectives set out within 4.1.2 above and thus there are no changes to the EMS programme for the installation summarised in the design SPMP.

4.4.1 Personnel Issues

Personnel responsible for the inspection, testing and maintenance of pollution prevention infrastructure are trained to an appropriate level to ensure compliance with the existing Infrastructure Monitoring Programme. Roles and responsibilities for undertaking the Programme (including reporting) and ensuring adequate competence of staff are as required under the EMS.

4.5 Assessment and Reporting Procedures

4.5.1 Assessment Procedure

Groundwater monitoring will be undertaken on an annual basis. Results will be recorded and analysed internally. In order to determine any breaches of containment, downgradient groundwater monitoring results will be directly compared to those upgradient. If results downgradient significantly increase in comparison to the baseline data recorded, and this increase is not reflected in the analysis of the upgradient boreholes, then more intensive monitoring will be undertaken until assurances can be made that changes in concentrations cannot be attributed to the storage tanks that reference data has been collected for. The two fundamental questions to ask after obtaining monitoring data are:

- Has there been an increase in concentrations since the previous monitoring rounds?
- If yes, has a similar increase been seen in the upgradient boreholes to those downgradient? If not, further monitoring is required.

4.5.2 Reporting Procedure

Summaries of any monitoring data required as a consequence of the Environmental Monitoring Plan to be submitted with the Reference Data to the Agency, will be sent to the

Agency on the 31st of January each year along with the results of the data assessment, and any recommendations for amendments to the Monitoring Programme.

Any loss of containment is recorded internally within the procedures set out within the EMS and is immediately reported to the Agency under the conditions of the PPC permit.

4.5.3 Recording and Data Management

Results from groundwater monitoring will be recorded within the EMS and reported to the Agency annually.

5. References

1. Design of a Site Protection and Monitoring Programme for Cleveland Works, Teesside, Corus UK Ltd. Requiring Reference Data to be collected. K.E. Liddle. October 2004.

2. Design of a Site Protection and Monitoring Programme for Lackenby Works, Teesside, Corus UK Ltd. That does not require Reference Data to be collected. K.E. Liddle. April 2005.

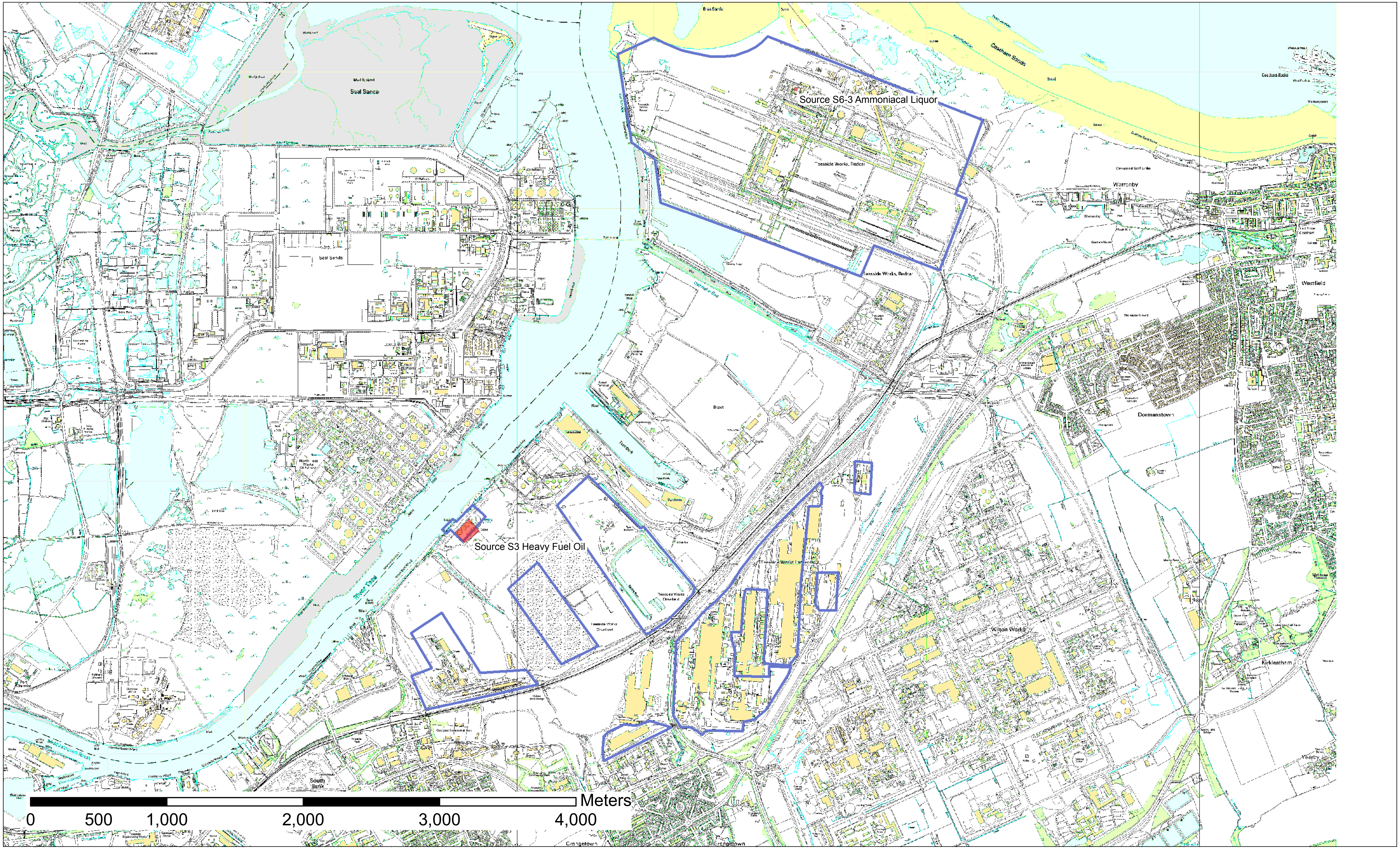
3. Design of a Site Protection and Monitoring Programme for Redcar Works, Teesside, Corus UK Ltd. Requiring Reference Data to be collected. K.E. Liddle. June 2005.

4. Teesside Integrated Iron and Steelworks. PPC Permit BK0493.

5. Supplementary Application Site Report for PPC Application BK0493. Teesside Works, Corus Construction and Industrial. K.E. Liddle. March 2004.

6. Revised Site Protection and Monitoring Programme for Cleveland and Redcar Works, Teesside, Teesside Cast Products. Letter to the Environment Agency. K.E. Liddle. 4th August 2006.

Appendix A
Figures and Drawings



Legend

🟥 Areas req Reference Data

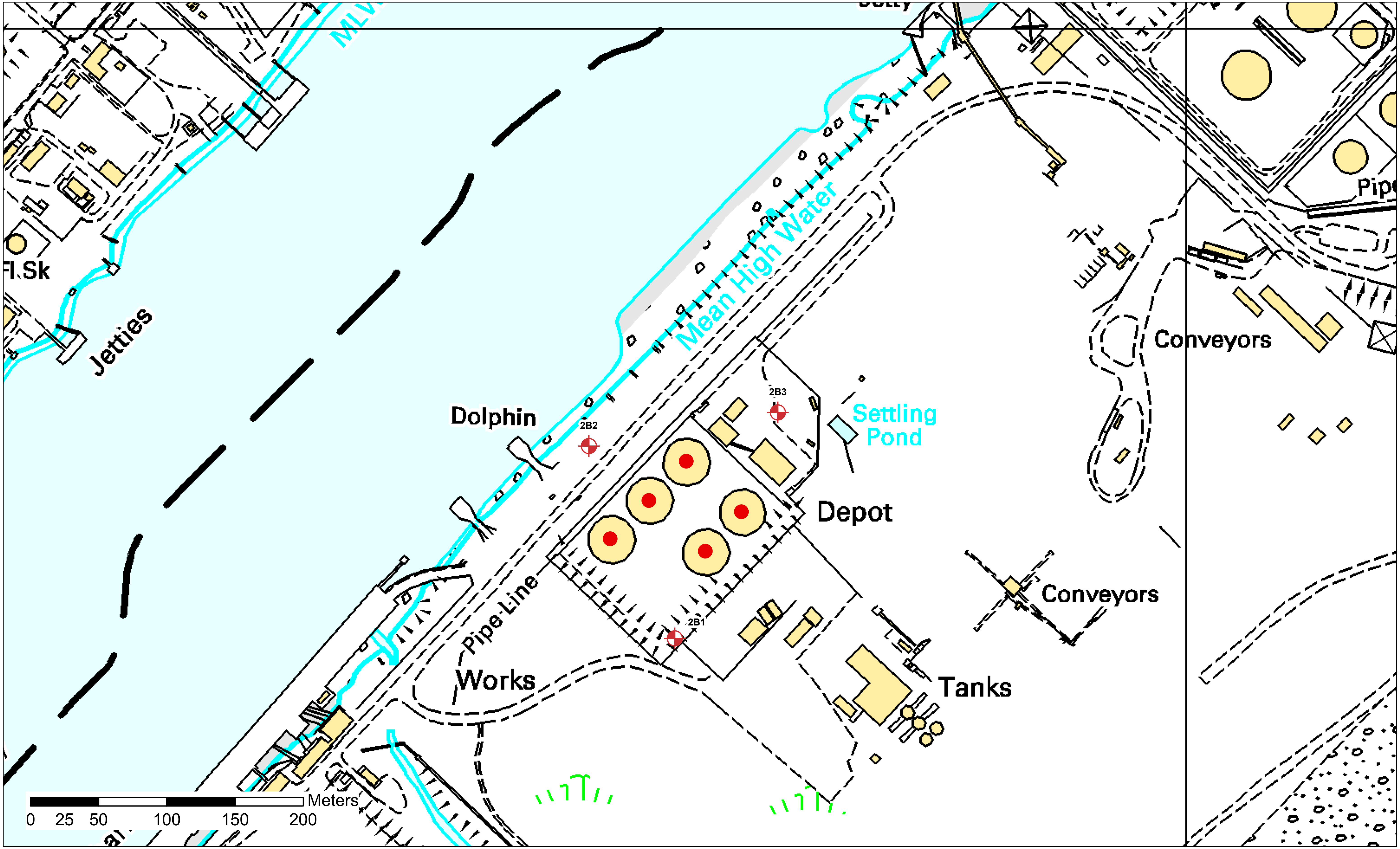
▭ Installation Boundary

N

corus

Drawn by:	**Richard Hardeman**
Date:	**11/02/2008**
Scale:	**1:25,000**
Revision No:	**N/A**

Drawing No:	**Figure 1**
Title:	**Installation Arrangement**
Project:	**Teesside SPMP Reference Data**



Legend

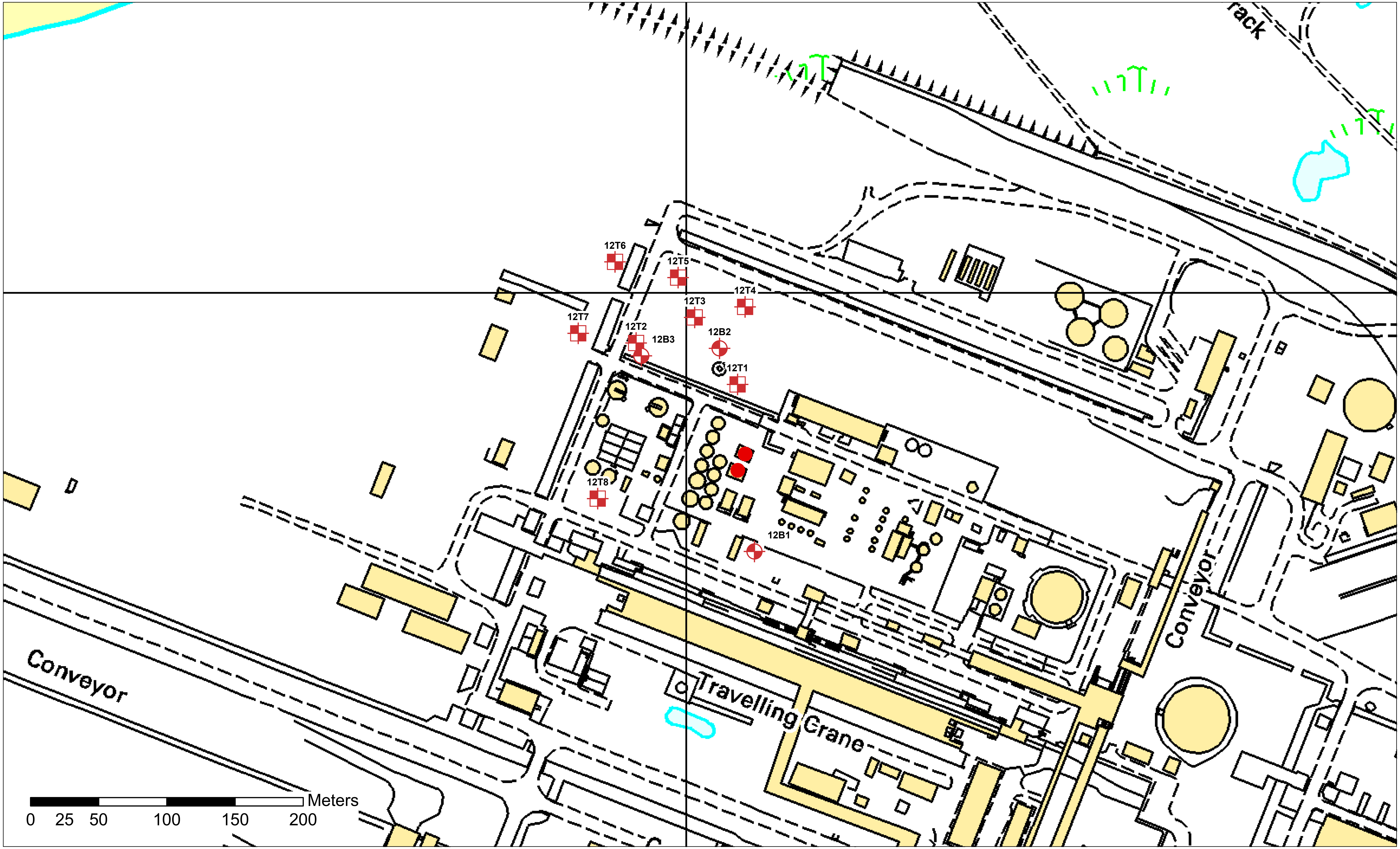
● Potentially Polluting Substances

⊕ BOREHOLES

N

Drawn by:	Richard Hardeman
Date:	11/02/2008
Scale:	1:2,500
Revision No:	N/A

Drawing No:	Figure 2
Title:	Exploratory Hole Location Plan- Area 2
Project:	Teesside SPMP Reference Data



Legend

- ● Potentially Polluting Substances
- ⊕ BOREHOLES
- ▣ TRIAL PITS

N

corus

Drawn by:	**Richard Hardeman**
Date:	**11/02/2008**
Scale:	**1:2,501**
Revision No:	**N/A**

Drawing No:	**Figure 3**
Title:	**Exploratory Hole Location Plan- Area 12**
Project:	**Teesside SPMP Reference Data**

Appendix B
Records of Investigation Findings

Appendix B1 Trial Pit Logs
Appendix B2 Borehole Logs

Appendix B1 Trial Pit Logs

Corus UK
Swinden Technology Centre, Moorgate
Rotherham, South Yorkshire S60 3AR
Telephone: 01709 825 521
Fax: 01709 825 400

TRIALPIT LOG

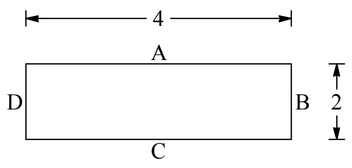
Project Reference Data Collection		Business Division		BOREHOLE No **12T1**
Job No 7129.19	Date 15-06-07	Ground Level (m) 0.00	Co-Ordinates (E 456,037.3 N 525,932.3)	
Business Unit		Site	Zone	Sheet 1 of 1

SAMPLES & TESTS

Depth	Sample Ref	Water
0.50	7/L/G/108	
1.00	7/L/G/109	
2.00	7/L/G/110	
3.00	7/L/G/111	
4.00	7/L/G/112	

STRATA

Reduced Level	Legend	Depth (Thickness)	DESCRIPTION
-0.30	▨	0.30	(MADE GROUND)
-0.90	▨	(0.60) 0.90	(MADE GROUND)
-1.70	▨	(0.80) 1.70	(MADE GROUND)
-4.00	▨	(2.30) 4.00	(MADE GROUND) 3.60 Becoming slightly clayey
			TP Terminated at 4



GENERAL REMARKS

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used Excavator	Logged By RH

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TRIALPIT LOG

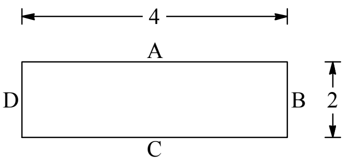
Project Reference Data Collection		Business Division		BOREHOLE No **12T2**
Job No 7129.19	Date 14-06-07	Ground Level (m) 0.00	Co-Ordinates (E 455,962.9 N 525,962.7)	
Business Unit		Site	Zone	Sheet 1 of 1

SAMPLES & TESTS

Depth	Sample Ref
0.50	7/L/G/91
1.00	7/L/G/92
2.00	7/L/G/93
3.00	7/L/G/94

STRATA

Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
	-0.10	▨	0.10	(MADE GROUND)
	-1.60	▨	(1.50) 1.60	(MADE GROUND)
	-2.10	▨	(0.50) 2.10	(MADE GROUND)
	-3.20	▨	(1.10) 3.20	(MADE GROUND)
				TP Terminated at 3.2



GENERAL REMARKS

TP terminated due to sides collapising

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used Excavator	Logged By RH

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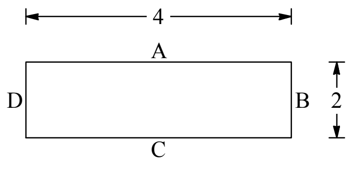
TRIALPIT LOG

Project Reference Data Collection		Business Division		BOREHOLE No **12T3**
Job No 7129.19	Date 14-06-07	Ground Level (m) 0.00	Co-Ordinates (E 456,005.9 N 525,981.4)	
Business Unit		Site	Zone	Sheet 1 of 1

SAMPLES & TESTS		Water	STRATA			
Depth	Sample Ref		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
			-0.20		0.20	(MADE GROUND)
			-0.40		0.40	(MADE GROUND)
0.50	7/L/G/120					Orange to brown sandy GRAVEL of slag, brick, ironstone, coal and mudstone, with cobbles of slag, brick and sandstone (MADE GROUND)
1.00	7/L/G/118					1.10 Cobbles of slag
						1.60 Boulders of slag with cobbles of brick
2.00	7/L/G/117				(3.60)	
						2.60 Fused slag
3.00	7/L/G/121					
			-4.00		4.00	
4.00	7/L/G/119					TP Terminated at 4



GENERAL REMARKS

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used Excavator	Logged By RH

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TRIALPIT LOG

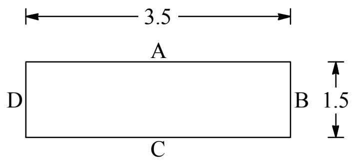
Project Reference Data Collection		Business Division		BOREHOLE No **12T4**
Job No 7129.19	Date 14-06-07	Ground Level (m) 0.00	Co-Ordinates (E 456,042.8 N 525,989.1)	
Business Unit		Site	Zone	Sheet 1 of 1

SAMPLES & TESTS

Depth	Sample Ref
0.50	7/L/G/89
1.00	7/L/G/90
2.00	7/L/G/88
3.00	7/L/G/87

STRATA

Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION
	-0.05	☒	0.05	(MADE GROUND)
	-1.70	☒	1.70 (1.65)	(MADE GROUND)
	-1.80	☒	1.80	(MADE GROUND)
	-3.10	☒	3.10 (1.30)	(MADE GROUND)
	-3.30	☒	3.30	(MADE GROUND)
				TP Terminated at 3.3



GENERAL REMARKS

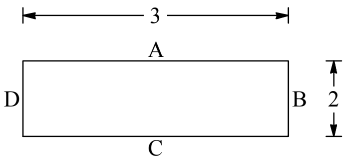
Trial pit teminated due to obstruction caused by fused slag

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used Excavator	Logged By RH

TRIALPIT LOG

Project Reference Data Collection		Business Division		BOREHOLE No **12T5**
Job No 7129.19	Date 14-06-07	Ground Level (m) 0.00	Co-Ordinates (E 455,993.7 N 526,010.6)	
Business Unit		Site	Zone	Sheet 1 of 1

SAMPLES & TESTS			STRATA			
Depth	Sample Ref	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
			-0.20	▨	0.20	(MADE GROUND)
0.50	7/L/G/83		-0.60	▨	(0.40) 0.60	(MADE GROUND)
1.00	7/L/G/82		-2.40	▨	(1.80) 2.40	(MADE GROUND)
2.00	7/L/G/85					
3.00	7/L/G/84		-4.00	▨	(1.60) 4.00	Dark brown clayey slightly gravelly coarse SAND with gravel of slag, coal and clinker, and clay clods (MADE GROUND)
4.00	7/L/G/85					TP Terminated at 4



GENERAL REMARKS

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used Excavator	Logged By RH

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TRIALPIT LOG

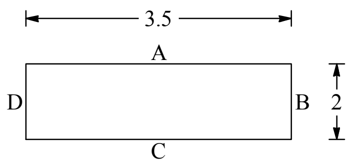
Project Reference Data Collection	Business Division		BOREHOLE No **12T6**
Job No 7129.19	Date 14-06-07	Ground Level (m) 0.00	Co-Ordinates (E 455,947.4 N 526,022.2)
Business Unit	Site	Zone	Sheet 1 of 1

SAMPLES & TESTS

Depth	Sample Ref
0.50	7/L/G/125
1.00	7/L/G/122
2.00	7/L/G/126
3.00	7/L/G/123
4.00	7/L/G/124

STRATA

Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
	-0.10	▨	0.10	(MADE GROUND)
	-1.30	▨	1.30 (1.20)	Cream to light brown sandy GRAVEL of ash, slag, ironstone and brick, with cobbles of slag and ash (MADE GROUND)
	-1.60	▨	1.60	Dark brown slightly gravelly SAND with brick, ash and slag (MADE GROUND)
	-2.90	▨	2.90 (1.30)	Dark red gravelly CLAY WITH COAL, BRICK AND IRONSTONE (MADE GROUND)
	-4.00	▨	4.00 (1.10)	Brown to cream clayey GRAVEL of coal, slag and ash with cobbles of refractory brick (MADE GROUND)
				TP Terminated at 4



GENERAL REMARKS

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used Excavator	Logged By RH

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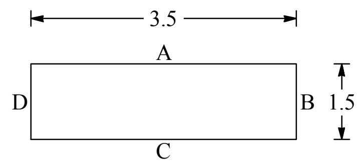
TRIALPIT LOG

Project Reference Data Collection		Business Division		BOREHOLE No **12T7**
Job No 7129.19	Date 14-06-07	Ground Level (m) 0.00	Co-Ordinates (E 455,920.4 N 525,969.8)	
Business Unit	Site	Zone		Sheet 1 of 1

SAMPLES & TESTS		Water	STRATA			
Depth	Sample Ref		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION
			-0.20		0.20	(TOPSOIL)
			-0.50		0.50	(MADE GROUND)
0.50	7/L/G/127					(MADE GROUND)
1.00	7/L/G/129				(1.90)	
2.00	7/L/G/130		-2.40		2.40	
			-2.50		2.50	(MADE GROUND)
						(MADE GROUND)
					(0.70)	
3.00	7/L/G/128		-3.20		3.20	3.10 Fused slag TP Terminated at 3.2



GENERAL REMARKS

Trial pit teminated due to obstruction caused by fused slag

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used Excavator	Logged By RH

LA AGS 3 UK TP TEESSIDE.GPJ LA AGS TEMPLATE.GDT 7/2/08

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Rotherham, South Yorkshire S60 3AR
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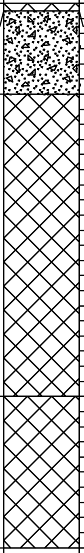
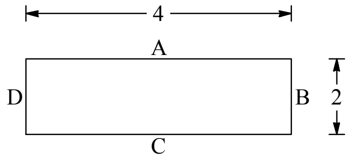
TRIALPIT LOG

Project Reference Data Collection		Business Division		BOREHOLE No **12T8**
Job No 7129.19	Date 14-06-07	Ground Level (m) 0.00	Co-Ordinates (E 455,934.8 N 525,848.6)	
Business Unit	Site	Zone		Sheet 1 of 1

SAMPLES & TESTS			STRATA			
Depth	Sample Ref	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION
			-0.05		0.05	(MADE GROUND)
			-0.60		(0.55) 0.60	(MADE GROUND)
1.00 2.00	7/L/G/131 7/L/G/132		-2.60		(2.00) 2.60	White to brown to black GRAVEL of slag, ash and concrete, with cobbles of slag (MADE GROUND) 1.50 Cobbles and boulders of slag 1.70 Brick 2.15 Fused slag
3.00	7/L/G/134		-3.60		(1.00) 3.60	Black to grey GRAVEL of slag (MADE GROUND)
3.60	7/L/G/133					TP Terminated at 3.6



GENERAL REMARKS

Trial pit teminated due to obstruction caused by fused slag

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used Excavator	Logged By RH

Appendix B2 Borehole Logs

Corus UK
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Fax: 01709 825 400

BOREHOLE LOG

Project Reference Data Collection		Business Division		BOREHOLE No **12B1**
Job No 7129.19	Date 13-06-07	Ground Level (m) 0.00	Co-Ordinates (E 456,052.7 N 525,809.4)	
Business Unit		Site	Zone	Sheet 1 of 2

SAMPLES & TESTS		Water	STRATA				Instrument/ Backfill
Depth	Sample Ref		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
				▨		Grey to brown GRAVEL of slag (MADE GROUND)	
0.50	7/L/G/99						
1.00	7/L/G/101					1.00 Cobbles of black slag	
2.00	7/L/G/102						
						2.20 Cobbles of slag	
					(5.50)		
3.00	7/L/G/100						
			-5.50		5.50		
				∵		Silty SAND (Alluvium)	

GENERAL REMARKS

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used	Logged By RH

Corus UK
Swinden Technology Centre, Moorgate
Rotherham, South Yorkshire S60 3AR
Telephone: 01709 825 521
Fax: 01709 825 400

BOREHOLE LOG

Project Reference Data Collection		Business Division		BOREHOLE No **12B1**
Job No 7129.19	Date 13-06-07	Ground Level (m) 0.00	Co-Ordinates (E 456,052.7 N 525,809.4)	
Business Unit	Site	Zone		Sheet 2 of 2

SAMPLES & TESTS		Water	STRATA				Instrument/ Backfill
Depth	Sample Ref		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
					(5.00)	Silty SAND (Alluvium)	
			-10.50		10.50		
						BH terminated at 10.5 m	

GENERAL REMARKS

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used	Logged By RH

Corus UK
Swinden Technology Centre, Moorgate
Rotherham, South Yorkshire S60 3AR
Telephone: 01709 825 521
Fax: 01709 825 400

BOREHOLE LOG

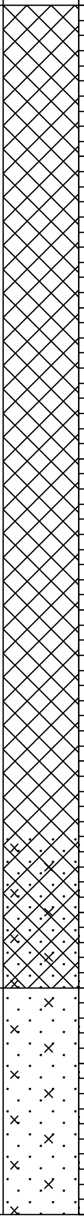
Project Reference Data Collection	Business Division		BOREHOLE No **12B2**
Job No 7129.19	Date 04-12-07	Ground Level (m) 0.00	Co-Ordinates (E 456,024.1 N 525,958.8)
Business Unit	Site	Zone	Sheet 1 of 2

SAMPLES & TESTS

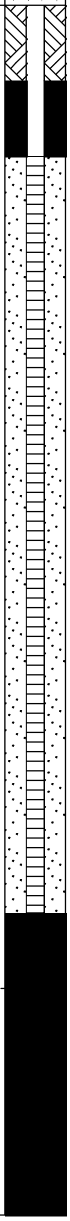
Depth	Sample Ref
0.50	7/L/G/113
1.00	7/L/G/114
2.00	7/L/G/116
3.00	7/L/G/115

STRATA

Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION
				Gravel of Slag with Brick and Concrete 0.30 Brick wall in easter edge of pit 2.05 - 2.70 Fused slag 3.20 Fused slag
			(6.50)	
	-6.50		6.50	Brown Silty SAND (Alluvium)
			(4.50)	



Instrument/ Backfill



GENERAL REMARKS

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used	Logged By RH

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Telephone: 01709 825 521
Fax: 01709 825 400

BOREHOLE LOG

Project Reference Data Collection		Business Division		BOREHOLE No **12B2**
Job No 7129.19	Date 04-12-07	Ground Level (m) 0.00	Co-Ordinates (E 456,024.1 N 525,958.8)	
Business Unit	Site	Zone		Sheet 2 of 2

SAMPLES & TESTS			STRATA				
Depth	Sample Ref	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument/ Backfill
			-10.00	×··	10.00	Brown Silty SAND (Alluvium)	■
						BH terminated at 10 m	

GENERAL REMARKS

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used	Logged By RH

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Rotherham, South Yorkshire S60 3AR
Telephone: 01709 825 521
Fax: 01709 825 400

BOREHOLE LOG

Project Reference Data Collection		Business Division		BOREHOLE No **12B3**
Job No 7129.19	Date 14-06-07	Ground Level (m) 0.00	Co-Ordinates (E 455,966.7 N 525,953.3)	
Business Unit		Site	Zone	Sheet 1 of 2

SAMPLES & TESTS		Water	STRATA				Instrument/ Backfill
Depth	Sample Ref		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
0.50	7/L/G/98					Grey slag with brick and concrete	
1.00	7/L/G/95						
2.00	7/L/G/97						
3.00	7/L/G/96				(6.50)		
			-6.50		6.50		
						Cream to brown to black sandy GRAVEL of slag, ash and concrete with cobbles of slag and brick (MADE GROUND)	

GENERAL REMARKS

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used	Logged By RH

corus
Corus UK
Swinden Technology Centre, Moorgate
Rotherham, South Yorkshire S60 3AR
Telephone: 01709 825 521
Fax: 01709 825 400

BOREHOLE LOG

Project Reference Data Collection		Business Division		BOREHOLE No **12B3**
Job No 7129.19	Date 14-06-07	Ground Level (m) 0.00	Co-Ordinates (E 455,966.7 N 525,953.3)	
Business Unit		Site	Zone	Sheet 2 of 2

SAMPLES & TESTS		Water	STRATA				Instrument/ Backfill
Depth	Sample Ref		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
			-10.00		(3.50) 10.00	Cream to brown to black sandy GRAVEL of slag, ash and concrete with cobbles of slag and brick (MADE GROUND)	
						BH terminated at 10 m	

GENERAL REMARKS

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used	Logged By RH

Corus UK
Swinden Technology Centre, Moorgate
Rotherham, South Yorkshire S60 3AR
Telephone: 01709 825 521
Fax: 01709 825 400

BOREHOLE LOG

Project Reference Data Collection		Business Division		BOREHOLE No **2B1**
Job No 7129.19	Date 13-06-07	Ground Level (m) 0.00	Co-Ordinates (E 453,626.2 N 522,552.5)	
Business Unit		Site	Zone	Sheet 1 of 2

SAMPLES & TESTS		Water	STRATA				Instrument/ Backfill
Depth	Sample Ref		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
				▨		Slag Fill	
0.50	7/L/G/49						
						0.75 Concrete and ash 0.80 Cobbles and boulders of slag	
1.00	7/L/G/48						
2.00	7/L/G/47						
3.00	7/L/G/50					3.00 Red and refractory bricks	
					(10.00)		

GENERAL REMARKS

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used	Logged By RH

Corus UK
Swinden Technology Centre, Moorgate
Rotherham, South Yorkshire S60 3AR
Telephone: 01709 825 521
Fax: 01709 825 400

BOREHOLE LOG

Project Reference Data Collection		Business Division		BOREHOLE No **2B1**
Job No 7129.19	Date 13-06-07	Ground Level (m) 0.00	Co-Ordinates (E 453,626.2 N 522,552.5)	
Business Unit		Site	Zone	Sheet 2 of 2

SAMPLES & TESTS		Water	STRATA				Instrument/ Backfill
Depth	Sample Ref		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
			-10.00	▨	10.00	Slag Fill	■
			-12.00	⁙	(2.00) 12.00	Silty SAND (Alluvium)	⁙
						BH terminated at 12 m	

GENERAL REMARKS

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used	Logged By RH

Corus UK
Swinden Technology Centre, Moorgate
Rotherham, South Yorkshire S60 3AR
Telephone: 01709 825 521
Fax: 01709 825 400

BOREHOLE LOG

Project Reference Data Collection		Business Division		BOREHOLE No **2B2**
Job No 7129.19	Date 12-06-07	Ground Level (m) 0.00	Co-Ordinates (E 453,562.3 N 522,693.8)	
Business Unit		Site	Zone	Sheet 1 of 2

SAMPLES & TESTS		Water	STRATA				Instrument/ Backfill
Depth	Sample Ref		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
						Grey slag Fill	
0.50	7/L/G/51					0.60 - 1.00 Red brick	
1.00	7/L/G/52						
						1.50 Fused slag	
2.00	7/L/G/53						
2.70	7/L/G/54					2.70 Fused slag	
					(8.50)		

GENERAL REMARKS

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used	Logged By RH

Corus UK
Swinden Technology Centre, Moorgate
Rotherham, South Yorkshire S60 3AR
Telephone: 01709 825 521
Fax: 01709 825 400

BOREHOLE LOG

Project Reference Data Collection		Business Division		BOREHOLE No **2B2**
Job No 7129.19	Date 12-06-07	Ground Level (m) 0.00	Co-Ordinates (E 453,562.3 N 522,693.8)	
Business Unit		Site	Zone	Sheet 2 of 2

SAMPLES & TESTS		Water	STRATA				Instrument/ Backfill
Depth	Sample Ref		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
			-8.50	▨	8.50	Grey slag Fill	■
			-10.00	⁙	(1.50) 10.00	Grey black silty SAND (Alluvium)	⁙
						BH terminated at 10 m	

GENERAL REMARKS

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used	Logged By RH

Corus UK
Swinden Technology Centre, Moorgate
Rotherham, South Yorkshire S60 3AR
Telephone: 01709 825 521
Fax: 01709 825 400

BOREHOLE LOG

Project Reference Data Collection		Business Division		BOREHOLE No **2B3**
Job No 7129.19	Date 13-06-07	Ground Level (m) 0.00	Co-Ordinates (E 453,700.7 N 522,718.5)	
Business Unit		Site	Zone	Sheet 1 of 2

SAMPLES & TESTS		Water	STRATA				Instrument/ Backfill
Depth	Sample Ref		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
				▨		Gravel and boulders of slag	
0.50	7/L/G/55						
1.00	7/L/G/56						
2.00	7/L/G/57						
3.00	7/L/G/58						
					(9.50)		

GENERAL REMARKS

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used	Logged By RH

Corus UK
Swinden Technology Centre, Moorgate
Rotherham, South Yorkshire S60 3AR
Telephone: 01709 825 521
Fax: 01709 825 400

BOREHOLE LOG

Project Reference Data Collection		Business Division		BOREHOLE No **2B3**
Job No 7129.19	Date 13-06-07	Ground Level (m) 0.00	Co-Ordinates (E 453,700.7 N 522,718.5)	
Business Unit		Site	Zone	Sheet 2 of 2

SAMPLES & TESTS		Water	STRATA				Instrument/ Backfill
Depth	Sample Ref		Reduced Level	Legend	Depth (Thick- ness)	DESCRIPTION	
			-9.50		9.50	Gravel and boulders of slag	
			-13.00		(3.50) 13.00	Brown to light grey sandy GRAVEL of slag and concrete with cobbles and boulders of slag (MADE GROUND)	
						BH terminated at 13 m	

GENERAL REMARKS

All dimensions in metres Scale 1:50	Contractor	Method/ Plant Used	Logged By RH

Appendix C
Investigation and Sampling Protocols

Appendix C1 Trial Pits
Appendix C2 Rotary Boreholes
Appendix C3 Sonic Boreholes

Appendix C1 Trial Pits

Procedures for the Supervision of and Sampling from Temporary Trial Pit Excavations

1.0 Scope of Works

Trial pitting is one of the most commonly used intrusive techniques for the characterisation of subsurface soils up to a maximum depth of 4 metres. Trial pitting involves the use of a tracked or wheeled excavator to excavate a pit, which is typically 3m in length, 1m in width and up to 4m in depth. The primary advantages of trial pitting are; a) it is cost effective, b) it exposes a larger surface area than other intrusive techniques allowing more representative sampling and logging and c) it allows for the direct observation and monitoring of the base of the trial pit for services, contamination and groundwater seepage/ inflow as the excavation progresses.

2.0 Hazards Associated With Trial Pit Excavation

During the course of trial pitting operations, it is necessary for the trial pitting engineer to operate in close proximity to both the excavator and the trial pit in order to; a) collect representative soil and groundwater samples for chemical analysis, b) monitor the progress of the excavation and record the depth from which soil / groundwater samples are being collected, c) record changes in the underlying strata and the depth at which those changes occur, d) observe the base of the trial pit for evidence of services and contamination and e) observe the walls of the trial pit for evidence of instability or groundwater seepage / inflow.

A number of hazards associated with the excavation and logging of trial pits are listed within **Table 1**, below.

Table 1: Typical Hazards associated with the Excavation and Logging of Trial Pits (Adapted HSE; Construction Sheet 8 & Entec; 2004)

Activity:	Hazard(s)
Breaking Out Structures	Physical injury from Flying Fragments Noise Inhalation of Potentially Contaminated Dusts
Excavation and Logging Operations	Collapse of the Sides of the Excavation (i.e. Ground Instability Issues) Physical Impact from Machinery Physical Impact from Excavated Material Vehicles falling into the Open Excavation Falls / Trips into the Open Excavation Undermining Nearby Structures Explosion / Electric Arcing etc. resulting from contact with underground and overhead services / utilities Underground Voids (mine shafts, natural voids, basement structures etc.) Noise Inhalation of Potentially Contaminated Dusts Asphyxiation (Fumes, Naturally Occurring Gases i.e. CO_2, CH_4 & HS) Handling of Potentially Contaminated Arisings (i.e. Soil / Groundwater) Exposure of Contaminated Material

3.0 Safe Working Procedure

The following safe working procedure has been developed with a view to minimise the risk of those hazards, identified in **Table 1**, from occurring. The working procedure is split into three sections; a) preparation for site work, b) excavation and logging operations and c) reinstatement.

Preparation for Site Work

Prior to commencing any intrusive site work it is necessary to undertake a site reconnaissance (a risk assessment must be undertaken for this task- refer to Document No. H&S012a: 'Risk Assessment- Five Step Procedure', and Document Number ENV000004. During the site reconnaissance, the following details must be clarified:

1. Who is the site/plant contact(s) and how can they be contacted?
2. What Corus site inductions are required?
3. What plant specific site inductions are required?
4. Is it necessary to register as a contractor?
5. What other training requirements are required? i.e. Passport to safety
6. What permits are required? Who is responsible for obtaining them? What timescale is required to obtain them? For trial pitting, the minimum is a contractor's access to site permit, permit to commence work, and a permit to excavate.
7. What information is required to be provided to obtain the necessary permits? i.e. risk assessment, method statement/working instruction, plan of the proposed exploratory locations (Some business units require this information to be provided using their own templates)
8. What PPE is mandatory on site/plant?
9. Is a COSHH assessment needed? Under Regulation 6 of the Control of Substances Hazardous to Human Health Regulations, all those working on potentially contaminated land are required to make an assessment of the potential risks to human health entailed in the work. Information on the potential contaminants associated with both the historical and current operations carried out in the area under investigation should be sourced from literature, anecdotal evidence and Material Safety Data Sheets (MSDS). PPE appropriate to the potential contaminants of concern should be worn at all times during the investigation. This information must be made available to all those undertaking the intrusive works.
10. Who is responsible for the identification and validation (scanning) of both above and below ground services? Who is required to sign-off the proposed exploratory locations and is the requirement specifically identified on the permit to excavate?
11. Are there any access restrictions at each proposed exploratory location? I.e. access for equipment to the location, sufficient space for the excavator to operate safely, is it required to break out hard standing, and sufficient room for the trial pit engineer to work safely and vacate to a safe location in the event of an on-site incident.
12. Identify what operations / activities could be taking in and around the proposed exploratory locations i.e. what site-specific hazards are present?
13. Is there any excavator available to use during the site work? Is it in a well-maintained condition and certified as appropriate (i.e. LOLER; Lifting Operations and Lifting Equipment Regulations 1998). Unsafe plant should not be utilised. Is the operator competent (CITB certificate of training achievement)
14. What level of reinstatement is required by the site/plant contact

It may be necessary to complete more than one site visit to ensure that all the necessary inductions and permits are completed in advance of commencing the site work, and also to agree the final locations of all exploratory holes.

Excavation and Logging Operations

The Corus RD&T Team leader must:

1. Understand and advise all other team members and sub-contractors of the permit requirements and ensure that these are followed throughout the site work.
2. Discuss the scope of the works, potential health and safety risks and necessary control measures to all other team members and sub-contractors. All personnel must sign the RD&T Environment Department Risk Assessment prior to commencing work to confirm that they understand the potential risks and controls and ensure that all other team members have read and understood this work instruction document.

An initial briefing should be held between the trial pitting engineer and the plant operator so as to describe the working method to be undertaken (i.e. sample collection, depth measurements, logging operations etc.) and to agree upon a signalling system (i.e. the cessation of operational activities when a sample is to be collected etc.)

Personal Protective Equipment (PPE)

All standard requirements of the site/plant for PPE should be adhered to. If no site/plant requirements are set out, as a minimum, the following PPE should be worn:

- It is mandatory that hard hats are worn by all persons on a site, within a 20m radius of any operational plant, or where there is a risk of falling objects. Safety boots must also be worn.
- The use of ear defenders is mandatory for operatives when working in the vicinity of noisy machinery such as the excavator or hydraulic pecker attachment.
- Other PPE, such as gloves, overalls, dust-masks, respirators etc. should be worn where determined by the control measures identified within the pre-tender COSHH assessment for the potential contaminants of concern in the area(s) under investigation.

Excavation

- Excavations should be advanced with caution during the early stages of the investigation. Although the permit to excavate will have cleared the location for services, there is still the potential for services to be present.
- Plant should be set up in a manner that is safe for operating personnel and other site operatives. (This may necessitate the provision of fencing or a temporary barrier.)
- Surface material i.e. topsoil, ballast, tarmac etc. and underlying strata should be heaped in separate piles to avoid mixing and to aid in the reinstatement of the original ground conditions upon completion of the trial pit.
- Spoil will be placed away from the edge of the trial pit at a distance equivalent to the depth of the trial pit.
- Spoil will be placed so as not to cause contamination of nearby watercourses or surface materials. Polythene sheeting may be laid down to prevent contamination of surface soils, whilst dewatering of trial pits may be required to protect nearby water bodies.

Logging

The trial pitting engineer shall:

1. Maintain a look out for anything that may affect the safety of the trial pitting exercise i.e. site operatives stopping to observe the sampling exercise; signs of instability within the

trial pit etc. Should the excavation become unsafe, operations shall be suspended until the situation is rectified.

2. Exercise caution when working alongside trial pits as the sides can become unstable, especially so along the long side. Only work near the edges of the trial pits by using the temporary working platform (Youngman boards with handrails) as a barrier to prevent falling into the Trial Pit. Ensure that this temporary platform is suitably located when working alongside the pit when taking measurements, logging, photographs are required, and that is sufficiently stable to be walked across. Do not place the temporary platform on ground that has been undercut. the temporary working platform should only be accessed for as long as necessary to undertake the work required. Excavation can continue once personnel are off the temporary working platform.
3. Ensure that the temporary working platform is of suitable construction and is positioned adjacent to the excavation and that the maximum load is not breached. The temporary platform shall be used when the excavation reaches depths of greater than 0.5m. The temporary platform will not span the excavation, but will be positioned alongside the trial pit in order to view into the excavation. The platform should be positioned as shown in figure 1. The platform will only be accessed when the excavator driver is aware of this and the machine is at rest.
4. Only approach the pit from the working platform when the plant operator is fully aware of his/her intention to do so and at all times with an awareness of the pit's stability and the surrounding ground conditions. Do not approach the excavator from the plant operator's, blind side and keep a safe distance from the machine, as excavators can rotate their mechanical arm around 360^{o}. Ensure that the temporary working platform with handrails is put in place and is sufficiently stable. Care should be taken not to stand on ground that has been undercut by the excavator. The plant operator should be asked to make safe any undercut ground.
5. Limit the extent of the excavation and orientate the excavation so as to best position sampling equipment etc.
6. Organise his/her sampling equipment i.e. cooler boxes, sampling containers etc. at a safe distance from the excavation, so that they do not constitute a trip hazard.
7. Consider the need for dust suppression methods, if excessive dust is being generated.
8. Terminate and backfill an excavation if ground stability issues and / or unexpected ground conditions (i.e. ground gases/odours/dusts) or unmanageable materials (i.e. friable asbestos) are encountered, which make the excavation unsafe. The excavation may be re-established, once the method of investigation and the health and safety arrangements have been reappraised. If large amounts of contaminated materials or dusty / odorous conditions etc. are present, trial pits may be an **INAPPROPRIATE** method for investigation.

The trial pitting engineer shall not:

1. Under any circumstances, enter trial pits due to the hazards associated with pit instability, the potential for gaseous contaminants (i.e. CO_2, CH_4 & HS) and depleted oxygen levels making the pit(s) unsafe for entry.
2. Not approach the edge of the excavation without the use of the temporary platform.
3. Not lean over the edge of the excavation
4. Use the bucket as a working platform
5. Undermine built structures or supporting platforms i.e. walls and tanks etc.

Reinstatement / Backfilling

- All trial pits should be excavated and backfilled in one shift wherever possible. In the event that a trial pit has not been completed by the end of a shift, or is left unattended, it shall be securely fenced.

- On completion, the pit will either be backfilled with arisings or reinstated with imported materials. Where possible the materials excavated from the pit will be replaced in the pit in the same order they were excavated. Backfilling will be completed in layers, each layer being compacted by the bucket of the excavator.
- The pit shall be properly instated so that no depression is left. The surrounding area shall be left clean and cleared of any debris. Any excess spoil shall be removed to the site collection point.
- During backfilling, any gases/vapours can be forced out of the pit. The trial pitting engineer and other site personnel should stand well clear of the backfilling exercise.
- After backfilling, the pit and the affected ground must be left safe i.e. saturated pits will need to be fenced off for an appropriate amount of time, any broken reinforcing bars bent down and any exposed contaminated material covered with clean arisings. Surplus arisings need to be properly managed and dealt with in accordance with current waste legislation.

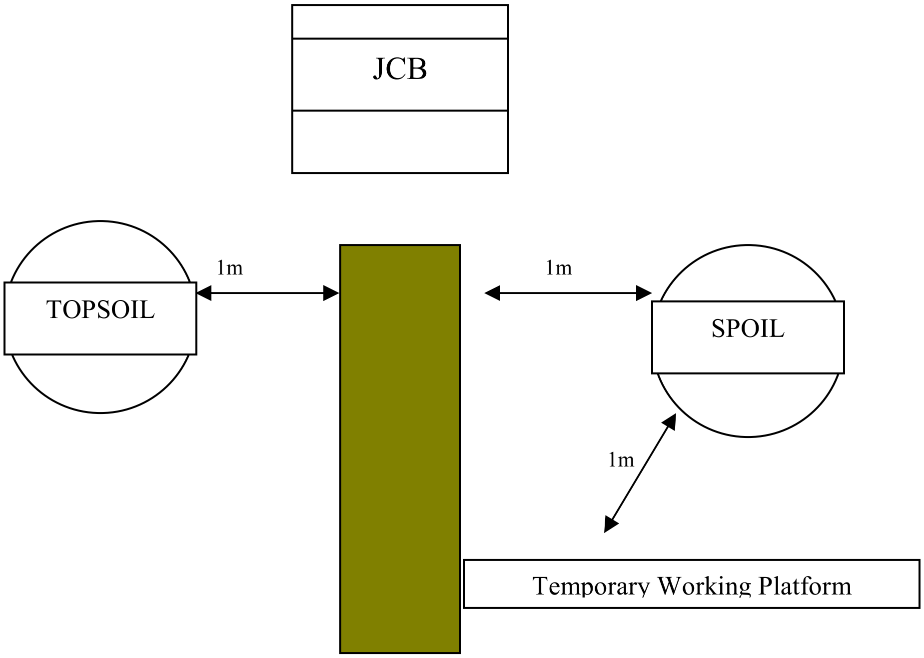

Figure 1: Schematic Diagram identifying the Safe Working Zone during Trial Pitting
(Adapted; Mowlem Environmental Sciences Group)

Appendix C2 Rotary Boreholes

1.0 SCOPE

To define the processes involved in rotary open hole drilling.

2.0 DEFINITIONS

Rotary open hole drilling is carried out by a minimum of a two man crew. The Lead Driller, who is one of the crew, will hold a suitable qualification or experience and should be BDA accredited.

3.0 RESPONSIBILITIES

The Site Supervisor is responsible for:

- inducting the site team on the contents of the Project Plan which includes the risk assessment
- the setting out of each borehole at the location required by the Contract documentation and agreeing any revised locations
- the identification and avoidance of buried services at each borehole location
- general site, safety and environmental management
- issuing drilling and testing instructions to the Lead Driller using a Borehole Instruction prior to commencement of drilling. These instructions may be varied as the borehole progresses, depending on and / or as a result of conditions encountered during drilling.
- visiting the rig as required to provide supervision and guidance to the Lead Driller.
- verifying the daily records and where necessary obtaining approval signatures from the Client's Engineer.

The Lead Driller is responsible for:

- ensuring that the control measures specified in the Project Plan are implemented and advising the Site Supervisor of any change in conditions which may require those measures to be varied
- the safe and environmentally sound condition and operation of the drilling equipment.
- the supervision of the drilling team.
- carrying out whatever coring, testing and installation required in the borehole as advised on the Borehole Instruction, under the supervision and guidance of the Logger where necessary
- safely transporting and setting the rig up over the borehole location, the safe execution of the borehole, and dismantling on completion
- proper backfilling of the borehole on completion and reinstatement of the borehole site and access routes used.
- ensuring where practicable that the site adjacent to the borehole is kept tidy, and that equipment and any samples of arisings are accurately and properly labelled, stored and maintained as necessary.
- ensuring the safe transportation of samples of arisings to a designated storage area at the end of each shift, or on completion of each borehole, as instructed by the Logger.
- recording the arisings, flush returns and drill behaviour.
- produce and submit daily records as detailed in the procedure below.

4.0 PROCEDURES

Rotary open hole drilling is carried out as described in BS5930: Section 20.7 and as detailed below.

Pre-requisites

Drilling will normally be carried out using a rotary rig and attendant downhole equipment, casings (where necessary) and a flushing medium. It is normal for diesel engine powered rigs to be used, however, electric or pneumatic rigs are also available.

The rotary rigs will generally be topdrive and mounted on a variety of carriers, eg lorry, tractor, trailer, tracks or skids. The company holding includes rigs manufactured by Beratta, Casagrande, Comacchio, Dando, Gryphon, Hands England and Soil-Mech.

A variety of downhole tools are available including rock roller or drag bits run on the base of drill strings or down hole hammers.

The flushing medium will conventionally be compressed air, air/mist or foam. The flush requires an attendant pump and/or compressor to accompany the rig.

Selection of the drilling unit and associated equipment should be made considering access, ground surface conditions, likely downhole conditions, contract specification and environmental constraints.

Setting up

The boreholes will be made at the locations indicated by the Site Supervisor. Where the rotary drilling commences from ground level, as opposed to extending a previous boring, the following will apply. Prior to any drilling each location will be checked for the presence of buried services (IMS-SOP-SE756) and overhead services (IMS-SOP-SE1046). Every location will be CAT scanned even where no services appear on service plans. Hand dug inspection pits will be required in **all** locations except where there are specific instructions to the contrary. All services located in the pits will be accurately noted on the Rotary Drilling Journal, referenced to existing permanent points, for example buildings, and reported to the Site Supervisor and in turn the Client's representative as appropriate. The inspection pit should be backfilled prior to commencing drilling.

The rotary rig and associated machinery will be set up in a manner that is safe for operating personnel and the general public; this may necessitate the provision of fencing. The vicinity will be checked for any other safety, health and environmental hazards (particularly where identified in the Project Plan). Control measures will be implemented to remove or reduce such hazards. Control measures must be adopted to address the particular hazards associated with the flushing medium at the surface; these should be detailed on the Project Plan.

Drilling

The boreholes will be numbered precisely as outlined by the Site Supervisor on the Borehole Instruction. The diameter and depth of hole and all casings will be noted on the Rotary Drilling Journal along with depths at which water is encountered, strata descriptions (given the limitations of the method), tests carried out and any other relevant information.

Equipment and arisings will be placed so as not to present a hazard to the rig operatives, the environment or the general public.

Where difficulties are encountered, eg borehole wall instability, loss of flush returns, the Lead Driller shall inform the Site Supervisor. The Site Supervisor shall in conjunction with the lead driller determine a course of action and if necessary secure the agreement of the Project Leader.

Where artesian water is encountered the Lead Driller shall immediately inform the Site Supervisor who will agree a solution with the Project Leader. Under no circumstances shall the casing be removed from the hole until the artesian problem has been addressed.

In the event of discovering an unexpected condition (eg contamination or gassing ground) drilling should cease and an instruction sought from the Project Leader.

Testing

In situ tests and monitoring are carried out in accordance with IMS-SOP-SI200 series procedures.

Backfilling and Completion

On completion of drilling, the borehole will either be grouted up or a monitoring device installed. Details of any installation must be confirmed before backfilling. A precise record of backfilling and/or installation will be made on the Rotary Drilling Journal.

If it is not possible to extract the casing then the Site Supervisor will be informed to determine further action. A record of size and depth of any casings left in the ground will be made on the Rotary Drilling Journal.

Where artesian conditions are encountered an instruction shall be sought from the Project Leader.

The borehole will be properly reinstated so that no depression is left; a certain amount of mounding may be required to achieve this in the longer term. The surrounding areas will be left reasonably clean and cleared of any debris. Any excess spoil will be removed to the site collection point and removed from site in accordance with the waste management procedure (IMS-SOP-SE816).

Records

The top three copies of the Rotary Drilling Journal will be given or forwarded daily, at the end of each shift, or the following morning at the latest to the Site Supervisor who will check the content before countersigning and distributing as necessary.

5.0 REFERENCES (Forms, Guidance, etc)

BS5930 1999
BS4019 1974
BDA : 'Code of Safe Drilling Practice'
SISG : 'Guidance Notes for the Safe Drilling of Landfills and Contaminated Land'

Forms: SOP-SI040-F1 Rotary Drilling Journal

ISSUE & REVISION LOG

	Name	Position in Company	Date
Prepared by:	A P Whittlestone	Technical Manager (SM)	April 2004
Authorised by:	P Rainbow	IMS Manager	April 2004

Revision No	Authorised by	Principal Change	Date
2	P Rainbow	Updated for ESGL	21 June 2006

Appendix C3 Sonic Boreholes

BOART LONGYEAR

Boart Longyear
Drilling Services UK

East Gogar, Blairlogie, Stirling, FK95QB, UK
Tel: +44 (0)1259 727614
Fax: +44 (0)1259 728201
E-mail: infouk-ds@boartlongyear.com
www.boartlongyear.com

Method Statement for Sonic Drilling

Relevant Drill Rig Safety Features

Operator Position

Our rigs are controlled with a separate control panel that is connected to the machine with an umbilical cord. This allows the driller to operate the rig from a safe position approximately 3 metres away from the drill string. This distance makes it impossible for him to come into contact with the drill string whilst operating the machine. In addition the remote position gives him good overview of the operations, helping him to recognize potential hazards at an early stage.

Footclamps

The rigs are equipped with double hydraulic footclamps and a break-out function, precluding the use of pipe or chain wrenches to break the casing or rod joints with all associated hazards. This also removes the necessity of the second man to be in close proximity of the drill string when joints are broken under normal drilling conditions.

Slow Rotation

The sonic drilling method relies almost solely on the vibrations that are generated by the drill head for the ground-penetrating action. This allows rotation of the drill string during drilling to be relatively slow (max. 125 RPM). In the unlikely event of an object coming loose from the drill string and being ejected it will therefore only travel a limited distance at moderate speed and is thus less likely to cause harm.

Movable Barrier

Our rigs are equipped with a movable rotation barrier. This barrier can be swung open to allow the second man to access the drill string when casing or rods are to be added or removed.

Emergency Stops

Each rig is equipped with two trip wires in close proximity of the mast. One wire is installed on the rod rack to the right of the mast and another is incorporated into the moveable barrier at the left side of the mast. This last wire is mounted at the hinge point of the barrier so that it effectively remains at the same position irrespective of whether the barrier is open or closed, granting access in both positions. Both trip wires are well within reach of the second man from the position from where he is handling the rods / casing or performing other operations in close proximity of the drill hole.
All operating panels are also equipped with emergency stop buttons so that the operator can stop the operation of the rig at any given time.

Site access

Transport of the rig to site will be per low loader. We can offload the rig at a site of your convenience and tram the rig from there. Our requirements for the offloading site are limited to a sufficiently large reasonably flat and competent surface. For overnight storage we would wish to tram the rig to a secure area that lies within tracking-distance (some 100 meters).
As support vehicles we have a Santana 4WD with a 2 ton trailer. All our crews are trained and certified in off road driving.
We may need water for our drilling operations and would therefore ideally have access to a drinking water source on site. If this is not feasible we will be able to obtain water from the

nearest fire hydrant. For transporting the water we have a trailer available with two 1000 L carboids.

Rig setup
After checking for overhead power lines the rig is levelled out by means of 4 jacks on the rig. If any doubt exists over the presence of utilities the hole is commenced by hand digging to 1.2m. Then the mast is towered up, locked into vertical position and adjusted in height for drilling.

Sampling Operation
The sonic drilling method that we use produces a high quality continuous core with a corebarrel that is driven into the formation to be drilled. Corebarrels are advanced into the ground by use of thrust, vibration and if need be rotation. The procedure is conventional; after every 1.5 or 3m drilled the corebarrel needs to be retrieved from the hole by pulling the drill rods.
Depending upon the method selected by the client the core samples can either be delivered in PE core bags or in liners. With both methods coring is generally possible without the use of any flushing medium. Only in solid rock flushing while coring may be required.

Core Bag Samples
Available standard corebarrels for use with core bags are 1.5 or 3m long, see Table 1 below, for specific dimensions and sample sizes. To extract the core the corebarrel is tilted to the left side by rotating the head to provide easier access. The bit is then unscrewed and a PE sample bag is stripped over the outside of the barrel. With the help of vibration the sample is extracted from the corebarrel and is caught into the sample bag, which is steadily retreated until the core has been recovered. With 3m long samples the vibration and therewith the sample extraction is stopped after 1.5m has been recovered and the process is repeated with a new sample bag. The bag(s) are then marked with top and depth interval and stored away. Meanwhile the bit is put back on and the corebarrel is tripped back into the hole for a new round.

Lined Core Samples
To produce lined samples special corebarrels and bits are available that produce a hole of 4,5" and an 85mm diameter sample. The lined corebarrel has a length of 1.5m, however 3m runs may be made possible in the near future. After retrieving the corebarrel it is again tilted to the side and the core liner is extracted from it. The liner ends are capped and taped off and after marking the core the liner is stored.

Tripping in/out the Hole
First the corebarrel is lowered into the hole by means of the top winch with the second man guiding it. When the corebarrel is being held by a footclamp the hoisting plug is removed and the head is brought down and threaded to it. The corebarrel is lowered until the backhead of the barrel is gripped with the bottom footclamp, the head is then unthreaded and raised. Meantime the second man takes a rod from the adjacent rod rack and sets the pin of this rod in the box of the clamped corebarrel or rod. While he holds the rod in position the head is lowered until the rod is stabbed. The head is then threaded to the rod, the footclamp is released and the rod is lowered until its top is gripped with the bottom footclamp. This operation is repeated until the corebarrel reaches the bottom of the hole and coring can begin.
When tripping out the above operations are reversed.

Casing the hole

Casing is used in case the hole will not stay open by itself or if wells need to be installed. It is available in 1.5m lengths in diameters of 5.5" and 7 5/8". To prevent cuttings from falling into the open hole while drilling the casing it is normally advanced over the full corebarrel to the cored depth, before the corebarrel is retrieved. In certain conditions it may be favourable however to drill the casing to the cored depth without the corebarrel present in the hole.
In deeper applications it is possible to telescope the smaller casing from inside the 7 5/8" casing, so that friction of the smaller casing in the hole is reduced.
With the help of the larger diameter casing it is also possible to isolate a shallower (polluted) water reservoir from deeper water bearing layers that need to be sampled.
Depending on ground conditions it may be necessary to flush with water while advancing the casing. Because the casing is only set in the part of the hole that has already been sampled, the next sample is normally obtained without having been in contact with the drilling fluid. The water that returns out of the hole is efficiently contained in a tub from where it can be responsibly disposed of.

Backfilling the hole

Depending upon the client's preferences the hole can be backfilled with grout or bentonite pellets. The backfilled material is normally poured or pumped into the cased hole, by subsequent application of the sonic vibration during casing pullback the risk of material bridging off in the hole or casing reduced to a minimum. In holes that are not cased-off or if preferred by the client a tremie-pipe can be used as well to pump the grout in from the bottom of the hole.

Additional applications

<u>Well installations</u>: Wells can be very efficiently placed directly into the casing. By applying the sonic vibrations while pulling the casing up the risk of screen and seal material bridging off is minimized.
<u>SPT</u>: With the on-board SPT hammer that only needs to be swung into place it is possible to obtain fast SPT measurements in the hole that is being sampled.
<u>Windowless sampling</u>: If requested it is possible to take samples with windowless samplers or similar at certain depth intervals, the ground formation allowing.
<u>Water sampling</u>: Water samples can be taken at different depth stadiums of the borehole and with the formation to be sampled being fully isolated from other parts of the borehole.

Description		Nominal Outer Diameter		Nominal Inner Diameter		Nominal Wall Thickness	
		Inches	mm	Inches	mm	Inches	mm
CASING	5.5" x 5' Casing	5.5	139.7	4.750	120.7	0.375	9.5
	7 5/8" x 5' Casing	7.625	193.7	6.875	174.6	0.375	9.5
CASING BITS	5.5" Casing Bit	5.779	146.8	4.756	120.8	N/A	N/A
	7 5/8" Casing Bit	8.066	204.9	6.592	167.4	N/A	N/A
CORE BARREL	4 1/2" x 5' Core Barrels	4.500	114.3	3.750	95.3	0.375	9.5
	6" x 5' Core Barrels	6.000	152.4	5.250	133.4	0.375	9.5
CORE BITS	4.5" Core Barrel Bit	4.716	119.8	3.440	87.4	N/A	N/A
	6" Core Barrel Bit	6.163	156.5	4.912	124.8	N/A	N/A

Table 1: Core Barrel, Casing & Bits

Reference Source no. 136323

Appendix D
Justification of Analytical Strategy

Zone	Source No.	Storage Area	Sampling Location	Potentially Polluting Substance	Chemical Composition	Analytical Suite	Analytical Technique	Detection Limit	Accreditation
Area 2 South Bank Oil Farm	S^{3}	Storage Tanks	**Soil Samples** 2B1 to 2B3	Heavy Fuel Oil	Contains free and fixed ammonia and phenols*	Benzene	BTEXHSA	10 ug/kg	UKAS
						Toluene	BTEXHSA	10 ug/kg	UKAS
						Ethylbenzene	BTEXHSA	10 ug/kg	UKAS
						Xylene	BTEXHSA	10 ug/kg	UKAS
						Polycyclic Aromatic Hydrocarbons (PAH) EPA16	PAHFID	1mg/kg	UKAS
						Total Petroleum Hydrocarbons (TPH)	TPHFID	10 mg/kg	UKAS
			Water Samples 2B1 to 2B3			Benzene	BTEXHSA	5ug/l	UKAS
						Toluene	BTEXHSA	5ug/l	UKAS
						Ethylbenzene	BTEXHSA	5ug/l	UKAS
						Xylene	BTEXHSA	10ug/l	UKAS
						Polycyclic Aromatic Hydrocarbons (PAH) EPA16	PAHFID	0.01 mg/l	UKAS
						Total Petroleum Hydrocarbons (TPH)	TPHFID	0.1 mg/l	UKAS
Area 12 Redcar Coke Ovens and By-product Plant	$S6^{3}$	Storage Tanks	**Soil Samples** 12T1 to 12T8 12B1 to 12B3	Ammoniacal Liquor	Contains free and fixed ammonia and phenols*	Total phenols	BTEXHSA	0.02 mg/kg	UKAS
						Ammoniacal nitrogen	Distallation & Titration	5.5 mg/kg	UKAS
						Nitrate	Kone Analyser	1.0 mg/kg	UKAS
			Water Samples 12T1 to 12T8 12B1 to 12B3			Total phenols	Segemented Flow Colourimetry**	0.02 mg/l	UKAS
						Ammoniacal nitrogen	Segemented Flow Colourimetry***	0.2 mg/l	UKAS
						Nitrate	Segemented Flow Colourimetry***	0.5 mg/l	UKAS
						Biochemical Oxygen Demand	SCA Method 0117522120	1.0 mg/l	UKAS

Note:
* Data obtained from Suppliers Product/Hazard Data Sheet
** EPA Method 9066(SW-846) 3rd Edition Sept 1986
*** EPA Methods for Chemical Analysis and Wastes 1983:

Table 1 Analytical Strategy

Appendix E
Analytical Results

Appendix E1.1 Area 2 Soil Analysis
Appendix E1.2 Area 2 Groundwater Analysis
Appendix E2.1 Area 12 Soil Analysis
Appendix E2.2 Area 12 Groundwater Analysis

Appendix E1.1 Area 2 Soil Analysis

		Determinant	TPH [C10-C40]	Total PAH [EPA-16]	Naphthalene	Acenaphthylene	Acenapthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyren	Di-Benzo(a)anthracen	Benzo(g,h,i)perylene	Benzene	Toluene	Ethylbenzene	Xylene
		Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Sample I.D.	**Location**	**Depth**																						
7/L/G/0049	**2B1**	**0.50**	100	8.1	<0.2	<0.1	<0.1	<0.1	0.7	0.1	1.4	1	0.6	0.8	1.2	0.3	0.6	0.6	0.2	0.6	<0.1	<0.1	<0.1	<0.1
7/L/G/0048	**2B1**	**1.00**	67	25	0.6	0.2	<0.1	<0.1	2.1	0.4	4	3	2.1	2.5	3.4	1.3	1.4	1.9	0.4	1.7	<0.1	<0.1	<0.1	<0.1
7/L/G/0047	**2B1**	**2.00**	68	21	0.4	0.2	<0.1	<0.1	3.2	0.4	3.7	2.2	1.3	2.2	3	0.9	0.8	1.3	0.4	1.2	<0.1	<0.1	<0.1	<0.1
7/L/G/0050	**2B1**	**3.00**	<50	2.6	0.3	<0.1	<0.1	<0.1	0.4	<0.1	0.4	0.3	0.2	0.3	0.4	<0.1	0.1	0.2	<0.1	0.2	<0.1	<0.1	<0.1	<0.1
7/L/G/0051	**2B2**	**0.50**	<50	8.2	<0.2	<0.1	<0.1	<0.1	0.4	<0.1	1.6	1.3	0.8	0.8	1.1	0.4	0.7	0.6	<0.1	0.5	<0.1	<0.1	<0.1	<0.1
7/L/G/0052	**2B2**	**1.00**	60	6.7	<0.2	<0.1	<0.1	<0.1	0.3	<0.1	1.1	0.9	0.6	0.7	1	0.3	0.5	0.5	0.1	0.5	<0.1	<0.1	<0.1	<0.1
7/L/G/0053	**2B2**	**2.00**	<50	<2	<0.2	<0.1	<0.1	<0.1	<0.2	<0.1	<0.2	<0.2	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
7/L/G/0054	**2B2**	**2.70**	<50	<2	0.2	<0.1	<0.1	<0.1	<0.2	<0.1	<0.2	<0.2	<0.1	<0.1	0.2	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
7/L/G/0055	**2B3**	**0.50**	179	16.3	0.6	<0.1	<0.1	<0.1	2	0.3	2.9	1.5	0.9	2	2.2	0.8	1.2	0.8	0.3	0.8	<0.1	<0.1	<0.1	<0.1
7/L/G/0056	**2B3**	**1.00**	55	9.1	0.5	<0.1	<0.1	<0.1	1	<0.1	1.7	0.7	0.3	1.6	1.3	0.4	0.7	0.3	0.1	0.4	<0.1	<0.1	<0.1	<0.1
7/L/G/0057	**2B3**	**2.00**	<50	<2	<0.2	<0.1	<0.1	<0.1	<0.2	<0.1	<0.2	<0.2	<0.1	0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
7/L/G/0058	**2B3**	**3.00**	285	<2	<0.2	<0.1	<0.1	<0.1	0.3	<0.1	0.3	0.2	0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

ANALYTICAL REPORT

Report Number	**39301-07**
Date Sampled	
Date Received	**20-Jun-2007**
Date Reported	**03-Jul-2007**
Project	**SOIL SAMPLES**
Reference	**RICHARD HARDEMAN**
Order Number	**SL240775**

G966
SHAUN MCKENNA
CORUS R D & T
SWINDEN TECHNOLOGY CENTRE
MOORGATE ROAD
ROTHERHAM
S60 3AR

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME
GLP Compliant Laboratory
UKAS TESTING 2334

Laboratory Reference	**CTAM5129**	**CTAM5130**									
Sample Reference	**7/L/G/0057**	**7/L/G/0058**									
Sample Description											
Location Reference	2B3	2B3									
Depth (m)	2.00	3.00									
Colour	Brown	Brown									
Major Matrix	Granular Waste	Granular Waste									
Minor Components	Concrete	Stones (< 5 mm)									
		Stones (5 - 20 mm)									
Material Removed % w/w (> 5mm)	48	60									

The description of the sample matrix is not intended as a structural classification of the soil type or a full geological assessment. It can be used for customer reference and is a laboratory check to ensure MCERTS validation data is held for that matrix.
Information on sampling date, location and depth has been provided by the customer (~ indicates that information was not provided).

Matrix Assessment:
Accreditation is NOT held for all sample matrices in this report.

Notes:
Spike studies were carried out on the granular waste matrix for PAH and TPH analysis, see separate notes.

nrm laboratories

ANALYTICAL REPORT

Report Number	**39301-07**	**G966**	**SHAUN MCKENNA**
Date Sampled			**CORUS R D & T**
Date Received	**20-Jun-2007**		**SWINDEN TECHNOLOGY CENTRE**
Date Reported	**03-Jul-2007**		**MOORGATE ROAD**
Project	**SOIL SAMPLES**		**ROTHERHAM**
Reference	**RICHARD HARDEMAN**		**S60 3AR**
Order Number	**SL240775**		

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

GLP Compliant Laboratory

UKAS TESTING 2334

Laboratory Reference			**CTAM5129**	**CTAM5130**								
Sample Reference			**7/L/G/0057**	**7/L/G/0058**								
Determinand	**Unit**	**Method**	**SOIL**	**SOIL**								
TPH [C10-C40]	mg/kg	383 V	<50	285								
Total PAH [EPA-16]	mg/kg	349 V	<2	<2								
Naphthalene	mg/kg	349 V	<0.2	<0.2								
Acenaphthylene	mg/kg	349 V	<0.1	<0.1								
Acenapthene	mg/kg	349 V	<0.1	<0.1								
Fluorene	mg/kg	349 V	<0.1	<0.1								
Phenanthrene	mg/kg	349 V	<0.2	0.3								
Anthracene	mg/kg	349 V	<0.1	<0.1								
Fluoranthene	mg/kg	349 V	<0.2	0.3								
Pyrene	mg/kg	349 V	<0.2	0.2								
Benzo(a)anthracene	mg/kg	349 V	<0.1	0.1								
Chrysene	mg/kg	349 V	0.1	0.2								
Benzo(b)fluoranthene	mg/kg	349 V	0.2	0.2								
Benzo(k)fluoranthene	mg/kg	349 V	<0.1	<0.1								
Benzo(a)pyrene	mg/kg	349 V	<0.1	<0.1								
Indeno(1,2,3-cd)pyrene	mg/kg	349 V	<0.1	<0.1								
Di-Benzo(a)anthracene	mg/kg	349 V	<0.1	<0.1								
Benzo(g,h,i)perylene	mg/kg	349 V	<0.1	<0.1								
Benzene	mg/kg	414 U	<0.1	<0.1								
Toluene	mg/kg	414 U	<0.1	<0.1								
Ethylbenzene	mg/kg	414 U	<0.1	<0.1								
Xylene	mg/kg	414 U	<0.1	<0.1								

ANALYTICAL NOTES

Report Number	**39301-07**	**G966**	**SHAUN MCKENNA**
Date Sampled			**CORUS R D & T**
Date Received	**20-Jun-2007**		**SWINDEN TECHNOLOGY CENTRE**
Date Reported	**03-Jul-2007**		**MOORGATE ROAD**
Project	**SOIL SAMPLES**		**ROTHERHAM**
Reference	**RICHARD HARDEMAN**		**S60 3AR**
Order Number	**SL240775**		

Method Reference	**Soil Cond.**	**Description**
JAS - 383	Air-dried	Total petroleum hydrocarbons are extracted in hexane and determined by GC-FID (C10-C40).
JAS - 349	Fresh	Polyaromatic hydrocarbons (PAHs) are extracted into solvent and determined by GC-MS.
JAS - 414	As-received	BTEX are extracted from the as-received sample by headspace extraction and determined by GC-MS.
Definitions:	Fresh	Sieved to 5mm
	Air-dried	Dried overnight at < 30 C and ground to 2mm
Notes		
Analysis Notes		Analysis was carried out between 20-Jun-2007 and 29-Jun-2007. Further details are available on request.
		The sample submitted was of adequate size to complete all analysis requested.
		The results as reported relate only to the item(s) submitted for testing.
		The results are presented on a dry matter or corrected dry matter basis.
Sample Storage		A portion of the sample will be stored for 3 weeks from the reported date.
Accreditation		MCERTS accreditation is held for all tests except those indicated:
		U UKAS accredited method.
		V Accreditation is valid for Soil samples only.
		* Non-accredited method.
		# This analysis has been subcontracted.
Document Control		**This test report shall not be reproduced, except in full, without the written approval of the laboratory.**
Reported by		*Dr S Pitcher* Principal Scientist Natural Resource Management Ltd. Coopers Bridge, Braziers Lane, Bracknell, Berkshire, RG42 6NS Tel: 01344 886338 Fax: 01344 890972 email: enquiries@nrm.uk.com

ANALYTICAL REPORT

Report Number	**39300-07**	**G966**	**SHAUN MCKENNA**
Date Sampled			**CORUS R D & T**
Date Received	**20-Jun-2007**		**SWINDEN TECHNOLOGY CENTRE**
Date Reported	**03-Jul-2007**		**MOORGATE ROAD**
Project	**SOIL SAMPLES**		**ROTHERHAM**
Reference	**RICHARD HARDEMAN**		**S60 3AR**
Order Number	**SL240775**		

UKAS TESTING 2334

Laboratory Reference	**CTAM5119**	**CTAM5120**	**CTAM5121**	**CTAM5122**	**CTAM5123**	**CTAM5124**	**CTAM5125**	**CTAM5126**	**CTAM5127**	**CTAM5128**
Sample Reference	**7/L/G/0047**	**7/L/G/0048**	**7/L/G/0049**	**7/L/G/0050**	**7/L/G/0051**	**7/L/G/0052**	**7/L/G/0053**	**7/L/G/0054**	**7/L/G/0055**	**7/L/G/0056**
Sample Description										
Location Reference	2B1	2B1	2B1	2B1	2B2	2B2	2B2	2B2	2B3	2B3
Depth (m)	2.00	1.00	0.50	3.00	0.50	1.00	2.00	2.70	0.50	1.00
Colour	Brown / Grey	Brown / Grey	Dark Brown / Grey	Dark Grey	Brown / Red	Brown	Dark Grey + White	Grey	Dark Brown	Dark Grey
Major Matrix	Sandy Soil	Sandy Soil	Loamy Soil	Granular Waste	Fine / Granular Waste	Fine / Granular Waste	Granular Waste	Granular Waste	Granular Waste	Granular Waste
Minor Components	Stones (< 5 mm)	Stones (5 - 20 mm)	Stones (< 5 mm)	Stones (< 5 mm)	Rubble	Brick	Stones (< 5 mm)		Stones (< 5 mm)	Stones (< 5 mm)
	Stones (5 - 20 mm)	Brick	Stones (5 - 20 mm)	Rubble		Roots / Plant matter	Stones (5 - 20 mm)		Roots / Plant matter	Rubble
	Brick	Rubble				Rubble	Stones (> 20 mm)			
	Ceramic									
	Rubble									
Material Removed % w/w (> 5mm)	62	63	53	74	49	50	56	60	49	49

The description of the sample matrix is not intended as a structural classification of the soil type or a full geological assessment. It can be used for customer reference and is a laboratory check to ensure MCERTS validation data is held for that matrix.
Information on sampling date, location and depth has been provided by the customer (~ indicates that information was not provided).

Matrix Assessment:
Accreditation is NOT held for all sample matrices in this report.

Notes:
Spike studies were carried out on the granular waste matrix for PAH and TPH analysis, see separate notes.

ANALYTICAL REPORT

Report Number 39300-07 G966
Date Sampled
Date Received 20-Jun-2007
Date Reported 03-Jul-2007
Project SOIL SAMPLES
Reference RICHARD HARDEMAN
Order Number SL240775

SHAUN MCKENNA
CORUS R D & T
SWINDEN TECHNOLOGY CENTRE
MOORGATE ROAD
ROTHERHAM
S60 3AR

Laboratory Reference			**CTAM5119**	**CTAM5120**	**CTAM5121**	**CTAM5122**	**CTAM5123**	**CTAM5124**	**CTAM5125**	**CTAM5126**	**CTAM5127**	**CTAM5128**
Sample Reference			7/L/G/0047	7/L/G/0048	7/L/G/0049	7/L/G/0050	7/L/G/0051	7/L/G/0052	7/L/G/0053	7/L/G/0054	7/L/G/0055	7/L/G/0056
Determinand	**Unit**	**Method**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**
TPH [C10-C40]	mg/kg	383 V	100	67	68	<50	<50	60	<50	<50	179	55
Total PAH [EPA-16]	mg/kg	349 V	8.1	25.0	21.0	2.6	8.2	6.7	<2	<2	16.3	9.1
Naphthalene	mg/kg	349 V	<0.2	0.6	0.4	0.3	<0.2	<0.2	<0.2	0.2	0.6	0.5
Acenaphthylene	mg/kg	349 V	<0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenapthene	mg/kg	349 V	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	349 V	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	349 V	0.7	2.1	3.2	0.4	0.4	0.3	<0.2	<0.2	2.0	1.0
Anthracene	mg/kg	349 V	0.1	0.4	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1
Fluoranthene	mg/kg	349 V	1.4	4.0	3.7	0.4	1.6	1.1	<0.2	<0.2	2.9	1.7
Pyrene	mg/kg	349 V	1.0	3.0	2.2	0.3	1.3	0.9	<0.2	<0.2	1.5	0.7
Benzo(a)anthracene	mg/kg	349 V	0.6	2.1	1.3	0.2	0.8	0.6	<0.1	<0.1	0.9	0.3
Chrysene	mg/kg	349 V	0.8	2.5	2.2	0.3	0.8	0.7	<0.1	<0.1	2.0	1.6
Benzo(b)fluoranthene	mg/kg	349 V	1.2	3.4	3.0	0.4	1.1	1.0	0.2	0.2	2.2	1.3
Benzo(k)fluoranthene	mg/kg	349 V	0.3	1.3	0.9	<0.1	0.4	0.3	<0.1	<0.1	0.8	0.4
Benzo(a)pyrene	mg/kg	349 V	0.6	1.4	0.8	0.1	0.7	0.5	<0.1	0.1	1.2	0.7
Indeno(1,2,3-cd)pyrene	mg/kg	349 V	0.6	1.9	1.3	0.2	0.6	0.5	<0.1	<0.1	0.8	0.3
Di-Benzo(a)anthracene	mg/kg	349 V	0.2	0.4	0.4	<0.1	<0.1	0.1	<0.1	<0.1	0.3	0.1
Benzo(g,h,i)perylene	mg/kg	349 V	0.6	1.7	1.2	0.2	0.5	0.5	<0.1	<0.1	0.8	0.4
Benzene	mg/kg	414 U	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene	mg/kg	414 U	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	mg/kg	414 U	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Xylene	mg/kg	414 U	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

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ANALYTICAL NOTES

Report Number	**39300-07**	**G966**	**SHAUN MCKENNA**
Date Sampled			**CORUS R D & T**
Date Received	**20-Jun-2007**		**SWINDEN TECHNOLOGY CENTRE**
Date Reported	**03-Jul-2007**		**MOORGATE ROAD**
Project	**SOIL SAMPLES**		**ROTHERHAM**
Reference	**RICHARD HARDEMAN**		**S60 3AR**
Order Number	**SL240775**		

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GLP Compliant Laboratory
UKAS TESTING 2334

Method Reference	**Soil Cond.**	**Description**
JAS - 383	Air-dried	Total petroleum hydrocarbons are extracted in hexane and determined by GC-FID (C10-C40).
JAS - 349	Fresh	Polyaromatic hydrocarbons (PAHs) are extracted into solvent and determined by GC-MS.
JAS - 414	As-received	BTEX are extracted from the as-received sample by headspace extraction and determined by GC-MS.
Definitions:	Fresh	Sieved to 5mm
	Air-dried	Dried overnight at < 30 C and ground to 2mm
Notes		
Analysis Notes		Analysis was carried out between 20-Jun-2007 and 29-Jun-2007. Further details are available on request. The sample submitted was of adequate size to complete all analysis requested. The results as reported relate only to the item(s) submitted for testing. The results are presented on a dry matter or corrected dry matter basis.
Sample Storage		A portion of the sample will be stored for 3 weeks from the reported date.
Accreditation		MCERTS accreditation is held for all tests except those indicated: U UKAS accredited method. V Accreditation is valid for Soil samples only * Non-accredited method. # This analysis has been subcontracted.
Document Control		**This test report shall not be reproduced, except in full, without the written approval of the laboratory.**
Reported by		*Dr S Pitcher* Principal Scientist Natural Resource Management Ltd. Coopers Bridge, Braziers Lane, Bracknell, Berkshire, RG42 6NS Tel: 01344 886338 Fax: 01344 890972 email: enquiries@nrm.uk.com

SHAUN MCKENNA
CORUS R D & T
SWINDEN TECHNOLOGY CENTRE
MOORGATE ROAD
ROTHERHAM
S60 3AR

G966

Please quote above code for all enquiries

MCERTS NOTES

Lab Report Refs: **39300-1** Project Ref: **Richard Hardeman Samples**

Background:

Samples were received for an analytical suite requiring analysis to MCERTS. The major sample matrix for the bulk of the samples was a granular waste material and not a soil. Accreditation is not held for this matrix and so a validation batch of spikes for PAH and TPH analysis was carried out.

Validation Work:

Samples and spiked samples were analysed in duplicate at two spiking levels. The results are presented below.

Sample ref: CTAM/5125

	Sample result (1)	Sample result (2)	Low Spike (1)	Low Spike (2)	High Spike (1)	High Spike (2)
Target conc:			200 mg/kg		2000 mg/kg	
TPH [C10-C40]	57	60	261	207	1698	1677

Sample ref: CTAM/5125

	Sample result (1)	Sample result (2)	Low Spike (1)	Low Spike (2)	High Spike (1)	High Spike (2)
Target conc:			1 mg/kg		20 mg/kg	
Naphthalene	0.5	0.3	1.4	1.1	18.5	19.7
Acenaphthylene	<0.1	<0.1	0.9	0.8	17.5	18.1
Acenaphthene	<0.1	<0.1	1.0	0.9	17.9	18.4
Fluorene	<0.1	<0.1	0.8	0.8	17.1	17.0
Phenanthrene	<0.2	<0.2	0.8	0.8	17.4	17.4
Anthracene	<0.1	<0.1	0.8	0.9	19.1	19.8
Fluoranthene	0.2	<0.2	1.0	0.9	19.0	19.5
Pyrene	0.2	<0.2	1.0	0.9	18.0	18.3
Benzo[a]anthracene	0.1	<0.1	0.9	0.9	19.2	20.7
Chrysene	0.1	<0.1	1.0	1.0	20.9	22.7
Benzo[b]fluoranthene	0.2	0.1	1.0	1.0	18.5	20.2
Benzo[k]fluoranthene	0.1	<0.1	1.0	1.0	20.2	22.2
Benzo[a]pyrene	0.1	<0.1	0.9	0.8	18.4	19.7
Indeno[123-cd]pyrene	0.1	<0.1	1.0	0.9	20.1	20.4
Dibenzo[ah]anthracene	<0.1	<0.1	1.0	0.9	18.7	19.3
Benzo[ghi]perylene	0.1	<0.1	1.0	1.0	19.6	20.0

NOTE: The TPH and PAH results have not been blank corrected.

Comments:

Acceptable spike recoveries have been achieved for both PAH and TPH methods on the granular waste matrix.

Dr S Pitcher **03-Jul-07**

Principal Scientist, NRM Laboratories

Appendix E1.2 Area 2 Groundwater Analysis

Determinant	Units	2B1	2B2	2B3
Naphthalene	ug/l	<0.1	<0.1	<0.1
Acenaphthylene	ug/l	<0.1	<0.1	<0.1
Acenapthene	ug/l	<0.1	<0.1	<0.1
Fluorene	ug/l	<0.1	<0.1	<0.1
Phenanthrene	ug/l	<0.1	<0.1	<0.1
Anthracene	ug/l	<0.1	<0.1	<0.1
Fluoranthene	ug/l	<0.1	<0.1	<0.1
Pyrene	ug/l	<0.1	<0.1	<0.1
Benzo(a)anthracene	ug/l	<0.1	<0.1	<0.1
Chrysene	ug/l	<0.1	<0.1	<0.1
Benzo(b)fluoranthene	ug/l	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	ug/l	<0.1	<0.1	<0.1
Benzo(a)pyrene	ug/l	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	ug/l	<0.1	<0.1	<0.1
Di-Benzo(a)anthracene	ug/l	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	ug/l	<0.1	<0.1	<0.1
Benzene	mg/l	<0.1	<0.1	<0.1
Toluene	mg/l	<0.1	<0.1	<0.1
Ethylbenzene	mg/l	<0.1	<0.1	<0.1
Xylene	mg/l	<0.1	<0.1	<0.1
Total PAH	ug/l	<2	<2	<2
Total Petroleum Hydrocarbons	ug/l	<10	30	62

Appendix E1.2
Area 2 Water Analysis

ANALYTICAL REPORT

Report Number	**40671-07**	**G966**	**SHAUN MCKENNA**
Date Received	**17-JUL-2007**		**CORUS R D & T**
Date Reported	**30-JUL-2007**		**SWINDEN TECHNOLOGY CENTRE**
Project	**WATER SAMPLES**		**MOORGATE ROAD**
Reference	**RICHARD HARDEMAN**		**ROTHERHAM**
Order Number	**7129-19**		**S60 3AR**

Laboratory Reference		**CTAM5494**	**CTAM5495**								
Sample Reference		**7/L/G/0135**	**7/L/G/0136**								
Determinand	**Unit**	**WATER**	**WATER**								
Naphthalene	ug/l	<0.1	<0.1								
Acenaphthylene	ug/l	<0.1	<0.1								
Acenapthene	ug/l	<0.1	<0.1								
Fluorene	ug/l	<0.1	<0.1								
Phenanthrene	ug/l	<0.1	<0.1								
Anthracene	ug/l	<0.1	<0.1								
Fluoranthene	ug/l	<0.1	<0.1								
Pyrene	ug/l	<0.1	<0.1								
Benzo(a)anthracene	ug/l	<0.1	<0.1								
Chrysene	ug/l	<0.1	<0.1								
Benzo(b)fluoranthene	ug/l	<0.1	<0.1								
Benzo(k)fluoranthene	ug/l	<0.1	<0.1								
Benzo(a)pyrene	ug/l	<0.1	<0.1								
Indeno(1,2,3-cd)pyrene	ug/l	<0.1	<0.1								
Di-Benzo(a)anthracene	ug/l	<0.1	<0.1								
Benzo(g,h,i)perylene	ug/l	<0.1	<0.1								
Benzene	mg/l	<0.1	<0.1								
Toluene	mg/l	<0.1	<0.1								
Ethylbenzene	mg/l	<0.1	<0.1								
Xylene	mg/l	<0.1	<0.1								
Total PAH	ug/l	<2	<2								
Total Petroleum Hydrocarbons	ug/l	30	62								

ANALYTICAL NOTES

Report Number	**40671-07**	**G966**	**SHAUN MCKENNA**
Date Received	**17-JUL-2007**		**CORUS R D & T**
Date Reported	**30-JUL-2007**		**SWINDEN TECHNOLOGY CENTRE**
Project	**WATER SAMPLES**		**MOORGATE ROAD**
Reference	**RICHARD HARDEMAN**		**ROTHERHAM**
Order Number	**7129-19**		**S60 3AR**

Analysis Notes	The sample submitted was of adequate size to complete all analysis requested. The results as reported relate only to the item(s) submitted for testing.
Sample Storage	A portion of the sample will be stored for 3 weeks from the reported date.
Document Control	**This test report shall not be reproduced, except in full, without the written approval of the laboratory.**
Reported by	*Dr S Pitcher* Principal Scientist Natural Resource Management Ltd. Coopers Bridge, Braziers Lane, Bracknell, Berkshire, RG42 6NS Tel: 01344 886338 Fax: 01344 890972 email: enquiries@nrm.uk.com

ANALYTICAL REPORT

Report Number	**49747-08**	**G966**	**SHAUN MCKENNA**
Date Received	**14-JAN-2008**		**CORUS R D & T**
Date Reported	**30-JAN-2008**		**SWINDEN TECHNOLOGY CENTRE**
Project	**WATER SAMPLE**		**MOORGATE ROAD**
Reference	**SHAUN MCKENNA**		**ROTHERHAM**
Order Number			**S60 3AR**

Laboratory Reference		**CTAM7706**									
Sample Reference		**8/L/G/21**									
Determinand	**Unit**	**WATER**									
Naphthalene	ug/l	<0.1									
Acenaphthylene	ug/l	<0.1									
Acenapthene	ug/l	<0.1									
Fluorene	ug/l	<0.1									
Phenanthrene	ug/l	<0.1									
Anthracene	ug/l	<0.1									
Fluoranthene	ug/l	<0.1									
Pyrene	ug/l	<0.1									
Benz[a]anthracene	ug/l	<0.1									
Chrysene	ug/l	<0.1									
Benzo[b]fluoranthene	ug/l	<0.1									
Benzo[k]fluoranthene	ug/l	<0.1									
Benzo[a]pyrene	ug/l	<0.1									
Indeno[1,2,3-cd]pyrene	ug/l	<0.1									
Dibenz[a,h]anthracene	ug/l	<0.1									
Benzo[g,h,i]perylene	ug/l	<0.1									
Benzene	mg/l	<0.1									
Toluene	mg/l	<0.1									
Ethylbenzene	mg/l	<0.1									
Xylene	mg/l	<0.1									
Total PAH	ug/l	<2									
Total Petroleum Hydrocarbons	ug/l	<10									

ANALYTICAL NOTES

Report Number	**49747-08**	**G966**	**SHAUN MCKENNA**
Date Received	**14-JAN-2008**		**CORUS R D & T**
Date Reported	**30-JAN-2008**		**SWINDEN TECHNOLOGY CENTRE**
Project	**WATER SAMPLE**		**MOORGATE ROAD**
Reference	**SHAUN MCKENNA**		**ROTHERHAM**
Order Number			**S60 3AR**

Analysis Notes	The sample submitted was of adequate size to complete all analysis requested. The results as reported relate only to the item(s) submitted for testing.
Sample Storage	A portion of the sample will be stored for 3 weeks from the reported date.
Document Control	**This test report shall not be reproduced, except in full, without the written approval of the laboratory.**
Reported by	*Dr S Pitcher* Principal Scientist Natural Resource Management Ltd. Coopers Bridge, Braziers Lane, Bracknell, Berkshire, RG42 6NS Tel: 01344 886338 Fax: 01344 890972 email: enquiries@nrm.uk.com

Appendix E2.1 Area 12 Soil Analysis

		Determinant	Nitrate Nitrogen	Ammonium Nitrogen	Total Phenols Index
		Units	mg/kg	mg/kg	mg/kg
Sample I.D.	**Location**	**Depth**			
7/L/G/0099	**12B1**	**0.50**	15.3	<1	<1
7/L/G/0101	**12B1**	**1.00**	2.3	<1	<1
7/L/G/0102	**12B1**	**2.00**	4.1	<1	<1
7/L/G/0100	**12B1**	**3.00**	5.3	<1	<1
7/L/G/0113	**12B2**	**0.50**	5.6	<1	<1
7/L/G/0114	**12B2**	**1.00**	<1	<1	<1
7/L/G/0116	**12B2**	**2.00**	<1	<1	<1
7/L/G/0115	**12B2**	**3.00**	<1	<1	<1
7/L/G/0098	**12B3**	**0.50**	1.8	<1	<1
7/L/G/0095	**12B3**	**1.00**	<1	<1	<1
7/L/G/0097	**12B3**	**2.00**	<1	<1	<1
7/L/G/0096	**12B3**	**3.00**	8.7	<1	<1
7/L/G/0108	**12T1**	**0.50**	1.3	<1	<1
7/L/G/0109	**12T1**	**1.00**	<1	<1	<1
7/L/G/0110	**12T1**	**2.00**	1.8	<1	<1
7/L/G/0111	**12T1**	**3.00**	<1	<1	<1
7/L/G/0112	**12T1**	**4.00**	3.1	<1	<1
7/L/G/0091	**12T2**	**0.50**	295	<1	<1
7/L/G/0092	**12T2**	**1.00**	39.2	<1	<1
7/L/G/0093	**12T2**	**2.00**	137	<1	<1
7/L/G/0094	**12T2**	**3.00**	65.7	<1	<1
7/L/G/0120	**12T3**	**0.50**	8	<1	<1
7/L/G/0118	**12T3**	**1.00**	1.5	<1	<1
7/L/G/0117	**12T3**	**2.00**	11.4	<1	<1
7/L/G/0121	**12T3**	**3.00**	23	1.6	<1
7/L/G/0119	**12T3**	**4.00**	8.8	1.5	<1
7/L/G/0089	**12T4**	**0.50**	1.9	<1	<1
7/L/G/0090	**12T4**	**1.00**	3.3	<1	<1
7/L/G/0088	**12T4**	**2.00**	<1	<1	<1
7/L/G/0087	**12T4**	**3.00**	1.8	<1	<1
7/L/G/0083	**12T5**	**0.50**	2.4	<1	<1
7/L/G/0082	**12T5**	**1.00**	7.8	<1	<1
7/L/G/0085	**12T5**	**2.00**	<1	<1	<1
7/L/G/0084	**12T5**	**3.00**	5.3	<1	<1
7/L/G/0086	**12T5**	**4.00**	<1	<1	<1
7/L/G/0125	**12T6**	**0.50**	11.9	<1	<1
7/L/G/0122	**12T6**	**1.00**	13.2	<1	<1
7/L/G/0126	**12T6**	**2.00**	3.7	4.9	<1
7/L/G/0123	**12T6**	**3.00**	4.3	<1	<1
7/L/G/0124	**12T6**	**4.00**	2.4	1.8	<1
7/L/G/0127	**12T7**	**0.50**	<1	<1	<1
7/L/G/0129	**12T7**	**1.00**	30.4	1.4	<1
7/L/G/0130	**12T7**	**2.00**	<1	<1	<1
7/L/G/0128	**12T7**	**3.00**	1	<1	<1
7/L/G/0131	**12T8**	**1.00**	5.6	<1	<1
7/L/G/0132	**12T8**	**2.00**	4.1	<1	<1
7/L/G/0134	**12T8**	**3.00**	<1	<1	<1
7/L/G/0133	**12T8**	**3.60**	<1	<1	<1

ANALYTICAL REPORT

Report Number	**39305-07**	**G966**	**SHAUN MCKENNA**
Date Sampled			**CORUS R D & T**
Date Received	**20-Jun-2007**		**SWINDEN TECHNOLOGY CENTRE**
Date Reported	**02-Jul-2007**		**MOORGATE ROAD**
Project	**SOIL SAMPLE**		**ROTHERHAM**
Reference	**RICHARD HARDEMAN**		**S60 3AR**
Order Number	**SL240775**		

Laboratory Reference	**CTAM5161**	**CTAM5162**	**CTAM5163**	**CTAM5164**	**CTAM5165**	**CTAM5166**	**CTAM5167**	**CTAM5168**	**CTAM5169**	**CTAM5170**
Sample Reference	**7/L/G/0123**	**7/L/G/0124**	**7/L/G/0125**	**7/L/G/0126**	**7/L/G/0117**	**7/L/G/0118**	**7/L/G/0119**	**7/L/G/0120**	**7/L/G/0121**	**7/L/G/0108**
Sample Description										
Location Reference	12T6	12T6	12T6	12T6	12T3	12T3	12T3	12T3	12T3	12T1
Depth (m)	3.0	4.0	0.5	2.0	2.0	1.0	4.0	0.5	3.0	0.5
Colour	Dark Brown / Black	Dark Brown	Brown / Grey	Dark Brown	Brown / Red	Brown / Red	Brown	Brown / Red	Brown / Red	Brown
Major Matrix	Sandy Soil	Sandy Soil	Granular Waste	Sandy Soil	Loam Soil / Stones	Loam Soil / Stones	Loamy Soil	Loamy Soil	Loamy Soil	Sandy Soil
Minor Components	Coal	Stones (< 5 mm)		Coal			Stones (< 5 mm)	Stones (< 5 mm)	Stones (< 5 mm)	Stones (< 5 mm)
	Rubble			Waste / Rubble			Stones (5 - 20 mm)	Stones (5 - 20 mm)		Stones (5 - 20 mm)
								Coal		Coal
Material Removed % w/w (> 5mm)	0	0	0	0	0	0	0	0	0	0

The description of the sample matrix is not intended as a structural classification of the soil type or a full geological assessment. It can be used for customer reference and is a laboratory check to ensure MCERTS validation data is held for that matrix.

Information on sampling date, location and depth has been provided by the customer (~ indicates that information was not provided).

Matrix Assessment:

Accreditation is NOT held for all sample matrices in this report.

Notes:

A spike study was carried out on the granular waste matrix for Phenols analysis, see separate notes.

ANALYTICAL REPORT

Report Number	**39305-07**	**G966**	**SHAUN MCKENNA**
Date Sampled			**CORUS R D & T**
Date Received	**20-Jun-2007**		**SWINDEN TECHNOLOGY CENTRE**
Date Reported	**02-Jul-2007**		**MOORGATE ROAD**
Project	**SOIL SAMPLE**		**ROTHERHAM**
Reference	**RICHARD HARDEMAN**		**S60 3AR**
Order Number	**SL240775**		

UKAS TESTING 2334

Laboratory Reference			**CTAM5161**	**CTAM5162**	**CTAM5163**	**CTAM5164**	**CTAM5165**	**CTAM5166**	**CTAM5167**	**CTAM5168**	**CTAM5169**	**CTAM5170**
Sample Reference			**7/L/G/0123**	**7/L/G/0124**	**7/L/G/0125**	**7/L/G/0126**	**7/L/G/0117**	**7/L/G/0118**	**7/L/G/0119**	**7/L/G/0120**	**7/L/G/0121**	**7/L/G/0108**
Determinand	**Unit**	**Method**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**
Nitrate Nitrogen	mg/kg	134 *	13.2	3.7	4.3	2.4	2.4	7.8	<1	5.3	<1	8.0
Ammonium Nitrogen	mg/kg	134 *	<1	4.9	<1	1.8	<1	<1	<1	<1	<1	<1
Total Phenols Index	mg/kg	464 V	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

ANALYTICAL NOTES

Report Number	**39305-07**	**G966**	**SHAUN MCKENNA**
Date Sampled			**CORUS R D & T**
Date Received	**20-Jun-2007**		**SWINDEN TECHNOLOGY CENTRE**
Date Reported	**02-Jul-2007**		**MOORGATE ROAD**
Project	**SOIL SAMPLE**		**ROTHERHAM**
Reference	**RICHARD HARDEMAN**		**S60 3AR**
Order Number	**SL240775**		

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

GLP Compliant Laboratory

UKAS TESTING 2334

Method Reference	**Soil Cond.**	**Description**
JAS - 134	As-received	The ammonium and nitrate forms of nitrogen are determined colorimetrically on a potassium chloride extract.
JAS - 464	As-received	Phenols are extracted by steam distillation and determined colorimetrically.
Definitions:	As-received	No further sample preparation on receipt at laboratory.
	Air-dried	Dried overnight at < 30 C and ground to 2mm / 0.5mm
Notes		
Analysis Notes		Analysis was carried out between 20-Jun-2007 and 28-Jun-2007. Further details are available on request. The sample submitted was of adequate size to complete all analysis requested. The results as reported relate only to the item(s) submitted for testing. The results are presented on a dry matter or corrected dry matter basis.
Sample Storage		A portion of the sample will be stored for 3 weeks from the reported date.
Accreditation		MCERTS accreditation is held for all tests except those indicated: U UKAS accredited method. V Accreditation is NOT valid for non-soil matrices. * Non-accredited method. # This analysis has been subcontracted.
Document Control		**This test report shall not be reproduced, except in full, without the written approval of the laboratory.**
Reported by		*Dr S Pitcher* Principal Scientist Natural Resource Management Ltd. Coopers Bridge, Braziers Lane, Bracknell, Berkshire, RG42 6NS Tel: 01344 886338 Fax: 01344 890972 email: enquiries@nrm.uk.com

ANALYTICAL REPORT

Report Number	**39304-07**	**G966**	**SHAUN MCKENNA**
Date Sampled			**CORUS R D & T**
Date Received	**20-Jun-2007**		**SWINDEN TECHNOLOGY CENTRE**
Date Reported	**02-Jul-2007**		**MOORGATE ROAD**
Project	**SOIL SAMPLE**		**ROTHERHAM**
Reference	**RICHARD HARDEMAN**		**S60 3AR**
Order Number	**SL240775**		

Laboratory Reference	**CTAM5151**	**CTAM5152**	**CTAM5153**	**CTAM5154**	**CTAM5155**	**CTAM5156**	**CTAM5157**	**CTAM5158**	**CTAM5159**	**CTAM5160**
Sample Reference	**7/L/G/0086**	**7/L/G/0127**	**7/L/G/0128**	**7/L/G/0129**	**7/L/G/0130**	**7/L/G/0131**	**7/L/G/0132**	**7/L/G/0133**	**7/L/G/0134**	**7/L/G/0122**
Sample Description										
Location Reference	12T5	12T7	12T7	12T7	12T7	12T8	12T8	12T8	12T8	12T6
Depth (m)	4.0	0.5	3.0	1.0	2.0	1.0	2.0	3.6	3.0	1.0
Colour	Dark Brown	Brown / Grey	Brown / Grey	Brown / Yellow	Brown	Dark Brown	Grey	Grey	Dark Grey	Dark Brown
Major Matrix	Granular Waste	Granular Waste	Granular Waste	Sand + Rubble	Granular Waste	Granular Waste	Granular Waste	Granular Waste	Granular Waste	Granular Waste
Minor Components	Sandy Soil	Sandy Soil	Sandy Soil		Sand	Sandy Soil				Sandy Soil
		Concrete								Rubble
		Rubble								
Material Removed % w/w (> 5mm)	0	0	0	0	0	0	0	0	0	0

The description of the sample matrix is not intended as a structural classification of the soil type or a full geological assessment. It can be used for customer reference and is a laboratory check to ensure MCERTS validation data is held for that matrix.

Information on sampling date, location and depth has been provided by the customer (~ indicates that information was not provided).

Matrix Assessment:

Accreditation is NOT held for all sample matrices in this report.

Notes:

A spike study was carried out on the granular waste matrix for Phenols analysis, see separate notes.

ANALYTICAL REPORT

Report Number	**39304-07**	**G966**	**SHAUN MCKENNA**
Date Sampled			**CORUS R D & T**
Date Received	**20-Jun-2007**		**SWINDEN TECHNOLOGY CENTRE**
Date Reported	**02-Jul-2007**		**MOORGATE ROAD**
Project	**SOIL SAMPLE**		**ROTHERHAM**
Reference	**RICHARD HARDEMAN**		**S60 3AR**
Order Number	**SL240775**		

UKAS TESTING 2334

Laboratory Reference			**CTAM5151**	**CTAM5152**	**CTAM5153**	**CTAM5154**	**CTAM5155**	**CTAM5156**	**CTAM5157**	**CTAM5158**	**CTAM5159**	**CTAM5160**
Sample Reference			7/L/G/0086	7/L/G/0127	7/L/G/0128	7/L/G/0129	7/L/G/0130	7/L/G/0131	7/L/G/0132	7/L/G/0133	7/L/G/0134	7/L/G/0122
Determinand	**Unit**	**Method**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**
Nitrate Nitrogen	mg/kg	134 *	5.6	<1	30.4	<1	1.0	5.6	4.1	<1	<1	11.9
Ammonium Nitrogen	mg/kg	134 *	<1	<1	1.4	<1	<1	<1	<1	<1	<1	<1
Total Phenols Index	mg/kg	464 V	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

nrm laboratories

ANALYTICAL NOTES

Report Number	**39304-07**	**G966**	**SHAUN MCKENNA**
Date Sampled			**CORUS R D & T**
Date Received	**20-Jun-2007**		**SWINDEN TECHNOLOGY CENTRE**
Date Reported	**02-Jul-2007**		**MOORGATE ROAD**
Project	**SOIL SAMPLE**		**ROTHERHAM**
Reference	**RICHARD HARDEMAN**		**S60 3AR**
Order Number	**SL240775**		

MCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

GLP Compliant Laboratory

UKAS TESTING 2334

Method Reference	**Soil Cond.**	**Description**
JAS - 134	As-received	The ammonium and nitrate forms of nitrogen are determined colorimetrically on a potassium chloride extract.
JAS - 464	As-received	Phenols are extracted by steam distillation and determined colorimetrically.
Definitions:	As-received	No further sample preparation on receipt at laboratory.
	Air-dried	Dried overnight at < 30 C and ground to 2mm / 0.5mm

Notes

Analysis Notes	Analysis was carried out between 20-Jun-2007 and 28-Jun-2007. Further details are available on request. The sample submitted was of adequate size to complete all analysis requested. The results as reported relate only to the item(s) submitted for testing. The results are presented on a dry matter or corrected dry matter basis.
Sample Storage	A portion of the sample will be stored for 3 weeks from the reported date.
Accreditation	MCERTS accreditation is held for all tests except those indicated: U UKAS accredited method. V Accreditation is NOT valid for non-soil matrices. * Non-accredited method. # This analysis has been subcontracted.
Document Control	**This test report shall not be reproduced, except in full, without the written approval of the laboratory.**

Reported by

Dr S Pitcher
Principal Scientist
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Fax: 01344 890972
email: enquiries@nrm.uk.com

ANALYTICAL REPORT

Report Number	**39303-07**	**G966**	**SHAUN MCKENNA**
Date Sampled			**CORUS R D & T**
Date Received	**20-Jun-2007**		**SWINDEN TECHNOLOGY CENTRE**
Date Reported	**02-Jul-2007**		**MOORGATE ROAD**
Project	**SOIL SAMPLE**		**ROTHERHAM**
Reference	**RICHARD HARDEMAN**		**S60 3AR**
Order Number	**SL240775**		

Laboratory Reference	**CTAM5141**	**CTAM5142**	**CTAM5143**	**CTAM5144**	**CTAM5145**	**CTAM5146**	**CTAM5147**	**CTAM5148**	**CTAM5149**	**CTAM5150**
Sample Reference	**7/L/G/0093**	**7/L/G/0094**	**7/L/G/0087**	**7/L/G/0088**	**7/L/G/0089**	**7/L/G/0090**	**7/L/G/0082**	**7/L/G/0083**	**7/L/G/0084**	**7/L/G/0085**
Sample Description										
Location Reference	12T2	12T2	12T4	12T4	12T4	12T4	12T5	12T5	12T5	12T5
Depth (m)	2.0	3.0	3.0	2.0	0.5	1.0	1.0	0.5	3.0	2.0
Colour	Dark Brown / Grey	Dark Brown / Grey	Brown	Brown	Dark Brown	Brown / Grey	Grey	Brown	Dark Brown	Light Grey
Major Matrix	Granular Waste	Granular Waste	Loamy Soil	Loamy Soil	Sandy Soil	Sandy Soil	Granular Waste	Granular Waste	Sandy Soil	Granular Waste
Minor Components	Sandy Soil	Sandy Soil	Stones (< 5 mm)	Stones (< 5 mm)	Stones (< 5 mm)	Waste Material		Sandy Soil	Stones (< 5 mm)	
		Stones (< 5 mm)	Stones (5 - 20 mm)	Stones (5 - 20 mm)	Waste / Rubble	Stones (< 5 mm)		Rubble	Stones (5 - 20 mm)	
		Rubble							Rubble	
Material Removed % w/w (> 5mm)	0	0	0	0	0	0	0	0	0	0

The description of the sample matrix is not intended as a structural classification of the soil type or a full geological assessment. It can be used for customer reference and is a laboratory check to ensure MCERTS validation data is held for that matrix.

Information on sampling date, location and depth has been provided by the customer (~ indicates that information was not provided).

Matrix Assessment:

Accreditation is NOT held for all the sample matrices in this report.

Notes:

A spike study was carried out on the granular waste matrix for Phenols analysis, see separate notes.

ANALYTICAL REPORT

Report Number 39303-07
Date Sampled
Date Received 20-Jun-2007
Date Reported 02-Jul-2007
Project SOIL SAMPLE
Reference RICHARD HARDEMAN
Order Number SL240775

G966 **SHAUN MCKENNA**
CORUS R D & T
SWINDEN TECHNOLOGY CENTRE
MOORGATE ROAD
ROTHERHAM
S60 3AR

Laboratory Reference			**CTAM5141**	**CTAM5142**	**CTAM5143**	**CTAM5144**	**CTAM5145**	**CTAM5146**	**CTAM5147**	**CTAM5148**	**CTAM5149**	**CTAM5150**
Sample Reference			7/L/G/0093	7/L/G/0094	7/L/G/0087	7/L/G/0088	7/L/G/0089	7/L/G/0090	7/L/G/0082	7/L/G/0083	7/L/G/0084	7/L/G/0085
Determinand	**Unit**	**Method**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**
Nitrate Nitrogen	mg/kg	134 *	8.7	1.3	<1	<1	<1	1.8	15.3	2.3	4.1	5.3
Ammonium Nitrogen	mg/kg	134 *	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Phenols Index	mg/kg	464 V	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

ANALYTICAL NOTES

Report Number	**39303-07**	**G966**	**SHAUN MCKENNA**
Date Sampled			**CORUS R D & T**
Date Received	**20-Jun-2007**		**SWINDEN TECHNOLOGY CENTRE**
Date Reported	**02-Jul-2007**		**MOORGATE ROAD**
Project	**SOIL SAMPLE**		**ROTHERHAM**
Reference	**RICHARD HARDEMAN**		**S60 3AR**
Order Number	**SL240775**		

Method Reference	**Soil Cond.**	**Description**
JAS - 134	As-received	The ammonium and nitrate forms of nitrogen are determined colorimetrically on a potassium chloride extract.
JAS - 464	As-received	Phenols are extracted by steam distillation and determined colorimetrically.
Definitions:	As-received	No further sample preparation on receipt at laboratory.
	Air-dried	Dried overnight at < 30 C and ground to 2mm / 0.5mm

Notes		
Analysis Notes		Analysis was carried out between 20-Jun-2007 and 28-Jun-2007. Further details are available on request. The sample submitted was of adequate size to complete all analysis requested. The results as reported relate only to the item(s) submitted for testing. The results are presented on a dry matter or corrected dry matter basis.
Sample Storage		A portion of the sample will be stored for 3 weeks from the reported date.
Accreditation		MCERTS accreditation is held for all tests except those indicated: U UKAS accredited method. V Accreditation is NOT valid for non-soil matrices. * Non-accredited method. # This analysis has been subcontracted.
Document Control		**This test report shall not be reproduced, except in full, without the written approval of the laboratory.**
Reported by		*Dr S Pitcher* Principal Scientist Natural Resource Management Ltd. Coopers Bridge, Braziers Lane, Bracknell, Berkshire, RG42 6NS Tel: 01344 886338 Fax: 01344 890972 email: enquiries@nrm.uk.com

ANALYTICAL REPORT

Report Number	**39302-07**	**G966**	**SHAUN MCKENNA**
Date Sampled			**CORUS R D & T**
Date Received	**20-Jun-2007**		**SWINDEN TECHNOLOGY CENTRE**
Date Reported	**02-Jul-2007**		**MOORGATE ROAD**
Project	**SOIL SAMPLE**		**ROTHERHAM**
Reference	**RICHARD HARDEMAN**		**S60 3AR**
Order Number	**SL240775**		

UKAS TESTING 2334

Laboratory Reference	**CTAM5131**	**CTAM5132**	**CTAM5133**	**CTAM5134**	**CTAM5135**	**CTAM5136**	**CTAM5137**	**CTAM5138**	**CTAM5139**	**CTAM5140**
Sample Reference	**7/L/G/0099**	**7/L/G/0100**	**7/L/G/0101**	**7/L/G/0102**	**7/L/G/0095**	**7/L/G/0096**	**7/L/G/0097**	**7/L/G/0098**	**7/L/G/0091**	**7/L/G/0092**
Sample Description										
Location Reference	12B1	12B1	12B1	12B1	12B3	12B3	12B3	12B3	12T2	12T2
Depth (m)	0.5	3.0	1.0	2.0	1.0	3.0	2.0	0.5	0.5	1.0
Colour	Grey + White	Grey	Grey	Grey	Dark Grey	Dark Grey	Grey / Brown	Dar Brown	Brown / Grey	Grey
Major Matrix	Granular Waste	Granular Waste	Granular Waste	Granular Waste	Granular Waste	Granular Waste	Granular Waste	Granular Waste	Granular Waste	Granular Waste
Minor Components						Sandy Soil	Sandy Soil	Sandy Soil		Rubble
Material Removed % w/w (> 5mm)	0	0	0	0	0	0	0	0	0	0

The description of the sample matrix is not intended as a structural classification of the soil type or a full geological assessment. It can be used for customer reference and is a laboratory check to ensure MCERTS validation data is held for that matrix.

Information on sampling date, location and depth has been provided by the customer (~ indicates that information was not provided).

Matrix Assessment:

Accreditation is NOT held for the sample matrices in this report.

Notes:

A spike study was carried out on the granular waste matrix for Phenols analysis, see separate notes.

ANALYTICAL REPORT

Report Number **39302-07** **G966**
Date Sampled
Date Received **20-Jun-2007**
Date Reported **02-Jul-2007**
Project **SOIL SAMPLE**
Reference **RICHARD HARDEMAN**
Order Number **SL240775**

SHAUN MCKENNA
CORUS R D & T
SWINDEN TECHNOLOGY CENTRE
MOORGATE ROAD
ROTHERHAM
S60 3AR

2334

Laboratory Reference			**CTAM5131**	**CTAM5132**	**CTAM5133**	**CTAM5134**	**CTAM5135**	**CTAM5136**	**CTAM5137**	**CTAM5138**	**CTAM5139**	**CTAM5140**
Sample Reference			**7/L/G/0099**	**7/L/G/0100**	**7/L/G/0101**	**7/L/G/0102**	**7/L/G/0095**	**7/L/G/0096**	**7/L/G/0097**	**7/L/G/0098**	**7/L/G/0091**	**7/L/G/0092**
Determinand	**Unit**	**Method**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**
Nitrate Nitrogen	mg/kg	134 *	295	39.2	137	65.7	<1	1.8	<1	3.1	<1	<1
Ammonium Nitrogen	mg/kg	134 *	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Phenols Index	mg/kg	464 V	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

ANALYTICAL NOTES

Report Number	**39302-07**	**G966**	**SHAUN MCKENNA**
Date Sampled			**CORUS R D & T**
Date Received	**20-Jun-2007**		**SWINDEN TECHNOLOGY CENTRE**
Date Reported	**02-Jul-2007**		**MOORGATE ROAD**
Project	**SOIL SAMPLE**		**ROTHERHAM**
Reference	**RICHARD HARDEMAN**		**S60 3AR**
Order Number	**SL240775**		

Method Reference	**Soil Cond.**	**Description**
JAS - 134	As-received	The ammonium and nitrate forms of nitrogen are determined colorimetrically on a potassium chloride extract.
JAS - 464	As-received	Phenols are extracted by steam distillation and determined colorimetrically.
Definitions:	As-received	No further sample preparation on receipt at laboratory.
	Air-dried	Dried overnight at < 30 C and ground to 2mm / 0.5mm
Notes		
Analysis Notes		Analysis was carried out between 20-Jun-2007 and 28-Jun-2007. Further details are available on request. The sample submitted was of adequate size to complete all analysis requested. The results as reported relate only to the item(s) submitted for testing. The results are presented on a dry matter or corrected dry matter basis.
Sample Storage		A portion of the sample will be stored for 3 weeks from the reported date.
Accreditation		MCERTS accreditation is held for all tests except those indicated: U UKAS accredited method. V Accreditation is not valid for this sample matrix * Non-accredited method. # This analysis has been subcontracted.
Document Control		**This test report shall not be reproduced, except in full, without the written approval of the laboratory.**
Reported by		Dr S Pitcher Principal Scientist Natural Resource Management Ltd. Coopers Bridge, Braziers Lane, Bracknell, Berkshire, RG42 6NS Tel: 01344 886338 Fax: 01344 890972 email: enquiries@nrm.uk.com

ANALYTICAL REPORT

Report Number	**39306-07**	**G966**	**SHAUN MCKENNA**
Date Sampled			**CORUS R D & T**
Date Received	**20-Jun-2007**		**SWINDEN TECHNOLOGY CENTRE**
Date Reported	**02-Jul-2007**		**MOORGATE ROAD**
Project	**SOIL SAMPLE**		**ROTHERHAM**
Reference	**RICHARD HARDEMAN**		**S60 3AR**
Order Number	**SL240775**		

Laboratory Reference	**CTAM5171**	**CTAM5172**	**CTAM5173**	**CTAM5174**	**CTAM5175**	**CTAM5176**	**CTAM5177**	**CTAM5178**		
Sample Reference	**7/L/G/0109**	**7/L/G/0110**	**7/L/G/0111**	**7/L/G/0112**	**7/L/G/0113**	**7/L/G/0114**	**7/L/G/0115**	**7/L/G/0116**		
Sample Description										
Location Reference	12T1	12T1	12T1	12T1	12B2	12B2	12B2	12B2		
Depth (m)	1.0	2.0	3.0	4.0	0.5	1.0	3.0	2.0		
Colour	Grey	Brown / Dark Brown	Brown	Brown	Brown / Red	Brown	Brown	Brown		
Major Matrix	Granular Waste	Sandy Soil	Sandy Loam Soil	Sandy Soil	Sandy Soil	Sandy Soil	Loamy Soil	Sandy Soil		
Minor Components	Sandy Soil		Stones (< 5 mm)	Stones (< 5 mm)	Stones (< 5 mm)	Stones (< 5 mm)	Stones (< 5 mm)	Stones (< 5 mm)		
	Stones (< 5 mm)		Rubble		Coal	Rubble	Coal	Rubble		
	Rubble				Rubble					
Material Removed % w/w (> 5mm)	0	0	0	0	0	0	0	0		

The description of the sample matrix is not intended as a structural classification of the soil type or a full geological assessment. It can be used for customer reference and is a laboratory check to ensure MCERTS validation data is held for that matrix.

Information on sampling date, location and depth has been provided by the customer (~ indicates that information was not provided).

Matrix Assessment:

Accreditation is NOT held for all sample matrices in this report.

Notes:

A spike study was carried out on the granular waste matrix for Phenols analysis, see separate notes.

ANALYTICAL REPORT

Report Number	**39306-07**	**G966**	**SHAUN MCKENNA**
Date Sampled			**CORUS R D & T**
Date Received	**20-Jun-2007**		**SWINDEN TECHNOLOGY CENTRE**
Date Reported	**02-Jul-2007**		**MOORGATE ROAD**
Project	**SOIL SAMPLE**		**ROTHERHAM**
Reference	**RICHARD HARDEMAN**		**S60 3AR**
Order Number	**SL240775**		

2334

Laboratory Reference			**CTAM5171**	**CTAM5172**	**CTAM5173**	**CTAM5174**	**CTAM5175**	**CTAM5176**	**CTAM5177**	**CTAM5178**		
Sample Reference			**7/L/G/0109**	**7/L/G/0110**	**7/L/G/0111**	**7/L/G/0112**	**7/L/G/0113**	**7/L/G/0114**	**7/L/G/0115**	**7/L/G/0116**		
Determinand	**Unit**	**Method**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**		
Nitrate Nitrogen	mg/kg	134 *	1.5	11.4	23.0	8.8	1.9	3.3	<1	1.8		
Ammonium Nitrogen	mg/kg	134 *	<1	<1	1.6	1.5	<1	<1	<1	<1		
Total Phenols Index	mg/kg	464 V	<1	<1	<1	<1	<1	<1	<1	<1		

ANALYTICAL NOTES

Report Number	**39306-07**	**G966**	**SHAUN MCKENNA**
Date Sampled			**CORUS R D & T**
Date Received	**20-Jun-2007**		**SWINDEN TECHNOLOGY CENTRE**
Date Reported	**02-Jul-2007**		**MOORGATE ROAD**
Project	**SOIL SAMPLE**		**ROTHERHAM**
Reference	**RICHARD HARDEMAN**		**S60 3AR**
Order Number	**SL240775**		

Method Reference	**Soil Cond.**	**Description**
JAS - 134	As-received	The ammonium and nitrate forms of nitrogen are determined colorimetrically on a potassium chloride extract.
JAS - 464	As-received	Phenols are extracted by steam distillation and determined colorimetrically.
Definitions:	As-received	No further sample preparation on receipt at laboratory.
	Air-dried	Dried overnight at < 30 C and ground to 2mm / 0.5mm
Notes		
Analysis Notes		Analysis was carried out between 20-Jun-2007 and 28-Jun-2007. Further details are available on request.
		The sample submitted was of adequate size to complete all analysis requested.
		The results as reported relate only to the item(s) submitted for testing.
		The results are presented on a dry matter or corrected dry matter basis.
Sample Storage		A portion of the sample will be stored for 3 weeks from the reported date.
Accreditation		MCERTS accreditation is held for all tests except those indicated:
		U UKAS accredited method.
		V Accreditation is NOT valid for non-soil matrices.
		* Non-accredited method.
		# This analysis has been subcontracted.
Document Control		**This test report shall not be reproduced, except in full, without the written approval of the laboratory.**
Reported by		*Dr S Pitcher* Principal Scientist Natural Resource Management Ltd. Coopers Bridge, Braziers Lane, Bracknell, Berkshire, RG42 6NS Tel: 01344 886338 Fax: 01344 890972 email: enquiries@nrm.uk.com

Appendix E2.2 Area 12 Groundwater Analysis

Determinant	**Units**	**12B1**	**12B2**	**12B3**
Total Phenols	mg/l	<1	<0.1	1.2
Nitrate Nitrogen	mg/l	1.3	<0.1	1.3
B.O.D	mg/l	1.5	30.6	5.1
Ammonium Nitrogen	mg/l	36.3	23	23

ANALYTICAL REPORT

Report Number	**40674-07**	**G966**	**SHAUN MCKENNA**
Date Received	**17-JUL-2007**		**CORUS R D & T**
Date Reported	**27-JUL-2007**		**SWINDEN TECHNOLOGY CENTRE**
Project	**WATER SAMPLES**		**MOORGATE ROAD**
Reference	**RICHARD HARDEMAN**		**ROTHERHAM**
Order Number	**7129-19**		**S60 3AR**

Laboratory Reference		**CTAM5500**	**CTAM5501**								
Sample Reference		**7/L/G/0141**	**7/L/G/0142**								
Determinand	**Unit**	**WATER**	**WATER**								
Total Phenols	mg/l	<0.1	1.2								
Nitrate Nitrogen	mg/l	<0.1	1.3								
B.O.D	mg/l	30.6	5.1								
Ammonium Nitrogen	mg/l	23.0	23.0								

Analysis Notes	The sample submitted was of adequate size to complete all analysis requested. The results as reported relate only to the item(s) submitted for testing.
Sample Storage	A portion of the sample will be stored for 3 weeks from the reported date.
Document Control	**This test report shall not be reproduced, except in full, without the written approval of the laboratory.**

Reported by

Dr S Pitcher
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SHAUN MCKENNA
CORUS R D & T
SWINDEN TECHNOLOGY CENTRE
MOORGATE ROAD
ROTHERHAM
S60 3AR

G966

Please quote above code for all enquiries

SHAUN MCKENNA

WATER SAMPLE

ANALYTICAL REPORT

Laboratory References	
Report Number	49748
Sample Number	7707

Sample Reference :

8/L/G/022

Sample Matrix : WATER

Date Received	14-JAN-2008
Date Reported	22-JAN-2008

The sample submitted was of adequate size to complete all analysis requested.

The sample will be kept under refrigeration for at least 3 weeks.

ANALYTICAL RESULTS *on 'as received' basis.*

Determinand	Value	Units
Nitrate Nitrogen	1.3	mg/l
B.O.D	1.5	mg/l
Ammonium Nitrogen	36.3	mg/l
Total Phenols	<1	mg/l

Released by Dr S Pitcher Principal Scientist Date 22/01/08

Appendix F
Reference Data

Appendix F1 Area 2 Reference Data
Appendix F2 Area 12 Reference Data

Appendix F1 Area 2 Reference Data

SOIL

Upgradient Samples to set control levels to measure deterioration

	Determinant	TPH [C10-C40]	Total PAH [EPA-16]	Naphthalene	Acenaphthylene	Acenapthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Di-Benzo(a)anthracene	Benzo(g,h,i)perylene	Benzene	Toluene	Ethylbenzene	Xylene
	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Location	**Depth**																						
2B1	**0.50**	100	8.1	<0.2	<0.1	<0.1	<0.1	0.7	0.1	1.4	1	0.6	0.8	1.2	0.3	0.6	0.6	0.2	0.6	<0.1	<0.1	<0.1	<0.1
2B1	**1.00**	67	25	0.6	0.2	<0.1	<0.1	2.1	0.4	4	3	2.1	2.5	3.4	1.3	1.4	1.9	0.4	1.7	<0.1	<0.1	<0.1	<0.1
2B1	**2.00**	68	21	0.4	0.2	<0.1	<0.1	3.2	0.4	3.7	2.2	1.3	2.2	3	0.9	0.8	1.3	0.4	1.2	<0.1	<0.1	<0.1	<0.1
2B1	**3.00**	<50	2.6	0.3	<0.1	<0.1	<0.1	0.4	<0.1	0.4	0.3	0.2	0.3	0.4	<0.1	0.1	0.2	<0.1	0.2	<0.1	<0.1	<0.1	<0.1

Downgradient Samples to identify breaches of storage of potentially polluting substances

	Determinant	TPH [C10-C40]	Total PAH [EPA-16]	Naphthalene	Acenaphthylene	Acenapthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Di-Benzo(a)anthracene	Benzo(g,h,i)perylene	Benzene	Toluene	Ethylbenzene	Xylene
	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Location	**Depth**																						
2B2	**0.50**	<50	8.2	<0.2	<0.1	<0.1	<0.1	0.4	<0.1	1.6	1.3	0.8	0.8	1.1	0.4	0.7	0.6	<0.1	0.5	<0.1	<0.1	<0.1	<0.1
2B2	**1.00**	60	6.7	<0.2	<0.1	<0.1	<0.1	0.3	<0.1	1.1	0.9	0.6	0.7	1	0.3	0.5	0.5	0.1	0.5	<0.1	<0.1	<0.1	<0.1
2B2	**2.00**	<50	<2	<0.2	<0.1	<0.1	<0.1	<0.2	<0.1	<0.2	<0.2	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2B2	**2.70**	<50	<2	0.2	<0.1	<0.1	<0.1	<0.2	<0.1	<0.2	<0.2	<0.1	<0.1	0.2	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2B3	**0.50**	179	16.3	0.6	<0.1	<0.1	<0.1	2	0.3	2.9	1.5	0.9	2	2.2	0.8	1.2	0.8	0.3	0.8	<0.1	<0.1	<0.1	<0.1
2B3	**1.00**	55	9.1	0.5	<0.1	<0.1	<0.1	1	<0.1	1.7	0.7	0.3	1.6	1.3	0.4	0.7	0.3	0.1	0.4	<0.1	<0.1	<0.1	<0.1
2B3	**2.00**	<50	<2	<0.2	<0.1	<0.1	<0.1	<0.2	<0.1	<0.2	<0.2	<0.1	0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2B3	**3.00**	285	<2	<0.2	<0.1	<0.1	<0.1	0.3	<0.1	0.3	0.2	0.1	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

GROUNDWATER

Upgradient Borehole to set control levels to measure deterioration

	Determinant	Total Petroleum Hydrocarbons	Total PAH	Naphthalene	Acenaphthylene	Acenapthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Di-Benzo(a)anthracene	Benzo(g,h,i)perylene	Benzene	Toluene	Ethylbenzene	Xylene
Location	**Units**	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	mg/l
2B1		<10	<2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Downgradient Boreholes to identify breaches of storage of potentially polluting substances

	Determinant	Total Petroleum Hydrocarbons	Total PAH	Naphthalene	Acenaphthylene	Acenapthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Di-Benzo(a)anthracene	Benzo(g,h,i)perylene	Benzene	Toluene	Ethylbenzene	Xylene
Location	**Units**	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	mg/l
2B2		30	<2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2B3		62	<2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Appendix F2 Area 12 Reference Data

SOIL

Upgradient Samples to set control levels to measure deterioration

	Determinant	Nitrate Nitrogen	Ammonium Nitrogen	Total Phenols Index
	Units	mg/kg	mg/kg	mg/kg
Location	Depth			
12B1	0.50	15.3	<1	<1
12B1	1.00	2.3	<1	<1
12B1	2.00	4.1	<1	<1
12B1	3.00	5.3	<1	<1
12T8	1.00	5.6	<1	<1
12T8	2.00	4.1	<1	<1
12T8	3.00	<1	<1	<1
12T8	3.60	<1	<1	<1

Downgradient Samples to identify

	Determinant	Nitrate Nitrogen	Ammonium Nitrogen	Total Phenols Index
	Units	mg/kg	mg/kg	mg/kg
Location	Depth			
12B2	0.50	5.6	<1	<1
12B2	1.00	<1	<1	<1
12B2	2.00	<1	<1	<1
12B2	3.00	<1	<1	<1
12B3	0.50	1.8	<1	<1
12B3	1.00	<1	<1	<1
12B3	2.00	<1	<1	<1
12B3	3.00	8.7	<1	<1
12T1	0.50	1.3	<1	<1
12T1	1.00	<1	<1	<1
12T1	2.00	1.8	<1	<1
12T1	3.00	<1	<1	<1
12T1	4.00	3.1	<1	<1
12T2	0.50	295	<1	<1
12T2	1.00	39.2	<1	<1
12T2	2.00	137	<1	<1
12T2	3.00	65.7	<1	<1
12T3	0.50	8	<1	<1
12T3	1.00	1.5	<1	<1
12T3	2.00	11.4	<1	<1
12T3	3.00	23	1.6	<1
12T3	4.00	8.8	1.5	<1
12T4	0.50	1.9	<1	<1
12T4	1.00	3.3	<1	<1
12T4	2.00	<1	<1	<1
12T4	3.00	1.8	<1	<1
12T5	0.50	2.4	<1	<1
12T5	1.00	7.8	<1	<1
12T5	2.00	<1	<1	<1
12T5	3.00	5.3	<1	<1
12T5	4.00	<1	<1	<1
12T6	0.50	11.9	<1	<1
12T6	1.00	13.2	<1	<1
12T6	2.00	3.7	4.9	<1
12T6	3.00	4.3	<1	<1
12T6	4.00	2.4	1.8	<1
12T7	0.50	<1	<1	<1
12T7	1.00	30.4	1.4	<1
12T7	2.00	<1	<1	<1
12T7	3.00	1	<1	<1

Groundwater

Upgradient Samples to set control levels to measure deterioration

Determinant	Total Phenols	Nitrate Nitrogen	B.O.D	Ammonium Nitrogen
Units	mg/l	mg/l	mg/l	mg/l
Location				
12B1	<1	1.3	1.5	36.3

Downgradient Samples to identify breaches of storage of potentially polluting substances

Determinant	Total Phenols	Nitrate Nitrogen	B.O.D	Ammonium Nitrogen
Units	mg/l	mg/l	mg/l	mg/l
Location				
12B2	<0.1	<0.1	30.6	23
12B3	1.2	1.3	5.1	23

Appendix G
Monitoring Infrastructure Checklist

Monitoring Checklist		
Site Name: Teesside	Site Operator: Teesside Cast Products	**Sheet 1 of 1**
Environment Agency Permit Number: BK0493	Date:	Borehole

Item	**Description**	**Yes**	**No**	**Comments**
1.	Is the borehole still accessible for monitoring?			
2.	Has the height of the headworks above ground level changed?			
3.	Is the padlock on the borehole cover in place and locked?			
4.	Is there any damage to the headworks, surface seal, pipework etc?			
6.	Has the depth to the base of the borehole significantly decreased, possibly due to silting or blockage? (Record depth on the Water Level Record form)			
7.	Is the waterra tubing or foot valve damaged?			
8.	Is the pipework damaged or blocked?			

Instruction:

- The checklist should be completed during each monitoring visit, with date recorded.
- Where there is found to be a deficit in the monitoring infrastructure this should be recorded andrecommendations for remedial action made.
- Where there is found to be a deficit in the monitoring infrastructure this should be communicated to the Competent Person.

Appendix H8: Design of a Site Protection and Monitoring Programme for Cleveland Works, Teesside

25th October 2004

Our Ref: E7129.19-081004-R1.1-Cleveland SPMP.doc

DESIGN OF A SITE PROTECTION AND MONITORING PROGRAMME FOR CLEVELAND WORKS, TEESSIDE, CORUS UK LTD.

Requiring reference data to be collected.

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Corus Group plc
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25 October 2004

Summary

Liddle, K.E

This document represents the design Site Protection and Monitoring Programme (SPMP) for Cleveland Works, Teesside submitted to the Environment Agency (the "Agency") in pursuance of Condition 4.1.7 of Permit No.BK0493 (the "Permit") authorising the operation of Teesside Integrated Iron and Steelworks (the "installation"). The SPMP for Lackenby and Redcar will subsequently be submitted to the Agency within 4 months and 6 months of issue of the Permit as in accordance with Condition 4.1.7.

The design document for Cleveland Works is required by Condition 4.1.7 to be submitted to the Agency within 2 months of the date of issue of the Permit.

An intrusive investigation is required to be undertaken to characterise substances identified as being potentially present in, on or under the ground in the Supplementary Application Site Report (the "ASR") submitted to the Agency on 9th March 2004. This document also contains the scope of those investigations to collect Reference Data and should be read in conjunction with the Supplementary ASR for the installation.

The proposal for the location, nature, frequency, sampling and analysis of the Environmental Monitoring Plan for Cleveland Works shall be submitted to the Agency within the timeframe set for reporting Reference Data. This will allow the most appropriate monitoring programme to be designed based on the results of the intrusive investigation.

The Infrastructure Monitoring plan already in place through the SMS, EMS and COMAH will continue throughout the life of the Permit and will be reviewed in light of any modifications or changes to infrastructure, working practices or any guidance/statutory requirement.

1. Introduction

The assessment of Cleveland Works have been undertaken by Miss Katherine Liddle, Geo-environmental Engineer at Corus's Research Development & Technology Centre in Rotherham on behalf of Mrs Philippa Forster, Environment Manager at Teesside Works.

1.1. Site Location

The installation is located at Teesside Integrated Iron and Steelworks, Corus UK Ltd, Redcar, Cleveland TS10 5QW. The centre of the site is at National Grid Reference NZ 5400 2240. The site can be seen in Figures A1.1 to A1.4 of Appendix A1.

1.2. Details of Installation

Cleveland works is occupied by South Bank Coke Ovens, South Bank Oil Tank Farm, the Solid and Liquids Environmental Management System (SLEMS) and the slag handling plant operated by Heckett Multiserv. Operations conducted within the four areas are further detailed below.

1.2.1 Area 1 South Bank Coke Ovens

South Bank Coke Ovens (SBCO) produces in the order of 10,000 to 17,000 tonnes per week of wet wharf coke for use at Redcar Blast Furnace, elsewhere within Corus or is sold to third parties. SBCO comprises of two coke oven batteries and associated gas collection and By-product recovery plant. Other structures include coal handling and importing, cooling water towers, silica brick shed, garage, wagon repair shop, engineering workshops and offices.

Coal is prepared and blended at Redcar site, then transported to South Bank and charged into the oven where it is heated in the absence of air. After the time required to convert the coal to coke, the oven doors are removed, and the hot coke is pushed out of the oven into the coke car, which then transports it to the quencher where it is quenched with water.

In the conversion of coal to coke, gases are given off which are collected, cleaned in the By-product plant and the clean gas exported and used as a fuel by the coke ovens or other users. The solid and liquid by products are either sold for further processing, recycled or disposed of as waste.

The plant can be split into four discrete areas of operation; Coal Handling & Charging, Carbonisation including Coke Quenching, Coke Handling, and Gas Cleaning and By-product Recovery. For further details the reader is directed to Section B2.3.3 of the PPC Application (Ref. 2).

Since the 1950's continued improvement in operation, training of the work force, a drastic change in maintenance theory and principles and a recent capital investment has seen a marked improvement in the amount and frequency of controlled and uncontrolled releases and emissions. The coal handling area of SBCO has also been redesigned and re-sited completely over the last few years with a marked reduction in environmental impact.

1.2.2 Area 2 South Bank Oil Tank Farm

The Cleveland Oil Installation is situated on the south bank of the River Tees. The installation comprises a jetty with the facility for discharging fuel oil from ships of up to approximately 30,000 tonnes capacity, five 10,000 tonne capacity oil storage tanks located within a single bund, a pumphouse for oil distribution and loading of tankers, and two package boilers to provide steam for tank heating and pipeline tracing. For further details the reader is directed to Section B2.3.1 of the PPC Application (Ref. 2).

1.2.3 Area 3b Solid and Liquids Environmental Management System (SLEMS)

The SLEMS consists of a number of sections of open channels and lagoons, which allow solids in the streams that feed the SLEMS to deposit out of suspension prior to discharge from the Installation. The water lagoons were originally natural streams that discharged into the Tees and consequently the water level in the area varies with the weather and the tide. Levels of solids entering the site are also variable as silt, debris and sewage enters the Installation and passes into the SLEMS after being culverted under the Installation from outside the Works. The lagoons are periodically dredged, the dredgings dried and landfilled.

The SLEMS is used for Iron and Steel slurries and dusts drying prior to sale or landfill and final polishing of Lackenby and Cleveland effluent prior to discharge from C3 outfall. For further details the reader is directed to Section B2.3.24 of the PPC Application (Ref. 2).

1.2.4 Area 4 Heckett Multiserv Operations

The slag handling plant is operated by Heckett Multiserv where steelmaking slag and refractories are de-metaled for sale.

2. Objectives

Within the Supplementary ASR (Ref. 1) an assessment of the pollution prevention measures was made for each location where potentially polluting substances were identified to be stored or used. This assessment was undertaken in accordance with the Agency's Technical Guidance Note IPPC H7 (Ref. 3) and as agreed with the Agency on 13th November 2003. The assessment was made by Miss Katherine Liddle, Geo-environmental Engineer at Corus's Research Development & Technology Centre in Rotherham and the results of this work are shown in Tables A4.1 to A4.4 in the Supplementary ASR (Ref. 1).

The conclusion of this assessment was accepted by the Agency on issuing PPC Permit No. BK0493 to Corus UK Ltd for Teesside Integrated Iron and Steelworks on the 19th August 2004. The conclusion of the assessment and subsequent focus of the proposed SPMP for Cleveland Works is summarised below.

Area 1 South Bank Coke Ovens

For all relevant activities at the installation there is little likelihood that land pollution or leaks to the land will occur during the future life of the installation. It is concluded that reference data for Area 1 does not need to be collected.

Area 2 South Bank Oil Tank Farm

The assessment identified one relevant activity where there is a reasonable possibility that there is or will be current or future pollution of the land from the installation. Reference Data will be collected and reported for source S3 the 5 x 100,000 litre capacity heavy fuel oil tanks located at NZ 5370 2250.

Under a strategic review to assess compliance with The Control of Pollution (Oil storage) (England) Regulations 2001 by mid 2005, it has been estimated that the cost to install an appropriate bund will be in the region of £3 million. The option is therefore not available to improve the bund within the timescale available to meet the requirements of Technical Guidance Note IPPC H7 (Ref. 3). Consequently it is proposed to collect Reference Data until the future direction of South Bank Oil Tank Farm has been decided.

Area 3b Solid and Liquids Environmental Management System (SLEMS)

The assessment identified two relevant activities where there is a reasonable possibility that there is or will be current or future pollution of the land from the installation. It was requested that the requirement to collect Reference Data was discussed with the Environment Agency for source S4 the Settling Ponds and Drying Bays located at NZ 5490 2248, and the Oil Mop House located at NZ 5525 2218. A considered proposal is provided within the following sections.

Area 4 Heckett Multiserv Operations

For all relevant activities at the installation there is little likelihood that land pollution or leaks to the land will occur during the future life of the installation. It is concluded that reference data for Area 4 does not need to be collected.

Subsequently the objectives of this report are:

1. To design investigations to collect Reference Data for Area 2 and 3b of Cleveland Works by:
    - obtaining sufficient information with respect to the site to allow the refinement of the conceptual model of the site and its surroundings, and
    - designing a robust and adequate intrusive investigation, which would allow the collection of Reference Data for the Cleveland Works.
2. To consider a monitoring programme for Cleveland Works to:
    - monitor the effectiveness of pollution prevention infrastructure and provide early warning of any release of polluting substances to ground and groundwater.
3. To review and if necessary amend the inspection, testing and maintenance programme for pollution prevention infrastructure at Cleveland Works to ensure their continued integrity.

3. Intrusive Investigations

The objectives of the intrusive investigation are:

- to collect data to reduce the uncertainties in the conceptual model presented within the Supplementary Phase I Report (Ref. 4) submitted to the Agency on 31st March 2003, and

- to collect sufficient data on the potentially polluting activities identified in Tables A4.2 and A4.3 of Appendix A4 of the Supplementary ASR in order to set Reference Data for Areas 2 and 3b for Cleveland Works.

These tables are reproduced as Tables A2.1 and A2.2 within Appendix A2 of this report.

3.1. Investigation and Sampling Strategy

3.1.1 General

Due to the size and complexity of the site the requirement to produce an SPMP has been staggered across the three geographical areas of Teesside Works; Cleveland Works, Lackenby Works and Redcar Works. This has allowed adequate time to review the potential sources of emissions identified in the Supplementary ASR and consider the practical and financial aspects of improving the pollution prevention measures within the timeframe for the provision of Reference Data. Where this has not proved possible the conceptual site model for each area has been reviewed together with the source characteristics to design an intrusive investigation to:

- characterise the potential pollutant distribution,
- resolve any uncertainties in the conceptual site model, and
- collect Reference Data for soil and water.

To control the costs of mobilisation, the intrusive investigation will be timed to collectively meet the objectives outlined within the three SPMPs for Cleveland Works, Lackenby Works and Redcar Works. In addition, monitoring instruments will be installed in all boreholes for the future assessment of land condition at Permit surrender.

The site investigation will commence with a walkover, agreement and preliminary mark up of exploratory points with a Corus Health & Safety advisor familiar with the operational area. The site investigation will comprise of intrusive sampling using a tracked excavator for trial pitting and a cable percussive drilling rig for installation of boreholes. The site investigation will be awarded to a Corus approved contractor, with all personnel working on site attending a site induction. A member of the Teesside Environment Department will manage the contractor on site, with technical supervision provided by a member of the land quality group at Corus RD&T, Rotherham.

Soil and groundwater samples collected will be sent for chemical analysis at an external UKCAS accredited laboratory that complies with the Agency’s Monitoring Certification Scheme (MCERTS).

In summary the site investigation for Cleveland Works will comprise:

Area 2 South Bank Oil Tank Farm:

- 2 trial pits, and
- 1 borehole with a combined gas and groundwater monitoring instrument.

Area 3b Solid and Liquid Effluent Management System:

- 2 trial pits, and
- 4 boreholes with combined gas and groundwater monitoring instruments.

3.1.2 Constraints on Investigations

As an operational site there were a number of Health and Safety considerations that limit the location of the exploratory points within Area 2 South Bank Oil Tank Farm and Area 3b SLEMS. The general and specific issues are summarised below:

General:

- accessibility to the drilling rig and excavator in areas of very rough ground, steep slopes and areas constrained by height or width,
- avoidance of underground services (gas, electricity, telephone and drainage),
- avoidance of above ground services (gas, electricity and telephone), and
- avoidance of heavy traffic areas and mobile tools including rail lines.

Area 2 South Bank Oil Tank Farm:

- designated ‘intrinsically safe’. No task that may create static, sparks or flames can be conducted within or close to an ‘intrinsically safe’ area, and
- the high pressure gas mains and electricity services running below and above ground.

Area 3b SLEMS:

- working on banks adjacent to deep open water channels.

All method statements and health and safety risk assessments are to be approved by Corus and contractor personnel prior to commencement of the work. Risk assessments and method statements will be produced for all work carried out on site and can be available for review on request.

3.1.3 Soil Investigation and Sampling Techniques and Protocols

Cable percussion (shell and auger) is the most cost effective technique for the installation of shallow boreholes through the made ground and into the underlying drift deposits. It is not considered necessary to extend the boreholes to rockhead, which can be at significant depth due to the thickness of made ground. Previous experience of borehole installation through the dense slag across the works has required preliminary excavation with a 20 tonne excavator to loosen the ground. Trial pits will therefore be excavated at each borehole location.

Boreholes will provide:

- confirmation of the geological strata within the CSM,
- samples from depths greater than 4m (nominal extent of trial pitting) to provide Reference Data from the likely zone of vertical influence from the storage of potentially polluting substances,
- groundwater monitoring instrumentation to be installed to confirm the groundwater regime of the CSM and provide Reference Data for water quality, and
- a barrier to preferential pathways for migration of pollution by advancing the borehole through steel casing.

Due to the constraints discussed in section 3.1.2 trial pits will require excavation by a 20 tonne tracked excavator to a maximum depth of 4m. Hydraulic hammers (‘pecker’) may be required to break out hard ground at the surface or obstructions encountered during excavation, with the arisings returned in the same order as encountered to prevent contamination.

Trial pits will provide:

- detailed examination of ground conditions over a large area in three dimensions to confirm the geological strata within the CSM, and
- discrete and bulk samples to provide Reference Data from the likely zone of vertical and horizontal influence from the storage of potentially polluting substances.

Intrusive investigation and sampling by cable percussive and trial pit techniques will be performed in accordance with BS 5930:1999 (Ref. 5) and BS 10175:2001(Ref. 6). In addition, cable percussive operatives will have British Drilling Association accreditation and all materials encountered shall be logged against depth in accordance with BS 5930:1999 by an experienced Engineer/Geologist/Environmental Scientist. Standard operating procedures for cable percussive and trial pit techniques are reproduced within Appendix B1.

At each location the presence of any visual and/or olfactory contamination will be noted. Sample selection will be made on this basis and also on the depth of the investigation and the nature of the strata. Samples will be taken using stainless steel sampling equipment and clean nitrile/disposable gloves at each location. All sampling equipment is to be cleaned between each location to minimise possible cross contamination. A minimum of two sets of samples, comprising 1 x 500g plastic tub, 1 x 500g amber glass jar and 1 x 125g amber glass jar, will be taken per exploratory point, labelled to identify the nature, depth, date and sample ID, and a full chain of custody established prior to collection at site by the contracted external chemical laboratory.

3.1.4 Groundwater Investigation and Sampling Techniques and Protocols

Groundwater monitoring wells will be installed in each borehole to a maximum depth of 10m depending on the ground conditions encountered. During borehole completion, care should be taken to ensure that vertical contaminant pathways are not created between the various strata penetrated. This shall be achieved where necessary by the use of bentonite seals in the boreholes. Where contamination is encountered drilling equipment shall be pressure washed to minimise possible cross contamination. Installation of groundwater monitoring instruments shall be conducted in accordance with BS 5930:1999 (Ref. 5) and BS 10175:2001 (Ref. 6). All materials shall be approved prior to installation.

Groundwater sampling shall be undertaken upon completion of drilling works. At each location water levels and depth to the base of the monitoring well shall be measured and recorded. Sampling of groundwater from the boreholes is to be undertaken in accordance with BS 6068-6.11:1993 (Ref. 7), with three well volumes purged using dedicated Wattera inertial pumping equipment. The determination of successful borehole development shall be either when the pumped water is visually clear and when the field measurements of electrical conductivity and pH stabilise, or if the borehole has purged dry prior to stabilisation. Groundwater samples shall be taken using HDPE tubing dedicated to each well to prevent cross contamination between wells and to minimise the loss of volatile contaminations from water samples. At each location, one water sample shall be taken, comprising 1 x 1litre plastic bottle, 2 x 1litre amber glass bottles (for TPH and PAH) and 1 x 40ml glass vial (for VOCs). Samples will be labelled and a full chain of custody established prior to collection at site by the external chemical laboratory.

3.1.5 Soil-Gas and Vapour Investigation and Sampling Techniques and Protocols

Soil-gas and vapour analysis will not be undertaken during the site investigation period.

3.1.6 Surface Water Investigation and Sampling Techniques and Protocols

There are no surface water receptors within Area 2 or Area 3b, consequently the collection of Reference Data for surface waters does not form part of the SPMP for Cleveland Works.

3.1.7 Infrastructure Investigations and Sampling Techniques and Protocols

The requirement to collect Reference Data stems from the lack of pollution prevention controls at the identified sources of potential contamination. As such it is not necessary to recommend infrastructure investigations as part of the SPMP for Cleveland Works.

3.2. Sampling Locations

Sample locations were chosen with reference to the sources, pathways and receptors identified within the conceptual model for the site detailed with the Supplementary Phase I Report (Ref. 4) and Supplementary ASR (Ref. 1).

Sample locations will be surveyed to the local Ordnance Survey grid and have a horizontal and vertical accuracy of better than 1m.

Sample locations for Area 2 South Bank Oil Tank Farm and Area 3b SLEMS are shown on Figures A3.1 and A3.2 respectively of Appendix A3.

Discussion of the selection, justification and design for each sample location with respect to individual zones for the site are given in the following sections.

Sampling locations were based on a system denoting which area the sample was located, the type of sampling location and the number. These numbered areas correlate to the PPC operational areas used within the Supplementary Phase I Report (Ref. 4) and Supplementary ASR (Ref. 1).

A single letter is used to denote the sampling type e.g. trial pit (T), borehole (B). Numbers were then used to identify each sampling location within an area. A trial pit soil sample taken from Area 2 South Bank Oil Tank Farm, trial pit number 4 would thus appear as 2T4.

3.2.1 Area 2 South Bank Oil Tank Farm

The sample locations for Area 2 are shown on Figure A3.1 of Appendix A3.

Sampling locations were selected to:

- provide targeted sampling to collect Reference Data for source S3 the 5 x 100,000 litre capacity heavy fuel oil tanks located at NZ 5370 2250, and

- confirm the ground and groundwater aspect within the conceptual site model.

Sample Location 2T1 and 2T2

Sample locations 2T1 and 2T2 are located down gradient between the heavy fuel oil storage area (source) and the River Tees (receptor). The sample locations shall be investigated using a mechanical excavator to a maximum of 4m depth below ground level (bgl). Details of the investigation technique are included in Appendix B1.

The collection of Reference Data at these locations provides an appropriate position to report the condition of land adjacent to the fuel oil source where the bund would not provide adequate containment from leaks or spills. Trial pits shall be utilised as they provide a large inspection area to identify any visual or olfactory contamination from fuel oil. A minimum of two soil samples shall taken from each location, one from the surface and one from the base.

Sample Location 2B1

Sample location 2B1 is also located down gradient between the potential source and receptor. The sample location shall be investigated by advancing a borehole through the made ground to 10m depth. Details of the investigation technique are included in Appendix B1.

The sampling location point aims to provide an appropriate position to report the condition of land and perched water adjacent to the fuel oil source where the bund would not provide adequate containment from leaks or spills. Due to the environmental properties of heavy fuel oil (Table A1.2 Ref. 1) samples shall be taken at depth during investigations. Three soil samples shall be taken, with additional samples where contamination is suspected. In addition a combined gas and groundwater monitoring instrument shall be installed to assess the levels of perched water within the made ground, to provide Reference Data for perched water and to provide further assessment during Permit surrender. One water sample shall be collected.

3.2.2 Area 3b Solid and Liquids Environmental Management System (SLEMS)

The sample locations for Area 3b are shown on Figure A3.2 of Appendix A3.

Sampling locations were selected to:

- provide targeted sampling to collect Reference Data for source S4 the Settling Ponds and Drying Bays located at NZ 5490 2248 and the Oil Mop House located at NZ 5525 2218, and

- confirm the ground and groundwater aspect within the conceptual site model.

Sample Location 3T1 and 3T2

Sample locations 3T1 and 3T2 are located within the main drying and loading area central to the SLEMS and the drying bed adjacent to the Cleveland Silt Settling Pond. Both drying areas accept the settled out suspended solids that are dredged from the channels. The sample locations shall be investigated using a mechanical excavator to a maximum of 4m depth bgl. Details of the investigation technique are included in Appendix B1.

The collection of Reference Data at these locations provides an appropriate position to report the condition of land at the location of the suspended solid drying beds where no pollution prevention measures are in place. Trial pits shall be utilised as they provide a large inspection area to identify any visual or olfactory surface contamination. A minimum of two soil samples shall be taken at each location, with additional samples where contamination is suspected.

Sample Location 3B1 and 3B2

Sample locations 3B1 and 3B2 are also located within the main drying and loading area central to the SLEMS and the drying bed adjacent to the Cleveland Silt Settling Pond. The sample locations shall be investigated by advancing boreholes through the made ground to prove the natural clay beneath the site expected to be at approximately 5m depth bgl. Details of the investigation technique are included in Appendix B1.

The sampling location points aim to provide an appropriate position to report the condition of land and perched water at the location of the suspended solid drying beds where no pollution prevention measures are in place. Three soil samples shall be taken at each location, with additional samples where contamination is suspected. In addition a combined gas and groundwater monitoring instrument shall be installed to assess the level of perched water within the made ground, to provide Reference Data for perched water and to provide further assessment during Permit surrender. One water sample shall be collected from each borehole.

Sample Location 3B3

Sample location 3B3 is located adjacent to the Settling Ponds that accept BOS Slurry from Lackenby and which is subsequently combined with BOS abatement dusts and dried hydrocyclone material from Redcar Blast Furnace. The sample location shall be investigated by advancing a borehole through the made ground to prove the natural clay beneath the site expected to be at approximately 5m depth bgl. Details of the investigation technique are included in Appendix B1.

The sampling location point aims to provide an appropriate position to report the condition of land and perched water adjacent to the Settling Ponds where no pollution prevention measures are in place. Three soil samples shall be taken, with additional samples where contamination is suspected. In addition a combined gas and groundwater monitoring instrument shall be installed to assess the level of perched water within the made ground, to provide Reference Data for perched water and to provide further assessment during Permit surrender. One water sample shall be collected.

Sample Location 3B4

Sample location 3B4 is located adjacent to the Oil Mop House oil storage tank and the Redcar Blast Furnace hydrocyclone drying beds. The sample location shall be investigated by advancing a borehole through the made ground to prove the natural clay beneath the site expected to be at approximately 5m depth bgl. Details of the investigation technique are included in Appendix B1.

The collection of Reference Data at this location provides an appropriate position to report the condition of land and perched water adjacent to the hydrocyclone drying beds and the oil storage tank where appropriate pollution prevention measures are not in place. Two soil samples shall be taken, with additional samples where contamination is suspected. In addition a combined gas and groundwater monitoring instrument shall be installed to assess the level of perched water within the made ground, to provide Reference Data for perched water and to provide further assessment during Permit surrender. One water sample shall be collected.

3.3. Analytical Strategy

3.3.1 Justification of Analytical Suites

The analytical suites for each Area (or Zone) was chosen by reviewing Tables A2.1 and A2.2 of Appendix A2 and are shown in Table C1 of Appendix C1.

3.3.2 Justification of Analytical / Field Technique and Detection Limits

The laboratory analytical technique for each analysis is referenced in Table C1 of Appendix C1.

Detection limits for each analytical technique is shown in Table C1 of Appendix C1.

The chose of technique for a particular substance in a particular phase was taken based on the expertise of a chemical laboratory commonly employed by Corus. The detection limit of a substance using that technique is as required for the environmental assessment against relevant guideline values e.g. CLEA, UK Drinking Water Standards.

3.3.3 Laboratory Accreditation / Quality Assurance and Quality Control

3.3.3.1 Laboratory Accreditation

Table C1 of Appendix C1 details which analytical techniques are UKAS Accredited. The external laboratory's quality assurance procedures for the individual techniques undertaken outside UKAS accreditation shall be reproduced and submitted with the results of the Reference Data.

3.3.3.2 Quality Control

Quality control is expected from the external chemical laboratory contracted to undertake all analysis of soil and water samples. This is not just required to ensure a robust CSM, but is also a prerequisite in approval of third party contractors. The analytical quality assurance and quality control plan expected of a contracted laboratory is reproduced below.

The laboratory's confidence in the quality of the data produced should be supported by the preparation and analysis of a range of analytical quality control (AQC) samples with each batch of unknown samples. These AQC samples shall be drawn from the following sources depending upon the type of matrix and nature of the analysis being performed:

- Certified Reference Materials.
- Secondary reference materials produced In-House.
- Replicate testing.
- Blank Spikes.
- Matrix Spikes.
- Blank Samples.
- Surrogate recoveries.

QC samples will normally be required for analysis at the rate of 1 in every batch of twenty unknown samples.

The data obtained from the analysis of the associated AQC samples should be examined by a Senior Analyst and released only where the results are within acceptable limits. AQC data should also be examined for adverse trends.

The QC regime is to be applied to all routine analyses regardless of their accredited status.

At an instrument level performance is to be verified by the use of :

- Instrument Blanks
- Continuing calibration checks
- Independent calibration verification samples
- System suitability checks

4. Monitoring Programme

4.1. Objectives of the Monitoring Programme

4.1.1 Objectives of Environmental Monitoring Programme

The requirement for on-going environmental monitoring is only considered relevant for those areas of Cleveland Works where the collection of Reference Data is warranted due to the assessment that there is “a reasonable possibility of current or future pollution of the land from the installation”. This requirement is further confined to potentially polluting activities as identified in Tables A2.1 and A2.2 of Appendix A2.

The application of an Environmental Monitoring Programme for Cleveland Works is therefore only considered applicable to:

- Area 2 South Bank Oil Tank Farm
  - Source S3 5 x 100,000 litre capacity heavy fuel oil tanks located at NZ 5370 2250.

- Area 3b Solid and Liquids Environmental Management System:
  - Source S4 the Drying Bays and Settling Ponds located at NZ 5490 2248, and
  - The oil storage tank within the Oil Mop House located below ground at NZ 5525 2218.

The requirement for environmental monitoring is only necessary whilst the pollution prevention controls and/or management controls are insufficient to conclude that there is “little likelihood that pollution or leaks to land will occur during the future life of the installation”. Beyond this, implementation of the Infrastructure Monitoring Programme is considered sufficient. Consequently the SPMP does not propose to undertake environmental monitoring for Source S3 in Area 2 South Bank Oil Tank Farm on the provision that an appropriate bund will be in place or alternative action will have been taken during 2005 to comply with the Oil Storage Regulations. However, if Reference Data indicates that short term environmental monitoring is prudent until this time, it will be proposed with the submission of the Reference Data to the Agency.

Though it is considered likely that an Environmental Monitoring Programme will be required for Area 3b, it is proposed that its objectives and design are specified after Reference Data has been collected, reviewed and the CSM updated. If at this time a programme of continued monitoring is necessary it will be proposed with the submission of Reference Data to the Agency. This will ensure that the most appropriate programme of continued monitoring is employed.

4.1.2 Objectives of Infrastructure Monitoring Programme

The purpose of the Infrastructure Monitoring Programme is to demonstrate the effectiveness of pollution prevention measures at the installation throughout the life of the Permit. This occurs through a process of planned inspection, testing and maintenance of infrastructure.

4.2 Environmental Monitoring Infrastructure

The proposal for the location, nature, frequency, sampling and analysis of the environmental monitoring plan for Cleveland Works shall be submitted to the Agency within the timeframe set for reporting Reference Data. This will allow the most appropriate monitoring programme to be designed based on the results of the intrusive investigation.

4.3 Infrastructure Monitoring Programme

The existing inspection, testing and maintenance of pollution prevention infrastructure programme meets the objectives identified within Section 4.1.2 above and thus there are no changes to the EMS programme for the installation summarised within the Permit Application (Ref. 2).

There are three fully documented systems implemented within the Teesside Installation designed to identify hazards and prevent accidents, which may have environmental consequences and to limit those consequences.

These systems are:

1. A Safety Management System (SMS)
2. An Environmental Management System (EMS)
3. The Control Of Major Hazards Regulations 1999 (COMAH)

4.3.1 Safety Management System (SMS)

The SMS implemented at Teesside Installation represents an integrated and comprehensive approach to safety and environmental management, which is applicable to all aspects of the manufacturing, operational, maintenance, design and construction activities undertaken within the Installation. The overall objective of the system is to systematically identify hazards and eliminate or control, risks to people to acceptable levels and at the same time take into consideration environmental issues. The SMS includes the completion and use of risk assessments and safe working procedures for both day to day tasks and unfamiliar tasks. Those found to be significant are formally written down and subsequently monitored to ensure procedures are followed correctly.

Prior to substances being brought on to the site their hazards are assessed and stored within a product safety database. Substances are assessed internally and assigned a hazard classification 1,2 or 3, where 3 is the highest classification. Company policy requires that where possible grade 3 substances are substituted by lower grade substances.

4.3.2 Environmental Management System (EMS)

The international standard ISO14001 requires that the business identifies those operations or activities that are associated with significant Aspects in line with its policy, objectives and targets. Having undertaken this evaluation, operational procedures are identified or where necessary developed:

- to control and verify all processes and activities which if uncontrolled, could have a significant impact on the environment.
- to cover situations where the lack of procedures could lead to deviations from environmental policy and objectives and targets.
- to cover goods and services used by the business.

ISO14001 requires that procedures are in place to identify the potential for and the action to be taken in the case of accidents and emergency situations having an impact on the environment. The Environmental Management System developed at the Teesside Installation either contains relevant procedures or signposts the procedures/incident plans located elsewhere within the overall management system.

The types of procedures/plans include:

- Site Major Incident Plan;
- Plant Disaster Plans;
- Emergency Procedures for Oil Spills;
- Bund Wall Inspection;
- Oil and Grease Control;
- Waste Management Guidelines;
- Suppliers and Contractors Environmental Policy.

An EMS operating to ISO14001 requires procedures to investigate and evaluate environmental Aspects of the Company's operations in order for it to determine those that have, or can have, significant impacts on the environment. Furthermore these significant Aspects should be considered when setting environmental objectives and the information kept up to date. An 'environmental Aspect' is defined in ISO14001 as 'element of an organisations activities, products or services that can interact with the environment'. An 'environmental impact' is defined as 'any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisations activities, products or services'.

The Aspects selected are both direct and indirect being derived from consideration of normal operating conditions, shut down, start up and those realistic potential significant impacts associated with abnormal or emergency situations. An Aspect can be an area of the Site, a piece of plant, an activity, a product, a by-product, raw materials, waste materials or other local or environmental issues or impacts.

Subsequently specific operating procedures have been produced to deal with accident situations. For example with materials handling operations, environmental control procedures detail actions to be taken in the event of material lift-off from the process. Each plant has oil pollution control procedures, outlining the steps to follow in the event of an oil spillage. In addition, to ensure that control is maintained in emergency situations process design alarms, trips and other control aspects are installed at sensitive locations.

Procedures are also in place for:

- ensuring there is adequate storage for raw materials, products and wastes;
- checking of raw materials and wastes to ensure compatibility with other substances with which they may accidentally come into contact;
- provision of preventative techniques, such as suitable barriers to prevent damage to equipment as a result of the movement of vehicles;
- provision of appropriate containment e.g. bunds, catch pits and building containment;
- ensuring that the composition of the contents of a bund or sump are checked before recycling or disposal;
- prevention of overfilling of storage tanks;
- provision of adequate standby plant, with maintenance and testing to the same standards as the main plant.

All information on the above is kept in the Environmental Management System database.

The EMS puts in place the requirement to:

- identify items of plant or equipment that may contain and/or transport substances, which if released may lead to pollution of the land i.e. primary containment such as tanks, pipes,

- identify plant, equipment and infrastructure that are intended to prevent pollutants being released to land when there has been a loss of containment i.e. secondary containment such as bunds or catch pits,

- identify protective devices designed to bring failure of pollution prevention techniques to the attention of the Operator to shut sown equipment in the event of failure or to relieve the impact of abnormal operations i.e. alarms, automatic shut offs,

- identify other techniques relied on to prevent a loss of containment of substances that may lead to pollution i.e. accident responses, off loading proceedings.

Integrity testing is undertaken on tanks, bunds and pipelines as prescribed by TEMS – Total Engineering and Maintenance System, which forms part of the EMS. TEMS is a computer-assisted system that notifies the appropriate persons when engineering works or maintenance is required in line with statutory and mandatory requirements. Additionally a Bund Register has been established which identifies the location and inspection routine for each bund.

4.3.3 COMAH

Teesside Site is also a top tier COMAH site. An establishment report was submitted to the competent authority in February 2002. The report covers the major accident scenarios that have the potential to occur within Teesside installation.

With respect to the environment the following are included within the overall COMAH system:

1. Ensuring environmental hazards are identified and understood.
2. Ensuring equipment is fit for purpose including environmental control equipment.
3. Ensuring environmental control systems and procedures maintain integrity.
4. Ensuring staff are environmentally aware.
5. Ensuring adequate environmental procedures in the case of emergencies.
6. Ensuring performance is monitored, audited and reviewed.
7. Measures for reducing the risks of environmental accidents are also included.

Within the COMAH Regulations there is a requirement for emergency planning. Considering the potentially hazardous nature of the processes, ‘major incident plans’ have been required for many years, but have been developed to meet the additional regulations.

The site emergency plan not only address the requirements for localised on-site incidents but also for on-site incidents which may impact on the local community or neighbouring industries together with off-site incidents which may impact on the installation.

Communication routes are established with relevant authorities (Local authority, Environment Agency, Tees and Hartlepool Port Authority, INCA and Tees Valley Wildlife Trust) and emergency services both before and in the event of an incident. Post accident procedures include consultation with ecology conservation bodies for the assessment of harm and steps needed to redress this. The roles and responsibilities of persons involved in accident management have been identified and personnel training requirements have been identified and provided.

4.3.4 Continuation of Infrastructure Monitoring

The Infrastructure Monitoring plan already in place through the SMS, EMS and COMAH will continue throughout the life of the Permit and will be reviewed in light of any modifications or changes to infrastructure, working practices or any guidance/statutory requirement.

4.3.5 Personnel Issues

Personnel responsible for the inspection, testing and maintenance of pollution prevention infrastructure are trained to an appropriate level to ensure compliance with the existing Infrastructure Monitoring Programme. Roles and responsibilities for undertaking the Programme (including reporting) and ensuring adequate competence of staff are as required under the EMS.

4.4 Assessment and reporting Procedures

4.4.1 Assessment Procedure

The methods and procedures for assessing monitoring data as a result of operating the Site Protection and Monitoring Programme shall be provided as part of the Environmental Monitoring Plan on submission of the Reference Data to the Agency.

The method and procedures for infrastructure monitoring outlined within Section 4.1.2 are covered within the existing EMS.

4.4.2 Reporting Procedure

Summaries of any monitoring data required as a consequence of the Environmental Monitoring Plan to be submitted with the Reference Data to the Agency, will be sent to the Agency on the 31st of January each year along with the results of the data assessment, and any recommendations for amendments to the Monitoring Programme.

5. References

1. Supplementary Application Site Report for PPC Application Number BK0493. Teesside Works, Corus Construction and Industrial. March 2004. Liddle. K.E. Corus Research, Development& Technology.

2. Teesside Integrated Iron and Steelworks. IPPC Application BK 0493. August 2001. Corus Construction & Industrial.

3. Technical Guidance Note IPPC H7. Guidance on the Protection of Land Under the PPC Regime; Application Site Report and Site Protection and Monitoring Programme. August 2003. Environment Agency.

4. Supplementary Phase 1 Report. Site Condition Report. Corus Construction & Industrial – Teesside Installation. March 2003. Liddle. K.E. Corus Construction and Industrial.

5. British Standard 5930:1999. Code of Practice for Site Investigations.

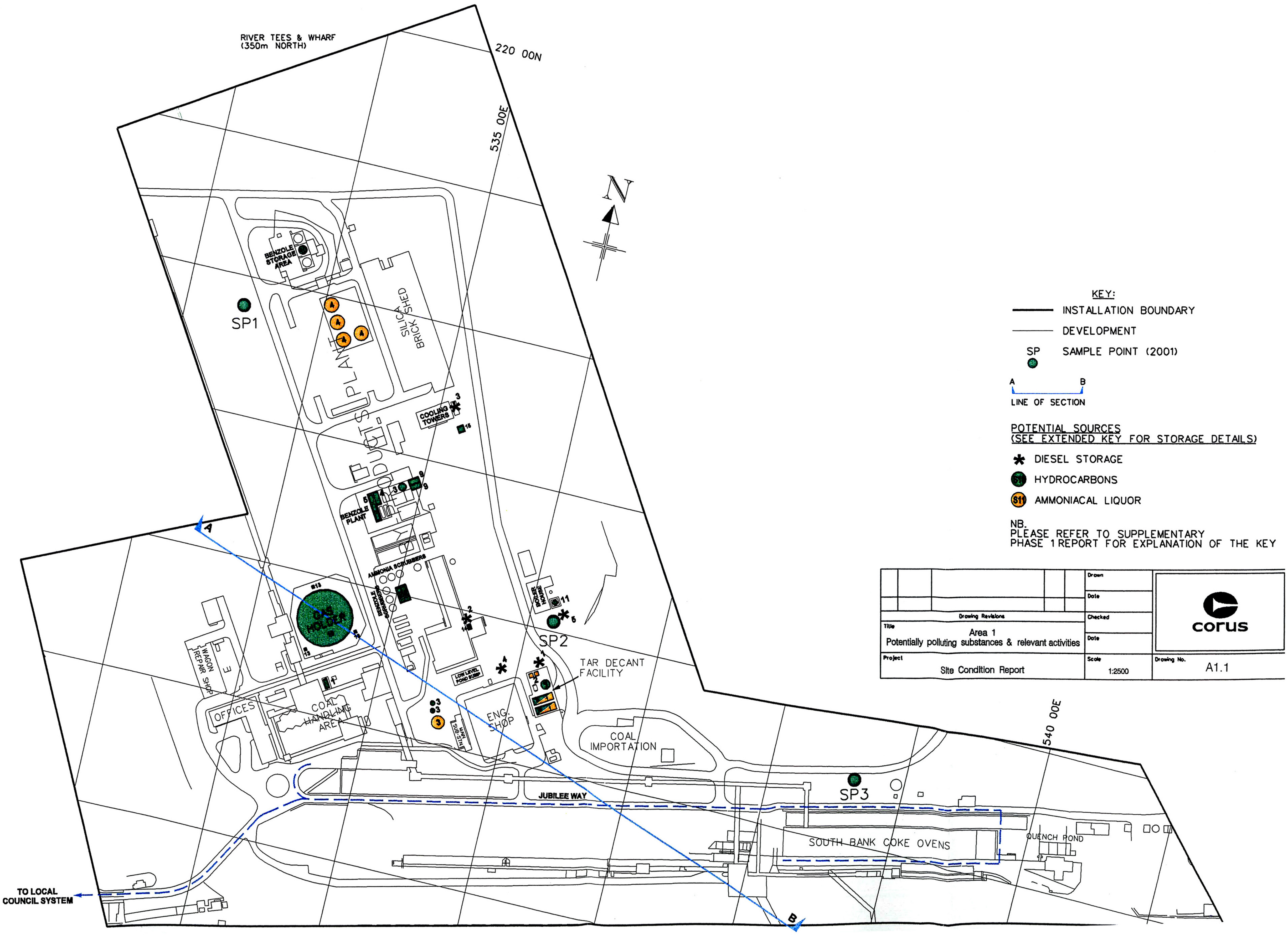
6. British Standard 10175:2001. Investigation of potentially contaminated sites – Code of Practice.

7. British Standard 6068-6.11:1993. Water Quality. Sampling. Guidance on sampling of groundwaters.

Appendix A

Figures, Plans and Tables

Contents



KEY:

━━	INSTALLATION BOUNDARY
——	DEVELOPMENT
SP ●	SAMPLE POINT (2001)
A ⌐¬ B	LINE OF SECTION

POTENTIAL SOURCES
(SEE EXTENDED KEY FOR STORAGE DETAILS)

✱	DIESEL STORAGE
●	HYDROCARBONS
S11	AMMONIACAL LIQUOR

NB.
PLEASE REFER TO SUPPLEMENTARY
PHASE 1 REPORT FOR EXPLANATION OF THE KEY

Drawing Revisions	Drawn	corus
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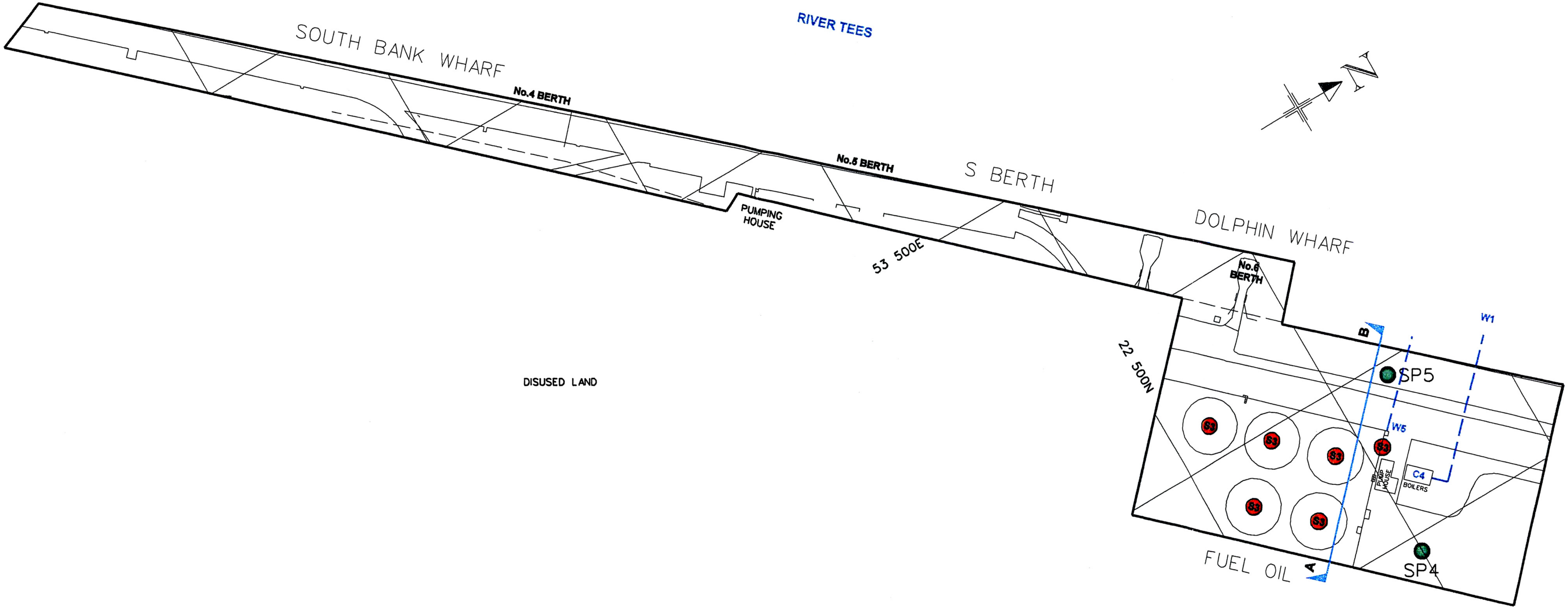
	Date	
Project Site Condition Report	Scale 1:2500	Drawing No. A1.1



POTENTIAL SOURCES

● S3 HEAVY FUEL OIL

NB.
PLEASE REFER TO SUPPLEMENTARY
PHASE 1 REPORT FOR EXPLANATION OF THE KEY

KEY:

━━	INSTALLATION BOUNDARY
──	CURRENT DEVELOPMENT
— — ·	CONSENTED DISCHARGE
SP ●	SAMPLE POINT (2001)
A └──┘ B	LINE OF SECTION

Drawing Revisions

Drawn

Date

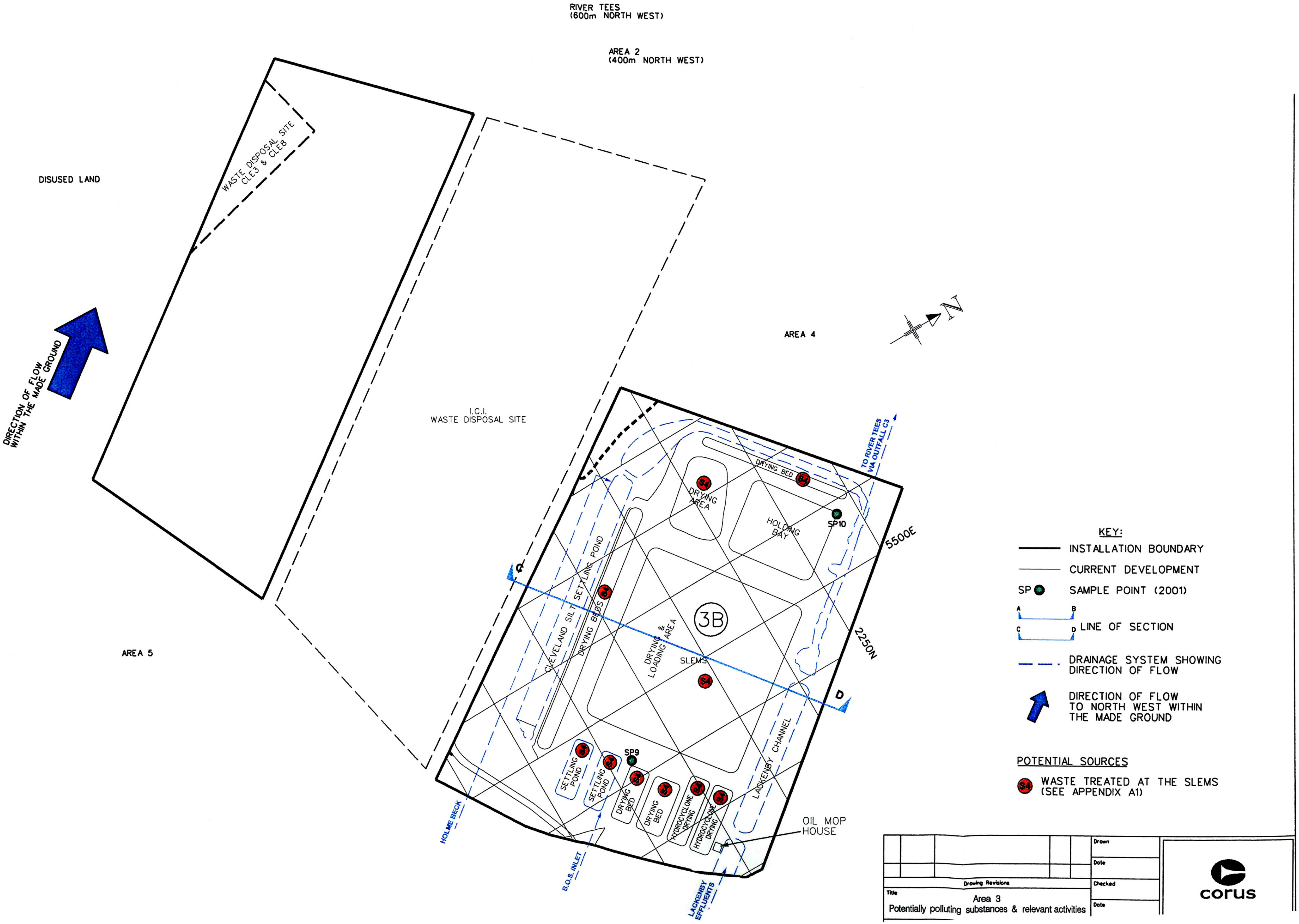
Checked

Date

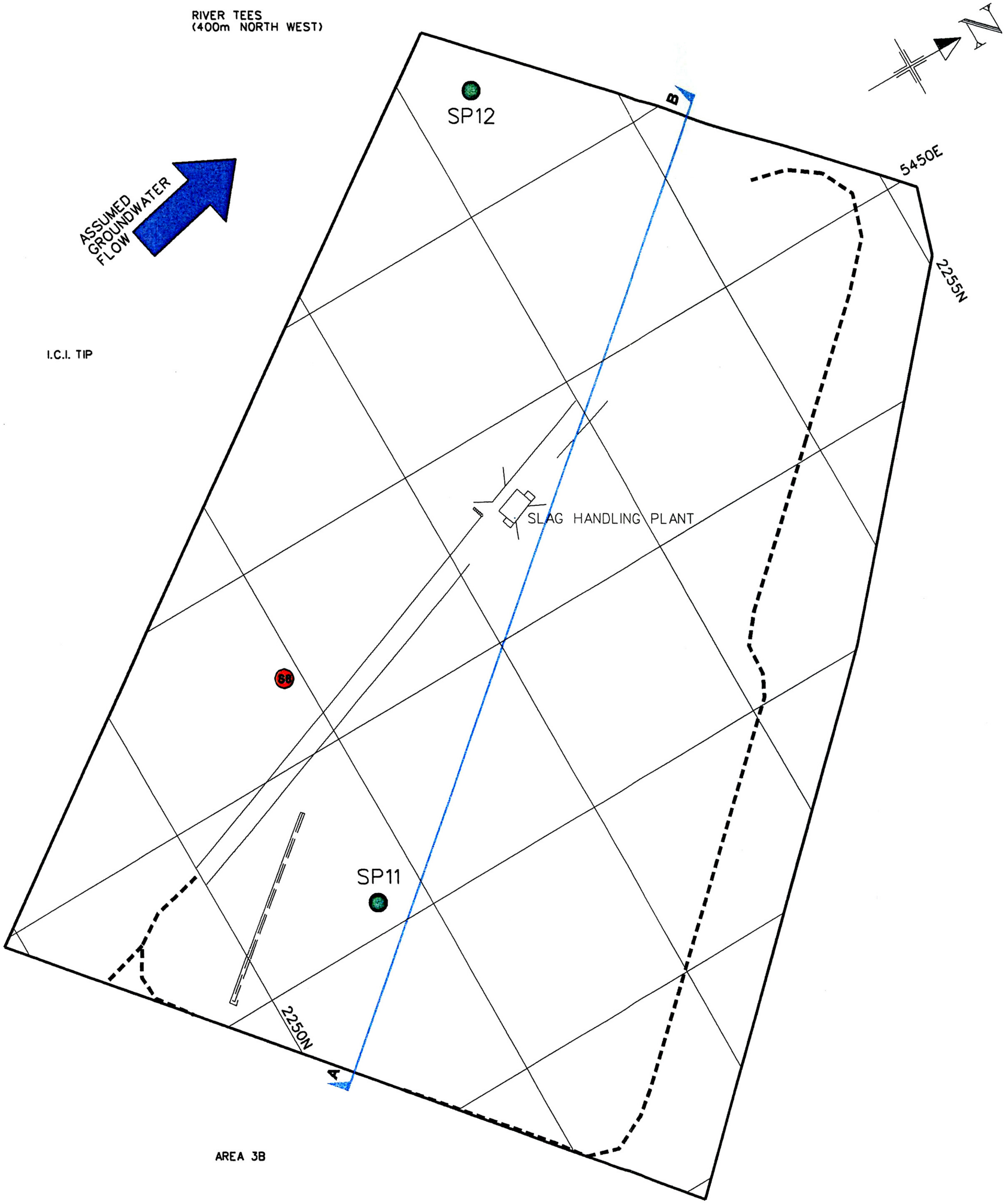
Title

Area 2
Potentially polluting substances & relevant activit

corus



Title
Area 3
Potentially polluting substances & relevant activities



KEY:

▬	INSTALLATION BOUNDARY
─	CURRENT DEVELOPMENT
SP●	SAMPLE POINT (2001)
A B	LINE OF SECTION
➚	ASSUMED DIRECTION OF GROUNDWATER FLOW TO THE NORTH WITHIN THE SANDS

POTENTIAL SOURCES

S8	KEROSENE

NB.
PLEASE REFER TO SUPPLEMENTARY
PHASE 1 REPORT FOR EXPLANTION OF KEY

Drawing Revisions

Title
Area 4
Potentially polluting substances & relevant activities

Drawn
Date
Checked
Date

corus

Source Code (see Appendix A2)	**Activity**	**Substance**	**Volume in tonnes (capacity)**	**1. Do Preventative Measures Exist?**			**2. Are Preventative Measures Adequate for Above Ground Storage Bunds?**									**Are Preventative Measures Adequate for Subsurface Structures?**		**2. Are Preventative Measures Adequate for Surfacing?** **What is its condition?**	**3. There are NO records of pollution incidents or spills?**	**4. Are there proposals to conduct integrity testing of preventative measures?**	**5. Is there an adequate documented management system?**	**Have you answered "no" to any of the five questions?**	
				Primary	**Secondary**	**Tertiary**	**The bund is impermeable and resistant to the substance stored within**	**Bund has no outlet and drains to a collection point**	**Pipework routed within bunded areas**	**Designed to catch leaks from fittings and tank**	**Bund has a capacity >110% of largest tank or 25% of total tankage**	**Contents of the bund are subject to regular visual inspection and any present are subsequently removed**	**Where the bund is not frequently inspected, it is fitted with a high-level probe and alarm as appropriate**	**Fill points are within the bund where possible, otherwise adequate containment for filling facilities are provided**	**The bund is subject to a routine programme of inspections (normally visual, extending to water testing where structural integrity is in doubt)**	**Can the location of the subsurface structure be identified?**	**Is secondary containment and/or leakage detection provided?**					**YES** **Collect Reference Data**	**NO** **Collection of Reference Data is NOT Required**
S3	Heavy Fuel Oil Storage	Heavy Fuel Oil	5 x 10,000	Tank	Concrete containment wall on three sides	None	Yes	Yes drains to a collection pit	Yes	Yes	Yes	Contents periodically removed. Inspected as part of the EMS.	Fitted with a high level alarm system	Yes and filling is monitored by level indication in two control rooms	Inspected as part of the EMS	n/a	n/a	No	Agree	Yes through TEMS*	ISO 14001 accreditation	Yes	-

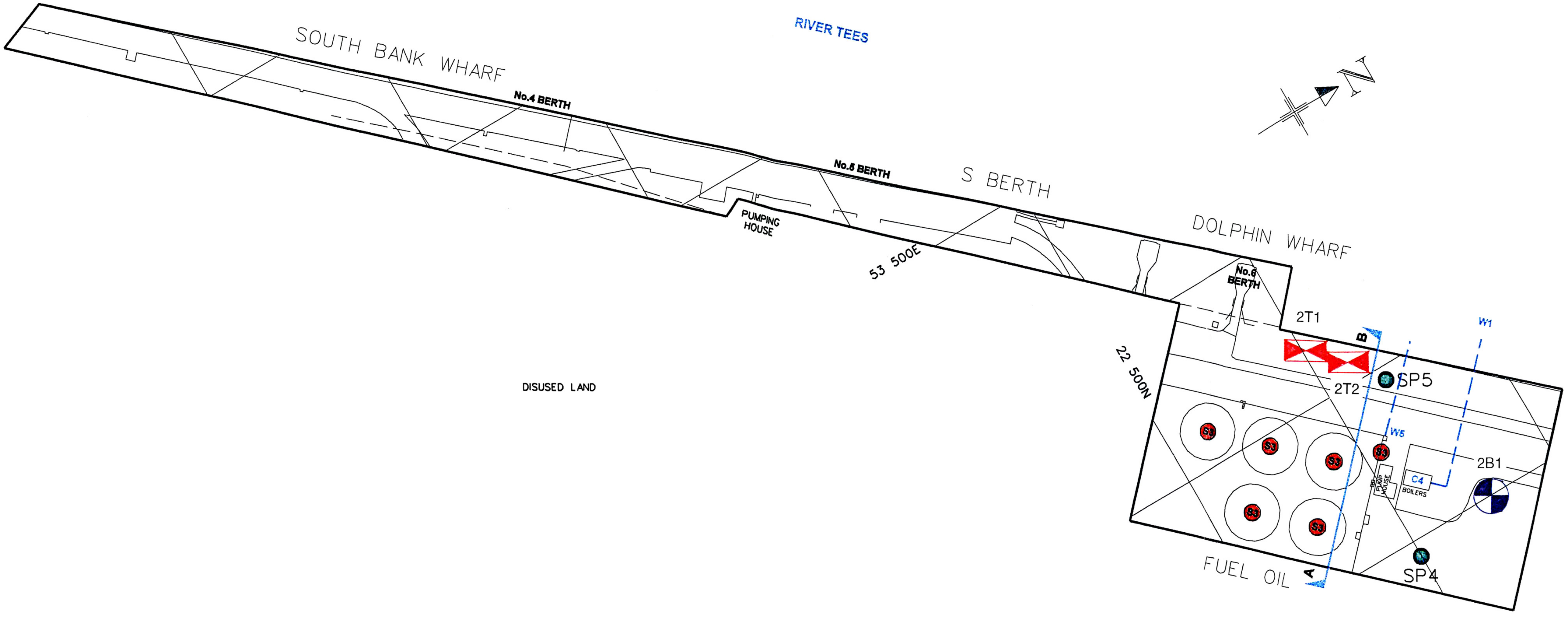
Notes:

* If visual inspections identify a deficit in the primary and secondary preventative measures appropriate integrity testing will be commissioned.

Source Code (see Appendix A2)	Activity	Substance	Volume (capacity)	1. Do Preventative Measures Exist?			2. Are Preventative Measures Adequate for Above Ground Storage Bunds?									Are Preventative Measures Adequate for Subsurface Structures?		2. Are Preventative Measures Adequate for Surfacing? What is its condition?	3. There are NO records of pollution incidents or spills?	4. Are there proposals to conduct integrity testing of preventative measures?	5. Is there an adequate documented management system?	Have you answered "no" to any of the five questions?	
				Primary	Secondary	Tertiary	The bund is impermeable and resistant to the substance stored within	Bund has no outlet and drains to a collection point	Pipework routed within bunded areas	Designed to catch leaks from fittings and tank	Bund has a capacity >110% of largest tank or 25% of total tankage	Contents of the bund are subject to regular visual inspection and any present are subsequently removed	Where the bund is not frequently inspected, it is fitted with a high-level probe and alarm as appropriate	Fill points are within the bund where possible, otherwise adequate containment for filling facilities are provided	The bund is subject to a routine programme of inspections (normally visual, extending to water testing where structural integrity is in doubt)	Can the location of the subsurface structure be identified?	Is secondary containment and/or leakage detection provided?					YES Collect Reference Data	NO Collection of Reference Data is NOT Required
S4	Settling ponds and drying bays	BOS Slurry, BOS Filter Bag Dusts, Hydrocyclone, Area 5 Bag Filter Dusts	$25m^3$/hr 3,087t/yr 24,000t/yr 820t/yr	none	none	none	n/a	n/a	n/a	n/a	n/a	Inspected as part of the EMS	n/a	n/a	Inspected as part of the EMS	n/a	n/a	n/a	Agree	No	ISO 14001 accreditation	Yes	-
-	Oil Mop House	Oil	300 litres	Tank	None	None	n/a	n/a	n/a	n/a	n/a	Inspected as part of the EMS	n/a	n/a	Inspected as part of the EMS	n/a	n/a	n/a	Agree	No	ISO 14001 accreditation	Yes	-

Notes:

* If visual inspections identify a deficit in the primary and secondary preventative measures appropriate integrity testing will be commissioned.



Sampling Location Index

⧓ Trial Pit

⊕ Borehole

POTENTIAL SOURCES

S3 HEAVY FUEL OIL

NB.
PLEASE REFER TO SUPPLEMENTARY
PHASE 1 REPORT FOR EXPLANATION OF THE KEY

KEY:

━━	INSTALLATION BOUNDARY
──	CURRENT DEVELOPMENT
– – –	CONSENTED DISCHARGE
SP ●	SAMPLE POINT (2001)
A ⎣__⎦ B	LINE OF SECTION

Drawing Revisions	Drawn
	Date
Title	Checked
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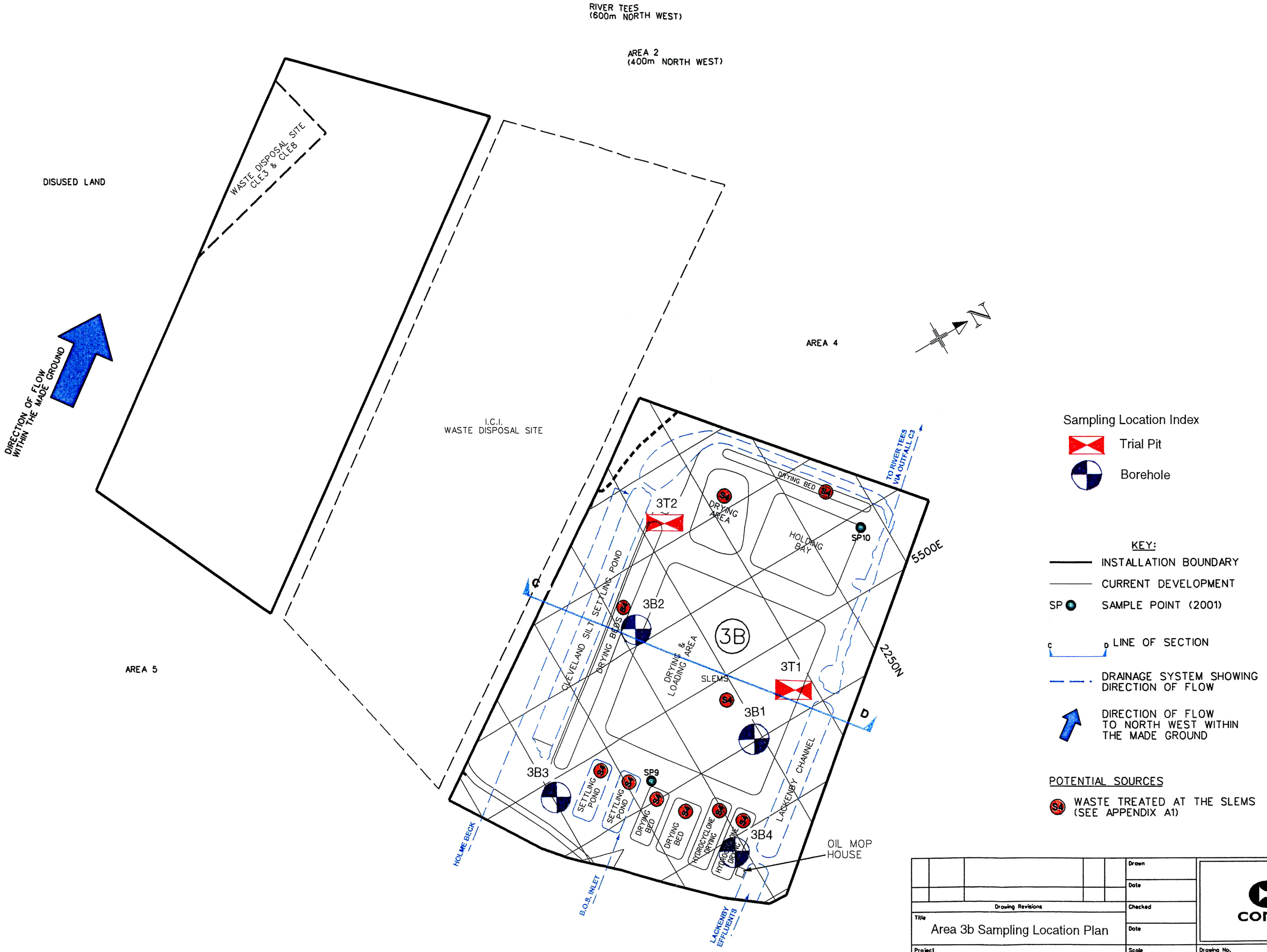
Project Site Condition	Scale 1:2500
Drawing No.	A3.1

corus



Drawing Revisions	Drawn	corus
	Date	
	Checked	
Title Area 3b Sampling Location Plan	Date	
Project Site Condition	Scale 1:5000	Drawing No. A3.2

Appendix B

Investigation and Sampling Protocols

Contents

1.0 SCOPE

To define the procedure by which trial pits and trenches are excavated in open ground without man entry and sampled in a safe manner. This procedure applies to trial pits up to a depth of 4.5 metres which are excavated and backfilled in the same day.

2.0 DEFINITIONS

Non-man entry pits are machine dug and are not entered under any circumstances.

The Logger shall be an experienced person who has under gone appropriate training in safety and technical training. The Logger and Site Supervisor may in some circumstances be the same person.

3.0 RESPONSIBILITIES

The Site Supervisor is responsible for :

- inducting the site team on the contents of the Project Plan
- the setting out of each trial pit at the location required by the Contract documentation
- the identification and avoidance of buried services at each trial pit location
- general site, safety and environmental management
- check by inspection that the machine operator holds the requisite Skill Card (CPCS) and that his machine has an appropriate test certificate (LOLER)
- issuing instructions to the Logger. These instructions may be varied as the pitting progresses, depending on and / or as a result of conditions encountered during excavation
- obtaining services drawings
- checking for underground voids (mineworkings, natural voids, cellars etc).

The Logger shall be responsible for

- ensuring that the control measures specified in the Project Plan are implemented and advising the Site Supervisor of any change in conditions which may require those measures to be varied
- the identification and avoidance of buried services at each trial pit location
- the supervision of the machine operator.
- carrying out whatever sampling and testing is required and for providing a geotechnical description of the pit using the appropriate forms
- ensuring samples are accurately and properly labelled and stored as necessary.
- the safe construction of trial pits ensuring that the adjacent property or ground is not affected by the digging of the pits
- the pitting site is kept tidy and spoil is properly placed.
- the backfilling of the pits in a safe manner such that the backfilled pit does not present a hazard and reinstatement of the site and access routes used.

The machine operator shall ensure :

- the safe and environmentally sound condition and operation of the equipment.
- safely moving between trial pit locations and the safe excavation of the trial pits.

4.0 PROCEDURES

Pre-requisites

The Site Supervisor shall issue on-site instructions as pitting proceeds based on the Client's Engineer's instruction. The pits shall be dug at the locations indicated by the Site Supervisor or Logger. If there is some doubt then clarification on position shall be sought from the Client's Engineer as required. The pits shall be numbered precisely as outlined by the Site Supervisor.

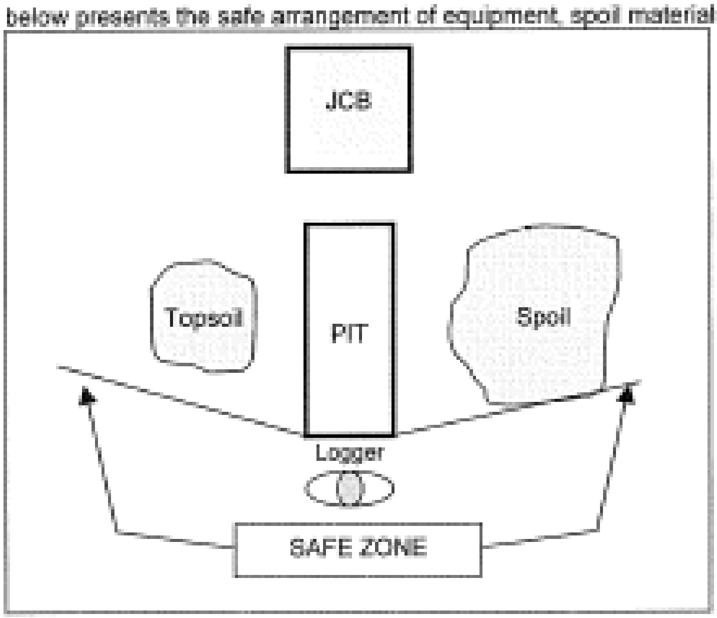
Where the pits are dug with a mechanical excavator the operator shall possess a relevant Skill Card (CPCS). The Logger shall be in attendance throughout the work. It is essential that an initial briefing occurs between the Logger and the machine operator to agree a signalling system and method of working. The machinery will be set up in a manner that is safe for operating personnel and the general public; this may necessitate the provision of fencing. The vicinity will be checked for any other safety, health and environmental hazards (particularly where identified in the Project Plan).

The area in which the pits are to be excavated must be checked for access and services in accordance with IMS-SOP-SI011, IMS-SOP-SE1046 and IMS-SOP-SE758.

Excavation

Equipment, arisings and spoil shall be placed so as not to present a hazard to the operatives or the general public. All spoil shall be heaped at least 1 m from the edge of the pit; greater distances maybe required for deeper pits. The surface material, be it topsoil, turf, ballast, tarmac or concrete shall be heaped in separate piles to avoid mixing where possible. The spoil should be placed so as not to cause contamination of any water courses.

The drawing below presents the safe arrangement of equipment, spoil materials and Logger.



Trial pits shall be excavated and backfilled in one shift wherever possible. In the event that a pit has not been completed by the end of a shift or is left unattended, it shall be securely fenced. The area shall be left safe and tidy to the satisfaction of the Logger.

Whilst excavation proceeds the stability of the excavation walls shall be assessed by the Logger. If there is any doubt over the stability of the walls, such that instability shall cause surface settlement which might jeopardise the safety of personnel, equipment or property, the excavation shall be terminated and pit backfilled.

NO PERSON SHALL ENTER THE PIT UNDER ANY CIRCUMSTANCES.

The logger shall :

- only approach the pit from the short ends when the JCB arm is at rest and the driver is aware of your approach
- approach the edge of the excavation with caution and check its stability
- not lean over the edge of the excavation

- not stay at the edge any longer than necessary
- not use the bucket as a working platform

Records, Sampling and Testing

Details of the strata encountered, pit stability and other observations are recorded on Form IMS-SOP-SI130-F3.

Particular attention should be given to groundwater. A water inflow should be recorded either as a seepage or as an entry.

- Seepage is where the quantity of water is insufficient to sample.
- Entry is a larger inflow of water where it will be possible to measure water level after a certain time and sample the liquid. The water level change over a period of time should be recorded.

All sampling and testing in the excavation shall be carried out in accordance with procedures IMS-SOP-SI100 (geotechnical samples), IMS-SOP-SI121 (geoenvironmental samples) and IMS-SOP-SI131 (hand vane and pocket penetrometer). Photography shall be carried out in accordance with ISM-SOP-SI140.

A minimum of two photographs shall be taken of the excavation; one of the pit faces and a second of the spoil.

It is useful to take an additional photograph showing location of the pit and spoil pile

Completion

On completion, the pit will either be backfilled with arisings or reinstated with imported material as appropriate. Where possible materials shall be replaced in the pit in the same order that they were excavated. Backfilling shall be carried out in layers, each layer being tamped by the bucket of the excavator.

The pit shall be properly reinstated so that no depression is left; a certain amount of mounding may be required to achieve this in the longer term. The surrounding areas shall be left reasonably clean and cleared of any debris. Any excess spoil shall be removed to the site collection point.

5.0 REFERENCES (Forms, Guidance, etc)

Standards: B5930 1999

Forms: Trial pit logging form IMS-SOP-SI130-F3

ISSUE & REVISION LOG

	Name	Position in Company	Date
Prepared by:	A P Whittlestone	Technical Manager (SM)	February 2004
Authorised by:	P Rainbow	IMS Manager	February 2004

Revision No	Authorised by	Principal Change	Date

Dando 150
Cable Percussive Rig

Medium duty cable tool rig suitable for sampling, testing, instrumentation in both granular and cohesive deposits.

Rated capacity:
150mm diameter up to 75mdepth
380mm diameter up to 45m depth

Maximum single line lift: 1.5 tonnes
Maximum derrick loading: 6 tonnes

Accepts rotary pendant attachment with separate power pack

Power unit:
16 hp 2 cylinder diesel engine

Mounting: Towed with suitable vehicle

Company holding: 14 No.

Dimensions

Erected

Width:	2.45m
Length:	4.45m
Extended Height:	5.50m
Min. working area:	4.00m x 10.00m

Travelling

Towing:	7.50m x 1.68m
Weight:	1350kg (nominal)

1.0 SCOPE

To define the processes involved in cable percussion boring and sampling

2.0 DEFINITIONS

Cable percussion boring is carried out by a minimum of a two man crew. The Lead Driller, who is one of the crew, will hold a suitable qualification or experience and should be BDA accredited.

The Logging Geologist will be an experienced person who has undergone appropriate training in safety and technical training. The Logging Geologist and Site Supervisor may be in certain circumstances be the same person.

3.0 RESPONSIBILITIES

The Site Supervisor is responsible for:

- inducting the site team on the contents of the Project Plan which includes the risk assessment
- the setting out of each borehole at the location required by the Contract documentation and agreeing any revised locations
- the identification and avoidance of buried services at each borehole location
- general site, safety and environmental management
- issuing boring, sampling and testing instructions to the Lead Driller using a Borehole Instruction prior to commencement of boring. These instructions may be varied as the borehole progresses, depending on and / or as a result of conditions encountered during boring.

The Lead Driller is responsible for:

- ensuring that the control measures specified in the Project Plan are implemented and advising the Site Supervisor of any change in conditions which may require those measures to be varied
- the safe and environmentally sound condition and operation of the drilling equipment.
- the supervision of the drilling team.
- carrying out whatever sampling, testing and installation required in the borehole as advised on the Borehole Instruction, under the supervision and guidance of the Logging Geologist where necessary
- safely transporting and setting the rig up over the borehole location, the safe execution of the borehole, and dismantling on completion
- proper backfilling of the borehole on completion and reinstatement of the borehole site and access routes used.
- ensuring where practicable that the site adjacent to the borehole is kept tidy, and that equipment and samples are accurately and properly labelled, stored and maintained as necessary.
- ensuring the safe transportation of samples to a designated storage area at the end of each shift, or on completion of each borehole, as instructed by the Logging Geologist.
- produce and submit daily records as detailed in the procedure below.

The Logging Geologist is responsible for:

- accurately logging the samples recovered from the borehole.
- visiting the rig as required to provide supervision and guidance to the Lead Driller.
- verifying the daily records and where necessary obtaining approval signatures from the Client's Engineer.

4.0 PROCEDURES

Cable percussion boring is carried out as described in BS5930: Section 20.5 and as detailed below.

Pre-requisites

Boring will normally be carried out using a cable percussion rig (Dando 150, Dando 175, Pilcon Wayfarer or similar), and tools such as casings, shells, stubbers, chisels and sinker bars, as permitted by the Site Supervisor. This technique can also be carried out using modular rigs capable of working down to a headroom of 2.5 m. The minimum diameter of borings or internal diameter of casing will normally be 150 mm, however, casings of 200, 250 and 300 mm and larger sizes are also used. It is normal for diesel engine powered rigs to be used, however, pneumatic or electric rigs are also available.

Where borings are of such depth that the advancement of a casing may become impracticable, or where hard strata and obstructions are likely to be met, additional strings of casing of sufficient diameter to complete the work will be provided.

Setting up

The borings will be made at the locations indicated by the Site Supervisor. Prior to any boring each location will be checked for the presence of buried services (IMS-SOP-SE756) and overhead services (IMS-SOP-SE1046). Every location will be CAT scanned even where no services appear on service plans. Hand dug inspection pits will be required in **all** locations except where there are specific instructions to the contrary. All services located in the pits will be accurately noted on the Cable Percussion Boring Journal, referenced to existing permanent points, for example buildings, and reported to the Site Supervisor and in turn the Client's representative as appropriate. The inspection pit should be backfilled prior to commencing boring.

The boring rig and machinery will be set up in a manner that is safe for operating personnel and the general public; this may necessitate the provision of fencing. The vicinity will be checked for any other safety, health and environmental hazards (particularly where identified in the Project Plan). Control measures will be implemented to remove or reduce such hazards.

Boring

The borings will be numbered precisely as outlined by the Site Supervisor on the Borehole Instruction. The diameter and depth of boring and the diameter and depth of all casings will be noted on the Cable Percussion Boring Journal along with depths at which water is encountered, strata descriptions, depths of changes in strata, depths and types of samples recovered, tests carried out and any other relevant information.

Equipment, arisings and spoil will be placed so as not to present a hazard to the rig operatives. the environment or the general public.

In granular soils above the water table and cohesive soils the minimum amount of water necessary to satisfactorily advance the boring will be added. In granular soils below the water table a positive head of water (ie above ground water level) will be maintained during boring and sampling in order to counteract the disturbance caused by the removal of overburden.

Where artesian water is encountered the Lead Driller shall immediately inform the Site Supervisor who will agree a solution with the Project Leader.

In borings where hard strata or obstructions are encountered the Lead Driller will continue boring using chisel or similar approved tool for a minimum approved time (normally 1 hour) in attempt to penetrate the hard strata or obstruction. After 1 hour of chiselling the Lead Driller shall inform the Site Supervisor.

The Site Supervisor, after discussion with the Client's Engineer where necessary, should instruct the Lead Driller to proceed in one or more of the following ways;
(a) Continue chiselling in an attempt to break it up sufficiently for fragments to be recovered and identified, until otherwise instructed.
(b) Abandon the boring, leaving a casing in place so that drilling can be continued by rotary methods.
(c) Withdraw the casing and abandon the boring completely after proper backfilling, and commence boring at a new nearby and agreed position.

In the event of discovering an unexpected condition (eg contamination) boring should cease and an instruction sought from the Project Leader.

Sampling and Testing

Sampling, testing and their frequency will be in accordance with Borehole Instructions issued. The preparation for and methods of taking samples, together with their size, preservation and handling will be in accordance with IMS-SOP-SI100 (geotechnical samples) and IMS-SOP-SI121 (geoenvironmental samples).

In situ tests and monitoring are carried out in accordance with IMS-SOP-SI200 series procedures.

When an uncompleted hole is left overnight, no soil samples will be taken until the hole has been advanced by a minimum of 300 mm from the overnight depth, unless otherwise instructed.

Backfilling and Completion

On completion of boring, the borehole will either be backfilled with arisings, grouted up or a monitoring device installed. Details of any installation must be confirmed before backfilling. A precise record of backfilling and/or installation will be made on the Cable Percussion Boring Journal.

If it is not possible to extract the casing then the Site Supervisor will be informed to determine further action. A record of size and depth of any casings left in the ground will be made on the Cable Percussion Boring Journal.

Where artesian conditions are encountered an instruction shall be sought from the Project Leader.

The borehole will be properly reinstated so that no depression is left; a certain amount of mounding may be required to achieve this in the longer term. The surrounding areas will be left reasonably clean and cleared of any debris. Any excess spoil will be removed to the site collection point and removed from site in accordance with the waste management procedure (IMS-SOP-SE816).

Records

The top three copies of the Cable Percussion Boring Journal will be given or forwarded daily, at the end of each shift, or the following morning at the latest to the Logging Geologist or Site Supervisor who will check the content before countersigning and distributing as necessary.

5.0 REFERENCES (Forms, Guidance, etc)

1.BS5930 1999
2.BS1377 1990
3.BDA : 'Code of Safe Drilling Practice'
4.SISG : 'Guidance Notes for the Safe Drilling of Landfills and Contaminated Land'

Forms: SOP-SI031-F1 Cable Percussion Boring Journal

ISSUE & REVISION LOG

	Name	**Position in Company**	**Date**
Prepared by:	A P Whittlestone	Technical Manager (SM)	February 2004
Authorised by:	P Rainbow	IMS Manager	February 2004

Revision No	**Authorised by**	**Principal Change**	**Date**

Appendix C

Analytical Protocols and Laboratory Accreditation

Contents

Zone	Source No.	Storage Area	Sampling Location	Potentially Polluting Substance	Chemical Composition	Analytical Suite	Analytical Technique	Detection Limit	Accreditation
Area 12 Redcar Coke Ovens and By-product Plant	S6[3]	Storage Tanks	**Soil Samples** 12T1 to 12T9 12B1 to 12B3	Ammoniacal Liquor	Contains free and fixed ammonia and phenols*	Total phenols	BTEXHSA	0.02 mg/kg	UKAS
							BTEXHSA		UKAS
							BTEXHSA		UKAS
							BTEXHSA		UKAS
							PAHFID		UKAS
							TPHFID		UKAS
Area 3b Solid and Liquids Environmental Management System	S4	Drying Bays and Settling Ponds	3T1 3T2 3B1 3B2 3B3	Dredged solids from the settlement channels and settling ponds	Potential composite composition of iron, silica, zinc, calcium, sodium magnesium, aluminium, sulphur, lead, carbon and selenium	Lead	ICPMSS/ICPMSW	0.5 mg/kg (soil), 0.001 mg/l (water)	UKAS
						Selenium	ICPMSS/ICPMSW	0.5 mg/kg (soil), 0.001 mg/l (water)	UKAS
						Sulphur	CL7	400 mg/kg (soil)	NO
						Sulphide (free) as S	ISESW24	0.2 mg/l (water)	UKAS
						Water soluble sulphate as SO4	ICPWSS/ICPWATER	0.1 mg/l (soil test), 0.06 mg/l (water)	UKAS
						Acid soluble sulphide	ICTSCN28	5 mg/kg (soil)	UKAS
						Zinc	ICPMSS/ICPMSW	3 mg/kg (soil), 0.002 mg/l (water)	UKAS
	-	Oil Mop House Storage Tank and Hydrocyclone Drying Bay	3B4	Oil (various), Hydrocyclone fine fraction	Hydrocarbons (unspecified). Fluoride, lead, selenium and zinc.	Benzene	BTEXHSA	10 ug/kg (soil), 5ug/l (water)	UKAS
						Toluene	BTEXHSA	10 ug/kg (soil), 5ug/l (water)	UKAS
						Ethylbenzene	BTEXHSA	10 ug/kg (soil), 5ug/l (water)	UKAS
						Xylene	BTEXHSA	10 ug/kg (soil), 10ug/l (water)	UKAS
						Polycyclic Aromatic Hydrocarbons (PAH) EPA16	PAHFID	1mg/kg (soil), 0.01 mg/l (water)	UKAS
						Total Petroleum Hydrocarbons (TPH)	TPHFID	10 mg/kg (soil), 0.1 mg/l (water)	UKAS
						Lead	ICPMSS/ICPMSW	0.5 mg/kg (soil), 0.001 mg/l (water)	UKAS
						Selenium	ICPMSS/ICPMSW	0.5 mg/kg (soil), 0.001 mg/l (water)	UKAS
						Zinc	ICPMSS/ICPMSW	3 mg/kg (soil), 0.002 mg/l (water)	UKAS

Note:
* Data obtained from Suppliers Product/Hazard Data Sheet

Appendix H9: Soil and Groundwater Baseline Characterisation Study, Teesside Works, prepared by Enviros for Corus UK Ltd [Enviros 2004]

9.1 Volume 1 – Factual Report, Ref. Rlp250604corusteessidefactual.Doc dated 25th June 2004 and marked Final

9.2 Volume 2 – Interpretive Report Ref. Mwicorusdraftinterpretivemmdv#2.Doc dated 25th June 2004 and marked Final

9.3 Volume 3 – Summary Report dated June 2004.

Redcar

Lackenby

Cleveland

CORUS UK Ltd

Soil and Groundwater Baseline Characterisation Study

Teesside Works

Factual Report

Volume 1 of 3

June 2004

Publication title	Baseline Soil and Groundwater Characterisation, Corus Teesside
CAN	CO0520017A
Volume number	Volume 1 of 3
Version	Final Report
Date	25 June 2004
File Reference	Rlp250604corusteessidefactual.Doc

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REFERENCES

FIGURES

APPENDICES

INTRODUCTION

Commissioning

In April 2004 Enviros was appointed by Corus to undertake an intrusive environmental investigation of their Teesside Works, which incorporates the Redcar, Lackenby and Cleveland sites (See Figure 1a). All works have been completed in accordance with our letter to Corus of 8th April 2004 (Ref. CO0520017p/mmcd/cons#1) and have been undertaken based upon an amended form of Corus Conditions of Contract for Professional Services (CC11) agreed between Enviros and Corus.

Objectives

The key objective of this investigation has been to establish a baseline for soil and groundwater conditions across the Teesside Works. The investigation has been completed in advance of the transfer of the majority of the landholding at Teesside by Corus to a new joint venture company. The extent of Corus landholding that has been included in this investigation is defined on Corus Drawing No. A-119972 (See Figure 1b).

Key Tasks

Key tasks which have been completed during the course of the investigation include the following:

1. Review of information held by Corus including a recently prepared PPC report in order to aid development of our site investigation strategy.
2. Holding the duty of Designer and Principal Contractor under the CDM Regulations.
3. Intrusive investigations and chemical testing of recovered soil and groundwater samples in order to provide sufficient information on which to complete the baseline assessment.
4. Tier 1 screening of chemical analysis against appropriates standards and preparation of reports based on our investigation findings.

Project Timescale and Constraints

The project was commissioned by Corus on March 15th 2004 with the issuance of a purchase order for the review of desktop information held by Corus in order to develop a detailed site investigation strategy. Seven weeks were allowed for site work within an overall timescale of thirteen weeks from project commencement till the report delivery deadline.

Site work was commenced by a walk over and preliminary mark up of locations on 30th March 2004. Intrusive sampling using tracked excavators and shell and auger drilling equipment was commenced on the week of March 5th 2004 and site works were completed on 18th May 2004.

The investigation has been designed to provide broad characterisation of soil and groundwater conditions across each of the three sites. In addition, operational, infrastructure and access related issues in areas of plant limited accessibility in certain areas of the sites. Project timescales also allowed for only one round of groundwater sampling.

Previous Investigations

A number of previous investigations have been carried out at the Teesside Works, mainly for the purposes of on going development at the site. These previous investigations are summarised within a Pollution Prevention and Control (PPC) report (Ref. 4) which has been referred during the course of this investigation.

Reporting Structure

Our reports are divided into three volumes.

1. Factual report. Chapter 1 outlines the location of the site, a brief site history and the environmental setting. Chapter 2 summarises the approach and methodologies used during the course of the investigation. The factual report is divided between the three sites; Redcar (Chapter 3), Lackenby (Chapter 4) and Cleveland (Chapter 5).

   For each site the scope of field work, ground conditions and chemical analysis is presented for each of the areas contained within the site. In order to put the chemical results into context, chemical analysis data have been screened in relation to several sets of guideline values. This is a Tier 1 assessment with testing data compared against generic values published by authoritative bodies. Exceedance of screening levels does not necessarily imply that an unacceptable level of risk exists (See Appendix 5). A table is presented for each area within the site summarising chemical testing information by exceedances of soil guidance values. Groundwater conditions are also described for each site. A summary of ground conditions and contamination for each site is presented at the end of each chapter.

   A list of figures shows the location of the site, the position of trial pits and boreholes and the locations of exceedance values. Appendices contain further information regarding methodologies, trial pit logs, borehole logs and chemical data.

2. Interpretive report. The interpretive report presents a risk assessment through consideration of each of the three sites separately. Risks arising from identified soil and groundwater conditions have been assessed using current UK guidance, which in this case has involved development of a conceptual model for the three sites representing the relationship between contamination source areas, migration pathways and receptors.

3. Executive report. The report summarises the main outcomes of the investigation and the implications thereon for each of the three sites.

1. SITE DESCRIPTION

1.1 Site Location and Description

1.1.1 The Corus Works at Teesside lies approximately 2km west of Redcar on the northern side of the A1085, as shown on Figure 1a. The three separate works comprise Redcar, Cleveland and Lackenby, all of which produce carbon steel for export nationally and internationally.

1.1.2 The Redcar Works borders the River Tees in the west and the coastal Gare and Coatham Sands Site of Special Scientific Interest (SSSI) to the north east (See Figure 1a). The Lackenby Works are located further inland and south of Redcar between the A1085 trunk road to the east and the rail line to the west. Adjacent to the Lackenby Works to the west are the Cleveland Works which are bordered by the rail line to the south east and the River Tees to the west (See Figure 1a).

1.1.3 The main areas of the Redcar Works include the Blast Furnace, Power Station, Coke Ovens, By-Products Plant, Burden Preparation Area, Ore Stocking Grounds, Sinter Plant and Wharfe (See Figure 3).

1.1.4 The Lackenby Works comprises the BOS/CONCAST Plant, Iron Granulation Plant and Loco Repair Shop (See Figure 4).

1.1.5 The Cleveland Works comprises the South Bank Coke Ovens, Torpedo and Ladle Repair Shop, Former Pig Casting Area, SLEMS (Solid Liquid Effluent Management System) and the Cleveland Oil Farm (See Figure 5).

2. SITE INVESTIGATION METHODOLOGY AND REPORTING

2.1 Site Investigation Procedures

2.1.1 The site investigation was designed to assess ground conditions, soil and groundwater quality, and potential pathways for contaminant migration. The investigation comprised the excavation of 264 trial pits using 20 ton tracked excavators and advancing 42 boreholes using shell and auger (cable percussive) techniques.

2.1.2 Soil Mechanics, a specialist sub contractor, was appointed to undertake completion of the boreholes and installation of ground water monitoring wells. SCB, a specialist sub contractor, was appointed to undertake excavation of the trial pits. The site work took place between 5th April and 17th May 2004, with locations of all exploratory points shown in Figures 3, 4 and 5. All work was designed and fully supervised by engineers from Enviros who managed and controlled all activities on site. Work on site was guided by the use of relevant standards for contaminated land investigation i.e. BS5930:1999 (Appendix 1).

2.1.3 All method statements and health and safety plans were issued and approved by both Corus and contractor personnel prior to commencement of the work. Health and safety plans, risk assessments and method statements were drawn up for all work carried out on site, and can be found in Appendix 1.

2.2 Summary of Methodologies

2.2.1 Sampling Locations

2.2.2 Sampling locations were based on a system denoting which area the sample was located, the specific sub-area it was derived from, the type of sampling location and the number. Table 1 shows how each of the three sites were divided into a number of areas. These numbered areas do not pertain to the PPC report numbering plan but pertain to a system developed during the proposal phase which was modified to include relevant sections of land to be transferred to the new joint venture company (See Fig 1b).

2.2.3 During the course of the investigation each area was then divided into manageable sub-areas if required (A, B, C etc) for the purposes of obtaining excavation permits. It should be noted that these sub-areas do not reflect contamination zoning.

2.2.4 A single letter was used to denote whether the sampling location was a trial pit (T), borehole, (B) or surface water sampling location (S). Numbers were then used to identify each sampling location. A trial pit soil sample taken from Redcar Area 15, sub-area F, no. 23 would thus appear as 15FT23.

2.2.5 Where excavations and boreholes have not been possible because of factors listed in 2.5.3, they have been indicated on the accompanying maps in Figures 2, 3 and 4. Due to the scale of the maps only larger areas of inaccessibility have been indicated.

2.2.6 Borehole Drilling

2.2.7 A total of 42 boreholes were attempted, of which 37 were installed for groundwater monitoring (borehole logs are provided in Appendix 2-4). 20 tonne excavators were used to break out any obstructions or hard ground and excavate through Made Ground at the borehole drilling locations.

2.2.8 Due to difficult ground conditions encountered at all three sites, such as large cobbles and boulders of slag, almost all boreholes required the preliminary excavation with the 20 tonne excavator to loosen the ground. On a number of occasions the excavator was unable to penetrate the full thickness of Made Ground. Where drilling was unsuccessful at these locations relocation of drilling locations was required. Samples were collected where a change in ground conditions, or visible evidence of contamination was observed.

2.2.9 Monitoring wells were installed to a maximum depth of 10m bgl (below ground level) depending on ground conditions. Each borehole was completed with one installation. During borehole completion, care was taken to ensure that vertical contaminant pathways were not created between the various strata penetrated. This was achieved by the use of bentonite seals in the boreholes, as detailed in the logs. Where contamination was encountered drilling equipment was pressure washed to minimise cross contamination. After boreholes had been completed they were surveyed to the local OS grid (see Appendix 1 for further details of the methodologies used on site).

2.2.10 Trial Pitting

2.2.11 A total of 264 locations were excavated using 20 ton tracked excavators. Hydraulic hammers ('pecker') were used to break out hard ground prior to completion of the excavation to maximum depth of 4m. For health and safety reasons no person was to be within 3m of the trial pit once a depth of 1.2m had been reached. As a result it was not possible to measure trial pit depth using a tape measure from the edge of the trial pits. No open trial pits were left unattended and once arisings from the trial pits had been logged the trial pits were immediately backfilled (see Appendix 1 for further details of the methodologies used on site).

2.3 Soil and Water Sampling

2.3.1 Soil Sampling

2.3.2 At each location visual and olfactory examination of the sub-surface strata was undertaken and soil samples were collected by Enviros engineers for chemical analysis. Samples were taken using stainless steel sampling equipment and clean nitrile/ disposable gloves at each location. All sampling equipment was cleaned to minimise the potential for cross contamination. Visible dirt was removed from the stainless steel trowel after the collection of each sample.

2.3.3 Samples were collected from both the borehole and trial pit locations on the basis of depth, nature of strata or where visual or olfactory evidence of contamination was apparent. Two samples were taken from each location; however more or less samples were taken based on the assessment of the Enviros engineer. At each location, the following containers were filled with soil sample: 1 x 500g capacity plastic tub, 1 x 500g capacity amber glass, and 1 x 125g capacity amber glass jar. Sample containers were labelled and chain of custodies filled in prior to dispatch to TES Bretby laboratories in insulated containers.

2.3.4 Groundwater Sampling

2.3.5 Groundwater sampling was undertaken by an Enviros engineer upon completion of drilling works. At each location water levels and depth to the monitoring well base were measured and recorded, thereafter the boreholes were purged using Wattera pumping equipment and tubing. The determination of successful borehole development was either when the pumped water was visually clear and when the field measurements of electrical current and pH stabilised or if the borehole had purged dry prior to stabilisation. Groundwater samples were taken using HDPE tubing dedicated to each well to avoid cross contamination between boreholes and to minimise the loss of volatile contaminants from the water samples. At each location, the following containers were filled with sample: 1 x 1l plastic bottle, 2 x 250ml glass vials (for phenol index, and cyanide), 2 x 1l amber glass bottles (for TPH, and PAH) and 40ml glass vials (for VOCs).

2.3.6 Surface Water Sampling

2.3.7 Surface water sampling at eight locations within Redcar Area F (a SSSI) was undertaken by an Enviros engineer during the period of site works. Samples were collected directly from water bodies using sterilised sample containers to avoid potential cross-contamination and to minimise the loss of volatile contaminants. At each location, the following containers were filled with sample: 1 x 1l plastic bottle, 2 x 250ml glass vials (for phenol index, and cyanide), 2 x 1l amber glass bottles (for TPH, and PAH) and 40ml glass vials (for VOCs).

2.3.8 Chemical Analysis

2.3.9 Laboratory analysis was undertaken by TES Bretby, a laboratory accredited through UKAS. All soil and water samples were analysed for a wide range of potential contaminants. These included arsenic, cadmium, chromium lead, mercury, selenium, copper, nickel, zinc, boron, total cyanide, free cyanide, acid soluble sulphide, water soluble sulphate, total sulphur, pH units and phenol index.

2.3.10 Organic analysis included Total Petroleum Hydrocarbons (TPH C8-C37), Gasoline Range Organics (GRO C5-C10), Polyaromatic Hydrocarbons (PAH Total EPA 16), benzene, toluene, ethylbenzene and xylenes (BTEX compounds).

2.3.11 Tier 1 Screening

2.3.12 The chemical analyses are compared with relevant guideline levels for soils and water. For soil these include Contaminated Land Exposure Assessment (CLEA), Dutch Intervention Values (DIV) and Enviros Screening Values (ESV) in the absence of either CLEA or DIVs. For groundwater and surface water, UK Drinking Water Standards (UKDWS) and DIVs have been used (Appendix 5). It is recognised that comparison against UKDWS on an industrial complex such as the Teesside Works is necessarily conservative approach.

2.3.13 The comparison of the results against relevant guideline levels constitutes a Tier 1 screening process. Screening has been conducted on the numbered areas in Redcar, Lackenby and Cleveland (Table 1) and values which are in exceedance of the guideline levels have been highlighted in summary tables in the report and shown in the accompanying maps (Figure 6-8) for soil and (Figure 9-11) for groundwater.

2.3.14 The Mean Value Test (US95 or 95th Percentile) has been used to determine whether the Tier 1 screening values for each area has been exceeded (Appendix 5).

2.4 Rationale

2.4.1 The intrusive investigative techniques used on site reflect the nature of the materials likely to be encountered in the ground. From previous investigations and from its heavy industrialised history, it was understood that the majority of the site is underlain by Made Ground deposits, mainly consisting of cobbles and boulders of slag.

2.5 Access and Constraints

2.5.1 This report presents the information obtained during the site investigation and our opinion is based on observations and results arising from the site work and the information made available to us during the given time period. A site reconnaissance visit, meeting with key Corus staff and review of relevant documentation was undertaken prior to the commencement of the site investigation. Reliance has been made on available desk study information arising from the 2003 Corus Pollution Prevention and Control (PPC) (Ref. 4).

2.5.2 Access to certain areas of the site was constrained by Health and Safety considerations. Consequently it was not possible to place sample locations in certain locations where localised pollution may have occurred.

2.5.3 The selection of excavation locations was conducted by the Enviros working party leader in consultation with Corus personnel responsible for issuing daily work permits and excavation permits for each plant area. The original sampling criteria used by Enviros for selection of excavation locations were as follows:

- Areas near to sources of potential pollution;
- Ensuring adequate sample coverage within each area based on the number of boreholes and trial pits proposed in the scope.

Ensuring that trial pits and boreholes were completed safely to Corus health and safety standards was of paramount importance during the site investigation so constraints to sampling including the following:

- Accessibility to drilling rig and excavator; areas of very rough ground, stocking ground, steep slopes and areas constrained by height or width were avoided;
- Avoidance of underground services (gas, electricity, telephone, drainage, basements);
- Avoidance of above ground services (gas, electricity, telephone);
- Avoidance of heavy traffic areas and mobile tools including rail lines;
- Avoidance of areas of tarmac and concrete which would require reinstatement and:
- Restriction to areas outside buildings, intrinsically safe areas and operational plant.

The larger sections of the site showing restrictions to sampling are indicated on Figure 3 for Redcar, Figure 4 for Lackenby and Figure 5 for Cleveland.

2.6 Summary of Excavations and Boreholes

2.6.1 The Redcar, Lackenby and Cleveland sites cover approximately 560 hectares in total and have therefore have been divided into smaller, more manageable areas as detailed in Table 1 below (Figure 3, 4 and 5). This table also summarises the number of exploration locations completed during the site investigation.

Table 1 Excavations and Boreholes Undertaken at Corus Teesside.

Site	Area	Operations	Area size (ha)	No. Trial Pits	No. Boreholes
Redcar Works	11	Former Warrenby Works	27	9	2
	12	Power Station and Surrounding Areas	42	17	2
	13	Sinter Plant	42	17	2
	14	Blast Furnace	12	9	2
	15	Raw Coal and Ore Stocking Areas	176	41	3
	16	Coke Ovens	15.5	5	2
	17	By-Products	25	22	3
	F	South Gare and Coatham Sands SSSI*	24.5		[1]
Lackenby Works	7	Concast and BOS Plant	36	12	5
	8	No. 2 Primary Mill	16.1	6	2
	G	Iron Granulation and Loco Repair Shop	4.66	4	2
Cleveland Works	1	By-Products Plant and Coke Ovens	13.9	15	1
	2	By-Products Plant	14.6	14	3
	3	Fuel Oil Storage Area next to Dolphin Wharf	3.2	6	6[2]
	4	SLEMS Area	29	2	4
	D	Western side of Pig Caster	38	42	2[3]
	E	Tarmac and Wharf Area	36	41	-
	H	Torpedo and Ladle Repair Shop	3.4	2	1

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[1] Eight surface water samples were taken in this area.
[2] Two boreholes installed, four other attempts abandoned due to hard ground
[3] One borehole installed, one abandoned due to hard ground

Total		**560**	**264**	**42**

*The SSSI is located adjacent to Redcar Works and is analysed as part of the data Redcar data set.

2.7 Reporting Methodology

2.7.1 Per Site

2.7.2 The factual report has been divided into three main sections:

- Redcar (Section 3);
- Lackenby (Section 4);
- Cleveland (Section 5);

2.7.3 For each site there is a summary of the site history and an outline of the potential contamination from historical and current sources. The environmental setting of each site is described by and includes the following:

- Geology: drift and solid;
- Hydrogeology: Source Protection Zones, Groundwater Vulnerability, aquifer classification and groundwater abstractions;
- Hydrology: surface water features and regulated discharges;
- Ecology: sensitive receptors;
- Neighbouring sites: adjacent Corus land and third party land

2.7.4 Site sensitivities have then been tabulated for each of the above environmental factors.

2.7.5 The overall findings each of the three sites for the ground conditions, groundwater and Tier 1 screening are summarised at the end of each section.

2.7.6 Per Area

2.7.7 Within each site the report is broken down into the numbered areas as shown in Table 1. Within each area the results of the site investigation are reported and these include the following sections:

- The Scope of Works: this shows a breakdown of the number of exploratory locations and samples taken.
- Ground Conditions: a description of Made Ground and natural ground in each area based on the trial pit and borehole logs (Appendix 2-4) and a description of soil staining observed.
- Chemical Analysis Results: for each area a summary table has been produced. These show samples taken in soil, groundwater and surface water compared against the Tier 1 screening values. The table only shows locations where there

have been exceedances. Where there has been an exceedance of the Tier 1 guideline values these have been highlighted in the table. The table also shows the Mean Value Test (US95/95th Percentile). On the basis of the exceedance table the results have been reported for pH, toxic and phytotoxic metals, sulphide and sulphate and organics. Chemical testing certificates are presented in Appendix 6-9.

2.7.8 Summary of Results

2.7.9 At the end of the report a summary of the main findings for Redcar, Lackenby and Cleveland are described. The results of the Tier 1 screening are tabulated in Table 17, this presents each area and compares it against the chemical testing undertaken. A score is given depended on if: the 95th percentile is exceeded (Score 3); whether the 95th is not exceeded, but some localised exceedances occur or whether the 95th percentile is not exceeded and there are no localised exceedances (Score 1).

3. REDCAR WORKS

3.1 Site History

3.1.1 The following site history is based on a study of topographical maps held in the Corus archives (Ref. 4).

Table 2 **Summary of Redcar Site History**

Dates	Summary
1900-1914	Bran Sands reclaimed with steel slag and refactory materials.
1916	Dorman & Long Ltd built the Warrenby Steelworks and Plate Mills.
1917	Steel manufacture commenced.
1970s	Work commissioned on Redcar Works.
1973	1st phase comprising marine ore reception terminal and ore unloading facilities completed.
1978	2nd phase comprising ore stockyard, blending facilities, sinter plant, pellet plant and coke ovens completed.
1979	3rd phase comprising blast furnace and power plant completed.

3.2 Potential Contamination Sources

3.2.1 Based on our review of information contained within the existing PPC report and our understanding of site activities the following potential contamination sources have been identified.

Table 3 **Potential Contamination Sources at the Redcar Site**

Area	Historic	Current	Potential Contamination Sources	Comments
11	✓	✓	Steel slag	Sulphates in the slag buffer the pH of surface water run off creating alkaline leachates. Over 100 years the buffering effect of the slag will have been reduced to tolerable levels. Metals within slag are not likely to be mobile.
12	✓	✓		
13	✓	✓		
14	✓	✓		
15	✓	✓		
16	✓	✓		
17	✓	✓		
F	✓	✓		
14	✓		Dust and slurries	Possible heavy metals from flue cleaning. Blast furnace slurries stored on in skips. Mobility dependent on clay content and pH. Solubility of As, Cr, and Se will increase in alkaline conditions.
15	✓			
14	✓ ✓		Refactory materials and	Metals not in accessible form.

15			steel scrap	
12	✓	✓	Hydrocarbons	Stored in bunded tanks on the site. Lighter fractions more mobile than heavier fractions and would penetrate the ground easier. Potential hazard to controlled water ie. surface water and groundwater.
13	✓	✓		
14	✓	✓		
16	✓	✓		
15	✓	✓		
17	✓	✓		
15	✓	✓	Coal tar, spent oxide, ammonical liquor, foul lime, and creosote (Area 16).	From gas producers. Coal tar used to bind coal, contain phenol, benzene and toluene. Lighter fractions more mobile than heavier fractions and would penetrate the ground easier. Potential hazard to controlled water.
16	✓	✓		
17	✓	✓		
12		✓	Lubricating oils, hydraulic fluids, greases, solvents, cleaning fluids, water treatment chemicals.	Small volumes used in areas of hardstanding with accidental spillages treated as per operational procedures.
14		✓		
15		✓		
14		✓	Gas cleaning solids	Stockpiled at site, mobility of Pb and Zn reduced by high alkalinity.
14	✓		Transformers	PCB's phased out to legal levels.
15	✓			
12		✓	Inorganic compounds	Sulphuric acid, sodium hydroxide, sodium nitrite, ethanolamine, cycloyeylamine, N,N-diethylhyroxylamine stored in the power station in fully bunded alarmed tanks. Spillage trays and drainage trenches installed to contain spills.
13		✓	Coke and coal. Iron ore (in Area 15).	Carbon in particulate matter transported by wind action. Fines from stockpiles would increase suspended matter load in controlled waters. Pyrite in coal if exposed to air will oxidise and acidify surface water impairing water quality.
15		✓		
16		✓		
17		✓		
15		✓		
13	✓		Railway ballast	Contaminated ballast. May be locally contaminated by hydrocarbon spillages, may contain metals, phenols, sulphates and PAH's
14	✓			
16	✓			
17	✓			

3.3 Environmental Setting

3.3.1 Geology

3.3.2 The Redcar Works are extensively covered by Made Ground due to land reclamation. Underlying drift materials comprise Quaternary aeolian sands, tidal flat deposits of clay, silt, sand, and Boulder Clay.

3.3.3 Drift materials are underlain by Whitby Mudstones of the upper Lias Group, underlain in turn by mudstone of Cleveland Ironstone Formation (Ref. 1 & 2). Deeper strata comprise the Redcar Mudstones of the Lower Lias and mudstones of the Penarth Group. The Mercia Mudstone Group overly permeable formations of the Sherwood Sandstone group situated some 400-500m below Ordinance Datum. The angle of dip is approximately 10^0 to the south east. No major faulting is shown but minor faults may be present.

3.3.4 Hydrogeology

3.3.5 The Redcar Works are not situated within a groundwater Source Protection Zone designated by the Environment Agency (EA). There are no groundwater abstractions on the Redcar site or within 1km of the site boundary.

3.3.6 The Groundwater Vulnerability map classifies the drift of the Tidal Flats and recent sand and gravel deposits as a “Minor Aquifer” which may have “variable permeability” (Ref. 3). The map shows the site to be overlain by soils of a high leaching potential i.e. “soils with little ability to attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or to shallow groundwater.” The permeable formations of the Sherwood Sandstone Group are a Major Aquifer, however this is situated between 400-500m below ordinance datum and overlain by thick mudstone formations. Groundwater is abstracted from the Triassic Sandstone for industrial use 3km to the south west and for public drinking water 7km to the north west of the Teesside Works near Greatham.

3.3.7 Existing monitoring boreholes indicate that the water table ranges from 0.84m to 5.2m bgl, rising eastward away from the sea. These investigations found perched groundwater within this range between permeable Made Ground, sands and gravels, and less permeable Boulder Clay. The general direction of groundwater flow is north north-west toward the River Tees and the North Sea and possibly toward the South Gare and Coatham Sands SSSI at the northern part of the Redcar Works. Groundwater monitoring over a twelve hour period showed that the tidal influences on groundwater were not significant. The site geology and hydrogeology is summarised in Table 4.

Table 4 Summary of Site Geology & Hydrogeology

Unit	Composition	Thickness	Information Source(s)	Presence of Groundwater?	Aquifer Type
Made Ground	Dense to very dense gravel to boulder sized slag. Local variations in composition of brick fragments, coal and fine to coarse sand.	Up to 10.3m	Ref. 4	0.84mbgl to 5.2mbgl.	Non Aquifer.
Sand & gravel	Sand & gravel.	2.9m to 27m	Ref. 4	0.84mbgl to 5.2mbgl.	Minor Aquifer.
Estuarine Clay	Clay with bands of silt and sand.	Up to 4.8m	Ref. 4	Unlikely.	Minor Aquifer.
Boulder Clay	Stiff brown gravelly clay.	Up to 6.1m	Ref. 4	Unlikely.	Non Aquifer.
Redcar Mudstone	Mudstones with sandstone and limestone beds in lower part.	230-275m	Ref. 2	Possible if sufficiently fractured.	Non Aquifer.
Penarth Mudstone	Grey and green mudstone and sandstone.	10-15m	Ref. 2	Possible if sufficiently fractured.	Non Aquifer.
Mercia Mudstone	Red and green mudstone with gypsum and sandstone; halite in lower part.	200-270m	Ref. 2	Possible if sufficiently fractured.	Non Aquifer.
Sherwood Sandstone	Sandstone.	250-300m	Ref. 2	Likely.	Major Aquifer.

3.3.8 Hydrology

3.3.9 There are no surface water features crossing the site or surface water drainage systems within the Redcar site apart from Fleet Beck[4] situated in Area 11, Former Warrenby Works, which drains eastwards, ultimately joining the North Sea at Saltburn. All other surface water drains directly to ground and ultimately to the Tees Estuary.

3.3.10 Redcar is bound to the west by the River Tees and to the north by the North Sea (500m north to Mean High Water). In terms of the Classification of Estuaries Working Parties (CEWP) Classification Scheme the Tees Estuary is designated as Class A (Good) in the vicinity of the Corus discharges toward the mouth of the estuary and Class B (Fair) further upstream from the mouth[5.]

3.3.11 There are two authorised discharges from the Redcar Works, both of which are monitored for regulatory purposes; one from the Redcar Power Station and one from the Redcar Coke Ovens. Two ground soakaways are present, one for the Coke Ovens benzol fire fighting water and the other at the Blast Furnace quench tank.

3.3.12 The EA considers the area immediately north of the Redcar Works, i.e. South Gare and Coatham Sands SSSI, to be susceptible to flooding (1 in 200

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[4] Personal communication: Peter Boydell, Corus, 9/6/04.
[5] Correspondence: Katherine Liddle, Corus 24/6/04 and Ref. 4

chance) from the North Sea. The wharf area may also be prone to flooding (1 in 200) from the River Tees, possibly affecting the coal and ore stocking ground. However no record is held by Corus of flooding in this area.

3.3.13 Ecology

3.3.14 The Redcar Works are situated adjacent to South Gare and Coatham Sands which is designated a Site of Special Scientific Interest (SSSI), Ramsar Site and Special Protection Area. The site is designated due to the coastal sands habitat which includes the presence of rare orchids and the Little Tern [6.] The SSSI is situated down gradient of the works with respect to the groundwater flow and may be affected by the migration of any potential contaminants transported by surface water or groundwater. There are no other designated sensitive habitats in the area.

3.3.15 The majority of the site is covered by open ground, buildings or hard standing and therefore there is little potential for protected habitats or species to be present.

3.3.16 Site users

3.3.17 Authorised personnel on site follow Corus Health and Safety Procedures which would assess site specific risks. Health hazards would be minimised by use of appropriate personal protective equipment (PPE).

3.3.18 Neighbouring Sites

3.3.19 Migration of contaminants would be via groundwater and surface water to neighbouring sites. Land use and sensitivity of surrounding sites is industrial and is similar to the Redcar Works.

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6 Personal communication: Phillipa Forster, Corus. 25/6/04

3.4 Summary of Site Sensitivity

3.4.1 The sensitivity of each of the identified receptors in the vicinity of the site to contamination along with pathways from the site are summarised in Table 5.

Table 5 Sensitivity of Receptors in the Vicinity of the Site

Receptor Type	Receptor(s)	Sensitivity	Reasoning
Groundwater	Minor Aquifer	Low	Site underlain by a Minor Aquifer. No licensed groundwater abstractions within 1km of the site.
Surface water	River Tees Fleet Beck	Medium	The River Tees borders the north western part of the site. Surface drainage from former Warrenby Works into Fleet Beck. Two licensed discharge points. Groundwater flow toward north north west.
Ecological	South Gare and Coatham Sands, SSSI, SPA & Ramsar Site	High	The Redcar Works borders an ecologically sensitive area. Groundwater flow may be towards this ecologically sensitive area. The majority of the site is covered by open ground, buildings and hardstanding with low ecological sensitivity.
Site Users	Corus employees, contractors and visitors.	Low	Authorised personnel on site follow Corus Health and Safety Procedures which would assess site specific risks. Health hazards minimised by use of appropriate PPE.
Neighbouring sites	Adjacent Corus and third party land	Low	Migration of contaminants would be via groundwater and surface water to neighbouring sites. Land use and sensitivity of surrounding sites is industrial and is similar to the Redcar Works.

3.5 Area 11, Former Warrenby Works

3.5.1 Scope of Works

The site investigation in Area 11 comprised the following scope of works:

- Excavation of nine shallow trial pits (11AT1-4, 11BT5-10) using a 20 tonne tracked excavator and breaker;
- Advancing two groundwater monitoring boreholes (11AB1, 11AB2) using a shell and auger (cable percussive) rig;
- Recovery of 22 soil samples from Made Ground and natural strata (where encountered) and recovery of one groundwater sample.

3.5.2 Ground Conditions

- Made Ground comprising sandy coarse gravel, cobbles and boulders of slag with furnace bricks and ferrous metal debris was encountered to depths of up to 7.2m bgl with occasional lenses of sand and reworked clay;
- Groundwater was encountered at six locations within the Made Ground at depths of between 2.0 and 3.6m bgl;
- Owing to the general variability in Made Ground thickness between sampling locations across the site no generalised trends in thickness could be discerned;
- Site observations and monitoring did not reveal the presence of visual and/or olfactory evidence of possible contamination.

3.5.3 Chemical Analysis Results

- **Soil pH**

  Soil pH across the area was found to be alkaline to highly alkaline, in both Made Ground and natural deposits. The soil sample pH values range from 8.2 (11BT8, 4.0 m bgl) to 12.5 (11BT9, 3.8 m bgl). The 95th percentile calculated for pH (10.5) exceeds the guideline value of 10.

- **Toxic and Phytotoxic Metals**

  Levels of toxic metals were found to be below guidance limits, with the exception of one anomalous high lead value (782 mg/kg – 11AT4A, 3.0 m bgl). The 95th percentile calculated for lead (218 mg/kg) is well below the guideline value of 750 mg/kg.

  Concentrations of zinc within three samples exceeded guideline values (6,730 mg/kg – 11AT4A, 3.0 m bgl; 1,540 mg/kg - 11AT4A, 0.3m bgl; 1,140 mg/kg – 11BT9, 3.8 m bgl). However, the 95th percentile calculated for zinc (394 mg/kg) was well below the guideline value of 720 mg/kg.

Slightly elevated levels of boron were detected in samples from two locations (3.4 mg/kg – 11AB2, 6.0 m bgl; and 3.1 mg/kg – 11BT8, 4.0 m bgl). The 95th percentile calculated for boron (1.6 mg/kg) was well below the guideline value of 3 mg/kg.

Aside from these apparently localized areas with elevated levels of zinc and boron, phytotoxic metals were found to be in concentrations below guideline values.

- **Sulphide and Sulphate**

  Elevated levels of sulphide were detected in four locations (1,190 mg/kg – 11AB2, 3.9 m bgl; 1,112 mg/kg – 11BT5, 4.0 m bgl; 2,777 mg/kg – 11BT7, 4.0 m bgl; 1,131mg/kg – 11BT8, 0.3 m bgl). The 95th percentile calculated for sulphide (654 mg/kg) was well below the guideline value of 1,000 mg/kg.

  Elevated levels of sulphate were detected in three locations (1,930 mg/l – 11AT3, 2.0 m bgl; 1,810 mg/l – 11BT7, 4.0 m bgl; 2,070 mg/l – 11BT8, 0.3 m bgl). The 95th percentile calculated for sulphate (878 mg/l) was well below the guideline value of 1,200 mg/l.

- **Organics**

  Elevated levels of Total PAH were detected in only one sample (184 mg/kg – 11AT4A, 0.3 m bgl). The 95th percentile calculated for Total PAH (18 mg/kg) was well below the guideline value of 40 mg/kg.

  No other organic determinands were found in elevated concentrations.

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 6.

Summary of Results Showing Exceedances. Area: 11

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	11AB1	11AB2	11AB2	11AT3	11AT4A	11AT4A	11BT10	11BT10	11BT5	11BT5
			Depth m bgl		**7.4**	**3.9**	**6**	**2**	**0.3**	**3**	**1**	**3.9**	**0.4**	**4**
			Ground Type		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date		**19.04.04**	**21.04.04**	**21.04.04**	**14.04.04**	**15.04.04**	**15.04.04**	**15.04.04**	**15.04.04**	**15.04.04**	**15.04.04**
			Sample Number		**CL0410354**	**CL0410576**	**CL0410577**	**CL0410027**	**CL0410028**	**CL0410029**	**CL0410050**	**CL0410051**	**CL0410044**	**CL0410045**
ESV	<5 or >10	pH	pH	10.50	10.3	10.0	8.8	9.7	10.3	8.9	12.2	11.6	10.9	**11.2**
CLEA	500	mg/kg	Arsenic	41.52	5.1	5.8	7.6	26.1	37.3	64.9	10.6	11.7	8.7	8.2
CLEA	1,400	mg/kg	Cadmium	0.72	<0.10	0.3	<0.10	0.4	1.7	2.4	0.8	0.4	0.3	0.1
CLEA	5,000	mg/kg	Chromium	470.30	16.2	56.9	34.7	10.1	41.8	28.6	1260.0	1130.0	443.2	720.8
CLEA	750	mg/kg	Lead	218.09	9.1	41.5	19.5	15.3	590.6	782.0	145.2	74.5	56.5	17.0
CLEA	480	mg/kg	Mercury	0.32	<0.10	<0.10	<0.10	<0.10	**4.0**	1.5	<0.10	0.1	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.61	0.5	3.2	0.8	7.7	4.3	5.3	1.7	0.9	4.7	3.9
DIV	190	mg/kg	Copper	36.29	1.7	5.8	9.4	1.5	33.4	35.7	38.4	44.9	6.8	8.7
CLEA	5,000	mg/kg	Nickel	26.23	23.0	5.8	21.2	3.0	15.0	17.2	21.2	27.7	4.8	5.3
DIV	720	mg/kg	Zinc	394.89	26.1	50.9	73.2	47.4	1540.0	**6730.0**	228.7	188.7	169.0	40.7
ESV	3	mg/kg	Boron	1.59	1.1	1.9	3.4	1.0	<0.5	<0.5	0.8	1.2	1.4	0.7
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	245.24	54.0	<10.0	28.0	110.0	1000.0	117.0	251.0	168.0	<10.0	<10.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	654.46	80.0	1190.0	22.0	254.0	128.0	419.0	67.0	38.0	609.0	1112.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	877.77	582.0	527.0	429.0	1930.0	1040.0	885.0	19.3	66.4	1070.0	494.0
ESV	5,000	mg/kg	Tot Cyanide	4.26	<1	<1	<1	3.0	13.0	7.0	<1	<1	<1	3.0
ESV	20,000	mg/kg	Total Sulphur	4553.85	1500.0	4300.0	2100.0	5000.0	3800.0	4300.0	2400.0	1700.0	<400	10100.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	17.91	<16	<16	<16	<16	**<184**	<16	<18	<18	<16	<16
DIV	1	mg/kg	Benzene	N/A	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	N/A	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	N/A	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	N/A	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.55	<0.5	<0.5	<0.5	**0.9**	0.5	0.6	<0.5	0.6	<0.5	<0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 11

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	11BT7 0.3 - 15.04.04 CL0410042	11BT7 4 - 15.04.04 CL0410043	11BT8 0.3 - 15.04.04 CL0410046	11BT8 4 - 15.04.04 CL0410047	11BT9 2 - 15.04.04 CL0410048	11BT9 3.8 - 15.04.04 CL0410049
ESV	<5 or >10	pH	pH	10.50	11.1	10.5	9.2	8.2	12.1	12.5
CLEA	500	mg/kg	Arsenic	41.52	7.1	2.3	5.6	18.9	19.9	11.1
CLEA	1,400	mg/kg	Cadmium	0.72	0.5	0.2	0.3	0.5	0.7	0.7
CLEA	5,000	mg/kg	Chromium	470.30	493.1	53.1	17.5	28.5	1100.0	1030.0
CLEA	750	mg/kg	Lead	218.09	145.0	18.7	10.5	30.6	95.6	85.5
CLEA	480	mg/kg	Mercury	0.32	<0.10	<0.10	<0.10	<0.10	0.2	0.2
CLEA	8,000	mg/kg	Selenium	3.61	3.1	5.3	5.0	0.8	2.0	2.9
DIV	190	mg/kg	Copper	36.29	25.0	2.8	3.4	14.3	59.5	34.6
CLEA	5,000	mg/kg	Nickel	26.23	12.0	1.0	2.2	25.7	31.5	21.1
DIV	720	mg/kg	Zinc	394.89	127.0	29.2	22.9	320.3	177.6	1140.0
ESV	3	mg/kg	Boron	1.59	1.8	1.9	2.0	3.1	1.2	<0.5
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	245.24	95.0	<10.0	<10.0	26.0	253.0	300.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.20	<0.2	<0.2	**0.3**	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	654.46	549.0	2777.0	1131.0	15.0	60.0	158.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	877.77	854.0	1810.0	2070.0	382.0	26.5	27.6
ESV	5,000	mg/kg	Tot Cyanide	4.26	2.0	6.0	5.0	<1	<1	1.0
ESV	20,000	mg/kg	Total Sulphur	4553.85	4600.0	7900.0	7400.0	1300.0	2400.0	3800.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	17.91	<16	<16	<16	<16	<16	<28
DIV	1	mg/kg	Benzene	N/A	<10	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	N/A	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	N/A	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	N/A	<20	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.55	<0.5	<0.5	0.7	<0.5	<0.5	0.7

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

3.6 Area 12, Power Station and Surrounding Areas

3.6.1 Scope of Works

The site investigation in Area 12 comprised the following scope of works:

- Excavation of seventeen trial pits (12AT4-8, 12AT10-11, 12AT13, 12AT16-17, 12BT1-3, 12BT9, 12BT12, 12BT14-15) using a 20 tonne tracked excavator and breaker;
- Advancing two groundwater monitoring boreholes (12AB2, 12BB1) using a shell and auger (cable percussive) rig;
- Recovery of 38 soil samples from Made Ground and natural strata (where encountered) and recovery of two groundwater samples.

3.6.2 Ground Conditions

- Made Ground comprising sandy angular cobbles and boulders of slag, with furnace brick and ferrous metal debris was encountered in the majority of exploratory locations. Thicknesses of Made Ground were proven at four locations and found to extend between depths 3.0 and 7.5m bgl;
- Made Ground was found to be underlain by fine to coarse sand in four exploratory locations, although thicknesses were not fully proven;
- Groundwater was encountered at several locations within the Made Ground at depths of between 1.2 to 4.0m bgl;
- Owing to the general variability in Made Ground thickness between sampling locations across the site no generalised trends in thickness could be discerned;
- Site observations and monitoring did not reveal the presence of visual and/or olfactory evidence of possible contamination, with the exception of a slight hydrocarbon odour at a depth of 5.5m bgl in borehole 12AB2.

3.6.3 Chemical Analysis Results

- **Soil pH**

  Soil pH across the area was found to be alkaline to highly alkaline. The soil sample pH values range from 9.3 (12BA2, 7.5 m bgl) to 12.7 (12BT1, 0.2 m bgl). The 95th percentile calculated for pH (10.9) across Area 12 exceeds the guideline value of 10.

- **Toxic and Phytotoxic Metals**

  Levels of toxic and phytotoxic metals were found to be below guideline levels, with exception of elevated zinc in samples 12AT8, 4.2m bgl and 12BT15, 1.0m bgl (863 mg/kg, and 1,720 mg/kg, respectively). The 95th percentile calculated for zinc (164 mg/kg) across Area 12 is well below the guideline value of 720 mg/kg.

- **Sulphide and Sulphate**

  Elevated levels of sulphide were detected in fourteen samples across the site. The elevated sulphide levels ranged from 1,020 to 3,835 mg/kg (12BT9, 0.5m bgl; and 12AT10, 4.0m bgl, respectively). The 95th percentile calculated for sulphide (1,128 mg/kg) exceeds the guideline value of 1,000 mg/kg.

  Elevated levels of sulphate were detected in twelve samples across the site. The elevated sulphate levels ranged from 1,500 to 1,690 mg/l (12AT16, 0.3m bgl; and 12BT2, 3.9m bgl, respectively). The 95th percentile calculated for sulphate (1,011 mg/l) is below the guideline value of 1,200 mg/l.

- **Organics**

  Elevated levels of Total PAH were detected in six samples (12AT8, 2.0m bgl; 12AT11, 0.3m bgl; 12AT13, 0.2m bgl; 12AT13, 4.0m bgl; 12AT14, 0.3m bgl; and, 12AT17, 0.3m bgl). PAH values exceeding guideline values range from 41 mg/kg (12AT11, 0.3m bgl) to 309 mg/kg (12BT14, 0.3m bgl). The 95th percentile calculated for Total PAH (31 mg/kg) is below the guideline value of 40 mg/kg.

  No other organic determinands were found in elevated concentrations.

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 6.

Summary of Results Showing Exceedances. Area: 12

Guidance used	Guideline levels	Unit	**Client Sample ID** **Depth m bgl** **Ground Type** **Sample Date** **Sample Number**	95th Percentile (excluding outliers)	**12AB2** **6** **-** **22.04.04** **CL0410991**	**12AT13** **0.2** **-** **16.04.04** **CL0410286**	**12AT7** **0.25** **-** **16.04.04** **CL0410298**	**12AT4** **0.25** **-** **16.04.04** **CL0410302**	**12AT17** **0.3** **-** **16.04.04** **CL0410285**	**12AT11** **0.3** **-** **16.04.04** **CL0410288**	**12AT10** **0.3** **-** **16.04.04** **CL0410300**	**12AT16** **0.3** **-** **16.04.04** **CL0410290**	**12AT6** **1.4** **-** **16.04.04** **CL0410294**	**12AT5** **1.5** **-** **16.04.04** **CL0410292**
ESV	<5 or >10	pH	pH	10.91	10.3	10.2	10.8	11.2	9.4	10.5	10.2	9.6	12.5	11.6
CLEA	500	mg/kg	Arsenic	15.13	5.2	15.9	4.8	4.6	2.1	11.7	8.5	14.5	5.7	24.9
CLEA	1,400	mg/kg	Cadmium	0.68	<0.10	0.7	0.8	0.3	0.5	0.4	0.7	0.2	0.2	0.5
CLEA	5,000	mg/kg	Chromium	484.83	5.9	22.2	47.2	171.2	11.7	28.1	12.9	18.0	2260.0	814.2
CLEA	750	mg/kg	Lead	132.20	9.2	59.9	30.1	23.8	10.6	37.4	43.9	20.6	21.9	55.0
CLEA	480	mg/kg	Mercury	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	4.65	0.5	6.6	4.7	5.4	7.3	2.2	7.0	3.3	3.2	4.2
DIV	190	mg/kg	Copper	20.59	1.5	5.1	7.0	5.8	0.8	34.4	5.7	1.7	24.5	13.9
CLEA	5,000	mg/kg	Nickel	10.00	3.9	4.8	4.1	2.5	1.0	20.4	3.5	6.3	7.6	7.9
DIV	720	mg/kg	Zinc	163.71	28.7	113.8	86.5	43.8	23.9	123.8	126.9	32.0	54.3	219.3
ESV	3	mg/kg	Boron	1.31	0.6	0.7	1.1	1.6	1.4	1.6	1.2	1.3	0.6	1.0
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	380.43	70.0	548.0	233.0	92.0	45.0	427.0	72.0	202.0	<10.0	62.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	***<5.0***	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	1128.47	657.0	24.0	1130.0	983.0	2067.0	56.0	2589.0	528.0	12.0	47.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1010.99	588.0	1180.0	741.0	421.0	1600.0	900.0	480.0	1500.0	10.3	259.0
ESV	5,000	mg/kg	Tot Cyanide	4.41	<1	<1	3.0	<1	<1	<1	5.0	<1	5.0	<1
ESV	20,000	mg/kg	Total Sulphur	7139.99	1000.0	6500.0	4300.0	6500.0	12000.0	5400.0	5000.0	3600.0	4900.0	6000.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	30.80	<16	<120	<16	<16	<100	<41	<16	<16	<16	<16
DIV	1	mg/kg	Benzene	12.43	***<250***	<10	<10	<10	<10	<10	<10	*<25*	<10	<10
DIV	130	mg/kg	Toluene	12.43	***<250***	<10	<10	<10	<10	<10	<10	<25	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.43	***<250***	<10	<10	<10	<10	<10	<10	<25	<10	<10
DIV	25	mg/kg	Xylenes	24.87	***<500***	<20	<20	<20	<20	<20	<20	*<50*	<20	<20
DIV	40	mg/kg	Phenol Index	0.56	<0.5	1.3	**5.1**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 12

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	12AT17 2 - 16.04.04 CL0410284	12AT8 2 - 16.04.04 CL0410296	12AT16 2.2 - 16.04.04 CL0410291	12AT5 3.1 - 16.04.04 CL0410293	12AT4 4 - 16.04.04 CL0410303	12AT6 4 - 16.04.04 CL0410295	12AT7 4 - 16.04.04 CL0410299	12AT11 4 - 16.04.04 CL0410289	12AT10 4 - 16.04.04 CL0410301	12AT13 4 - 16.04.04 CL0410287
ESV	<5 or >10	pH	pH	10.91	9.7	11.1	9.4	11.0	12.3	11.9	10.1	10.6	9.6	9.6
CLEA	500	mg/kg	Arsenic	15.13	3.4	18.5	9.9	9.5	21.3	7.0	5.6	5.1	9.3	11.0
CLEA	1,400	mg/kg	Cadmium	0.68	0.5	0.4	0.2	0.1	<0.10	0.2	0.5	0.2	0.6	0.6
CLEA	5,000	mg/kg	Chromium	484.83	25.7	39.9	9.1	30.6	2220.0	1060.0	8.9	15.0	12.7	11.7
CLEA	750	mg/kg	Lead	132.20	507.4	190.1	12.8	24.6	11.8	19.0	5.4	14.0	24.6	398.3
CLEA	480	mg/kg	Mercury	0.10	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	4.65	6.4	2.5	2.8	0.6	2.2	5.3	8.7	2.6	7.4	7.9
DIV	190	mg/kg	Copper	20.59	6.2	37.2	1.1	2.9	65.3	12.5	0.8	14.2	2.9	3.9
CLEA	5,000	mg/kg	Nickel	10.00	2.6	18.3	4.3	3.7	23.1	4.1	1.7	10.1	2.9	3.5
DIV	720	mg/kg	Zinc	163.71	53.9	241.2	17.3	56.2	19.3	27.7	11.2	45.6	172.8	102.9
ESV	3	mg/kg	Boron	1.31	0.7	1.0	1.5	<0.5	1.2	0.7	3.0	2.3	1.5	0.8
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	380.43	2641.0	374.0	16.0	<10.0	<10.0	92.0	54.0	249.0	87.0	715.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5
ESV	1,000	mg/kg	Acid Soluble Sulphide	1128.47	1263.0	401.0	8.0	7.0	99.0	52.0	1550.0	820.0	3835.0	869.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1010.99	1670.0	597.0	1560.0	480.0	288.0	70.0	1730.0	590.0	1620.0	1600.0
ESV	5,000	mg/kg	Tot Cyanide	4.41	<1	3.0	<1	<1	<1	3.0	8.0	3.0	5.0	5.0
ESV	20,000	mg/kg	Total Sulphur	7139.99	9200.0	4200.0	3500.0	400.0	4400.0	8300.0	17000.0	7600.0	13300.0	8900.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	30.80	<16	<56	<16	<16	<16	<16	<17	<16	<22	<50
DIV	1	mg/kg	Benzene	12.43	<10	<10	<10	<10	<10	<10	<10	<10	<10	*<25*
DIV	130	mg/kg	Toluene	12.43	<10	<10	<10	<10	<10	<10	<10	<10	<10	<25
DIV	50	mg/kg	Ethylbenzene	12.43	<10	<10	<10	<10	<10	<10	<10	<10	<10	<25
DIV	25	mg/kg	Xylenes	24.87	<20	<20	<20	<20	<20	<20	<20	<20	<20	*<50*
DIV	40	mg/kg	Phenol Index	0.56	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**2.2**	<0.5	<0.5	<0.5

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Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 12

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	12AT8 4.2 - 16.04.04 CL0410297	12 5.5 - 22.04.04 CL0410993	12BB1 7.5 - 22.04.04 CL0410994	12BT2 0.1 - 20.04.04 CL0410321	12BT1 0.2 - 20.04.04 CL0410319	12BT3 0.2 - 20.04.04 CL0410323	12BT9 0.5 - 20.04.04 CL0410325	12BT9 3.2 - 20.04.04 CL0410326	12BT2 3.9 - 20.04.04 CL0410322	12BT3 4 - 20.04.04 CL0410324
ESV	<5 or >10	pH	pH	10.91	10.6	11.4	10.1	11.6	12.7	10.5	10.4	10.3	10.6	10.3
CLEA	500	mg/kg	Arsenic	15.13	23.7	10.6	6.0	6.7	6.7	13.4	34.1	40.8	19.3	19.8
CLEA	1,400	mg/kg	Cadmium	0.68	2.7	0.2	<0.10	0.3	0.6	0.5	0.6	0.6	0.6	1.2
CLEA	5,000	mg/kg	Chromium	484.83	54.5	46.7	8.9	246.0	1440.0	36.3	265.0	325.5	23.7	22.7
CLEA	750	mg/kg	Lead	132.20	600.5	52.0	10.3	24.0	72.8	41.7	102.9	106.8	41.9	68.9
CLEA	480	mg/kg	Mercury	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	**0.2**	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	4.65	3.0	0.7	0.5	4.6	1.8	5.8	2.9	3.1	5.4	5.9
DIV	190	mg/kg	Copper	20.59	29.5	9.4	2.8	4.7	40.1	6.2	41.2	46.4	3.2	4.0
CLEA	5,000	mg/kg	Nickel	10.00	19.0	9.3	6.7	3.0	16.9	3.4	20.2	21.8	2.8	3.0
DIV	720	mg/kg	Zinc	163.71	862.7	186.7	38.7	113.3	108.3	111.5	161.0	267.6	225.7	270.6
ESV	3	mg/kg	Boron	1.31	0.9	0.8	<0.5	1.4	1.2	1.3	<0.5	0.7	2.6	1.5
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	380.43	219.0	42.0	23.0	57.0	173.0	81.0	242.0	31.0	62.0	36.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	1128.47	333.0	<5	<5	1231.0	<5	1250.0	1020.0	604.0	2632.0	2652.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1010.99	1620.0	187.0	64.9	768.0	11.0	1620.0	700.0	498.0	1690.0	1640.0
ESV	5,000	mg/kg	Tot Cyanide	4.41	5.0	<1	<1	3.0	<1	8.0	18.0	3.0	6.0	10.0
ESV	20,000	mg/kg	Total Sulphur	7139.99	6700.0	800.0	<400	6200.0	2200.0	8600.0	5800.0	4500.0	12500.0	10500.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	30.80	<16	<16	<16	<16	<16	<17	<16	<16	<16	<16
DIV	1	mg/kg	Benzene	12.43	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	12.43	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.43	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	24.87	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.56	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 12

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	12BT1 4 - 20.04.04 CL0410320	12BT14 0.3 - 21.04.04 CL0410586	12BT12 0.4 - 21.04.04 CL0410584	12BT15 1 - 21.04.04 CL0410588	12BT14 3.9 - 21.04.04 CL0410587	12BT12 4 - 21.04.04 CL0410585
ESV	<5 or >10	pH	pH	10.91	12.8	10.0	10.6	11.4	9.6	11.0
CLEA	500	mg/kg	Arsenic	15.13	5.0	3.5	17.4	27.2	3.5	28.3
CLEA	1,400	mg/kg	Cadmium	0.68	0.4	0.6	0.6	1.7	0.5	0.4
CLEA	5,000	mg/kg	Chromium	484.83	1700.0	9.5	75.4	786.6	7.1	165.2
CLEA	750	mg/kg	Lead	132.20	68.6	30.8	93.7	367.0	6.3	281.3
CLEA	480	mg/kg	Mercury	0.10	0.1	<0.10	<0.10	**0.2**	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	4.65	2.2	7.0	4.1	3.1	7.0	2.9
DIV	190	mg/kg	Copper	20.59	37.8	1.2	13.5	65.3	0.5	31.2
CLEA	5,000	mg/kg	Nickel	10.00	10.6	0.9	7.0	23.2	1.0	13.4
DIV	720	mg/kg	Zinc	163.71	99.5	44.8	177.4	**1720.0**	11.9	83.7
ESV	3	mg/kg	Boron	1.31	2.1	1.3	0.6	0.6	1.3	1.1
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	380.43	62.0	1650.0	138.0	318.0	94.0	<10.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	1128.47	151.0	2039.0	1710.0	297.0	1509.0	414.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1010.99	7.5	1540.0	446.0	553.0	1580.0	773.0
ESV	5,000	mg/kg	Tot Cyanide	4.41	<1	3.0	3.0	3.0	7.0	6.0
ESV	20,000	mg/kg	Total Sulphur	7139.99	2500.0	8700.0	6700.0	4100.0	10600.0	6900.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	**2.0**	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	30.80	<16	**<309**	<22	<18	<26	<16
DIV	1	mg/kg	Benzene	12.43	<10	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	12.43	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.43	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	24.87	<20	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.56	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

3.7 Area 13, Sinter Plant

3.7.1 Scope of Works

The site investigation in Area 13 comprised the following scope of works:

- Excavation of seventeen trial pits (13AT1-7, 13BT8-13, 13CT14-17) using a 20 tonne tracked excavator and breaker;
- Advancing two groundwater monitoring boreholes (13AB2, 13CB1) using a shell and auger (cable percussive) rig;
- Recovery of 38 soil samples from Made Ground and natural strata (where encountered) and recovery of two groundwater samples.

3.7.2 Ground Conditions

- Made Ground in this area comprised coarse angular gravel, cobbles and boulders of brick and slag, with gravel of ash, coal and sinter and was encountered up to depths 7.0m;
- Firm gravelly, sandy clay was observed between depths of 0.4 to 2.0m at four locations in the north western portion of the area;
- Fine to coarse gravelly sand was encountered between depths of 5.5 and 7.7m, indicating the presence of natural strata, but thicknesses were not fully proven;
- Groundwater was encountered frequently in the Made Ground at depths of between 1.7 to 4.0m;
- Owing to the general variability in Made Ground thickness between sampling locations across the site no generalised trends in thickness could be discerned;
- Site observations and monitoring did not reveal the presence of visual and/or olfactory evidence of possible contamination.

3.7.3 Chemical Analysis Results

- **Soil pH**

  Soil pH across the area was found to be alkaline to highly alkaline. The soil sample pH values range from 8.6 (13CT17, 3.1 m bgl) to 12.7 (13BT12, 0.3 m bgl). The 95th percentile calculated for pH (11) exceeds the guideline value of 10.

- **Toxic and Phytotoxic Metals**

  Levels of toxic metals were found to be below guideline levels, with the exception of one anomalous high lead value (2030 mg/kg – 13AT1, 4.3 m bgl).

The 95th percentile calculated for lead (85 mg/kg) is well below the guideline value of 750 mg/kg.

Concentrations of zinc exceeded guideline values in two locations (2,710 mg/kg - 13AT1, 4.3 m bgl; 4,160 mg/kg – 13AT3, 4.0 m bgl). The 95th percentile calculated for zinc (370 mg/kg) was well below the guideline value of 720 mg/kg.

Elevated levels of boron were detected in one location, 4.1 mg/kg – 13BT13, 3.5 m bgl. The 95th percentile calculated for boron (1.8mg/kg) was below the guideline value of 3 mg/kg.

Aside from the samples with elevated levels of zinc and boron, phytotoxic metals were found to be in concentrations below guideline values.

- **Sulphide and Sulphate**

Elevated levels of sulphide were detected in nine samples across the area, ranging from 1,305 mg/kg (13AT7, 0.7 m bgl) to 3,448 mg/kg (13AT2, 0.15 m bgl). The 95th percentile calculated for sulphide (995 mg/kg) was below the guideline value of 1,000 mg/kg.

Elevated levels of sulphate were detected in fifteen samples across the area, ranging from 1250 mg/l (13AT3, 0.2 m bgl) to 2920 mg/l (13AT5, 4.0 m bgl).

There were no elevated concentrations of sulphate within samples from Sub-Area B.

In Sub-Area C four samples exhibited elevated levels of sulphate, 1,550 mg/l – 13CT14, 0.3 m bgl; 1,530 mg/l – 13CT15, 3.8 m bgl; 1,960 mg/l – 13CT16, 0.3 m bgl; 1,780 mg/l – 13CT17, 0.5 m bgl. The 95th percentile calculated for sulphate (1381 mg/l) was above the guideline value of 1,200 mg/l.

Only one sample (13AT3, 4.0m bgl) exhibited an elevated concentration of total sulphur (26,100 mg/kg). However, the 95th percentile for total sulphur (7,506 mg/kg) across Area 13, Sinter Plant is well below the guideline value of 20,000 mg/kg.

- **Organics**

Elevated levels of Total PAH were detected in two locations (47 mg/kg – 13BT11, 0.2 m bgl; 153 mg/kg – 13CT15, 3.8 m bgl). The 95th percentile calculated for Total PAH (19.5 mg/kg) was well below the guideline value of 40 mg/kg.

No other organic determinands were found in elevated concentrations.

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 6.

Summary of Results Showing Exceedances. Area: 13

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	13AB2	13AB2	13AT1	13AT1	13AT2	13AT2	13AT3	13AT3	13AT4	13AT4
			Depth m bgl		**3.8**	**5.6**	**0.1**	**4.3**	**0.15**	**4.1**	**0.2**	**4**	**0.25**	**4.1**
			Ground Type		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date		**15.04.04**	**15.04.04**	**13.04.04**	**13.04.04**	**13.04.04**	**13.04.04**	**14.04.04**	**14.04.04**	**14.04.04**	**14.04.04**
			Sample Number		**CL0410355**	**CL0410356**	**CL0409557**	**CL0409558**	**CL0409559**	**CL0409560**	**CL0410030**	**CL0410031**	**CL0410032**	**CL0410033**
ESV	<5 or >10	pH	pH	11.06	11.4	10.2	11.5	11.7	11.3	10.9	10.8	10.0	10.2	12.1
CLEA	500	mg/kg	Arsenic	21.00	12.5	5.4	14.1	92.5	8.8	10.2	25.6	**468.7**	19.3	20.3
CLEA	1,400	mg/kg	Cadmium	1.00	0.8	<0.10	0.7	**16.4**	0.2	0.1	0.4	5.6	0.4	2.0
CLEA	5,000	mg/kg	Chromium	429.55	438.1	36.9	361.4	441.6	61.4	29.7	184.2	173.6	29.3	1340.0
CLEA	750	mg/kg	Lead	84.59	39.0	18.4	124.3	**2030.0**	46.9	28.5	33.8	499.1	18.3	31.8
CLEA	480	mg/kg	Mercury	0.14	0.2	<0.10	0.1	0.3	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.76	2.4	<0.50	3.1	1.7	6.2	5.9	3.9	4.5	6.9	2.1
DIV	190	mg/kg	Copper	25.15	20.7	3.2	20.0	160.5	2.9	2.7	9.6	10.7	1.4	23.0
CLEA	5,000	mg/kg	Nickel	17.34	25.5	25.6	13.4	40.8	5.0	4.1	9.5	30.1	2.6	18.1
DIV	720	mg/kg	Zinc	369.65	138.3	27.5	331.3	2710.0	91.2	82.1	107.4	**4160.0**	211.1	145.7
ESV	3	mg/kg	Boron	1.83	1.4	1.0	1.7	0.8	1.4	2.6	1.2	1.6	1.7	0.7
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	417.10	40.0	<10.0	181.0	325.0	39.0	14.0	173.0	23.0	33.0	60.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.28	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	994.52	553.0	26.0	409.0	68.0	3448.0	2468.0	399.0	<5	654.0	16.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1381.43	670.0	262.0	1060.0	359.0	2160.0	2100.0	1250.0	2120.0	2390.0	97.7
ESV	5,000	mg/kg	Tot Cyanide	2.21	<1	<1	1.0	<1	<1	<1	2.0	<1	2.0	3.0
ESV	20,000	mg/kg	Total Sulphur	7505.58	6800.0	1200.0	4700.0	3300.0	8800.0	9900.0	7600.0	26100.0	9100.0	3100.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.56	<16	<16	<16	<16	<16	<16	<18	<16	<16	<16
DIV	1	mg/kg	Benzene	13.99	<10	<10	<10	*<25*	<10	*<25*	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	13.99	<10	<10	<10	<25	<10	<25	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	13.99	<10	<10	<10	<25	<10	<25	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	27.98	<20	<20	<20	*<50*	<20	*<50*	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.51	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 13

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	13AT5	13AT5	13AT6	13AT6	13AT7	13AT7	13BT10	13BT11	13BT11	13BT12
			Depth m bgl		**0.8**	**4**	**1.8**	**3.3**	**0.7**	**4.1**	**0.2**	**0.2**	**0.5**	**0.3**
			Ground Type		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date		**14.04.04**	**14.04.04**	**14.04.04**	**14.04.04**	**13.04.04**	**13.04.04**	**14.04.04**	**14.04.04**	**14.04.04**	**14.04.04**
			Sample Number		**CL0410036**	**CL0410037**	**CL0410034**	**CL0410035**	**CL0409561**	**CL0409562**	**CL0410062**	**CL0410056**	**CL0410057**	**CL0410060**
ESV	<5 or >10	pH	pH	11.06	10.6	10.8	10.3	10.5	11.5	10.9	10.8	11.6	10.8	12.7
CLEA	500	mg/kg	Arsenic	21.00	39.2	19.9	34.7	18.3	11.0	11.6	31.3	6.8	12.1	8.0
CLEA	1,400	mg/kg	Cadmium	1.00	1.0	0.8	0.6	0.4	0.2	<0.10	3.2	0.4	0.3	0.4
CLEA	5,000	mg/kg	Chromium	429.55	42.8	14.1	38.1	31.7	213.4	65.8	586.1	658.1	335.9	2580.4
CLEA	750	mg/kg	Lead	84.59	98.1	80.5	77.7	24.0	47.7	19.6	105.3	31.2	58.9	50.6
CLEA	480	mg/kg	Mercury	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.2
CLEA	8,000	mg/kg	Selenium	3.76	5.1	6.1	4.8	7.0	5.9	3.1	1.5	1.8	1.9	2.8
DIV	190	mg/kg	Copper	25.15	4.3	5.8	6.8	0.9	6.0	4.1	49.5	19.2	26.3	36.2
CLEA	5,000	mg/kg	Nickel	17.34	10.4	3.3	9.9	3.7	5.5	5.7	38.9	15.3	17.6	12.9
DIV	720	mg/kg	Zinc	369.65	609.7	292.9	292.6	93.2	90.0	35.8	372.2	80.2	146.1	102.5
ESV	3	mg/kg	Boron	1.83	2.6	3.0	2.1	2.7	1.3	2.4	1.7	1.2	2.3	0.6
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	417.10	41.0	<10.0	90.0	<10.0	54.0	19.0	172.0	2574.0	84.0	93.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.28	<0.2	<0.2	<0.2	<0.2	<0.2	**<5.0**	0.6	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	994.52	1921.0	2816.0	803.0	1919.0	1305.0	1773.0	<5	101.0	156.0	<5
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1381.43	2440.0	2920.0	2520.0	2760.0	2340.0	2040.0	410.0	180.0	592.0	13.0
ESV	5,000	mg/kg	Tot Cyanide	2.21	**14.0**	**15.0**	8.0	5.0	<1	<1	<1	<1	<1	<1
ESV	20,000	mg/kg	Total Sulphur	7505.58	11800.0	13600.0	14600.0	13600.0	9500.0	5000.0	2400.0	3700.0	3100.0	3400.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.56	<16	<16	<16	<16	<16	<16	<18	<47	<16	<16
DIV	1	mg/kg	Benzene	13.99	<10	<10	<10	<10	<10	***<250***	*<25*	<10	<10	<10
DIV	130	mg/kg	Toluene	13.99	<10	<10	<10	<10	<10	***<250***	<25	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	13.99	<10	<10	<10	<10	<10	***<250***	<25	<10	<10	<10
DIV	25	mg/kg	Xylenes	27.98	<20	<20	<20	<20	<20	***<500***	*<50*	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.51	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 13

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	13BT12 2 - 14.04.04 CL0410061	13BT13 0.4 - 14.04.04 CL0410058	13BT13 3.5 - 14.04.04 CL0410059	13BT8 0.3 - 14.04.04 CL0410053	13BT9 0.1 - 14.04.04 CL0410054	13CB1 5.5 - 21.04.04 CL0410590	13CT14 0.3 - 14.04.04 CL0410066	13CT14 3.6 - 14.04.04 CL0410067	13CT15 0.2 - 14.04.04 CL0410068	13CT15 3.8 - 14.04.04 CL0410069
ESV	<5 or >10	pH	pH	11.06	11.2	11.1	10.7	11.3	11.2	10.5	11.2	11.5	11.1	11.5
CLEA	500	mg/kg	Arsenic	21.00	17.5	21.9	16.7	12.7	9.5	2.4	13.6	21.4	9.4	26.3
CLEA	1,400	mg/kg	Cadmium	1.00	0.4	0.4	0.3	0.7	0.5	0.2	0.5	0.7	0.7	1.0
CLEA	5,000	mg/kg	Chromium	429.55	298.9	417.8	470.3	308.5	623.0	5.1	311.4	468.2	200.0	334.9
CLEA	750	mg/kg	Lead	84.59	61.0	48.0	33.4	93.6	62.8	12.9	47.4	71.6	47.0	88.0
CLEA	480	mg/kg	Mercury	0.14	<0.10	<0.10	<0.10	0.4	0.2	<0.10	<0.10	<0.10	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.76	1.1	3.3	4.1	2.0	2.8	5.0	4.1	3.7	4.3	4.5
DIV	190	mg/kg	Copper	25.15	20.9	14.6	13.5	30.1	27.0	1.1	10.1	18.1	13.1	13.6
CLEA	5,000	mg/kg	Nickel	17.34	26.5	11.8	10.0	21.8	15.5	1.1	7.1	9.5	8.2	5.9
DIV	720	mg/kg	Zinc	369.65	220.0	141.6	84.9	212.2	205.3	7.5	235.5	203.1	141.4	660.6
ESV	3	mg/kg	Boron	1.83	0.8	1.8	4.1	1.9	2.6	1.9	1.3	1.2	0.7	1.8
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	417.10	83.0	443.0	198.0	2808.0	91.0	<10.0	74.0	120.0	212.0	571.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.28	<0.2	<0.5	<0.2	<0.2	<0.2	<0.5	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	994.52	5.0	490.0	2055.0	415.0	30.0	3060.0	524.0	290.0	439.0	571.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1381.43	204.0	646.0	690.0	364.0	382.0	1020.0	1550.0	878.0	964.0	1530.0
ESV	5,000	mg/kg	Tot Cyanide	2.21	<1	<1	1.0	<1	1.0	7.0	2.0	<1	<1	5.0
ESV	20,000	mg/kg	Total Sulphur	7505.58	1200.0	5500.0	7300.0	3600.0	3700.0	7100.0	8100.0	4700.0	3300.0	9100.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.56	<16	<38	<16	<26	<16	<16	<16	<16	<16	**<153**
DIV	1	mg/kg	Benzene	13.99	<10	*<25*	<10	<10	<10	*<25*	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	13.99	<10	<25	<10	<10	<10	<25	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	13.99	<10	<25	<10	<10	<10	<25	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	27.98	<20	*<50*	<20	<20	<20	*<50*	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.51	<0.5	<0.5	**3.0**	<0.5	<0.5	**1.4**	<0.5	<0.5	<0.5	<0.5

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Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 13

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	13CT16 0.3 - 14.04.04 CL0410070	13CT16 4 - 14.04.04 CL0410071	13CT17 0.5 - 14.04.04 CL0410065
ESV	<5 or >10	pH	pH	11.06	11.3	11.3	11.4
CLEA	500	mg/kg	Arsenic	21.00	6.9	12.2	5.3
CLEA	1,400	mg/kg	Cadmium	1.00	0.6	0.7	0.6
CLEA	5,000	mg/kg	Chromium	429.55	22.1	196.0	35.9
CLEA	750	mg/kg	Lead	84.59	26.5	61.4	29.0
CLEA	480	mg/kg	Mercury	0.14	<0.10	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.76	2.1	4.0	1.6
DIV	190	mg/kg	Copper	25.15	12.8	8.4	16.4
CLEA	5,000	mg/kg	Nickel	17.34	12.4	5.2	11.9
DIV	720	mg/kg	Zinc	369.65	191.1	106.5	194.2
ESV	3	mg/kg	Boron	1.83	1.4	1.5	1.0
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	417.10	401.0	148.0	264.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.28	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	994.52	447.0	267.0	127.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1381.43	1960.0	583.0	1780.0
ESV	5,000	mg/kg	Tot Cyanide	2.21	<1	<1	<1
ESV	20,000	mg/kg	Total Sulphur	7505.58	4200.0	5900.0	2400.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.56	<16	<16	<16
DIV	1	mg/kg	Benzene	13.99	<10	<10	<10
DIV	130	mg/kg	Toluene	13.99	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	13.99	<10	<10	<10
DIV	25	mg/kg	Xylenes	27.98	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.51	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

3.8 Area 14, Blast Furnace

3.8.1 Scope of Works

The site investigation in Area 14 comprised the following scope of works:

- Excavation of nine trial pits (14AT1-9) using a 20 tonne tracked excavator and breaker;
- Advancing two groundwater monitoring boreholes (14AB1 and 14AB2A) using a shell and auger (cable percussive) rig;
- Recovery of 22 soil samples fom Made Ground and natural strata (where encountered) and recovery of two groundwater samples.

3.8.2 Ground Conditions

- Made Ground comprising sandy gravel, cobbles and boulders of brick, slag and ash was encountered in the majority of locations up to depths of 7.4m bgl;
- Owing to the general variability in Made Ground thickness between sampling locations across the site no generalised trends in thickness could be discerned;
- This found to be underlain by fine to coarse, occasionally gravelly sand at depths of between 1.8 and 8.0m bgl, although thicknesses were not fully proven;
- Groundwater was encountered at two locations at depths of 3.4 and 4.12m bgl;
- Site observations and monitoring did not reveal the presence of visual and/or olfactory evidence of possible contamination, with the exception of an oily material and a strong hydrocarbon odour in borehole 14AB1 below 3.4m bgl.

3.8.3 Chemical Analysis Results

- **Soil pH**

  Soil pH across the area was found to be alkaline to highly alkaline. The soil sample pH values range from 8.7 (14AT6, 0.2m bgl) to 12.4 (14AT6, 3.0m bgl). The 95th percentile calculated for pH (11) exceeds the guideline value of 10.

- **Toxic and Phytotoxic Metals**

  Levels of toxic metals were found to be below guideline levels, with the exception of one anomalous high lead value (1,450 mg/kg – 14AT3, 0.8 m bgl). The 95th percentile calculated for lead (69 mg/kg) is well below the guideline value of 750 mg/kg.

  Levels of phytotoxic metals were found to be below guideline levels, with the exception of one slightly elevated zinc value (878.3 mg/kg – 14AT2, 0.3 m bgl). The 95th percentile calculated for zinc (283 mg/kg) is well below the guideline value of 720 mg/kg.

- **Sulphide and Sulphate**

  Elevated levels of sulphide were detected in eight samples from Area 14, ranging between 1,141 mg/kg (14AT4, 3.8 m bgl) to 4,126 mg/kg (14AT5, 4.0 m bgl).

  Elevated levels of sulphate were detected in eight samples from Area 14, ranging from 1,340 mg/l (14AT4, 0.2 m bgl) to 2,990 mg/l (14AT5, 4.0 m bgl).

  The 95th percentiles calculated for sulphide (1,483 mg/kg) and sulphate (1,304 mg/l) were above the guideline values of 1,000 mg/kg and 1,200 mg/l, respectively.

- **Organics**

  Slightly elevated levels of Total PAH were detected at three locations (42 mg/kg – 14AB1, 3.4 m bgl; 44 mg/kg - 14AT2, 0.3 m bgl; 68 mg/kg - 14AT7, 4.0 m bgl). The 95th percentile calculated for Total PAH (26.07 mg/kg) was well below the guideline value of 40 mg/kg.

  Borehole 14AB1, 3.4 m bgl showed elevated levels of BTEX compounds toluene, ethylbenzene and xylene (620 mg/kg, 561 mg/kg and 2,230 mg/kg, respectively). This borehole is situated adjacent to a heavy fuel oil tank (Bunker C) which is used in the blast furnace.

  No other organic determinands were found in elevated concentrations.

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 6.

Summary of Results Showing Exceedances. Area: 14

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	14AB1	14AB2A	14AB2A	14AT1	14AT2	14AT2	14AT3	14AT3	14AT4	14AT4
			Depth m bgl		3.4	6	7.4	0.3	0.3	3.8	0.8	2.4	0.2	3.8
			Ground Type		-	-	-	-	-	-	-	-	-	-
			Sample Date		21.04.04	22.04.04	22.04.04	19.04.04	19.04.04	19.04.04	19.04.04	19.04.04	19.04.04	19.04.04
			Sample Number		CL0410578	CL0410999	CL0411000	CL0410155	CL0410157	CL0410158	CL0410153	CL0410154	CL0410151	CL0410152
ESV	<5 or >10	pH	pH	10.87	10.0	11.2	11.1	10.7	12.2	11.1	11.4	10.3	9.8	10.7
CLEA	500	mg/kg	Arsenic	18.83	14.2	14.4	**93.7**	5.5	6.9	7.4	31.6	6.5	25.8	9.9
CLEA	1,400	mg/kg	Cadmium	0.76	0.5	<0.10	<0.10	1.1	1.3	0.5	**7.6**	0.2	0.4	0.4
CLEA	5,000	mg/kg	Chromium	117.32	11.6	21.4	30.1	43.8	534.4	25.1	312.8	6.2	13.1	8.5
CLEA	750	mg/kg	Lead	68.99	3.8	16.1	7.0	130.2	176.7	19.1	**1450.0**	53.3	12.1	9.1
CLEA	480	mg/kg	Mercury	0.10	<0.10	0.1	<0.10	<0.10	0.1	<0.10	<0.10	<0.10	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	4.99	7.7	0.9	0.8	3.7	3.3	7.7	3.2	<0.50	6.1	7.3
DIV	190	mg/kg	Copper	18.10	8.0	5.3	8.5	12.6	20.3	1.6	63.5	3.5	8.4	2.8
CLEA	5,000	mg/kg	Nickel	13.50	2.3	6.9	55.6	5.7	11.0	1.6	26.7	3.0	5.2	1.5
DIV	720	mg/kg	Zinc	282.95	35.8	47.7	13.6	499.3	878.3	105.8	709.0	33.9	32.0	15.3
ESV	3	mg/kg	Boron	1.59	0.5	<0.5	<0.5	<0.5	1.5	2.7	1.8	<0.5	1.7	2.6
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	560.15	2420.0	45.0	23.0	959.0	362.0	39.0	695.0	<10.0	139.0	162.0
DIV	5,000	mg/kg	GRO (C5 - C10)	1.58	**15.6**	<0.2	<5.0	<0.2	<0.2	<0.2	0.2	<0.5	<5.0	0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	1483.29	2693.0	468.0	892.0	553.0	1507.0	1725.0	139.0	<5	532.0	1141.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1304.29	611.0	333.0	312.0	997.0	286.0	950.0	1040.0	288.0	1340.0	1910.0
ESV	5,000	mg/kg	Tot Cyanide	9.58	10.0	<1	<1	1.0	<1	10.0	<1	<1	11.0	8.0
ESV	20,000	mg/kg	Total Sulphur	7078.97	10300.0	800.0	900.0	4100.0	5600.0	8400.0	4800.0	<400	5600.0	9200.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	26.07	<42	<16	<16	<16	<44	<16	<27	<16	<16	<16
DIV	1	mg/kg	Benzene	90.13	*<250*	<10	*<250*	<10	<10	<10	<10	*<25*	*<250*	<10
DIV	130	mg/kg	Toluene	78.54	***620.0***	<10	*<250*	<10	<10	<10	<10	<25	*<250*	<10
DIV	50	mg/kg	Ethylbenzene	78.54	***561.0***	<10	*<250*	<10	<10	<10	<10	<25	*<250*	<10
DIV	25	mg/kg	Xylenes	157.08	***2230.0***	<20	*<500*	<20	<20	<20	<20	*<50*	*<500*	<20
DIV	40	mg/kg	Phenol Index	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 14

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	14AT5	14AT5	14AT6	14AT7	14AT8	14AT8	14AT9	14AT9
			Depth m bgl		**0.2**	**4**	**3**	**4**	**0.3**	**4**	**0.6**	**3.5**
			Ground Type		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date		**16.04.04**	**16.04.04**	**16.04.04**	**21.04.04**	**19.04.04**	**19.04.04**	**21.04.04**	**21.04.04**
			Sample Number		**CL0410039**	**CL0410038**	**CL0410041**	**CL0410583**	**CL0410149**	**CL0410150**	**CL0410580**	**CL0410581**
ESV	<5 or >10	pH	pH	10.87	10.6	10.6	12.4	10.2	10.9	11.2	10.7	9.7
CLEA	500	mg/kg	Arsenic	18.83	4.3	2.3	10.7	8.1	4.5	73.4	12.3	9.7
CLEA	1,400	mg/kg	Cadmium	0.76	1.8	0.6	0.6	0.6	0.4	1.4	0.5	1.2
CLEA	5,000	mg/kg	Chromium	117.32	48.0	10.8	70.1	18.8	31.7	215.6	81.5	22.9
CLEA	750	mg/kg	Lead	68.99	26.1	2.4	132.3	11.9	35.6	157.7	70.3	71.7
CLEA	480	mg/kg	Mercury	0.10	<0.10	<0.10	<0.10	<0.10	0.1	<0.10	<0.10	**0.1**
CLEA	8,000	mg/kg	Selenium	4.99	4.8	7.3	3.6	7.4	4.9	5.5	3.1	6.4
DIV	190	mg/kg	Copper	18.10	6.6	<0.50	48.1	2.1	5.8	19.2	22.7	10.5
CLEA	5,000	mg/kg	Nickel	13.50	4.3	<0.50	12.0	2.6	4.9	14.4	10.5	3.8
DIV	720	mg/kg	Zinc	282.95	160.5	13.7	80.0	75.0	120.7	579.5	170.0	381.1
ESV	3	mg/kg	Boron	1.59	1.8	1.7	<0.5	0.6	1.9	3.0	1.7	1.6
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	560.15	354.0	95.0	777.0	268.0	216.0	69.0	141.0	235.0
DIV	5,000	mg/kg	GRO (C5 - C10)	1.58	<0.2	<0.2	<0.2	<0.5	0.2	<0.2	<0.2	<0.5
ESV	1,000	mg/kg	Acid Soluble Sulphide	1483.29	941.0	4126.0	685.0	3617.0	1246.0	120.0	394.0	1563.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1304.29	2070.0	2990.0	2110.0	432.0	936.0	1250.0	1260.0	1590.0
ESV	5,000	mg/kg	Tot Cyanide	9.58	16.0	36.0	1.0	21.0	3.0	<1	3.0	10.0
ESV	20,000	mg/kg	Total Sulphur	7078.97	6900.0	15900.0	6800.0	9600.0	8500.0	6500.0	4600.0	8200.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	26.07	<16	<16	<16	**<68**	<18	<16	<32	<34
DIV	1	mg/kg	Benzene	90.13	<10	<10	<10	<10	<10	<10	<10	*<25*
DIV	130	mg/kg	Toluene	78.54	<10	<10	<10	<10	<10	<10	<10	<25
DIV	50	mg/kg	Ethylbenzene	78.54	<10	<10	<10	<10	<10	<10	<10	<25
DIV	25	mg/kg	Xylenes	157.08	<20	<20	<20	<20	<20	<20	<20	*<50*
DIV	40	mg/kg	Phenol Index	0.50	<0.5	**2.3**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

3.9 Area 15, Raw Coal and Ore Stocking Areas

3.9.1 Scope of Works

The site investigation in Area 15 comprised the following scope of works:

- Excavation of forty-one trial pits (15AT2-5, 15BT6-8, 15BT10-11, 15BT13-14, 15BT17, 15CT32, 15CT38-40, 15CT42-44, 15DT15-16, 15DT24-25, 15DT27, 15DT34, 15ET26, 15ET28-29, 15ET35-37, 15FT12, 15FT18-23, 15FT30-31, 15FT33) using a 20 tonne tracked excavator and breaker;
- Advancing three groundwater monitoring boreholes (15AB1-3) using a shell and auger (cable percussive) rig;
- Recovery of 84 soil samples from Made Ground and natural strata (where encountered) and recovery of three groundwater samples.

3.9.2 Ground Conditions

- Made Ground was found to consist of sandy angular fine to coarse gravel, cobbles and boulders of slag, ash and brick in the majority of locations across the area;
- Slag was underlain by medium to coarse sand with very occasional gravel of slag in approximately 25% of locations, between depths of 0.6 to 9.1m bgl;
- Groundwater was encountered frequently (generally in the Made Ground) at depths of between 2.9 to 6.0m bgl;
- Site observations and monitoring did not reveal the presence of visual and/or olfactory evidence of possible contamination, with the exception of a strong oily odour at location 15CT43, at a depth of between 2.5 to 4.0m bgl.

3.9.3 Chemical Analysis Results

- **Soil pH**

  Soil pH across the site was found to be alkaline to highly alkaline. The soil sample pH values range from 8.4 (15CT44, 0.2 m bgl) to 12.7 (15BT6, 0.5 m bgl). The 95th percentile calculated for pH (10.3) slightly exceeds the guideline value of 10.

- **Toxic and Phytotoxic Metals**

  Levels of toxic metals were found to be below guideline levels, with the exception of one anomalous high lead value (2,900 mg/kg – 15DT27, 0.8 m bgl). The 95th percentile calculated for lead (90 mg/kg) is well below the guideline value of 750 mg/kg.

  Concentrations of copper exceeded guideline values in three locations (380.3

mg/kg – 15AB3, 7.2 m bgl; 256.4 mg/kg – 15AT3, 0.3m bgl; 215.3 mg/kg – 15CT43, 3.9 m bgl). The 95th percentile calculated for copper (40 mg/kg) was well below the guideline value of 190 mg/kg.

Concentrations of zinc exceeded guideline values in seven samples taken within Area15, ranging between 765.2 mg/kg (15BT11, 0.5 m bgl) to 11,100 mg/kg (15DT27, 0.8 m bgl). The 95th percentile calculated for zinc (336 mg/kg) was well below the guideline value of 720 mg/kg.

Elevated levels of boron were detected in seventeen samples across the Area 15. Four samples from Sub-Area C contained elevated concentrations of boron (3.9 mg/kg - 15CT40, 0.2 m bgl; 3.3 mg/kg - 15CT40, 4.1 m bgl; 5.6 mg/kg - 15CT43, 3.9 m bgl; 3.8 mg/kg - 15CT44, 4 m bgl).

One sample from Sub-Area D had elevated levels of boron, 9.5 mg/kg - 15DT27 (0.8 m bgl).

Twelve samples from Sub-Area F contained elevated levels of boron, ranging from 3.2 mg/kg (15FT21, 4.1 m bgl; and, 15FT31, 0.2 m bgl) to 4.1 mg/kg (15FT19, 3.9 m bgl).

Samples from Sub-Areas A, B and E did not contain elevated concentrations of boron. The 95th percentile calculated for boron across Area 15 as a whole (2.2 mg/kg) was below the guideline value of 3 mg/kg.

Other than the samples with elevated levels of copper, zinc and boron, phytotoxic metals were found to be in concentrations below guideline values.

- **Sulphide, sulphate and sulphur**

Elevated levels of sulphide were detected in twenty-six samples taken from within Area 15.

In Sub-Area A there is only one sample with elevated levels of sulphide, 2,020 mg/kg - 15AT5 (0.4 m bgl).

In Area B there are four samples with elevated levels of sulphide, 1,596 mg/kg – 15BT6, 0.5 m bgl; 3,206 mg/kg - 15BT6, 4.0 m bgl; 2,488 mg/kg – 15BT13, 3.9 m bgl; 2,428 mg/kg – 15BT17, 3.8 m bgl.

In Area C there is only one sample with elevated levels of sulphide, 4,062 mg/kg – 15CT40, 0.2 m bgl.

In Area D there are two samples with elevated levels of sulphide, 1,465 mg/kg – 15DT15, 0.2 m bgl; 1,210 mg/kg – 15DT25, 0.6 m bgl.

In Area E there are six samples with elevated levels of sulphide, ranging between 1,440 mg/kg (15ET35, 0.3 m bgl) and 3,154 mg/kg (15ET36, 0.2 m bgl).

In Area F there are twelve samples with elevated levels of sulphide, ranging between 1,145 mg/kg (15FT12, 1.0 m bgl) to 3,556 mg/kg (15FT33, 4.0 m bgl).

The 95th percentile calculated for sulphide (972 mg/kg) was below the guideline value of 1,000 mg/kg.

Elevated levels of sulphate were detected in thirty-nine samples across the site.

In Sub-Area A there were three samples with elevated levels of sulphate, 1,860 mg/l – 15AT2, 0.8 m bgl; 1,730 mg/l – 15AT2, 4.0 m bgl; 1,320 mg/l - 15AT5, 0.4 m bgl.

In Sub-Area B there were four locations with elevated levels of sulphate, 2,060 mg/l – 15BT6, 4.0 m bgl; 1,220 mg/l – 15BT10, 4.2 m bgl; 2,080 mg/l – 15BT13, 3.9 m bgl; 2,350 mg/l – 15BT17, 3.8 m bgl.

In Sub-Area C there were five samples with elevated levels of sulphate, 2,400mg/l – 15CT40, 0.2 m bgl; 1,960 mg/l – 15CT40, 4.1 m bgl; 1,550 mg/l – 15CT42, 0.3 m bgl; 2,190 mg/l – 1CAT43, 3.9 m bgl; 2,260 mg/l – 15CT44, 4.0 m bgl.

In Sub-Area D there were two samples with elevated levels of sulphate, 2,940 mg/l – 15DT15, 0.2 m bgl; 2,620 mg/l – 15DT27, 4.0 m bgl.

In Sub-Area E there were nine samples with elevated levels of sulphate, ranging from 1,610 mg/l (15ET28, 0.7 m bgl) to 2,420 mg/l (15ET36, 0.2 m bgl).

In Sub-Area F there are sixteen samples with elevated levels of sulphate, ranging from 1,390 mg/l (15FT18, 4.0 m bgl) to 9,620 mg/l (15FT22, 4.0 m bgl).

The 95th percentile calculated for sulphate across the whole of Area 15 (1,448 mg/l) exceeds the guideline value of 1,200 mg/l.

Only one sample (15CT44, 0.2 m bgl) exhibited an elevated concentration of total sulphur (26,600 mg/kg). The 95th percentile for total sulphur (7,007 mg/kg) across Area 15 is well below the guideline value of 20,000 mg/kg.

- **Organics**

Elevated levels of Total PAH were detected in five samples (48 mg/kg – 15CT43, 0.2 m bgl; 96 mg/kg – 15CT44, 0.2 m bgl; 53.92 mg/kg – 15DT27, 0.8 m bgl; 40.82 mg/kg – 15DT29, 0.02 m bgl; 52 mg/kg – 15FT30, 3.5 m bgl). The 95th percentile calculated for Total PAH (19.5 mg/kg) across the whole of Area 15 was below the guideline value of 40 mg/kg.

Levels of TPH exceeding guideline values 5,000 mg/kg) were identified only in sample 15CT38, 0.2m bgl (6,020 mg/kg). The 95th percentile calculated for TPH (391 mg/kg) across the Area was below the guideline value of 5,000 mg/kg.

Elevated concentrations of BTEX compounds were detected in two samples. Sample 15AT4 (0.3 m bgl) had elevated levels of benzene (80 mb/kg) and sample 15CT43 (3.9 m bgl) had elevated levels of toluene (122 mg/kg), ethlybenzene (61 mg/kg) and xylene (481 mg/kg).

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 6.

Summary of Results Showing Exceedances. Area: 15

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	15AB3	15AT02	15AT02	15AT03	15AT05	15BT06	15BT06	15BT07	15BT07	15BT08
			Depth m bgl		**7.2**	**0.8**	**4**	**0.3**	**0.4**	**0.5**	**4**	**0.3**	**4**	**0.7**
			Ground Type			**-**	**-**	**-**	**-**			**-**		
			Sample Date		**15.04.04**	**06.04.04**	**06.04.04**	**06.04.04**	**06.04.04**	**06.04.04**	**06.04.04**	**06.04.04**	**06.04.04**	**06.04.04**
			Sample Number		**CL0410359**	**CL0408865**	**CL0408864**	**CL0408882**	**CL0408866**	**CL0408871**	**CL0408870**	**CL0408874**	**CL0408875**	**CL0408877**
ESV	<5 or >10	pH	pH	10.25	9.0	10.5	10.8	11.3	10.6	12.7	11.6	12.4	11.9	10.2
CLEA	500	mg/kg	Arsenic	18.42	21.8	60.1	16.5	40.9	13.6	6.1	3.9	6.2	7.9	24.2
CLEA	1,400	mg/kg	Cadmium	0.88	1.2	1.7	0.6	1.7	0.3	0.3	0.3	<0.10	0.2	0.4
CLEA	5,000	mg/kg	Chromium	238.14	90.5	193.3	83.0	335.6	54.3	291.0	58.7	2720.0	2000.0	25.6
CLEA	750	mg/kg	Lead	88.53	102.8	134.6	58.1	458.9	51.1	15.2	6.6	17.0	21.5	22.9
CLEA	480	mg/kg	Mercury	0.18	**2.9**	0.1	0.8	0.4	0.1	<0.10	<0.10	<0.10	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.56	1.2	3.6	1.8	2.5	4.4	4.4	5.5	3.5	2.0	1.2
DIV	190	mg/kg	Copper	39.50	380.3	18.9	48.8	256.4	10.4	13.2	6.8	39.2	58.4	19.3
CLEA	5,000	mg/kg	Nickel	19.70	23.3	15.3	11.8	21.6	4.4	24.2	15.8	17.0	32.6	29.8
DIV	720	mg/kg	Zinc	329.09	225.6	2023.0	354.6	569.4	95.7	44.2	19.2	59.9	191.9	65.2
ESV	3	mg/kg	Boron	2.14	2.1	2.9	1.4	1.4	1.7	<0.5	0.6	1.0	0.7	<0.5
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	390.56	320.0	190.0	140.0	250.0	<10.0	170.0	120.0	250.0	460.0	270.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.29	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	971.82	5.0	422.0	272.0	432.0	2020.0	1596.0	3206.0	168.0	75.0	<5
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1447.90	775.0	1860.0	1730.0	363.0	1320.0	765.0	2060.0	25.8	72.5	803.0
ESV	5,000	mg/kg	Tot Cyanide	4.53	1.0	2.0	<1	4.0	2.0	2.0	<1	4.0	1.0	<1
ESV	20,000	mg/kg	Total Sulphur	7007.44	6500.0	10000.0	4000.0	4100.0	7000.0	7300.0	11300.0	3900.0	3700.0	1600.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.45	<16	<32	<16	<28	<16	<16	<16	<16	<16	<16
DIV	1	mg/kg	Benzene	13.52	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	13.56	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	14.51	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	27.12	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.54	**1.6**	<0.5	<0.5	<0.5	<0.5	**5.2**	0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 15

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	15BT08 4 06.04.04 CL0408876	15BT10 0.6 06.04.04 CL0408880	15BT10 4.2 06.04.04 CL0408881	15BT11 0.5 07.04.04 CL0409563	15BT13 3.9 06.04.04 CL0408868	15BT17 3.8 07.04.04 CL0409566	15CT40 0.2 07.04.04 CL0409571	15CT40 4.1 07.04.04 CL0409572	15CT42 0.3 08.04.04 CL0409577	15CT42 2.3 08.04.04 CL0409578
ESV	<5 or >10	pH	pH	10.25	10.2	12.0	11.2	10.1	10.7	9.8	10.8	8.7	11.1	11.2
CLEA	500	mg/kg	Arsenic	18.42	**321.7**	17.0	10.9	26.9	4.2	6.1	8.7	12.1	35.5	19.6
CLEA	1,400	mg/kg	Cadmium	0.88	2.7	0.3	0.5	1.1	0.4	0.4	0.7	0.5	1.4	0.4
CLEA	5,000	mg/kg	Chromium	238.14	52.6	2250.0	404.9	36.2	58.8	31.0	51.3	23.7	319.4	88.3
CLEA	750	mg/kg	Lead	88.53	77.4	28.9	76.7	189.6	6.8	16.1	40.4	58.5	141.1	33.0
CLEA	480	mg/kg	Mercury	0.18	<0.10	<0.10	0.1	0.1	<0.10	0.2	<0.10	0.4	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.56	1.2	3.0	3.7	3.3	7.7	4.8	5.8	1.4	3.6	1.0
DIV	190	mg/kg	Copper	39.50	63.0	74.9	69.1	15.0	6.3	8.3	4.3	29.4	21.0	17.3
CLEA	5,000	mg/kg	Nickel	19.70	158.2	39.6	10.6	11.8	12.8	1.9	3.7	18.4	13.8	21.2
DIV	720	mg/kg	Zinc	329.09	175.9	78.2	338.5	765.2	28.5	43.7	86.2	122.9	685.1	72.3
ESV	3	mg/kg	Boron	2.14	0.6	1.2	1.0	0.6	1.4	2.6	3.9	3.3	1.3	1.1
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	390.56	300.0	470.0	390.0	260.0	70.0	35.0	130.0	420.0	1200.0	210.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.29	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	971.82	<5	35.0	297.0	760.0	2488.0	2428.0	4062.0	128.0	217.0	39.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1447.90	984.0	15.3	1220.0	81.3	2080.0	2350.0	2400.0	1960.0	1550.0	392.0
ESV	5,000	mg/kg	Tot Cyanide	4.53	<1	19.0	2.0	<1	<1	<1	9.0	<1	2.0	<1
ESV	20,000	mg/kg	Total Sulphur	7007.44	1700.0	2500.0	4800.0	3800.0	14000.0	7000.0	16100.0	3800.0	7900.0	1900.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.45	<16	<16	<17	<38.45	<16	<16	<17	<16	<31	<16
DIV	1	mg/kg	Benzene	13.52	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	13.56	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	14.51	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	27.12	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.54	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	0.6	<0.5	<0.5	0.6

DIV - Dutch Intervention Value
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Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 15

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	15CT43	15CT43	15CT44	15CT44	15DT15	15DT16	15DT24	15DT25	15DT27	15ET28
			Depth m bgl		**0.2**	**3.9**	**0.2**	**4**	**0.2**	**0.8**	**0.3**	**0.6**	**4**	**0.7**
			Ground Type											
			Sample Date		**08.04.04**	**08.04.04**	**07.04.04**	**07.04.04**	**14.03.04**	**13.04.04**	**14.03.04**	**13.04.04**	**13.04.04**	**13.04.04**
			Sample Number		**CL0409575**	**CL0409576**	**CL0409569**	**CL0409570**	**CL0409579**	**CL0409589**	**CL0409581**	**CL0409591**	**CL0409588**	**CL0409583**
ESV	<5 or >10	pH	pH	10.25	9.0	9.5	8.4	8.6	10.4	10.1	12.3	10.2	11.0	10.5
CLEA	500	mg/kg	Arsenic	18.42	6.8	26.5	0.6	37.0	26.8	39.8	5.9	6.9	13.1	16.0
CLEA	1,400	mg/kg	Cadmium	0.88	0.5	0.9	0.3	1.4	0.6	1.3	0.4	0.4	1.1	0.8
CLEA	5,000	mg/kg	Chromium	238.14	25.0	33.0	1.5	57.9	29.1	20.9	229.3	14.2	61.1	50.1
CLEA	750	mg/kg	Lead	88.53	9.4	114.9	2.2	184.9	63.2	76.7	36.0	23.9	73.5	72.6
CLEA	480	mg/kg	Mercury	0.18	<0.10	**2.6**	<0.10	**3.1**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.56	3.0	2.5	<0.50	2.3	5.3	4.0	0.8	2.1	6.5	5.4
DIV	190	mg/kg	Copper	39.50	6.4	215.3	4.2	93.7	2.6	11.2	23.9	3.2	7.5	13.8
CLEA	5,000	mg/kg	Nickel	19.70	3.2	15.4	16.4	27.1	3.4	12.6	24.7	2.9	3.7	4.8
DIV	720	mg/kg	Zinc	329.09	34.7	260.7	14.2	438.8	168.3	179.2	42.0	58.6	216.8	193.3
ESV	3	mg/kg	Boron	2.14	1.0	5.6	<0.5	3.8	2.9	2.1	1.0	1.0	2.1	1.9
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	390.56	750.0	370.0	2200.0	560.0	110.0	<10.0	790.0	78.0	110.0	74.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.29	<0.5	1.0	<0.5	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	971.82	191.0	725.0	<5	42.0	1465.0	<5	8.0	1210.0	656.0	1718.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1447.90	755.0	2190.0	51.9	2260.0	2940.0	712.0	15.5	557.0	2620.0	1610.0
ESV	5,000	mg/kg	Tot Cyanide	4.53	<1	8.0	<1	<1	<1	<1	<1	<1	6.0	<1
ESV	20,000	mg/kg	Total Sulphur	7007.44	5600.0	8000.0	26600.0	8500.0	7700.0	6200.0	900.0	3300.0	12700.0	12300.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.45	<48	<16	**<96**	<20	<16.07	<16	<20.88	<16	<16	<19.97
DIV	1	mg/kg	Benzene	13.52	*<25*	<10	*<25*	<10	<10	<10	<10	*<25*	<10	<10
DIV	130	mg/kg	Toluene	13.56	<25	**122.0**	<25	<10	<10	<10	<10	<25	<10	<10
DIV	50	mg/kg	Ethylbenzene	14.51	<25	***61.0***	<25	<10	<10	<10	<10	<25	<10	<10
DIV	25	mg/kg	Xylenes	27.12	*<50*	***481.0***	*<50*	<20	<20	<20	<20	*<50*	<20	<20
DIV	40	mg/kg	Phenol Index	0.54	0.6	<0.5	<0.5	1.1	0.6	<0.5	<0.5	<0.5	<0.5	<0.5

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Values highlighted in yellow - Exceedances of guidance limits
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Summary of Results Showing Exceedances. Area: 15

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	15ET28	15ET29	15DT34	15DT34	15ET26	15ET26	15ET35	15ET35	15ET36	15ET36
			Depth m bgl		**3.2**	**0.02**	**0.2**	**4**	**0.4**	**3.9**	**0.3**	**4.1**	**0.2**	**3.8**
			Ground Type											
			Sample Date		**13.04.04**	**13.04.04**	**08.04.04**	**08.04.04**	**14.03.04**	**14.03.04**	**14.03.04**	**14.03.04**	**14.03.04**	**14.03.04**
			Sample Number		**CL0409584**	**CL0409585**	**CL0409593**	**CL0409594**	**CL0409599**	**CL0409600**	**CL0409597**	**CL0409598**	**CL0409601**	**CL0409602**
ESV	<5 or >10	pH	pH	10.25	11.0	10.7	11.4	11.4	9.0	10.2	10.0	10.7	10.8	9.1
CLEA	500	mg/kg	Arsenic	18.42	20.1	12.8	14.6	16.7	**303.5**	59.5	17.9	12.8	9.8	11.4
CLEA	1,400	mg/kg	Cadmium	0.88	0.4	0.7	1.1	0.7	2.9	0.9	2.6	0.4	0.4	0.2
CLEA	5,000	mg/kg	Chromium	238.14	179.3	56.6	619.6	518.9	197.5	44.3	31.7	49.1	34.1	24.7
CLEA	750	mg/kg	Lead	88.53	25.9	68.2	153.7	97.2	255.7	131.9	303.7	53.8	32.9	33.0
CLEA	480	mg/kg	Mercury	0.18	<0.10	<0.10	0.3	0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.56	5.1	1.1	2.0	3.1	4.5	5.9	2.7	5.4	5.8	1.5
DIV	190	mg/kg	Copper	39.50	5.5	16.3	33.9	15.9	15.4	5.5	17.9	4.4	2.0	10.6
CLEA	5,000	mg/kg	Nickel	19.70	6.3	17.9	17.3	8.0	31.2	6.0	47.0	4.1	3.7	19.0
DIV	720	mg/kg	Zinc	329.09	57.5	181.6	236.5	203.5	2150.8	535.8	914.7	311.9	212.0	122.7
ESV	3	mg/kg	Boron	2.14	1.7	0.5	1.5	0.8	2.2	2.5	1.8	2.4	2.4	2.8
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	390.56	85.0	420.0	360.0	170.0	51.0	62.0	28.0	26.0	16.0	29.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.29	<0.2	<0.5	0.4	<0.2	<0.5	<0.2	<0.2	<0.5	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	971.82	1515.0	93.0	240.0	693.0	339.0	1529.0	1440.0	2318.0	3154.0	27.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1447.90	2380.0	114.0	260.0	481.0	1860.0	2280.0	1960.0	2060.0	2420.0	1630.0
ESV	5,000	mg/kg	Tot Cyanide	4.53	<1	<1	<1	4.0	14.0	5.0	6.0	4.0	8.0	20.0
ESV	20,000	mg/kg	Total Sulphur	7007.44	10900.0	2400.0	3300.0	5100.0	14500.0	11300.0	6200.0	11700.0	11000.0	2000.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.45	<19.87	<40.82	<18.6	<16	<16	<16	<16	<16	<16	<16
DIV	1	mg/kg	Benzene	13.52	<10	*<25*	<10	<10	*<25*	<10	<10	*<25*	<10	<10
DIV	130	mg/kg	Toluene	13.56	<10	<25	<10	<10	<25	<10	<10	<25	<10	<10
DIV	50	mg/kg	Ethylbenzene	14.51	<10	<25	<10	<10	<25	<10	<10	<25	<10	<10
DIV	25	mg/kg	Xylenes	27.12	<20	*<50*	<20	<20	*<50*	<20	<20	*<50*	<20	<20
DIV	40	mg/kg	Phenol Index	0.54	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

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Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

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Summary of Results Showing Exceedances. Area: 15

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	15ET37 0.15 14.03.04 CL0409595	15ET37 4.2 14.03.04 CL0409596	15FT12 1 07.04.04 CL0409615	15FT12 4 07.04.04 CL0409616	15FT18 4 07.04.04 CL0409618	15FT19 0.7 07.04.04 CL0409621	15FT19 3.9 07.04.04 CL0409622	15FT20 0.4 08.04.04 CL0409611	15FT20 3.8 08.04.04 CL0409612	15FT21 0.7 08.04.04 CL0409607
ESV	<5 or >10	pH	pH	10.25	10.9	10.9	9.7	10.5	11.2	10.3	9.7	9.1	11.3	10.3
CLEA	500	mg/kg	Arsenic	18.42	24.8	17.9	9.8	26.3	9.4	14.0	44.0	3.5	7.1	31.0
CLEA	1,400	mg/kg	Cadmium	0.88	4.2	1.5	0.7	1.7	0.7	0.7	1.1	0.8	0.6	0.9
CLEA	5,000	mg/kg	Chromium	238.14	95.0	66.9	43.8	205.0	235.4	24.3	87.9	9.2	389.6	74.8
CLEA	750	mg/kg	Lead	88.53	722.1	270.1	54.9	318.7	22.6	14.4	140.9	9.4	20.5	25.4
CLEA	480	mg/kg	Mercury	0.18	<0.10	<0.10	<0.10	0.2	<0.10	<0.10	0.2	<0.10	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.56	1.0	4.4	7.3	6.1	3.8	6.0	4.5	7.3	6.5	5.6
DIV	190	mg/kg	Copper	39.50	77.5	11.9	4.0	24.2	6.4	4.3	31.5	0.8	6.8	4.5
CLEA	5,000	mg/kg	Nickel	19.70	79.8	17.9	3.6	9.2	7.0	4.9	18.0	0.7	3.8	7.3
DIV	720	mg/kg	Zinc	329.09	3167.8	948.2	103.9	356.6	44.4	58.7	418.3	41.6	103.4	80.5
ESV	3	mg/kg	Boron	2.14	2.6	2.0	3.6	4.0	1.4	3.6	4.1	3.4	2.5	3.6
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	390.56	72.0	35.0	330.0	58.0	<10.0	56.0	43.0	120.0	53.0	35.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.29	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	971.82	158.0	863.0	1145.0	683.0	687.0	1275.0	529.0	1731.0	986.0	1841.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1447.90	305.0	2260.0	1830.0	1890.0	1390.0	1970.0	1800.0	2520.0	2120.0	2090.0
ESV	5,000	mg/kg	Tot Cyanide	4.53	5.0	13.0	<1	3.0	8.0	<1	7.0	5.0	6.0	2.0
ESV	20,000	mg/kg	Total Sulphur	7007.44	1400.0	10100.0	8500.0	8800.0	6300.0	9000.0	7500.0	12600.0	13300.0	14100.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.45	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16
DIV	1	mg/kg	Benzene	13.52	<10	<10	<10	<10	*<25*	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	13.56	<10	<10	<10	<10	<25	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	14.51	<10	<10	<10	<10	<25	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	27.12	<20	<20	<20	<20	*<50*	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.54	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 15

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	15FT21 4.1 08.04.04 CL0409608	15FT22 1 07.04.04 CL0409619	15FT22 4 07.04.04 CL0409620	15FT23 1 07.04.04 CL0409613	15FT23 3.4 07.04.04 CL0409614	15FT30 3.5 08.04.04 CL0409604	15FT31 0.2 08.04.04 CL0409609	15FT31 4 08.04.04 CL0409610	15FT33 1.2 08.04.04 CL0409605	15FT33 4 08.04.04 CL0409606
ESV	<5 or >10	pH	pH	10.25	9.9	10.0	9.5	11.0	9.7	9.8	8.8	10.1	9.5	9.9
CLEA	500	mg/kg	Arsenic	18.42	14.2	8.0	5.1	7.1	9.0	10.7	2.3	11.9	11.2	4.7
CLEA	1,400	mg/kg	Cadmium	0.88	0.7	0.8	0.7	0.5	0.6	0.6	0.7	0.7	1.2	0.9
CLEA	5,000	mg/kg	Chromium	238.14	55.0	27.4	17.7	89.3	30.7	42.3	8.8	45.5	21.4	15.8
CLEA	750	mg/kg	Lead	88.53	6.8	27.9	9.0	26.3	28.2	26.7	3.3	8.2	54.4	15.1
CLEA	480	mg/kg	Mercury	0.18	<0.10	<0.10	<0.10	<0.10	0.3	<0.10	<0.10	<0.10	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.56	7.3	6.5	4.7	6.4	1.4	1.4	6.5	7.5	8.3	7.3
DIV	190	mg/kg	Copper	39.50	4.5	3.5	1.7	2.7	34.9	8.5	<0.50	2.3	1.8	1.1
CLEA	5,000	mg/kg	Nickel	19.70	4.1	1.8	3.2	2.4	13.7	9.3	0.6	2.4	1.7	1.2
DIV	720	mg/kg	Zinc	329.09	52.7	61.9	25.5	33.0	67.9	73.4	14.1	31.4	214.4	50.3
ESV	3	mg/kg	Boron	2.14	3.2	3.3	3.7	3.6	3.5	1.3	3.2	3.0	2.1	2.5
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	390.56	<10.0	<10.0	<10.0	<10.0	41.0	250.0	91.0	120.0	<10.0	<10.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.29	<0.2	<0.2	<0.2	<0.5	**<5.0**	<0.2	<0.5	<0.2	<0.2	<0.5
ESV	1,000	mg/kg	Acid Soluble Sulphide	971.82	1778.0	1890.0	1768.0	2065.0	14.0	267.0	2551.0	2270.0	3361.0	3556.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1447.90	2190.0	1990.0	9620.0	1970.0	1190.0	568.0	2040.0	1980.0	1940.0	1900.0
ESV	5,000	mg/kg	Tot Cyanide	4.53	4.0	5.0	1.0	4.0	7.0	<1	5.0	5.0	8.0	11.0
ESV	20,000	mg/kg	Total Sulphur	7007.44	9800.0	10500.0	6800.0	9700.0	3100.0	1100.0	10000.0	12800.0	10000.0	13300.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.45	<16	<16	<16	<16	<16	<52	<16	<23	<16	<16
DIV	1	mg/kg	Benzene	13.52	<10	<10	<10	*<25*	***<250***	<10	*<25*	<10	<10	*<25*
DIV	130	mg/kg	Toluene	13.56	<10	<10	<10	<25	***<250***	<10	<25	<10	<10	<25
DIV	50	mg/kg	Ethylbenzene	14.51	<10	<10	<10	<25	***<250***	<10	<25	<10	<10	<25
DIV	25	mg/kg	Xylenes	27.12	<20	<20	<20	*<50*	***<500***	<20	*<50*	<20	<20	*<50*
DIV	40	mg/kg	Phenol Index	0.54	0.5	<0.5	1.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 15

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	15CT38	15CT38
			Depth m bgl		**0.2**	**3.5**
			Ground Type			
			Sample Date		**-**	**-**
			Sample Number		**CL0413989**	**CL0413990**
ESV	<5 or >10	pH	pH	10.25	9.2	10.5
CLEA	500	mg/kg	Arsenic	18.42	3.1	10.7
CLEA	1,400	mg/kg	Cadmium	0.88	<0.10	<0.10
CLEA	5,000	mg/kg	Chromium	238.14	3.1	25.4
CLEA	750	mg/kg	Lead	88.53	4.8	16.5
CLEA	480	mg/kg	Mercury	0.18	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.56	0.8	1.3
DIV	190	mg/kg	Copper	39.50	10.4	4.2
CLEA	5,000	mg/kg	Nickel	19.70	3.3	5.0
DIV	720	mg/kg	Zinc	329.09	22.2	31.8
ESV	3	mg/kg	Boron	2.14	<0.5	<0.5
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	390.56	6020.0	606.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.29	<5.0	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	971.82	<5	79.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1447.90	275.0	405.0
ESV	5,000	mg/kg	Tot Cyanide	4.53	<1	<1
ESV	20,000	mg/kg	Total Sulphur	7007.44	6400.0	400.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.45	<20	<16
DIV	1	mg/kg	Benzene	13.52	***<250***	<10
DIV	130	mg/kg	Toluene	13.56	***<250***	<10
DIV	50	mg/kg	Ethylbenzene	14.51	***<250***	<10
DIV	25	mg/kg	Xylenes	27.12	***<500***	<20
DIV	40	mg/kg	Phenol Index	0.54	<0.5	<0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

3.10 Area 16, Coke Ovens

3.10.1 Scope of Works

The site investigation in Area 16 comprised the following scope of works:

- Excavation of five trial pits (16AT1-5) using a 20 tonne tracked excavator and breaker;
- Advancing two groundwater monitoring boreholes (16BB1, 16AB2) using a shell and auger (cable percussive) rig;
- Recovery of 11 soil samples from Made Ground and natural strata (where encountered) and recovery of two groundwater samples.

3.10.2 Ground Conditions

- Made Ground comprising coarse angular gravel and cobbles of ash, brick and slag with boulders of slag was encountered to depths of 4.0m.
- Made Ground was found to be underlain by fine to coarse sand at two locations across the area, between depths of 5.6 to 9.0m bgl;
- Groundwater was encountered at two locations at 3.6 and 5.0m bgl;
- Owing to the general variability in Made Ground thickness between sampling locations across the site no generalised trends in thickness could be discerned;
- Site observations and monitoring did not reveal the presence of visual and/or olfactory evidence of possible contamination.

3.10.3 Chemical Analysis Results

- **Soil pH**

  Soil pH across the area was found to be highly alkaline. The soil sample pH values range from 10.9 (16AB2, 6.5 m bgl) to 12.8 (16BB1, 2.5 m bgl). The 95th percentile calculated for pH (12.5) exceeds the guideline value of 10.

- **Toxic and Phytotoxic Metals**

  Levels of all toxic metals analysed were found to be below guideline levels.

  Levels of phytotoxic metals were found to be below guideline levels, with the exception of one elevated zinc value (4,020 mg/kg – 16AT2, 3.9 m bgl). However the 95th percentile calculated for zinc (130 mg/kg) is well below the guideline value of 720 mg/kg.

- **Sulphide and Sulphate**

  Elevated levels of sulphide were detected in three locations (1,420 mg/kg – 16AT3, 4.0 m bgl; 1,782 mg/kg – 16AT4, 0.2 m bgl; and, 8,849 mg/kg – 16AT4, 3.9 m bgl). The 95th percentile calculated for sulphide (2,567 mg/kg) is above the guideline value of 1,000 mg/kg.

  Elevated levels of sulphate were detected in only one location (1,670 mg/l – 16AT4, 3.9 m bgl). The 95th percentile calculated for sulphate (628 mg/l) is well below the guideline value of 1,200 mg/l.

- **Organics**

  No organic determinands were found in elevated concentrations.

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 6.

Corus, Teesside - Summary of results. Area: 16

Guidance used	Guideline levels	Unit	Client Sample ID	16AB2	16AT1	16AT1	16AT2	16AT2	16AT3	16AT3	16AT4	16AT4	16BB1	16BB1
			Depth m bgl	**6.5**	**0.2**	**4**	**0.2**	**3.9**	**0.4**	**4**	**0.2**	**3.9**	**2.5**	**6.1**
			Ground Type	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date	**23.04.04**	**20.04.04**	**20.04.04**	**20.04.04**	**20.04.04**	**20.04.04**	**20.04.04**	**20.04.04**	**20.04.04**	**23.04.04**	**23.04.04**
			Sample Number	**CL0411001**	**CL0410329**	**CL0410330**	**CL0410327**	**CL0410328**	**CL0410331**	**CL0410332**	**CL0410333**	**CL0410334**	**CL0411002**	**CL0411003**
ESV	<5 or >10	pH	pH	10.9	12.5	12.6	12.6	12.5	12.6	12.4	11.5	11.0	12.8	12.1
CLEA	500	mg/kg	Arsenic	6.0	8.4	6.7	12.6	**33.9**	4.4	7.0	5.0	4.8	3.5	6.0
CLEA	1,400	mg/kg	Cadmium	<0.10	0.7	0.3	1.6	4.0	0.3	0.2	0.5	0.5	0.4	<0.10
CLEA	5,000	mg/kg	Chromium	10.6	1200.0	1950.0	1620.0	627.4	2060.0	841.1	251.5	13.2	2600.0	361.9
CLEA	750	mg/kg	Lead	5.1	96.6	31.4	341.9	346.3	30.1	21.0	38.3	1.8	23.8	6.8
CLEA	480	mg/kg	Mercury	<0.10	0.2	0.2	0.2	0.2	<0.10	<0.10	<0.10	<0.10	0.3	0.2
CLEA	8,000	mg/kg	Selenium	0.8	2.1	2.2	2.3	3.1	2.4	4.0	4.8	8.1	2.3	0.7
DIV	190	mg/kg	Copper	1.4	41.7	38.2	54.7	56.6	27.2	14.4	23.8	0.8	36.7	8.7
CLEA	5,000	mg/kg	Nickel	3.5	12.8	10.2	13.7	22.8	7.1	4.7	3.6	<0.50	10.3	5.4
DIV	720	mg/kg	Zinc	25.5	166.3	63.2	247.6	**4020.0**	110.8	65.0	80.9	6.6	87.3	17.8
ESV	3	mg/kg	Boron	<0.5	0.8	0.7	<0.5	0.8	0.9	1.2	1.7	1.2	1.3	<0.5
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	25.0	494.0	32.0	352.0	268.0	88.0	133.0	275.0	21.0	29.0	35.0
DIV	5,000	mg/kg	GRO (C5 - C10)	<0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**9.0**
ESV	1,000	mg/kg	Acid Soluble Sulphide	65.0	12.0	<5	<5	23.0	<5	1420.0	1782.0	8849.0	156.0	60.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	176.0	16.7	12.5	10.0	50.4	17.9	404.0	1050.0	1670.0	10.6	239.0
ESV	5,000	mg/kg	Tot Cyanide	<1	<1	<1	<1	<1	<1	**6.0**	<1	<1	<1	<1
ESV	20,000	mg/kg	Total Sulphur	<400	2800.0	3100.0	2800.0	3100.0	3300.0	6800.0	7300.0	13300.0	2600.0	500.0
DIV	20	mg/kg	Free Cyanide	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	<16	<31	<16	<27	<27	<16	<16	<29	<16	<16	<16
DIV	1	mg/kg	Benzene	*<25*	<10	<10	<10	<10	<10	<10	<10	<10	<10	***<250***
DIV	130	mg/kg	Toluene	<25	<10	<10	<10	<10	<10	<10	<10	<10	<10	***<250***
DIV	50	mg/kg	Ethylbenzene	<25	<10	<10	<10	<10	<10	<10	<10	<10	<10	***<250***
DIV	25	mg/kg	Xylenes	*<50*	<20	<20	<20	<20	<20	<20	<20	<20	<20	***<500***
DIV	40	mg/kg	Phenol Index	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**1.8**	<0.5	<0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

3.11 Area 17, By-Products

3.11.1 Scope of Works

The site investigation in Area 17 comprised the following scope of works:

- Excavation of twenty-two trial pits (17AT1-6, 17BT8-9, 17BT11-12, 17BT15-18, 17BT20-22, 17CT7, 17CT10, 17CT13-14, 17CT19) using a 20 tonne tracked excavator and breaker;
- Advancing three groundwater monitoring boreholes (17AB3, 17BB1, 17CB2) using a shell and auger (cable percussive) rig;
- Recovery of 45 soil samples from Made Ground and natural strata (where encountered) and recovery of three groundwater samples.

3.11.2 Ground Conditions

- Made Ground comprising sandy, ashy angular gravel, cobbles and boulders of slag was encountered in the majority of locations to depths of up to 4.6m;
- This was underlain in almost half of all locations by fine to medium sand with occasional gravel of slag and clinker;
- Groundwater was encountered frequently at depths of between 3.4 to 5.8m;
- Site observations and monitoring did not reveal the presence of visual and/or olfactory evidence of possible contamination with the exception of a diesel odour at 17AT3 between 4.0 to 4.2m bgl, and a solvent-like odour at 17AB3 between depths of 4.6 to 5.8m bgl.

3.11.3 Chemical Analysis Results

- **Soil pH**

  Soil pH across the area was found to be alkaline to highly alkaline. The soil sample pH values range from 9.2 (17AT4, 4.1 m bgl) to 12.8 (17AT5, 4.0 m bgl and 17BT8, 4.0 m bgl). The 95th percentile calculated for pH (11.4) exceeds the guideline value of 10.

- **Toxic and Phytotoxic Metals**

  The guidance limit for lead was exceeded in three samples (1,160 mg/kg – 17AT4, 1.5 m bgl; 1,600 mg/kg – 17BT9, 0.1 m bgl; 759.9 mg/kg – 17BT9, 3.9 m bgl). However, the 95th percentile calculated for lead (234 mg/kg) is well below the guideline value of 750 mg/kg. Concentrations of toxic metals in all other samples were below guideline levels.

  Concentrations of copper exceeded guideline values in three samples across the site (447.4 mg/kg - 17AT1, 1.0 m bgl; 304.4 mg/kg – 17AT1, 3.8 m bgl; 351.8 mg/kg – 17AT4, 1.5 m bgl). The 95th percentile calculated for copper

(66 mg/kg) was well below the guideline value of 190 mg/kg.

Concentrations of zinc exceeded guideline values in six samples across the site (864.6 mg/kg – 17AT3, 0.6 m bgl; 3,420 mg/kg – 17AT4, 1.5 m bgl; 1,760 mg/kg – 17AT4, 4.1 m bgl; 931.3 mg/kg - 17BT9, 0.1 m bgl; 3,300 mg/kg - 17BT9, 3.9 m bgl; and, 17CT19, 0.15 – 1,460 mg/kg). The 95th percentile calculated for zinc (534 mg/kg) was below the guideline value of 720 mg/kg.

Elevated levels of boron were detected in one location, 3.2 mg/kg – 17AT5, 2.4 m bgl. The 95th percentile calculated for boron (1.4mg/kg) across the Area was below the guideline value of 3 mg/kg.

Concentrations of phytotoxic metals in all other samples were below guideline values.

- **Sulphide and Sulphate**

Elevated levels of sulphide were detected in three samples (3,264 mg/kg - 17AT21, 3.9 m bgl; 1,794 mg/kg - 17AT5, 3.8 m bgl; 4,286 mg/kg – 17CT13, 1.2 m bgl). The 95th percentile calculated for sulphide (509 mg/kg) was well below the guideline value of 1,000 mg/kg.

Elevated levels of sulphate were detected in thirteen samples across the area. In Sub-Areas A and C, guidance levels were exceeded by six samples, ranging from 1,530 mg/l (17AT21, 3.9 m bgl) and 2,060 mg/l (17CT13, 1.2 m bgl). In Sub-Area B seven samples exceeded guidance levels for sulphate, with concentrations ranging between 1,400 mg/l (17BT18, 3.9 m bgl) and 2,070 mg/l (17BT9, 0.1 m bgl). The 95th percentile calculated for sulphate (869 mg/l) was below the guideline value of 1,200 mg/l.

Only one sample (17BT9, 3.9 m bgl) contained an elevated concentration of total sulphur (22,000 mg/kg). However, the 95th percentile for total sulphur (7,197 mg/kg) across Area 17 was below the guideline value of 20,000 mg/kg.

- **Organics**

Elevated levels of Total PAH were detected in seven samples across the area, with concentrations ranging from 43 mg/kg (17AT22, 0.2 m bgl) to 422 mg/kg (17AT5, 4.0 m bgl). The 95th percentile calculated for Total PAH across Area 17 (28 mg/kg) was below the guideline value of 40 mg/kg.

No other organic contamination was identified.

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 6.

Summary of Results Showing Exceedances. Area: 17

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	17AB3	17AB3	17AT1	17AT1	17AT2	17AT2	17AT20	17AT20	17AT21	17AT21
			Depth m bgl		**4**	**6**	**1**	**3.8**	**0.4**	**4.1**	**0.2**	**4**	**0.3**	**3.9**
			Ground Type		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date		**23.04.04**	**23.04.04**	**20.04.04**	**20.04.04**	**20.04.04**	**20.04.04**	**19.04.04**	**19.04.04**	**20.04.04**	**20.04.04**
			Sample Number		**CL0410996**	**CL0410997**	**CL0410341**	**CL0410342**	**CL0410343**	**CL0410344**	**CL0410165**	**CL0410166**	**CL0410335**	**CL0410336**
ESV	<5 or >10	pH	pH	11.44	11.4	12.7	12.3	12.6	12.6	12.4	10.9	11.9	9.9	10.1
CLEA	500	mg/kg	Arsenic	29.15	7.6	10.5	39.0	35.0	12.9	25.9	74.5	11.6	2.5	17.3
CLEA	1,400	mg/kg	Cadmium	1.45	<0.10	0.4	1.7	1.3	0.8	1.9	1.2	0.1	0.1	0.5
CLEA	5,000	mg/kg	Chromium	498.78	32.7	500.7	406.7	276.3	873.4	1620.0	348.4	1130.0	25.6	16.8
CLEA	750	mg/kg	Lead	234.44	11.6	35.9	441.9	331.1	88.3	125.5	359.7	23.1	14.2	7.7
CLEA	480	mg/kg	Mercury	0.16	0.1	0.1	0.1	<0.10	0.2	0.2	<0.10	0.1	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.17	0.7	1.9	1.8	2.5	2.0	2.2	2.6	2.0	1.5	6.4
DIV	190	mg/kg	Copper	65.89	3.1	23.2	447.4	304.4	51.2	139.9	27.6	32.3	11.5	2.8
CLEA	5,000	mg/kg	Nickel	21.61	5.6	16.3	61.3	53.7	24.0	32.9	36.7	13.3	4.4	1.8
DIV	720	mg/kg	Zinc	533.92	24.3	82.7	428.3	213.6	226.7	361.5	533.3	40.5	58.1	18.2
ESV	3	mg/kg	Boron	1.37	<0.5	<0.5	<0.5	<0.5	1.3	1.5	1.8	1.5	0.7	2.0
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	736.22	217.0	27.0	531.0	358.0	233.0	337.0	80.0	20.0	888.0	25.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.29	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.2	<0.2	<0.5	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	509.21	<5	57.0	<5	371.0	<5	21.0	<5	9.0	56.0	3264.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	868.63	207.0	128.0	126.0	29.7	13.4	12.7	792.0	371.0	503.0	1530.0
ESV	5,000	mg/kg	Tot Cyanide	5.25	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
ESV	20,000	mg/kg	Total Sulphur	7196.96	<400	4200.0	3200.0	5000.0	3200.0	2800.0	4600.0	3900.0	5600.0	11500.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	28.28	<19	<16	<16	<17	<25	<74	<16	<16	77.0	<16
DIV	1	mg/kg	Benzene	12.26	<10	<10	<10	<10	*<25*	<10	<10	<10	*<25*	<10
DIV	130	mg/kg	Toluene	12.26	<10	<10	<10	<10	<25	<10	<10	<10	<25	<10
DIV	50	mg/kg	Ethylbenzene	12.26	<10	<10	<10	<10	<25	<10	<10	<10	<25	<10
DIV	25	mg/kg	Xylenes	24.53	<20	<20	<20	<20	*<50*	<20	<20	<20	*<50*	<20
DIV	40	mg/kg	Phenol Index	0.58	<0.5	<0.5	<0.5	<0.5	<0.5	**1.6**	<0.5	<0.5	<0.5	0.6

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 17

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	17AT22 0.2 - 20.04.04 CL0410339	17AT22 3.9 - 20.04.04 CL0410340	17AT3 0.6 - 19.04.04 CL0410163	17AT3 4.1 - 19.04.04 CL0410164	17AT4 1.5 - 19.04.04 CL0410159	17AT4 4.1 - 19.04.04 CL0410160	17AT5 0.25 - 20.04.04 CL0410337	17AT5 2.4 - 19.04.04 CL0410161	17AT5 3.8 - 20.04.04 CL0410338	17AT5 4 - 19.04.04 CL0410162
ESV	<5 or >10	pH	pH	11.44	12.1	12.6	11.2	11.8	9.4	9.2	10.8	9.6	10.6	12.8
CLEA	500	mg/kg	Arsenic	29.15	7.9	3.4	21.5	9.0	56.2	69.7	4.8	11.1	2.1	18.7
CLEA	1,400	mg/kg	Cadmium	1.45	1.0	0.4	1.9	0.3	8.4	4.2	0.3	1.2	0.3	0.4
CLEA	5,000	mg/kg	Chromium	498.78	1820.0	1600.0	347.6	119.9	226.5	175.2	60.5	74.2	8.1	693.9
CLEA	750	mg/kg	Lead	234.44	116.5	37.2	210.2	41.8	1160.0	548.0	15.1	98.1	1.1	28.7
CLEA	480	mg/kg	Mercury	0.16	0.2	<0.10	0.3	0.2	**1.0**	0.5	<0.10	<0.10	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.17	2.1	1.7	2.0	0.8	1.8	2.4	1.3	2.5	6.0	2.0
DIV	190	mg/kg	Copper	65.89	52.9	47.6	55.7	32.8	351.8	80.5	14.6	13.6	0.6	19.6
CLEA	5,000	mg/kg	Nickel	21.61	19.5	9.7	32.8	13.7	58.8	58.9	16.8	15.3	<0.50	18.7
DIV	720	mg/kg	Zinc	533.92	380.8	89.3	864.6	86.0	3420.0	1760.0	57.3	99.1	5.6	70.7
ESV	3	mg/kg	Boron	1.37	1.7	1.9	2.8	1.1	0.6	1.0	0.6	3.2	2.4	<0.5
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	736.22	1165.0	108.0	121.0	118.0	309.0	262.0	429.0	106.0	<10.0	1020.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.29	<0.2	<0.5	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	509.21	<5	<5	347.0	20.0	12.0	32.0	32.0	168.0	1794.0	<5
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	868.63	79.3	12.8	807.0	574.0	105.0	1830.0	185.0	1820.0	1160.0	39.1
ESV	5,000	mg/kg	Tot Cyanide	5.25	<1	<1	3.0	<1	34.0	8.0	2.0	<1	<1	<1
ESV	20,000	mg/kg	Total Sulphur	7196.96	3400.0	1700.0	4700.0	2600.0	3300.0	5100.0	1500.0	4000.0	9900.0	3100.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	28.28	<43	<16	<16	<16	<18	<21	<23	<16	<16	**<422**
DIV	1	mg/kg	Benzene	12.26	<10	*<25*	<10	<10	<10	<10	*<25*	<10	<10	<10
DIV	130	mg/kg	Toluene	12.26	<10	<25	<10	<10	<10	<10	<25	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.26	<10	<25	<10	<10	<10	<10	<25	<10	<10	<10
DIV	25	mg/kg	Xylenes	24.53	<20	*<50*	<20	<20	<20	<20	*<50*	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.58	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 17

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	17AT6 1 - 20.04.04 CL0410345	17AT6 3.8 - 20.04.04 CL0410346	17BB1 4.5 - 23.04.04 CL0410998	17BT11 0.1 - 19.04.04 CL0410171	17BT11 3.7 - 19.04.04 CL0410172	17BT12 0.3 - 19.04.04 CL0410173	17BT12 4 - 19.04.04 CL0410174	17BT15 0.2 - 19.04.04 CL0410175	17BT15 4 - 19.04.04 CL0410176	17BT16 3.8 - 19.04.04 CL0410178
ESV	<5 or >10	pH	pH	11.44	12.6	11.8	10.6	11.3	10.5	11.2	11.2	10.8	10.6	10.6
CLEA	500	mg/kg	Arsenic	29.15	30.8	9.0	8.4	20.3	55.7	13.3	13.4	7.2	12.0	5.2
CLEA	1,400	mg/kg	Cadmium	1.45	2.2	1.4	<0.10	0.7	0.8	0.3	0.4	0.3	1.0	0.5
CLEA	5,000	mg/kg	Chromium	498.78	740.8	301.7	18.8	50.9	26.5	276.2	75.3	81.3	92.2	16.0
CLEA	750	mg/kg	Lead	234.44	261.9	155.3	26.6	37.9	469.3	58.8	36.9	25.7	90.4	21.4
CLEA	480	mg/kg	Mercury	0.16	0.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.2	0.2	<0.10
CLEA	8,000	mg/kg	Selenium	3.17	2.0	0.9	0.7	5.9	6.6	4.3	6.1	4.8	1.2	6.4
DIV	190	mg/kg	Copper	65.89	54.4	94.5	5.2	5.7	2.5	6.8	5.1	7.6	28.4	3.5
CLEA	5,000	mg/kg	Nickel	21.61	53.6	43.9	5.5	3.3	9.1	3.9	3.3	2.9	13.4	1.4
DIV	720	mg/kg	Zinc	533.92	582.3	138.7	58.3	146.9	420.5	112.3	81.0	123.0	306.9	48.8
ESV	3	mg/kg	Boron	1.37	0.6	1.5	<0.5	1.1	1.7	1.5	1.1	1.8	1.4	2.4
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	736.22	383.0	117.0	35.0	1206.0	256.0	168.0	121.0	931.0	54.0	323.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.29	<0.2	<0.2	**<5.0**	<0.2	<0.2	<0.2	<0.2	0.9	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	509.21	<5	<5	110.0	<5	690.0	356.0	376.0	183.0	33.0	862.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	868.63	6.5	134.0	401.0	1640.0	1800.0	1440.0	807.0	892.0	643.0	1700.0
ESV	5,000	mg/kg	Tot Cyanide	5.25	<1	<1	<1	<1	6.0	<1	3.0	5.0	13.0	5.0
ESV	20,000	mg/kg	Total Sulphur	7196.96	3400.0	1900.0	1000.0	13400.0	19100.0	9100.0	9200.0	8400.0	2200.0	6800.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	28.28	<25	<16	<16	<32	<16	<35	<25	<104	<16	<28
DIV	1	mg/kg	Benzene	12.26	<10	<10	***<250***	<10	<10	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	12.26	<10	<10	***<250***	<10	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.26	<10	<10	***<250***	<10	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	24.53	<20	<20	***<500***	<20	<20	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.58	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	<0.5	0.8

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 17

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	17BT17 0.2 - 19.04.04 CL0410179	17BT17 3.9 - 19.04.04 CL0410180	17BT18 0.2 - 19.04.04 CL0410181	17BT18 3.9 - 19.04.04 CL0410182	17BT8 0.2 - 19.04.04 CL0410167	17BT8 4 - 19.04.04 CL0410168	17BT9 0.1 - 19.04.04 CL0410169	17BT9 3.9 - 19.04.04 CL0410170	17CT10 1 - 20.04.04 CL0410351	17CT10 4 20.04.04 CL0410352
ESV	<5 or >10	pH	pH	11.44	11.2	12.2	11.3	12.1	12.4	12.8	11.1	10.2	10.6	9.8
CLEA	500	mg/kg	Arsenic	29.15	4.2	43.2	6.5	15.3	13.9	12.3	193.0	**438.7**	3.1	3.5
CLEA	1,400	mg/kg	Cadmium	1.45	0.2	0.2	0.5	0.1	0.1	<0.10	2.0	8.2	<0.10	<0.10
CLEA	5,000	mg/kg	Chromium	498.78	38.8	686.7	41.6	779.2	922.0	1440.0	313.1	288.1	19.6	18.8
CLEA	750	mg/kg	Lead	234.44	19.1	27.4	55.6	33.9	13.5	10.3	1600.0	759.9	8.3	11.2
CLEA	480	mg/kg	Mercury	0.16	<0.10	<0.10	0.4	<0.10	<0.10	<0.10	0.1	0.2	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.17	1.9	2.1	0.7	3.9	2.9	2.1	4.0	3.6	<0.50	<0.50
DIV	190	mg/kg	Copper	65.89	6.2	42.2	11.2	19.4	7.4	12.1	18.9	30.4	4.7	4.6
CLEA	5,000	mg/kg	Nickel	21.61	17.7	23.8	29.4	7.3	5.3	5.3	19.1	33.9	9.3	12.8
DIV	720	mg/kg	Zinc	533.92	51.7	76.5	141.4	51.7	63.6	18.8	931.3	3300.0	28.6	32.3
ESV	3	mg/kg	Boron	1.37	<0.5	1.4	<0.5	1.2	0.9	<0.5	1.2	1.3	0.7	0.9
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	736.22	3300.0	100.0	296.0	21.0	88.0	55.0	103.0	174.0	672.0	196.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.29	**1.5**	<0.2	<0.2	0.7	<0.2	<0.2	<0.2	<0.2	0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	509.21	320.0	<5	18.0	307.0	219.0	<5	84.0	48.0	<5	<5
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	868.63	397.0	149.0	109.0	1400.0	387.0	32.2	2070.0	1860.0	1680.0	1800.0
ESV	5,000	mg/kg	Tot Cyanide	5.25	8.0	<1	18.0	<1	1.0	<1	<1	<1	<1	<1
ESV	20,000	mg/kg	Total Sulphur	7196.96	4400.0	2800.0	3000.0	9700.0	5100.0	2200.0	17900.0	22000.0	16400.0	13400.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	28.28	<21	<16	<39	<16	<19	<16	<16	<17	<16	<16
DIV	1	mg/kg	Benzene	12.26	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	12.26	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.26	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	24.53	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.58	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 17

Guidance used	Guideline levels	Unit	**Client Sample ID**	95th Percentile (excluding outliers)	**17CT13**	**17CT13**	**17CT7**	**17CT7**	**17CT19**
			Depth m bgl		**1.2**	**3**	**0.7**	**4**	**0.15**
			Ground Type		**-**	**-**	**-**	**-**	**-**
			Sample Date		**20.04.04**	**20.04.04**	**20.04.04**	**20.04.04**	**-**
			Sample Number		**CL0410347**	**CL0410348**	**CL0410349**	**CL0410350**	**CL0414956**
ESV	<5 or >10	pH	pH	11.44	10.9	10.6	12.6	12.5	11.0
CLEA	500	mg/kg	Arsenic	29.15	22.2	7.4	13.0	45.1	5.4
CLEA	1,400	mg/kg	Cadmium	1.45	0.6	<0.10	0.2	0.6	2.8
CLEA	5,000	mg/kg	Chromium	498.78	52.7	17.4	1020.0	841.2	129.5
CLEA	750	mg/kg	Lead	234.44	34.3	19.6	18.4	66.2	229.7
CLEA	480	mg/kg	Mercury	0.16	<0.10	<0.10	0.2	**1.0**	0.2
CLEA	8,000	mg/kg	Selenium	3.17	6.0	<0.50	2.4	2.3	2.4
DIV	190	mg/kg	Copper	65.89	4.0	2.7	14.0	37.5	11.7
CLEA	5,000	mg/kg	Nickel	21.61	4.8	3.4	7.7	18.7	11.1
DIV	720	mg/kg	Zinc	533.92	147.2	34.6	55.9	222.8	1460.0
ESV	3	mg/kg	Boron	1.37	2.5	0.7	0.6	0.7	0.6
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	736.22	101.0	<10.0	5836.0	1050.0	1930.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.29	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	509.21	4286.0	16.0	<5	74.0	729.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	868.63	2060.0	253.0	33.5	178.0	601.0
ESV	5,000	mg/kg	Tot Cyanide	5.25	20.0	<1	<1	8.0	9.0
ESV	20,000	mg/kg	Total Sulphur	7196.96	14800.0	400.0	2400.0	3100.0	4200.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	28.28	<16	<16	**342.0**	**298.0**	<18
DIV	1	mg/kg	Benzene	12.26	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	12.26	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.26	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	24.53	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.58	<0.5	<0.5	<0.5	1.2	1.8

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

3.12 Area F, South Gare and Coatham Sands

3.12.1 Scope of Works

The site investigation in Area F (Site of Special Scientific Interest: South Gare & Coatham Sands) comprised the following works:

- Recovery of eight surface water samples from shallow ponds within the wetland area of the South Gare and Coatham Sands SSSI. The approximate sampling locations are shown on Figure 9.

3.12.2 Surface Water Lab Results

- **pH**

  Surface water Ph values were neutral, ranging between 6.6 to 7.4, with the exception of sample FAS7 (neutral) except for 1 sample that has a pH value of 5.1 (slightly acidic) – FAS7.

- **Toxic Metals**

  Three of the samples showed elevated concentrations of selenium (0.011 mg/l - FAS6; 0.011 mg/l - FAS7; 0.015 mg/l - FAS8) when compared with the UK Drinking Water Standard of 0.010 mg/l.

  FAS7 also has an elevated copper concentration (0.003 mg/l) when compared to the UK Drinking Water Standard of 0.002 mg/l.

- **Phytotoxic Metals**

  Concentrations of all phytotoxic metals tested for were below guideline values.

- **Sulphate**

  All samples showed elevated concentrations of total sulphur ranging from 656 mg/l (FAS3) to 1,200 mg/l (FAS7). Consequently the 95th percentile calculated for sulphate (1,170 mg/l) far exceeded the guideline value of 250 mg/l.

- **Organics**

  All organic determinands were found in concentrations below guideline values.

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 9.

Corus, Teesside - Summary of water results. Area: Redcar SW

Guidance used	Guideline levels	Unit	Client Sample ID Sample Date Sample Number	FAS1 04/05/2004 W/EX/0410646	FAS2 04/05/2004 W/EX/0410636	FAS3 04/05/2004 W/EX/0410645	FAS4 04/05/2004 W/EX/0410637	FAS5 04/05/2004 W/EX/0410638	FAS6 04/05/2004 W/EX/0410647	FAS7 04/05/2004 W/EX/0410639	FAS8 04/05/2004 W/EX/0410640
UKDWS	<6.5 or >10	pH	pH	7.4	7.4	7.4	7.2	6.9	6.7	5.1	6.6
UKDWS	0.01	mg/l	Arsenic	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
UKDWS	0.005	mg/l	Cadmium	<0.0001	<0.0001	<0.0001	0.000	<0.0001	<0.0001	<0.0001	<0.0001
UKDWS	0.05	mg/l	Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
UKDWS	0.025	mg/l	Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
UKDWS	0.001	mg/l	Mercury	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
UKDWS	0.01	mg/l	Selenium	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02
UKDWS	0.002	mg/l	Copper	0.002	0.002	0.001	0.001	0.002	0.001	0.003	<0.001
UKDWS	0.02	mg/l	Nickel	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
DIV	0.8	mg/l	Zinc	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
UKDWS	1	mg/l	Boron	1	1	0	1	1	1	1	1
DIV	0.6	mg/l	TPH GC	0.2	<0.1	<0.1	<0.1	<0.11	0.2	<0.1	<0.1
DIV	0.6	mg/l	Gasoline Range Organics	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
UKDWS	0.05	mg/l	Tot Cyanide	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*
UKDWS	250	mg/l	Total Sulphur as SO4	1100	1190	656	924	1070	1190	1200	1050
UKDWS	-	mg/l	Acid Soluble Sulphide	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
UKDWS	0.05	mg/l	Free Cyanide	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*
DIV	0.82	mg/l	PAH Total EPA16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16
UKDWS	1	ug/l	Benzene	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*
DIV	1000	ug/l	Toluene	<5	<5	<5	<5	<5	<5	<5	<5
DIV	150	ug/l	Ethylbenzene	<5	<5	<5	<5	<5	<5	<5	<5
DIV	70	ug/l	Xylenes	<10	<10	<10	<10	<10	<10	<10	<10
DIV	2	mg/l	Phenol Index	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

DIV - Dutch Intervention Value

UKDWS - UK Drinking Water Standards

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exc

NB. DIV for PAH is for sum of ten

3.13 Groundwater Results

3.13.1 Groundwater Levels

3.13.2 The results for the groundwater monitoring for boreholes advanced across the Redcar Works are detailed in the table below:

Table 6 **Groundwater Monitoring Results – Redcar Site**

Location	Groundwater (mAOD)	Groundwater (mbgl)	Borehole Depth (mAOD)	Borehole Depth (mbgl)	pH	EC (µS)
11AB1	4.13	3.13	0.49	6.67	8.82	826.2
11AB2	3.28	1.92	-0.50	5.70	6.68	1,125
12AB2	3.73	3.65	2.28	5.10	6.35	1,310
12BB1	3.79	3.87	2.29	5.37	-	2,330
13AB2	4.79	2.55	1.14	6.20	10.12	1,919
13CB1	4.15	3.66	1.75	6.06	8.32	985.1
14AB1	3.85	3.70	2.07	5.48	-	-
14AB2	3.93	3.90	2.09	5.74	-	1,330
15AB1	0.96	3.30	0.01	4.25	-	-
15AB2	2.27	5.08	0.35	7.00	7.82	613
15AB3	2.21	4.90	-1.79	8.90	-	820
16AB2	2.56	4.70	0.23	7.03	11.18	1,665
16BB1	4.07	3.35	1.90	5.52	9.75	1,390
17BB1	3.78	3.50	2.98	4.30	7.42	1,385
17CB2	3.64	3.80	1.13	6.31	7.56	902
17AB3	2.88	4.30	1.16	6.02	7.38	1,215
17AB4	3.66	3.61	3.33	3.94	-	-

3.13.3 The depth to groundwater at the Redcar Works varied between 1.92m bgl and 5.08m bgl and averaged 3.7m bgl. The water table is situated within the Made Ground which is underlain in most cases by slightly gravelly fine to coarse alluvial sand (See Appendix 2). Boulder clay or the underlying mudstones were not encountered during the course of drilling.

3.13.4 The pattern of shallow groundwater contours based on static water levels is shown on Figure 9. Groundwater levels were highest (5.0mOD) in Area 13, Sinter Plant with groundwater flow primarily northwards toward the South Gare and Coatham Sands SSSI at the Blast Furnace (3.75m OD). However in the eastern margins of the Sinter Plant ground water flow was eastward into Area 11, Former Warrenby Works, probably influenced by drainage into Fleet Beck (3.5m OD).

3.13.5 Groundwater levels in the north north-west of the Redcar Works, Area 16, Coke Ovens and Area 17, By-Products, was directed westward toward the River Tees with the lowest groundwater contours of 1.25mOD near to the site boundary (as shown in Figure 9).

3.13.6 Field Results for pH and Electrical Conductivity.

3.13.7 pH results show a range of 7.42 to 11.18 across the site, with the highest values observed at locations within Areas 13 and 16.

3.13.8 Values for EC show a range of 613 to 2330µS, with the greatest values observed within Areas 12, 13 16 and 17 in the north and east of the site.

3.13.9 Groundwater Lab Results

- **pH**

  Groundwater pH values ranged from acidic (pH 5.1 – FAS7) to highly alkaline (12.2 – 16BB1). However, the 95th percentile calculated for groundwater (9.4) across the Redcar site is below the guideline value of 10.

- **Toxic Metals**

  Groundwater samples from boreholes 13AB2 and 16AB2 contained arsenic concentrations of 0.03 mg/l and 0.02 mg/l respectively, slightly above the guideline value of 0.01 mg/l.

  Chromium contamination was found in groundwater from borehole 16BB1 (0.055 mg/l), slightly above the guideline value of 0.05 mg/l.

  Selenium contamination was found in groundwater from borehole 15AB1 (0.031 mg/l), above the guideline value of 0.01 mg/l.

- **Phytotoxic Metals**

  Copper levels in Area 17 and northwest Area 16 were slightly elevated compared with the guideline value of 0.002 mg/l.

  Elevated copper concentrations were detected in six of the groundwater samples (12BB1 – 0.004 mg/l; 15AB1 – 0.008 mg/l; 15AB2 – 0.003 mg/l; 0.003 mg/l – 16AB2; 0.004 mg/l – 17AB3; and, 0.004 mg/l – 17BB1).

  Boron levels exceeding guideline values (1.0 mg/l) were detected in two samples – 15AB1 (3.2 mg/l) and 15AB2 (1.1 mg/l).

- **Total Sulphur**

  All but two groundwater samples (14AB1, and 16BB1) contained elevated concentrations of total sulphur. The elevated levels of total sulphur ranged from 450 mg/l (14AB2) to 2,260 mg/l (15AB1), far above the guideline value of 250 mg/l.

- **Total Cyanide**

  Two groundwater samples from 11AB2 (0.10 mg/l) and 12BB1 (1.00 mg/l) exceeded the total cyanide guideline value of 0.05 mg/l. It should be noted however that the detection limits for this analysis were 0.1mg/l.

- **Organics**

  Four groundwater samples exceeded guideline values for TPH (0.6 mg/l) – (14AB1, 2.8 mg/l; 16AB2, 0.7 mg/l; 17AB3, 0.8 mg/l; and, 17BB1, 0.6 mg/l).

  No other elevated organic concentrations were identified.

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 9.

Summary of Water Results Showing Exceedances. Redcar GW

Guidance used	Guideline levels	Unit	Client Sample ID Sample Date Sample Number	95th Percentile (excluding outliers)	11AB2 29/04/2004 W/EX/0410350	12 28 04/2 04 W/EX/0410360	13AB2 30/04/200 W/EX/0410635	3CB1 9/04/2004 W/EX/0410351	14AB2 28/04/2004 W/EX/0410356	14AB1 27/04/2004 W/EX/0410241	15AB1 28/04/2004 W/EX/0410357	15AB2 28/04/2004 W/EX/0410358	15AB3 28/04/2004 W/EX/0410359
UKDWS	<6.5 or >10	pH	pH	9.42	7.1	10.3	10.5	7.7	8.6	7.1	7.3	7.7	7.5
UKDWS	0.01	mg/l	Arsenic	0.009	0.00	0.01	0.03	0.00	0.01	0.00	0.01	0.00	0.00
UKDWS	0.0050	mg/l	Cadmium	0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	**0.0018**	<0.0001	<0.0001	<0.0001
UKDWS	0.0500	mg/l	Chromium	0.0028	0.0070	<0.001	<0.001	0.0010	<0.001	0.0030	0.0050	0.0010	<0.001
UKDWS	0.025	mg/l	Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
UKDWS	0.0010	mg/l	Mercury	0.00	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
UKDWS	0.010	mg/l	Selenium	0.005	0.002	0.005	0.005	0.007	0.004	0.002	**0.031**	0.003	0.002
UKDWS	0.0020	mg/l	Copper	0.003	0.0010	0.0040	0.0020	<0.001	0.0010	<0.001	0.0080	0.0030	0.0020
UKDWS	0.02	mg/l	Nickel	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00
DIV	0.8	mg/l	Zinc	0.011	0.0	<0.002	<0.002	0.0	<0.002	0.0	0.0	0.0	0.0
UKDWS	1.0	mg/l	Boron	0.92	0.5	0.1	<0.05	0.4	0.3	0.6	3.2	1.1	0.7
DIV	0.6	mg/l	TPH GC	0.82	<0.1	0.3	0.6	<0.1	0.4	2.8	<0.1	0.5	<0.1
DIV	0.6	mg/l	Gasoline Range Organics	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
UKDWS	0.05	mg/l	Tot Cyanide	0.10	0.10	**1.00**	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*
UKDWS	250	mg/l	Total Sulphur as SO4	1434.43	1250	457	1410	1210	450	193	2260	2180	1540
UKDWS	-	mg/l	Acid Soluble Sulphide	0.26	<0.2	<0.2	<0.2	0.400	<0.2	0.400	<0.2	<0.2	<0.2
UKDWS	0.05	mg/l	Free Cyanide	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*
DIV	0.82	mg/l	PAH Total EPA16	0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16
UKDWS	1	ug/l	Benzene	5.00	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*
DIV	1000	ug/l	Toluene	5.00	<5	<5	<5	<5	<5	<5	<5	<5	<5
DIV	150	ug/l	Ethylbenzene	5.00	<5	<5	<5	<5	<5	<5	<5	<5	<5
DIV	70	ug/l	Xylenes	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	2	mg/l	Phenol Index	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

DIV - Dutch Intervention Value

UKDWS - UK Drinking Water Standards

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

NB. DIV for PAH is for sum of ten

Summary of Water Results Showing Exceedances. Redcar GW

Guidance used	Guideline levels	Unit	Client Sample ID Sample Date Sample Number	95th Percentile (excluding outliers)	16AB2 30/04/2004 W/EX/0410634	16BB1 30/04/2004 W/EX/0410633	12AB2 29/04/2004 W/EX/0410273	17AB3 29/04/2004 W/EX/0410274	17BB1 29/04/2004 W/EX/0410275	17CB2 29/04/2004 W/EX/0410276
UKDWS	<6.5 or >10	pH	pH	9.42	10.4	12.2	7.5	11.0	7.1	7.5
UKDWS	0.01	mg/l	Arsenic	0.01	0.02	<0.001	0.00	0.00	0.00	0.00
UKDWS	0.0050	mg/l	Cadmium	0.00	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001
UKDWS	0.0500	mg/l	Chromium	0.00	<0.001	**0.0550**	0.0010	<0.001	0.0010	0.0020
UKDWS	0.025	mg/l	Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
UKDWS	0.0010	mg/l	Mercury	0.00	<0.0001	<0.0001	0.0003	0.0001	**0.0005**	<0.0001
UKDWS	0.010	mg/l	Selenium	0.00	0.007	<0.001	0.003	0.002	0.007	0.003
UKDWS	0.0020	mg/l	Copper	0.00	0.0030	0.0010	0.0010	0.0040	0.0040	0.0010
UKDWS	0.02	mg/l	Nickel	0.01	0.01	<0.001	0.00	0.00	0.00	0.01
DIV	0.8	mg/l	Zinc	0.01	<0.002	<0.0002	0.0	0.0	0.0	0.0
UKDWS	1.0	mg/l	Boron	0.92	0.1	<0.05	0.6	<0.05	0.6	0.4
DIV	0.6	mg/l	TPH GC	0.82	0.7	<0.1	0.3	0.8	0.6	<0.2
DIV	0.6	mg/l	Gasoline Range Organics	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
UKDWS	0.05	mg/l	Tot Cyanide	0.10	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*
UKDWS	250	mg/l	Total Sulphur as SO4	1434.43	567	68	969	1990	975	1280
UKDWS	-	mg/l	Acid Soluble Sulphide	0.26	**0.900**	<0.2	<0.2	<0.2	<0.2	<0.2
UKDWS	0.05	mg/l	Free Cyanide	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*
DIV	0.82	mg/l	PAH Total EPA16	0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16
UKDWS	1	ug/l	Benzene	5.00	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*
DIV	1000	ug/l	Toluene	5.00	<5	<5	<5	<5	<5	<5
DIV	150	ug/l	Ethylbenzene	5.00	<5	<5	<5	<5	<5	<5
DIV	70	ug/l	Xylenes	<10	<10	<10	<10	<10	<10	<10
DIV	2	mg/l	Phenol Index	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

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3.14 Summary of Results for Redcar Works

3.14.1 Scope of Works

The site investigation at Redcar comprised the following scope of works:

- Excavation of 120 trial pits and 16 groundwater monitoring boreholes;
- Surface water sampling from eight locations in the SSSI;
- Recovery of 260 soil samples from Made Ground and natural strata (where encountered) and recovery of 15 groundwater samples from boreholes.

3.14.2 Ground Conditions

- Made Ground, as fill material, encountered across the Redcar site and generally comprised fine to coarse sandy angular gravel, cobbles and boulders of slag, brick and ash with very occasional pockets of clay. Made Ground ranges in thickness between 0.6 and 7.5m bgl, and appears to be thicker in the southern and eastern areas of the site and much shallower in the central northern areas;
- Fine to coarse, occasionally gravelly yellow, brown sand (Alluvium)was encountered frequently across the central, northern and western areas of the site between depths of 1.8 to 10.0m bgl;
- Firm sometimes gravelly clay was observed in several locations across the south east of the Redcar site between depths of 0.4 to 4.0m bgl. This is possibly reworked natural ground;
- Groundwater was encountered within the Made Ground where underlain by fine to coarse alluvial sands. Observations suggest the existence of a continuous water body within the Made Ground. Groundwater flow within Made Ground and underlying alluvial sands is taking place from the southern part of the site toward the north toward the South Gare and Coatham Sands SSSI. To the northwest in Area 17, By Products groundwater flow is in the direction of the River Tees.
- Site observations and monitoring revealed small, localised areas of very slight hydrocarbon contamination in five exploratory locations across the Redcar site, generally within the Made Ground at depths between 2.5 and 5.8m. Four of these locations are situated on the northern boundary of the site adjacent to the SSSI, in Areas 12, 14 and 17. The contamination in Areas 12 and 14 were observed within sand, and within sandy clay underlain by sand at locations in Area 17.

3.14.3 Chemical Analysis Results

- Across the site the soil pH was very high ranging from 8.2 to 12.8 at shallow and deep sampling location points, this being due to the alkalinity of widespread slag within the fill materials. However groundwater pH was only locally elevated in certain locations.

- Elevated sulphide and sulphate was evident in the ground across the site, at shallow and deep sampling location. Likewise, groundwater also was high in sulphate but sulphide levels were below detection limits.

- Toxic and phytotoxic metals including lead, copper, zinc and boron were found in the ground at sporadic locations at the Redcar Works in shallow and deep sampling location points. These seemed to be located primarily in the northern section of the site in Area 17, By-Products and in Area 16, Coke Ovens. Elevated boron characterised Area 15F, the ore stocking yard. Some toxic and phytotoxic metal contamination (including arsenic, chromium, selenium, copper and boron) was found in groundwater but appeared to be unrelated to overlying ground conditions.

- PAH's were elevated in the ground at shallow and deep samples primarily in northern areas of the site such as Area 17, By Products, Area 14, Blast Furnace and in eastern areas of Area 12, Power Station and Surrounding Areas. TPH in excess of guideline criteria in groundwater at 14AB1 may be a result of leakages from the heavy fuel oil tank at the Blast Furnace. Localised elevated hydrocarbons were found in the groundwater at four locations in the northern part of the site.

- In the surface water ponds of the SSSI there was no exceedance of hydrocarbons against Tier 1 screening values. Copper and sulphate exceeded the guideline criteria in surface water whilst selenium was and pH was locally elevated.

4. LACKENBY WORKS

4.1 Site History

4.1.1 The following site history is based on a study of topographical maps held in the Corus archives (Ref. 4).

Table 7 Summary of Lackenby Works Site History

Dates	Summary
1953	Dorman Long & Co opened 'open heart' steel plant.
1950s	No.9 Medium Section Mill and Teesside Beam Mill were constructed.
1965	Plate Coil Mill and Electrical Arc Furnaces were built.
1971	Basic Oxygen Steelmaking Plant was commissioned, leading to closure of 'open hearth furnace'.
1970s	Continuous Casting Plant commissioned (1972), Cleveland Steelworks ceased operations (1973) and Secondary Steelmaking facilities later commissioned.
1980s	Cleveland Engineering Shops were demolished (1984) and Mills No.6, 7 and 8, and the North Steel Plant were all decommissioned.
1990s	Hot metal desulphurising facilities (1992) and second vacuum degreaser at the BOS Plant (1999) were commissioned.
2000/2001	No.2 Primary Mill and Coil Plate Mills were closed.

4.2 Potential Contamination Sources

4.2.1 Based on our review of information contained within the existing PPC report and our understanding of site activities the following potential contamination sources have been identified.

Table 8 Potential Contamination Sources within Lackenby Works Site

Area	Historic	Current	Potential Contamination Sources	Comments
7 8 G	✓ ✓ ✓		Steel slag	Sulphates in the slag buffer the pH of surface water run off creating alkaline leachates. Over 100 years the buffering effect of the slag will have been reduced to tolerable levels. Metals within slag are not likely to be mobile.
G 7 8	✓ ✓ ✓		Transformers	PCB's phased out to legal levels.
G 7 8	 ✓ ✓	✓ ✓ ✓	Diesel, oil and greases	Exact storage locations unknown, possibility of spills or leakages from storage areas. Accidental spillages treated as per operational procedures. Organic contaminants may be highly mobile.

7 8	✓	✓	Iron Oxide Scale	Contained within mill buildings, but potential for migration via wind or suspended in steam to external areas.
7 8	✓ ✓		Contaminated straw	Oil and iron oxide scale from mill water treatment.
G 7 8	✓ ✓ ✓	✓	Railway ballast	Contaminated ballast. May be locally contaminated by hydrocarbon spillages, may contain metals, phenols, sulphates and PAH's
G		✓	Sodium hypochlorite in cooling tower	Contained within double skinned containers on concrete hardstanding.

4.3 Environmental Setting

4.3.1 Geology

4.3.2 The Lackenby Works are extensively covered by Made Ground from reclamation of ground. The exceptions are Steel Services, No. 2 Primary Mill and the southern part of No. 1 Primary Mill. Drift material at the Lackenby Works comprises Upper Boulder Clay and glacio-lacustrine laminated clay deposits.

4.3.3 Drift material at the Lackenby Works are underlain by Whitby Mudstones of the Upper Lias Group, underlain by mudstone of Cleveland Ironstone Formation (Ref. 1 & 2). Deeper layers comprise the Redcar Mudstones of the Lower Lias and mudstones of the Penarth Group. The Mercia Mudstone Group overly permeable formations of the Sherwood Sandstone Group situated some 400-500m below ordinance datum. The angle of dip is approximately 10^0 to the south east. No faulting is shown but minor faults may be present.

4.3.4 Hydrogeology

4.3.5 The Lackenby Works are not within a groundwater Source Protection Zone designated by the Environment Agency (EA). There are no groundwater abstractions on the Lackenby site or within 1km of the boundary.

4.3.6 The Groundwater Vulnerability map (Ref. 3) classifies the impermeable drift of the glacio-lacustrine laminated clays as a "Non Aquifer" of "negligible permeability". The map shows the site to be overlain by soils of a high leaching potential i.e. "soils with little ability to attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or to shallow groundwater." The permeable formations of the Sherwood Sandstone Group are a Major Aquifer, however this is situated between 400-500m below ordinance datum and overlain by thick overlying mudstone formations. Groundwater is abstracted from the Triassic Sandstone for industrial use 3km to the south west and for public drinking water 7km to the north west of the Teesside Works near Greatham.

4.3.7 Existing monitoring boreholes indicate that the water table ranges from 1.0m to 4.57m below ground level at the interface between permeable Made Ground and less permeable clays. Perched groundwater was found between depths of 0.57m and 1.52m below ground level within the drift deposits. However groundwater was not considered to be vertically or laterally continuous as the composition of the drift deposits varied with depth across the site (Ref. 4). The

PPC desk study did not indicate the direction of groundwater flow at the Lackenby Works. The site geology and hydrogeology is summarised in Table 9.

Table 9 Summary of Site Geology & Hydrogeology from Previous Desk Study

Unit	Composition	Thickness	Information Source(s)	Presence of Groundwater?	Aquifer Type
Made Ground	Slag, gravelly clay with variable brick, ash and metal.	Up to 3.69m	Ref. 4	0.57m to 4.57. Localised perched water.	Non Aquifer
Upper Boulder Clay	Dark grey mottled sandy silty clay with fine to coarse gravel.	Up to 7.74m	Ref. 4	Unlikely.	Non Aquifer
Glaciolacustrine Laminated Clay	Grey brown clay with yellow brown silty sand.	Up to 4.57m	Ref. 4	Unlikely.	Non Aquifer
Lower Boulder Clay	Red brown sandy silty clay with fine to medium clay.	0.9m to 5.88m	Ref. 4	Unlikely.	Non Aquifer
Redcar Mudstone	Mudstones with sandstone and limestone beds in lower part. Some Shale found.	230-275m	Ref. 2	Possible if sufficiently fractured.	Non Aquifer
Penarth Mudstone	Grey and green mudstone and sandstone.	10-15m	Ref. 2	Possible if sufficiently fractured.	Non Aquifer
Mercia Mudstone	Red and green mudstone with gypsum and sandstone; halite in lower part.	200-270m	Ref. 2	Possible if sufficiently fractured.	Non Aquifer
Sherwood Sandstone	Sandstone.	250-300m	Ref. 2	Likely.	Major Aquifer

4.3.8 Hydrology

4.3.9 The Lackenby Works are situated 750m to the south east of Tees Dock and 1,830m to the south east of the River Tees. A number of streams crossed the site when the land was used for agricultural purposes. During the development of Lackenby these streams were culverted to flow in a northerly direction to discharge at the Solid and Liquid Effluent Management System (SLEMS) as shown in Figure 2. Storm water drains collect surface water and channel it to the following becks shown below:

- Boundary Beck Culvert - surface water from Area 7 and 8; BOS and Concast plant.
- Kinkerdale Beck Culvert – surface water from No. 2 Primary Mill and Universal Beam Mill.

4.3.10 There is one authorised discharge from the Lackenby Works from Area G the Iron Granulation Plant, the discharge is monitored under the requirements of the authorisation.

4.3.11 Ecology

4.3.12 The majority of the site is covered by open ground, buildings or hard standing and therefore there is little potential for protected habitats or species to be present.

4.3.13 Site users

4.3.14 Authorised personnel on site follow Corus Health and Safety Procedures which would assess site specific risks. Health hazards would be minimised by use of appropriate personal protective equipment (PPE).

4.3.15 Neighbouring Sites

4.3.16 Migration of contaminants would be via groundwater and surface water to neighbouring sites. Land use and sensitivity of surrounding sites is industrial and is similar to the Lackenby Works.

3.5 Summary of Site Sensitivity

4.3.17 The sensitivity of each of the identified receptors in the vicinity of the site to contamination along with pathways from the site are summarised in Table 10.

Table 10 Sensitivity of Receptors in the Vicinity of the Site

Receptor Type	Receptor(s)	Sensitivity	Reasoning
Groundwater	Non Aquifer	Low	Site underlain by a Non Aquifer. No licensed groundwater abstractions within 1km of the site.
Surface water	River Tees	Low	Lackenby Works is situated 1,830m to the south east of the River Tees. One authorised discharge from Area G Iron Granulation Plant. Surface water discharges to SLEMS.
Ecological	None	Low	The majority of the site is covered by open ground, buildings and hardstanding with low ecological sensitivity.
Site Users	Corus employees, contractors and visitors.	Low	Authorised personnel on site follow Corus Health and Safety Procedures which would assess site specific risks. Health hazards minimised by use of appropriate PPE.
Neighbouring sites	Adjacent Corus and third party land	Low	Migration of contaminants would be via groundwater and surface water to neighbouring sites. Land use and sensitivity of surrounding sites is industrial and is similar to the Lackenby Works.

4.4 Area 7, Concast and BOS Plant

4.4.1 Scope of Works

The site investigation in Area 7 comprised the following scope of works:

- Excavation of twelve trial pits (7AT1-12) using a 20 tonne tracked excavator and breaker;
- Advancing five groundwater monitoring boreholes (7AB1-5) using a shell and auger (cable percussive) rig;
- Recovery of 32 soil samples from Made Ground and natural strata (where encountered) and recovery of five groundwater samples from boreholes.

4.4.2 Ground Conditions

- Made Ground comprising sandy angular medium to coarse gravel, cobbles and boulders of slag and brick was encountered in the majority of locations to depths of up to 3.5m bgl.
- Natural strata below the Made Ground consisted of Boulder Clay comprising stiff brown and red clay with much fine to coarse, angular to subangular gravel at depths between 0.6 and 10.0m bgl;
- Lenses of thinly laminated silt, interbedded with fine micaceous sand were observed at two locations at depths of 3.5m bgl (7AT11) and 3.75m bgl (7AT10)but full thickness were not proven;
- Groundwater was encountered frequently in both Made Ground and underlying Boulder Clay layers across the area, at depths of between 0.55 and 5.0m bgl;
- Black oily staining and oil-like odours were observed at depths of between 1.0 to 1.8m bgl at two locations (7AT8 and 7AT9) in the northern portion of the area. No other visual and/or olfactory evidence of possible contamination was observed.

4.4.3 Chemical Analysis Results

- **Soil pH**

  Soil pH across the area was found to be alkaline to highly alkaline. Elevated soil pH values range from 10.4 (7AT5, 0.1 m bgl) to 12.9 (7AT7, 3.0 m bgl). The 95th percentile calculated for pH (10.4) exceeds the guideline value of 10.

- **Toxic and Phytotoxic Metals**

  The guideline limit for lead was exceeded in two samples (1,080 mg/kg – 7AT7, 0.2 m bgl; and, 5,163 mg/kg – 7AT3, 0.2 m bgl). However, the 95th percentile calculated for lead across Area 7 (165 mg/kg) is well below the guideline value of 750 mg/kg. Concentrations of toxic metals in all other samples were below guideline levels.

Concentrations of copper exceeded guideline values in sample 7AT11, 0.2 m bgl (200.3 mg/kg). The 95th percentile calculated for copper across the area as a whole (25 mg/kg) was well below the guideline value of 190 mg/kg.

Concentrations of zinc exceeded guideline values in two samples (722.1 mg/kg – 7AT7, 3.0 m bgl; and, 3,520 mg/kg – 7AT7, 0.2m bgl). The 95th percentile calculated for zinc across the whole area (224 mg/kg) was well below the guideline value of 720 mg/kg.

Elevated levels of boron were detected in two locations 7AT6, 0.2m bgl (3.1 mg/kg) and 7AT10, 0.3m bgl (7.0 mg/kg). The 95th percentile calculated for boron (2 mg/kg) across the area was below the guideline value of 3 mg/kg.

Concentrations of phytotoxic metals in all other samples were below guideline values.

- **Sulphide and Sulphate**

  Elevated levels of sulphide were detected in four samples across the area, ranging from 1,084 mg/l (7AT5, 0.1m bgl) and 2,567 mg/l (7AT1, 1.5 m bgl). The 95th percentile calculated for sulphide across the area as a whole (553 mg/l) was below the guideline value of 1,000 mg/l.

  Elevated levels of sulphate were detected in five samples across the area, ranging from 1,230 mg/l (7AT9, 1.8m bgl) and 1,970 mg/l (7AT4, 3.0 m bgl). The 95th percentile calculated for sulphate across the area as a whole (750 mg/l) was below the guideline value of 1,200 mg/l.

- **Organics**

  In Area 7, elevated levels of Total PAH were detected in only one sample (7AT1, 1.5m bgl – 51 mg/kg). The 95th percentile calculated for Total PAH across the area as a whole (18 mg/kg) was well below the guideline value of 40 mg/kg.

  No other organic determinands were found in elevated concentrations.

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 7.

Summary of Results Showing Exceedances. Area: 7

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	7AB1	7AB4	7AT1	7AT1	7AT10	7AT11	7AT2	7AT3	7AT3	7AT4
			Depth m bgl		**1.7**	**2.6**	**1.5**	**3**	**0.3**	**0.2**	**0.5**	**0.2**	**1.2**	**3**
			Ground Type		-	-	-	-	-	-	-	-	-	-
			Sample Date		**28.04.04**	**28.04.04**	-	-	**23.04.04**	**23.04.04**	-	-	-	-
			Sample Number		**CL0411373**	**CL0411378**	**CL0414962**	**CL0414963**	**CL0410981**	**CL0410977**	**CL0413985**	**CL0414964**	**CL0414965**	**CL0413988**
ESV	<5 or >10	pH	pH	10.36	11.4	11.4	11.3	11.4	12.2	11.6	11.8	10.6	8.1	6.9
CLEA	500	mg/kg	Arsenic	11.71	10.6	9.1	10.5	7.1	6.2	**113.1**	14.7	3.0	12.2	24.6
CLEA	1,400	mg/kg	Cadmium	0.56	0.1	0.2	<0.10	0.3	0.1	1.5	1.0	0.3	0.7	0.7
CLEA	5,000	mg/kg	Chromium	196.74	139.7	59.8	339.9	284.1	22.0	20.1	597.0	141.0	47.6	28.7
CLEA	750	mg/kg	Lead	164.76	40.6	26.8	40.7	88.7	20.8	175.7	120.7	[illegible]163.0	229.4	169.6
CLEA	480	mg/kg	Mercury	0.21	<0.10	<0.10	0.2	0.2	<0.10	0.9	0.2	<0.10	0.1	0.3
CLEA	8,000	mg/kg	Selenium	2.23	1.5	0.6	4.3	3.4	0.5	1.7	5.4	5.5	0.6	1.3
DIV	190	mg/kg	Copper	24.48	12.0	15.9	11.3	34.6	16.5	**200.3**	14.8	19.3	22.9	34.1
CLEA	5,000	mg/kg	Nickel	24.16	14.4	24.7	5.8	13.9	25.3	16.6	7.7	2.8	33.7	23.9
DIV	720	mg/kg	Zinc	223.86	85.6	80.9	28.7	216.6	66.7	484.2	241.1	199.2	233.5	293.6
ESV	3	mg/kg	Boron	1.96	1.6	0.8	1.4	2.0	7.0	1.0	2.8	1.2	2.6	1.4
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	352.71	27.0	87.0	259.0	191.0	409.0	743.0	192.0	166.0	53.0	41.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**<0.5**	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	553.08	475.0	<5	2567.0	1113.0	<5	588.0	820.0	1997.0	<5	<5
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	750.24	508.0	151.0	1140.0	855.0	317.0	503.0	846.0	1540.0	1530.0	1970.0
ESV	5,000	mg/kg	Tot Cyanide	5.16	<1	<1	12.0	26.0	<1	<1	2.0	5.0	4.0	<1
ESV	20,000	mg/kg	Total Sulphur	4491.92	2200.0	<400	11400.0	9700.0	4900.0	3800.0	9900.0	6800.0	3000.0	4700.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	18.10	<16	<16	**<51**	<31	<16	<16	<17	<16	<16	<16
DIV	1	mg/kg	Benzene	10.00	<10	<10	<10	<10	<10	<10	<10	<10	***<25***	<10
DIV	130	mg/kg	Toluene	10.00	<10	<10	<10	<10	<10	<10	<10	<10	***<25***	<10
DIV	50	mg/kg	Ethylbenzene	10.00	<10	<10	<10	<10	<10	<10	<10	<10	***<25***	<10
DIV	25	mg/kg	Xylenes	20.00	<20	<20	<20	<20	<20	<20	<20	<20	***<50***	<20
DIV	40	mg/kg	Phenol Index	0.53	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.5	0.8

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 7

Guidance used	Guideline levels	Unit	**Client Sample ID**	95th Percentile (excluding outliers)	**7AT5**	**7AT6**	**7AT7**	**7AT7**	**7AT8**	**7AT9**	**7AT9**
			Depth m bgl		**0.1**	**0.2**	**0.2**	**3**	**0.3**	**0.2**	**1.8**
			Ground Type		**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date		**-**	**-**	**23.04.04**	**23.04.04**	**-**	**-**	**-**
			Sample Number		**CL0414966**	**CL0414968**	**CL0410979**	**CL0410980**	**CL0414970**	**CL0414972**	**CL0414973**
ESV	<5 or >10	pH	pH	10.36	10.4	12.4	12.4	12.9	11.6	12.6	8.5
CLEA	500	mg/kg	Arsenic	11.71	6.7	9.0	8.0	7.7	4.0	5.0	16.8
CLEA	1,400	mg/kg	Cadmium	0.56	0.6	1.2	**9.2**	1.0	0.1	0.4	0.3
CLEA	5,000	mg/kg	Chromium	196.74	59.3	274.9	300.0	501.0	441.1	468.1	28.7
CLEA	750	mg/kg	Lead	164.76	66.1	115.7	1080.0	96.2	13.6	30.4	70.8
CLEA	480	mg/kg	Mercury	0.21	<0.10	0.2	0.2	0.1	0.2	0.2	0.1
CLEA	8,000	mg/kg	Selenium	2.23	4.0	1.9	1.3	1.3	3.6	1.5	<0.50
DIV	190	mg/kg	Copper	24.48	43.6	27.2	50.5	37.2	9.4	18.7	**136.5**
CLEA	5,000	mg/kg	Nickel	24.16	19.6	25.8	33.7	26.4	4.2	11.8	36.1
DIV	720	mg/kg	Zinc	223.86	178.8	456.6	**3520.0**	722.1	53.1	163.0	136.4
ESV	3	mg/kg	Boron	1.96	1.3	3.1	1.5	2.3	2.1	1.5	1.9
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	352.71	166.0	492.0	140.0	231.0	1720.0	1490.0	37.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.20	<0.2	<0.2	<0.2	**<0.5**	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	553.08	1084.0	947.0	106.0	<5	763.0	165.0	29.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	750.24	586.0	314.0	45.3	33.0	1960.0	49.1	1230.0
ESV	5,000	mg/kg	Tot Cyanide	5.16	4.0	10.0	<1	<1	9.0	11.0	5.0
ESV	20,000	mg/kg	Total Sulphur	4491.92	4100.0	5200.0	1400.0	1800.0	9200.0	3600.0	3100.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	18.10	<18	<17	<16	<16	<16	<16	<16
DIV	1	mg/kg	Benzene	10.00	<10	<10	<10	***<25***	<10	<10	<10
DIV	130	mg/kg	Toluene	10.00	<10	<10	<10	**<25**	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	10.00	<10	<10	<10	**<25**	<10	<10	<10
DIV	25	mg/kg	Xylenes	20.00	<20	<20	<20	***<50***	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.53	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters ar

4.5 Area 8, No. 2 Primary Mill

4.5.1 Scope of Works

The site investigation in Area 8 comprised the following scope of works:

- Excavation of six trial pits (8AT1-6) using a 20 tonne tracked excavator and breaker;
- Advancing two groundwater monitoring boreholes (8AB1-2) using a shell and auger (cable percussive) rig;
- Recovery of 15 soil samples from Made Ground and natural strata (where encountered) and recovery of two groundwater samples from boreholes.

4.5.2 Ground Conditions

- Made Ground comprising sandy angular medium to coarse gravel, cobbles and boulders of slag, brick and ash was encountered in all locations, to depths of up to 4.0m bgl;
- Made Ground was found to be underlain by Boulder Clay comprising stiff, sandy, occasionally silty clay with fine to coarse angular to rounded gravel between depths of 0.8 and 3.0m bgl.
- Groundwater was encountered at two locations in Made Ground at depths of 0.56m, and ~1.8m bgl;
- Black oily staining and hydrocarbon odours were observed at two locations (8AT1 and 8AT2) at depths of between 1.1 and 2.0m bgl. No further visual and/or olfactory evidence of possible contamination was observed.

4.5.3 Chemical Analysis Results

- **Soil pH**

  Soil pH across the area was found to be alkaline to highly alkaline. The soil sample pH values range from 8.2 (8AB1, 2.2 m bgl) to 12.8 (8AT6, 0.3 m bgl). The 95th percentile calculated for pH (11) exceeds the guideline value of 10.

- **Toxic and Phytotoxic Metals**

  Levels of toxic and phytotoxic metals were found to be below guideline limits, with the exception of one anomalous boron value (3.5 mg/kg – 8AT3, 0.2 m bgl). The 95th percentile calculated for boron (1.76 mg/kg) is below the guideline value of 3 mg/kg.

- **Sulphide and Sulphate**

  Elevated levels of sulphide were detected in three samples across the area (1854 mg/kg – 8AT2, 0.2 m bgl; 1615 mg/kg – 8AT3, 0.2 m bgl; 3239 mg/kg –

8AT3, 3.8 m bgl). The 95th percentile calculated for sulphide (1081 mg/kg) is slightly above the guideline value of 1,000 mg/kg.

Elevated levels of sulphate were detected in two locations (1810 mg/l – 8AT1, 1.2 m bgl; 1480 mg/l – 8AT5, 0.3 m bgl). The 95th percentile calculated for sulphate (700 mg/l) is well below the guideline value of 1,200 mg/l.

- **Organics**

  Elevated levels of Total PAH were detected in only one sample (377 mg/kg – 8AT3, 0.2 m bgl). The 95th percentile calculated for Total PAH (18 mg/kg) was well below the guideline value of 40 mg/kg.

  No other organic determinands were found in elevated concentrations.

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 7.

Summary of Results Showing Exceedances. Area: 8

Guidance used	Guideline levels	Unit	**Client Sample ID**	95th Percentile (excluding outliers)	**8AB2**	**8AT1**	**8AT1**	**8AT2**	**8AT3**	**8AT3**	**8AT4**	**8AT5**	**8AT6**	**8AT6**
			Depth m bgl		**1**	**0.3**	**1.2**	**0.2**	**0.2**	**3.8**	**0.2**	**0.3**	**0.3**	**1.5**
			Ground Type		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date			**23.04.04**	**23.04.04**	**23.04.04**	**26.04.04**	**26.04.04**	**23.04.04**	**26.04.04**	**23.04.04**	**23.04.04**
			Sample Number		**CL0412182**	**CL0410985**	**CL0410986**	**CL0410983**	**CL0411176**	**CL0411177**	**CL0410989**	**CL0411174**	**CL0410987**	**CL0410988**
ESV	<5 or >10	pH	pH	11.12	10.5	12.5	10.2	12.1	11.2	11.4	11.1	11.1	12.8	10.4
CLEA	500	mg/kg	Arsenic	8.70	12.2	4.3	5.9	6.0	9.5	10.4	5.1	7.8	5.6	6.6
CLEA	1,400	mg/kg	Cadmium	0.32	0.2	0.4	0.3	0.1	0.6	0.1	0.3	0.3	0.3	0.3
CLEA	5,000	mg/kg	Chromium	262.76	69.5	645.9	35.4	458.5	199.2	288.1	201.3	94.5	419.3	55.6
CLEA	750	mg/kg	Lead	31.03	25.8	17.8	16.3	16.5	**102.0**	19.4	21.4	41.9	16.5	19.8
CLEA	480	mg/kg	Mercury	0.20	0.1	<0.10	<0.10	<0.10	0.3	0.2	<0.10	0.3	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.40	1.6	3.0	2.6	5.2	5.4	6.0	3.1	2.8	3.1	1.1
DIV	190	mg/kg	Copper	14.38	20.1	11.2	10.8	5.5	10.1	5.5	10.1	**42.5**	12.3	15.2
CLEA	5,000	mg/kg	Nickel	25.69	30.7	7.1	19.9	3.5	6.5	5.2	6.2	61.0	7.9	26.2
DIV	720	mg/kg	Zinc	80.30	88.0	39.3	51.2	64.6	**302.3**	39.3	40.9	92.1	53.9	63.2
ESV	3	mg/kg	Boron	1.76	1.7	0.8	1.7	<0.5	3.5	1.5	2.8	2.0	0.9	<0.5
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	358.48	41.0	309.0	16.0	90.0	1377.0	95.0	113.0	<10.0	94.0	36.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**<0.5**	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	1080.77	114.0	435.0	394.0	1854.0	1615.0	3239.0	912.0	425.0	<5	564.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	699.75	230.0	356.0	1810.0	540.0	95.8	78.8	660.0	1480.0	76.7	340.0
ESV	5,000	mg/kg	Tot Cyanide	1.66	2.0	3.0	<1	<1	1.0	3.0	<1	<1	<1	<1
ESV	20,000	mg/kg	Total Sulphur	5625.94	<400	4300.0	4900.0	12100.0	7100.0	11100.0	5300.0	2300.0	5300.0	600.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	17.58	<16	<16	<16	<24	**<377**	<16	<16	<16	<16	<16
DIV	1	mg/kg	Benzene	10.00	<10	<10	<10	<10	<10	<10	***<25***	<10	<10	<10
DIV	130	mg/kg	Toluene	10.00	<10	<10	<10	<10	<10	<10	**<25**	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	10.00	<10	<10	<10	<10	<10	<10	**<25**	<10	<10	<10
DIV	25	mg/kg	Xylenes	20.00	<20	<20	<20	<20	<20	<20	***<50***	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.52	<0.5	<0.5	0.6	**1.3**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

4.6 Area G, Iron Granulation and Loco Repair Shop

4.6.1 Scope of Works

The site investigation in Area G comprised the following scope of works:

- Excavation of four trial pits (GAT1-2, GAT4-5) using a 20 tonne tracked excavator and breaker;
- Advancing two groundwater monitoring boreholes (GAB1-2) using a shell and auger (cable percussive) rig;
- Recovery of 11 soil samples from Made Ground and natural strata (where encountered) and recovery of two groundwater samples from boreholes.

4.6.2 Ground Conditions

- Made Ground comprising sandy, angular fine to coarse gravel and cobbles of slag was encountered in the majority of locations, to depths of up to 3m;
- Made Ground was found to be underlain by firm reworked clay with much fine to coarse, angular to subangular gravel of mudstone, siltstone and sandstone;
- A band of weak, thinly laminated mudstone was observed at one location (GAB2) between depths of 6.5 to 7.0m bgl;
- Groundwater was encountered frequently across the area in Made Ground at depths of between 0.2 and 3.0m bgl;
- Site observations and monitoring did not reveal the presence of visual or olfactory evidence of contamination with the exception of some hydrocarbon staining and hydrocarbon odours in the reworked clay at location GAT4.

4.6.3 Chemical Analysis Results

- **Soil pH**

  Soil pH across the area was found to be alkaline to highly alkaline. The soil sample pH values range from 7.8 (GAB1, 2.0 m bgl) to 12.8 (GAT1, 1.6 m bgl). The 95th percentile calculated for pH (10.3) slightly exceeds the guideline value of 10.

- **Toxic and Phytotoxic Metals**

  Levels of toxic and phytotoxic metals were found to be below guideline limits.

- **Sulphide and Sulphate**

  Levels of sulphide were found to be below guideline limits.

  Elevated levels of sulphate were detected in one location (1410 mg/l – GAT5, 1.0 m bgl). The 95th percentile calculated for sulphate (715 mg/l) is well below the guideline value of 1,200 mg/l.

- **Organics**

  Elevated levels of Total PAH were detected in two locations (169 mg/kg – GAT4, 0.5 m bgl; 61 mg/kg – GAT5, 1.0 m bgl). The 95th percentile calculated for Total PAH (29 mg/kg) was below the guideline value of 40 mg/kg.

  No other organic determinands were found in elevated concentrations.

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 7.

Summary of Results Showing Exceedances. Area: G

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	GAB2	GAT1	GAT4	GAT5
			Depth m blg		1	1.6	0.5	1
			Ground Type		-	-	-	-
			Sample Date		28.04.04	26.04.04	27.04.04	26.04.04
			Sample Number		CL0411379	CL0411178	CL0411571	CL0411180
ESV	<5 or >10	pH	pH	10.29	11.4	12.8	10.3	10.4
CLEA	500	mg/kg	Arsenic	11.32	14.3	14.5	11.8	9.4
CLEA	1,400	mg/kg	Cadmium	1.13	2.1	2.4	0.2	1.3
CLEA	5,000	mg/kg	Chromium	164.34	451.0	**3350.0**	36.1	167.4
CLEA	750	mg/kg	Lead	74.89	120.4	138.0	24.5	86.7
CLEA	480	mg/kg	Mercury	0.13	0.2	0.2	<0.01	0.2
CLEA	8,000	mg/kg	Selenium	1.10	1.5	1.6	1.0	**3.2**
DIV	190	mg/kg	Copper	28.67	27.0	59.2	34.6	16.6
CLEA	5,000	mg/kg	Nickel	31.03	31.2	52.7	22.3	12.8
DIV	720	mg/kg	Zinc	262.41	483.9	530.2	52.4	239.7
ESV	3	mg/kg	Boron	1.04	1.4	<0.5	0.5	1.2
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	262.44	81.0	51.0	685.0	506.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.20	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	89.45	290.0	<5	39.0	**906.0**
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	714.98	559.0	540.0	642.0	1410.0
ESV	5,000	mg/kg	Tot Cyanide	N/A	<1	<1	<1	<1
ESV	20,000	mg/kg	Total Sulphur	4005.63	5800.0	4500.0	3100.0	4100.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	28.75	<16	<16	**<169**	<61
DIV	1	mg/kg	Benzene	N/A	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	N/A	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	N/A	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	N/A	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.50	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

4.7 Groundwater Results

4.7.1 Groundwater Levels

4.7.2 The results for the groundwater monitoring for boreholes advanced across the Lackenby Works are detailed in the table below:

Table 11 Groundwater Monitoring Results – Lackenby Works

Location	Groundwater (mAOD)	Groundwater (mbgl)	Borehole Depth (mAOD)	Borehole Depth (mbgl)	pH	EC (µS)
7AB1	8.91	1.02	4.02	5.91	11.13	726.5
7AB2	7.41	2.37	0.89	8.88	8.13	1,375
7AB3	8.79	1.29	3.53	6.55	11.88	1,095
7AB4	9.2	0.87	3.91	6.16	8.22	1,650
7AB5	7.57	2.35	2.88	7.04	8.58	1,085
8AB1	8.47	1.68	0.734	9.42	7.35	1,177
8AB2	8.92	1.31	1.13	9.10	8.70	1,010
GAB1	9.03	1.10	0.26	9.87	9.04	1,225.1
GAB2	7.14	2.90	4.49	5.55	13.05	2,430

4.7.3 The depth to groundwater at the Lackenby Works varied between 0.87 m bgl at 7AB4, and 2.9 m bgl at GAB2 an average of 1.65m bgl. The local water table is situated within the Made Ground which is underlain in most cases by Boulder Clay consisting of gravelly fine to medium clay (See Appendix 3).

4.7.4 The pattern of shallow groundwater contours based on static water levels is shown on Figure 10. Groundwater levels were highest (9mOD) in the south eastern part of the Lackenby works near the Loco Repair Shop (Area G) with flow directed north north-west toward the Beam Mill and the railway line. Groundwater levels in the south western part of the Lackenby Works were more variable, controlled by the depth of slag relative to the Boulder Clay. There are locally depressed groundwater levels at the BOS Stores (7.41mOD 7AB2) which directs groundwater flow in the area and from the No. 2 Primary Mill (8.92mOD 8AB1). It is possible that groundwater may be entering into the Boundary Beck Culvert located in this area lowering groundwater levels in the area. The culvert is a 1.2m diameter pipe at 6m depth located in this area which enter the works at ground level at Lackenby and discharges into the SLEMS. Adjacent to this area groundwater flow is south west from the Slag Transporter Workshop toward the Cleveland works (Figure 10). .

4.7.5 Field Results for pH and Electrical Conductivity

4.7.6 pH results show a range of 7.35 to 13.05 across the site, with the highest values observed at locations within Areas 7 and G.

4.7.7 Values for EC show a range of 726.5 to 1,650µS.

4.7.8 Groundwater Chemical Analysis Results

- **pH**

  Groundwater pH values ranged from neutral (pH 7.4 – 7AB4) to highly alkaline (12.1 – GAB2). The 95th percentile calculated for pH (10) across the Lackenby site was below the guideline value.

- **Toxic and Phytotoxic Metals**

  Elevated levels of total chromium were found in sample GAB2 (0.09 mg/l).

  Elevated levels of selenium were found in samples 8AB2 (0.02 mg/l) and GAB1 (0.02 mg/l).

  Levels of phytotoxic metals were found to be below guideline limits, with the exception of elevated concentrations of copper in six samples (0.003 mg/l – GAB1, 7AB2, and 7AB4; 0.004 – 7AB1; 0.017 mg/l – GAB2; 0.027 mg/l – 8AB2). The 95th percentile calculated for copper (0.012 mg/kg) is above the guideline value of 0.002 mg/l.

- **Total and Free Cyanide**

  Elevated levels of total cyanide were detected in the groundwater sample from 7AB2 (1.0 mg/l). The 95th percentile calculated for total cyanide (0.1 mg/l) is above the guideline value of 0.05 mg/l. It should be noted however that the detection limits for this analysis were 0.1mg/l.

  Elevated levels of free cyanide were detected in the groundwater sample from 7AB5 (5 mg/l). The 95th percentile calculated for total cyanide (0.1 mg/l) is above the guideline value of 0.05 mg/l. It should be noted however that the detection limits for this analysis were 0.1mg/l.

- **Total Sulphate and Sulphide**

  Elevated levels of total sulphate were detected in all but one (7AB5) of the 10 groundwater samples, ranging between 365 mg/l (8AB2) and 699 mg/l (7AB4). The 95th percentile calculated for sulphate (568 mg/l) exceeds the guideline value of 250 mg/l. Sulphide was below detection limits of <0.2mg/l.

- **Organics**

  Two locations show slightly elevated TPH concentrations; 7AB1 (0.9mg/l) and GAB2 (0.9mg/l) against the guideline value of 0.6mg/l. The 95th percentile for TPH at Lackenby is below the guideline value. Highly elevated concentrations of phenols were detected in the groundwater sample from 7AB5 (390 mg/l).

  No other organic determinands were found in elevated concentrations..

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 9.

Summary of Water Results Showing Exceedances. Lackenby GW

Guidance used	**Guideline levels**	**Unit**	**Client Sample ID** **Sample Date** **Sample Number**	**95th Percentile (excluding outliers)**	**7AB4** 05/05/2004 **W/EX/0410641**	**7AB3** 05/05/2004 **W/EX/0410642**	**7AB1** 06/05/2004 **W/EX/0410643**	**8AB2** 06/05/2004 **W/EX/0410644**	**8AB1** 05/05/2004 **W/EX/0410648**	**7AB2** 05/05/2004 **W/EX/0410649**	**GAB1** 06/05/2004 **W/EX/0410981**	**GAB2** 06/05/2004 **W/EX/0410982**	**7AB5** 06/05/2004 **W/EX/0411090**
UKDWS	<6.5 or >10	pH	pH	9.996	7.4	11.2	10.0	8.5	7.6	7.8	7.9	12.1	7.7
UKDWS	0.01	mg/l	Arsenic	0.005	0.00	0.00	0.01	0.01	<0.001	0.00	0.00	0.00	0.00
UKDWS	0.005	mg/l	Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
UKDWS	0.05	mg/l	Chromium	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	**0.09**	0.00
UKDWS	0.025	mg/l	Lead	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	**0.003**	<0.001
UKDWS	0.001	mg/l	Mercury	0.00010	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.000	**0.000**
UKDWS	0.01	mg/l	Selenium	0.012	0.01	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.01
UKDWS	0.002	mg/l	Copper	0.012	0.003	0.001	0.004	0.027	0.002	0.003	0.003	0.017	0.002
UKDWS	0.02	mg/l	Nickel	0.01	0.01	<0.001	0.00	0.00	0.00	0.01	0.00	0.00	0.00
DIV	0.8	mg/l	Zinc	0.01	0.0	<0.002	<0.002	0.0	<0.002	<0.002	0.0	0.0	0.0
UKDWS	1	mg/l	Boron	0.41	0	0	1	1	0	0	0	<0.05	0
DIV	0.6	mg/l	TPH GC	0.59	0.4	<0.1	0.9	0.4	<0.1	0.5	<0.1	0.9	<0.33
DIV	0.6	mg/l	Gasoline Range Organics	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
UKDWS	0.05	mg/l	Tot Cyanide	0.10	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	**1.00**	*<0.1*	*<0.1*	*<0.1*
UKDWS	250	mg/l	Total Sulphur as SO4	568.95	699	413	365	365	549	658	534	380	<0.2
UKDWS	-	mg/l	Acid Soluble Sulphide	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**<0.27**
UKDWS	0.05	mg/l	Free Cyanide	0.10	*<0.1*	*<0.1*	*<0.1*	-	*<0.1*	*<0.1*	*<0.1*	*<0.1*	**<5**
DIV	0.82	mg/l	PAH Total EPA16	0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	**<5**
UKDWS	1	ug/l	Benzene	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*	*<5*
DIV	1000	ug/l	Toluene	5.00	<5	<5	<5	<5	<5	<5	<5	<5	**<10**
DIV	150	ug/l	Ethylbenzene	5.47	<5	<5	<5	<5	<5	<5	<5	<5	<0.05
DIV	70	ug/l	Xylenes	10.95	<10	<10	<10	<10	<10	<10	<10	<10	<0.1
DIV	2	mg/l	Phenol Index	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	**390**

DIV - Dutch Intervention Value

UKDWS - UK Drinking Water Standards

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

NB. DIV for PAH is for sum of ten

Sample 8AB2 was not ammenable for analysis of free cyanide levels due to high sediment content.

4.8 Summary of Results for Lackenby Works

4.8.1 Scope of Works

The site investigation at Lackenby Works comprised the following scope of works:

- Excavation of 22 trial pits and nine groundwater monitoring boreholes;
- Recovery of 58 soil samples from Made Ground and natural strata (where encountered) and recovery of nine groundwater samples from boreholes.

4.8.2 Ground Conditions

- Made Ground encountered across the site consisted of fine to coarse angular gravel, cobbles and boulders of slag and brick to depths of up to 4.0m;
- Natural strata underlying the Made Ground comprised Boulder Clay consisting of soft to firm occasionally sandy clay with gravel of siltstone, mudstone and sandstone toward the base of boreholes;
- Groundwater flow is through the Made Ground above the Boulder Clay with flow direction being controlled by the depth of the Boulder Clay which is variable across the Lackenby Works. Groundwater flow is from the Loco Repair Shop toward the Beam Mill in the south east and offsite toward the Cleveland Works from the Slag Transporter Workshop in the south west of the Lackenby Works (Figure 10). Locally depressed groundwater levels exist near to the BOS Stores, this may be due to ingress of groundwater into the Boundary Beck Culvert located in this area (See Figure 2) at 6m depth which directs drainage to the SLEMS.
- Owing to the general variability in Made Ground thickness between sampling locations across the site no generalised trends in thickness could be discerned;
- Black oily staining and oily odours were observed within the Made Ground and natural clay in four locations across Areas 7 and 8 between depths of 1.0 to 2.0m bgl. Minimal hydrocarbon contamination was also observed in GAT4.

4.8.3 Soil and Groundwater Results

- Across the Lackenby Works the soil was highly alkaline and exceeded the guideline value of 10 at shallow and deep sampling locations. This is likely to be due to the alkalinity of widespread slag deposits. However groundwater pH was below guideline values and was only locally elevated.
- Elevated sulphide and sulphate were locally elevated at shallow and deep sampling locations at the Lackenby Works but were generally below guideline values. Conversely groundwater was high in sulphate but sulphide levels were below detection limits.
- Toxic and phytotoxic metals in the soil at the Lackenby Works were below guideline values apart from locally elevated copper, lead, zinc and boron.

Copper was slightly elevated with respect to the guideline values in both the groundwater and the shallow soil at the southern part of the Lackenby Works near the Slag Transporter Workshop, this may be related to the composition of the slag. The levels of toxic and phytotoxoic metals in groundwater at the Lackenby Works were below guideline levels with the exception of isolated levels of chromium, selenium and copper and boron. These appeared to be unrelated to overlying ground conditions.

- Hydrocarbons were below guideline values in the soil at the Lackenby Works apart from isolated levels of PAHs in the shallow soils, which are most likely as a result of localised spillages. Slightly elevated hydrocarbon levels were identified in the shallow groundwater at two locations at the BOS/Concast plant and at Iron Granulation Plant. Elevated levels of phenols were found in groundwater at one location at the Concast Plant.

5. CLEVELAND

5.1 Site History

The following site history is based on a study of topographical maps held in the Corus archives (Ref. 4).

Table 12 Summary of Cleveland Site History

Dates	Summary
1779-1881	Part of Bran Sands area reclaimed using slag to create a high water embankment.
1881	Construction of South Bank Iron Works.
1906	Remaining Bran Sands areas were reclaimed and wharf areas established.
Pre 1950s	Acceptance of waste effluents into SLEMS area from local ironworks.
1956	Construction of South Bank Coke Ovens, gas collection system and By-Products plant.
1964	Large oil storage tanks commissioned at South Bank Oil Installation.
1966	Power Station B commissioned.
1970's	Certain areas designated as waste disposal sites under Waste Management Regulations.
1971-1972	West and east coke batteries of South Bank Coke Ovens commissioned.
1999	Power Station B decommissioned and demolished.

5.2 Potential Contamination Sources

Based on our review of information contained within the existing PPC report and our understanding of site activities the following potential contamination sources have been identified.

Table 13 Potential Contamination Sources within the Cleveland Site

Area	Historic	Current	Potential Contamination Sources	Comments
1 2 3 E 4 D H	✓ ✓ ✓ ✓ ✓ ✓ ✓		Iron making slag	Sulphates in the slag buffer the pH of surface water run off creating alkaline leachates. Over 100 years the buffering effect of the slag will have been reduced to tolerable levels. Metals within slag are not likely to be mobile.
1 2 3 E	✓ ✓ ✓ ✓		Transformers	PCB's phased out to legal levels.

E 3	✓ ✓		Iron ore and coal	Heavy metals, suspended solids, carbon. Accidental spillages into River Tees during loading and unloading.
1 2	✓ ✓		Flue dust	Possible heavy metals from flue cleaning. Mobility dependant on clay content and pH. Solubility of As, Cr and Se will increase in alkaline conditions.
1 2	✓ ✓		Refactory waste	Ferrous and other heavy metals from maintenance work, iron and slag runners and furnace relining.
1 2	✓ ✓		Concrete works	Cement dust - calcium, silica, aluminium and iron.
1 2	✓ ✓	✓ ✓	Coke and coke dust	Spillages arising from door removal, vehicle movements, coke wharfs and conveyors.
1 2	✓ ✓		Secondary gas washing	Spillages of naphthalene during delivery or transfer. Possible ground migration.
1 2 3 E H	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	Hydrocarbon storage and use	Heavy fuel oil, creosote, tar, benzole, light oils, diesel. Exact historical storage locations unknown, possibility of spills or leakages from storage areas. Accidental spillages treated as per operational procedures. Organic contaminants may be highly mobile.
1 2 4	 ✓	✓ ✓	Ammoniacal liquor	Ammonia and phenols contained within bunded storage tanks.
4	✓	✓	Waste materials in SLEMS	Biological sludge, tar residue, lime slurry, ferromanganese dust, iron, lead, zinc, alkalis, oils, calcium, silicon, magnesium, aluminium, Lackenby works effluent, oil mill scale. Low liquid content will produce minimal leachate, but may be affected by rainwater ingress.
1 2 H	✓ ✓ ✓		Railway ballast	Contaminated ballast. May be locally contaminated by hydrocarbon spillages, may contain metals, phenols, sulphates and PAH's

5.3 Environmental Setting

5.3.1 Geology

5.3.2 The Cleveland Works are extensively covered by Made Ground from reclamation. Underlying drift material comprises Post Glacial estuarine and marine alluvium.

5.3.3 Drift materials at the Cleveland Works are underlain by Whitby Mudstones of the Upper Lias Group, underlain by mudstone of Cleveland Ironstone Formation (Ref. 1 & 2). Deeper layers comprise the Redcar Mudstones of the Lower Lias and mudstones of the Penarth Group. The Mercia Mudstone Group overly permeable formations of the Sherwood Sandstone group situated some 400-500m below Ordinance Datum. The angle of dip is approximately 10^0 to the south east. No major faulting is shown but minor faults may be present.

5.3.4 Hydrogeology

5.3.5 The Cleveland Works are not within a groundwater Source Protection Zone designated by the Environment Agency (EA). There are no groundwater abstractions on the Cleveland site or within 1km of the boundary.

5.3.6 The Groundwater Vulnerability map (Ref.3) classifies the drift of the tidal flats and recent sand and gravel deposits as a “Minor Aquifer” which may have “variable permeability”. The map shows the site to be overlain by soils of a high leaching potential i.e. “soils with little ability to attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges have the potential to move rapidly to underlying strata or to shallow groundwater.” The permeable formations of the Sherwood Sandstone Group are a Major Aquifer situated between 400-500m below Ordinance Datum and overlain by thick overlying mudstone formations. Groundwater is abstracted from the Triassic Sandstone for industrial use 3km to the south west and for public drinking water supply some 7km to the north west of the Teesside Works near Greatham.

5.3.7 Previous site investigations have indicated that the water table ranges from 1.16m to 7m below ground level. These investigations found perched groundwater occurs within this range between permeable Made Ground or sand and gravels and impermeable Boulder Clay. Perched water was not considered to be vertically or laterally continuous due to variability in the permeability and depth of permeable and less permeable layers.

5.3.8 It was suggested that variations in groundwater levels within the slag may be as a result of tidal influences from the River Tees, however the method used to record groundwater levels created some uncertainty in their interpretation and consequently have been disregarded. It is assumed that the groundwater flows north to the River Tees and Tees Dock. The site geology and hydrogeology is summarised in Table 14.

Table 14 Summary of Site Geology & Hydrogeology from Previous Desk Study

Unit	Composition	Thickness	Information Source(s)	Presence of Groundwater?	Aquifer Type
Made Ground	Dense to very dense gravel to boulder sized slag. Local variations in composition of brick fragments, ash and scrap iron.	1.3m to 8.66m	Ref. 4	1.16mbgl to 7mbgl.	Minor Aquifer
Estuarine and Marine Alluvium	Grey to brown soft brown sandy clay with laminations of silt.	Up to 9.1m	Ref. 4	1.16mbgl to 7mbgl.	Minor Aquifer
Upper Boulder Clay	Red brown firm to stiff sandy clay with fine to medium gravel	Up to 3.66m	Ref. 4	Unlikely	Non Aquifer
Lower Boulder Clay	Brown stiff sandy clay with fine to medium gravel. Lenses of silty fine sand and gravel encountered	2.13 to 6.89m	Ref. 4	Unlikely	Non Aquifer
Redcar Mudstone	Mudstones with sandstone and limestone beds in lower part	230-275m	Ref. 2	Possible if sufficiently fractured	Non Aquifer

Penarth Mudstone	Grey and green mudstone and sandstone	10-15m	Ref. 2	Possible if sufficiently fractured	Non Aquifer
Mercia Mudstone	Red and green mudstone with gypsum and sandstone; halite in lower part	200-270m	Ref. 2	Possible if sufficiently fractured	Non Aquifer
Sherwood Sandstone	Sandstone	250-300m	Ref. 2	Likely	Major Aquifer

5.3.9 Hydrology

5.3.10 The Cleveland Works is bounded by the River Tees in the west but no natural surface water features crossing the site. Surface water at Area 1, the South Bank Coke Ovens drains to the local foul water system. Surface water from Area 2, the South Bank By-Products Plant flows to low level sumps and is recycled through the By-Products system. Drainage received into Area 4, the SLEMS area, flows into a series of open channels and lagoons.

5.3.11 Effluent entering the SLEMS is treated to meet the consent limits and discharged to the River Tees. As the SLEMs is unlined, infiltration to ground would be expected although it would be limited by the underlying Boulder Clay and mudstone. The Cleveland Oil Farm soakaway (W5) provides a direct discharge to ground through an oil separator for surface water run off from the bunded tank area and hard standing. The steam blow discharge from the Cleveland Oil Farm enters the River Tees at Release Point W1 as shown on Figure 2. Both W5 and W1 are regulated under PPC consent[7].

5.3.12 Ecology

5.3.13 The Tees and Hartlepool Foreshore and Wetlands SSSI and the Teesmouth & Cleveland Coast Ramsar Site is situated on the north bank of the River Tees and is located approximately 900m west of the South Bank Coke Ovens. The majority of the Cleveland site is located over open ground, buildings or hard standing and therefore there is little potential for protected habitats or species to be present.

5.3.14 Site users

5.3.15 Authorised personnel on site follow Corus Health and Safety Procedures which would assess site specific risks. Health hazards would be minimised by use of appropriate personal protective equipment (PPE).

5.3.16 Neighbouring Sites

5.3.17 Migration of contaminants would be via groundwater and surface water to neighbouring sites. Land use and sensitivity of surrounding sites is industrial and is similar to the Cleveland Works.

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[7] Personal communication: Peter Boydell, Corus 2nd June 04.

3.5 Summary of Site Sensitivity

5.3.18 The sensitivity of each of the identified receptors in the vicinity of the site to contamination along with pathways from the site are summarised in Table 15.

Table 15 Sensitivity of Receptors in the Vicinity of the Site

Receptor Type	Receptor(s)	Sensitivity	Reasoning
Groundwater	Minor Aquifer	Low	Site underlain by a Minor Aquifer. No licensed groundwater abstractions within 1km of the site.
Surface water	River Tees	Moderate	The River Tees borders the western part of the site. Two consented discharges into the River Tees, one from the SLEMS and one from the Oil Storage Wharf. Indicative groundwater flow toward River Tees.
Ecological	Tees and Hartlepool Foreshore and Wetlands SSSI. Teesmouth & Cleveland Coast Ramsar Site.	Moderate	The Cleveland Works is on the opposite bank to a SSSI and Ramsar Site which are ecologically sensitive. Indicative groundwater flow toward River Tees. The majority of the site is covered by open ground, buildings and hardstanding with low ecological sensitivity.
Site Users	Corus employees, contractors and visitors.	Low	Authorised personnel on site follow Corus Health and Safety Procedures which would assess site specific risks. Health hazards minimised by use of appropriate PPE.
Neighbouring sites	Adjacent Corus and third party land	Low	Migration of contaminants would be via groundwater and surface water to neighbouring sites. Land use and sensitivity of surrounding sites is industrial and is similar to the Lackenby Works.

5.4 Area 1 – By-Products Plant and Coke Ovens

5.4.1 Scope of Works

The site investigation in Area 1 comprised the following scope of works:

- Excavation of fifteen trial pits (1AT1-15) using a 20 tonne tracked excavator and breaker;
- Advancing one groundwater monitoring borehole (1AB1) using a shell and auger (cable percussive) rig;
- Recovery of thirty soil samples from Made Ground and natural strata (where encountered) and recovery of one groundwater sample from boreholes.

5.4.2 Ground Conditions

- Made Ground comprising fine to coarse angular occasionally sandy gravel to cobbles of brick and slag was encountered in the majority of locations to depths of 4.0m;
- Natural strata was encountered at one location, 1AB1, consisting of very soft laminated clay / silt;
- Groundwater was encountered in the Made Ground, 2AB3 at a depth of 5.0m bgl;
- Site observations and monitoring did not reveal the presence of visual and/or olfactory evidence of contamination.

5.4.3 Chemical Analysis Results

- **Soil pH**

  Soil pH across the site was found to be alkaline to highly alkaline. Soil pH values range from 8.4 (AAT9, 3.5 m bgl) to 12.7 (1AT1, 3.6 m bgl). The 95th percentile calculated for pH (10.41) slightly exceeds the guideline value of 10.

- **Toxic and Phytotoxic Metals**

  Levels of toxic metals were found to be below guideline levels, with the exception of two elevated zinc values (845.2 mg/kg – 1AT15, 4.5 m bgl, and 2,070mg/kg – 1AT9, 3.5 m bgl). The 95th percentile calculated for zinc (464.72 mg/kg) is well below the guideline value of 720 mg/kg.

  No other exceedences were observed.

- **Sulphide and sulphate**

  Elevated levels of sulphide were detected in 14 samples taken from within Area 1 ranging between 1,051 mg/kg (1AT11, 3.3 m bgl) to 3,037 mg/kg

(1AT8, 3.6 m bgl). The 95th percentile calculated for sulphide (1327.96 mg/kg) exceeds the guideline value of 1,000 mg/kg.

Elevated levels of sulphate were detected in thirty-nine samples across the site ranging from 1,460.0 mg/l (1AT7, 3.9 m bgl) to 2,190.0 mg/l (1AT4, 3.6m bgl). The 95th percentile calculated for sulphate (1,167.21 mg/l) is below the guideline value of 1,200 mg/l.

- **Organics**

  Levels of Total PAH in excess of guideline criteria were detected in seven samples ranging from 50 mg/kg (1AT14, 0.2 m bgl) to 139 mg/kg (1AT6, 0.2 m bgl). The 95th percentile calculated for Total PAH (43.69 mg/kg) exceeds the guideline value of 40 mg/kg.

  No other organic determinands were present in elevated concentrations.

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 8.

Summary of Results Showing Exceedances. Area: 1

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	1AT1	1AT1	1AT10	1AT10	1AT11	1AT11	1AT12	1AT12	1AT13	1AT14
			Depth m bgl		**0.2**	**3.6**	**0.1**	**3.5**	**0.3**	**3.3**	**1**	**3.2**	**3.5**	**0.2**
			Ground Type		-	-	-	-	-	-	-	-	-	-
			Sample Date		**27.04.04**	**27.04.04**					**28.04.04**	**28.04.04**	**28.04.04**	**28.04.04**
			Sample Number		**CL0411582**	**CL0411583**	**CL0412193**	**CL0412192**	**CL0412188**	**CL0412189**	**CL0411590**	**CL0411591**	**CL0411593**	**CL0411594**
ESV	<5 or >10	pH	pH	10.41	9.1	12.7	9.6	9.0	10.5	10.5	9.4	12.0	10.6	9.9
CLEA	500	mg/kg	Arsenic	27.77	31.9	8.1	3.7	8.4	14.6	11.5	35.1	20.3	18.7	23.2
CLEA	1,400	mg/kg	Cadmium	0.67	2.7	0.3	0.2	0.8	0.6	0.9	0.9	0.4	0.4	0.3
CLEA	5,000	mg/kg	Chromium	81.57	26.9	**632.1**	14.4	10.3	29.2	71.0	34.2	26.4	47.7	33.8
CLEA	750	mg/kg	Lead	114.10	311.9	29.3	14.9	78.0	75.1	178.0	119.5	47.4	90.3	110.8
CLEA	480	mg/kg	Mercury	0.25	0.4	0.2	<0.10	0.2	0.3	0.4	0.2	<0.10	0.2	<0.10
CLEA	8,000	mg/kg	Selenium	3.77	2.8	0.8	1.2	5.8	4.6	4.1	5.1	5.2	3.4	4.1
DIV	190	mg/kg	Copper	16.38	13.9	19.1	14.3	7.6	8.0	9.7	11.9	5.7	11.7	9.7
CLEA	5,000	mg/kg	Nickel	15.35	12.4	8.7	3.4	2.8	4.2	4.4	9.6	6.0	8.2	7.6
DIV	720	mg/kg	Zinc	464.72	706.2	108.8	55.3	539.8	269.5	378.0	667.8	344.6	317.1	176.5
ESV	3	mg/kg	Boron	1.20	1.3	1.2	<0.5	<0.5	1.3	<0.5	0.7	0.8	0.9	1.3
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	638.01	681.0	170.0	219.0	81.0	288.0	275.0	336.0	314.0	390.0	302.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.34	<0.2	<0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	1327.96	762.0	14.0	33.0	2694.0	1419.0	1051.0	1972.0	2392.0	1071.0	1394.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1167.21	1750.0	16.0	282.0	1700.0	1020.0	1510.0	738.0	988.0	1020.0	1680.0
ESV	5,000	mg/kg	Tot Cyanide	5.85	4.0	<1	4.0	8.0	13.0	8.0	8.0	4.0	6.0	6.0
ESV	20,000	mg/kg	Total Sulphur	7405.40	6800.0	2500.0	6000.0	7600.0	9700.0	7100.0	8400.0	9000.0	6100.0	8100.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	1.0	1.0	1.0	1.0	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	43.69	<40	<20	<100	<16	<20	<19	<19	<16	<21	<50
DIV	1	mg/kg	Benzene	16.89	*<10*	*<25*	*<25*	*<10*	*<10*	*<10*	*<10*	*<25*	*<10*	*<10*
DIV	130	mg/kg	Toluene	16.89	<10	<25	<25	<10	<10	<10	<10	<25	<10	<10
DIV	50	mg/kg	Ethylbenzene	16.89	<10	<25	<25	<10	<10	<10	<10	<25	<10	<10
DIV	25	mg/kg	Xylenes	33.77	<20	*<50*	*<50*	<20	<20	<20	<20	*<50*	<20	<20
DIV	40	mg/kg	Phenol Index	0.53	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 1

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	1AT14	1AT15	1AT2	1AT2	1AT3	1AT3	1AT4	1AT4	1AT5	1AT6
			Depth m bgl		**3.8**	**4.5**	**0.25**	**3.9**	**0.2**	**3.9**	**0.25**	**3.6**	**0.2**	**0.2**
			Ground Type		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date		**28.04.04**	**27.04.04**	**27.04.04**	**27.04.04**	**28.04.04**	**28.04.04**	**27.04.04**	**27.04.04**	**28.04.04**	**28.04.04**
			Sample Number		**CL0411595**	**CL0411579**	**CL0411580**	**CL0411581**	**CL0411576**	**CL0411577**	**CL0411584**	**CL0411585**	**CL0411573**	**CL0411575**
ESV	<5 or >10	pH	pH	10.41	12.1	9.5	12.2	11.0	9.2	9.0	10.2	10.4	9.0	11.9
CLEA	500	mg/kg	Arsenic	27.77	29.8	39.9	5.9	63.3	9.2	21.3	94.2	13.6	17.9	28.5
CLEA	1,400	mg/kg	Cadmium	0.67	0.4	**6.3**	0.2	1.0	0.2	0.2	0.5	<0.10	0.3	0.5
CLEA	5,000	mg/kg	Chromium	81.57	35.5	44.2	230.3	80.0	16.1	232.3	59.3	13.4	48.3	248.6
CLEA	750	mg/kg	Lead	114.10	68.8	238.7	34.5	170.2	32.4	46.9	82.4	3.2	52.4	58.7
CLEA	480	mg/kg	Mercury	0.25	0.2	**1.4**	0.3	0.3	0.4	0.2	0.2	<0.10	0.4	0.2
CLEA	8,000	mg/kg	Selenium	3.77	4.7	1.6	0.7	1.6	0.9	3.4	3.1	5.7	1.5	2.3
DIV	190	mg/kg	Copper	16.38	15.1	19.9	13.5	42.9	16.5	8.1	15.2	1.4	23.1	13.4
CLEA	5,000	mg/kg	Nickel	15.35	9.3	25.2	9.0	24.1	9.3	9.8	17.6	3.0	**88.8**	12.7
DIV	720	mg/kg	Zinc	464.72	219.3	845.2	84.7	589.4	108.0	117.9	263.4	8.1	142.8	254.9
ESV	3	mg/kg	Boron	1.20	1.6	2.2	0.5	0.8	<0.5	1.2	0.7	2.8	0.6	<0.5
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	638.01	212.0	356.0	766.0	491.0	2864.0	371.0	269.0	64.0	1994.0	1262.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.34	<0.2	<0.2	<0.2	<0.5	<0.5	<0.2	<0.2	<0.5	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	1327.96	1773.0	<5	<5	138.0	129.0	726.0	452.0	2114.0	59.0	144.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1167.21	1720.0	2000.0	17.1	391.0	342.0	1620.0	7.9	2190.0	1600.0	364.0
ESV	5,000	mg/kg	Tot Cyanide	5.85	5.0	<1	<1	<1	<1	<1	<1	13.0	4.0	1.0
ESV	20,000	mg/kg	Total Sulphur	7405.40	8400.0	5300.0	4500.0	2800.0	5000.0	6400.0	4600.0	11700.0	7100.0	4200.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	43.69	<21	<61	<37	<20	85.0	<21	<16	<16	<61	139.0
DIV	1	mg/kg	Benzene	16.89	*<10*	*<10*	*<10*	*<25*	*<25*	*<10*	*<10*	*<25*	*<10*	*<10*
DIV	130	mg/kg	Toluene	16.89	<10	<10	<10	<25	<25	<10	<10	<25	<10	<10
DIV	50	mg/kg	Ethylbenzene	16.89	<10	<10	<10	<25	<25	<10	<10	<25	<10	<10
DIV	25	mg/kg	Xylenes	33.77	<20	<20	<20	*<50*	*<50*	<20	<20	*<50*	<20	<20
DIV	40	mg/kg	Phenol Index	0.53	<0.5	<0.5	<0.5	0.7	0.7	<0.5	<0.5	**1.5**	0.5	<0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 1

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	1AT7	1AT7	1AT8	1AT8	1AT9	1AT9
			Depth m bgl		**0.5**	**3.9**	**0.15**	**3.6**	**0.5**	**3.5**
			Ground Type		**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date		**28.04.04**	**28.04.04**	**28.04.04**	**28.04.04**		
			Sample Number		**CL0411586**	**CL0411587**	**CL0411588**	**CL0411589**	**CL0412191**	**CL0412190**
ESV	<5 or >10	pH	pH	10.41	10.4	10.5	9.5	9.8	8.7	8.4
CLEA	500	mg/kg	Arsenic	27.77	23.6	19.1	23.0	14.3	20.1	**166.8**
CLEA	1,400	mg/kg	Cadmium	0.67	0.4	0.2	0.3	<0.10	0.4	1.2
CLEA	5,000	mg/kg	Chromium	81.57	35.2	29.4	60.3	30.6	17.5	80.2
CLEA	750	mg/kg	Lead	114.10	63.2	42.0	62.0	18.0	25.5	201.3
CLEA	480	mg/kg	Mercury	0.25	0.3	0.2	0.1	0.1	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.77	5.1	5.3	4.1	5.6	5.6	3.1
DIV	190	mg/kg	Copper	16.38	10.1	6.5	9.6	4.6	2.7	24.1
CLEA	5,000	mg/kg	Nickel	15.35	7.1	7.0	9.2	6.1	5.4	44.5
DIV	720	mg/kg	Zinc	464.72	254.5	189.0	327.0	216.8	123.4	2070.0
ESV	3	mg/kg	Boron	1.20	0.8	0.9	1.3	1.8	0.9	0.7
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	638.01	483.0	183.0	240.0	78.0	97.0	148.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.34	<0.2	<0.2	<0.5	<0.5	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	1327.96	2855.0	2893.0	1501.0	3037.0	1145.0	122.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1167.21	657.0	1460.0	551.0	1730.0	1670.0	275.0
ESV	5,000	mg/kg	Tot Cyanide	5.85	11.0	5.0	7.0	5.0	11.0	2.0
ESV	20,000	mg/kg	Total Sulphur	7405.40	8100.0	8900.0	5900.0	14800.0	10400.0	5300.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	**2.0**	<1
DIV	40	mg/kg	PAH Total EPA16	43.69	<77	<16	<18	<16	<16	<16
DIV	1	mg/kg	Benzene	16.89	*<10*	*<10*	*<25*	*<25*	*<10*	*<10*
DIV	130	mg/kg	Toluene	16.89	<10	<10	<25	<25	<10	<10
DIV	50	mg/kg	Ethylbenzene	16.89	<10	<10	<25	<25	<10	<10
DIV	25	mg/kg	Xylenes	33.77	<20	<20	*<50*	*<50*	<20	<20
DIV	40	mg/kg	Phenol Index	0.53	<0.5	<0.5	<0.5	0.6	<0.5	<0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

5.5 Area 2 – By-Products Plant

5.5.1 Scope of Works

The site investigation in Area 2 comprised the following scope of works:

- Excavation of fourteen trial pits (2AT1-14) using a 20 tonne tracked excavator and breaker;
- Advancing three groundwater monitoring boreholes (2AB1-3) using a shell and auger (cable percussive) rig;
- Recovery of thirty four soil samples from Made Ground and natural strata (where encountered) and recovery of three groundwater samples from boreholes.

5.5.2 Ground Conditions

- Made Ground in the area comprised sandy fine to coarse gravel, cobbles and boulders of slag and brick, with ash and occasional metal fragments. Made Ground was encountered to depths of 4.0m in the majority of locations. Occasional pockets of soft to firm sandy, gravely clay were also observed;
- Natural ground in the form of loose orange sand was observed at 2AT2 between depths of 3.8 to 4.0m bgl. Soft laminated to thinly bedded gravelly clay was encountered at 2AB3 between depths of 7.4 to 8.5m bgl;
- Groundwater was encountered in the Made Ground at two locations at depths of 3.8 and 5.0m bgl;
- An oily, tarry deposit and strong hydrocarbon odours were noted in the Made Ground and groundwater during monitoring at 2AB2 situated near the benzol tanks, between depths of 3.8 to 4.7m bgl. Similar soil staining and odours were noted at 2AT12 (0.5-0.65m) and 2AB1A (6.0-6.7m).

5.5.3 Chemical Analysis Results

- **Soil pH**

  Soil pH across the site was found to be alkaline to highly alkaline. Soil pH values range from 8.4 (2AT10, 0.15 m bgl) to 12.8 (2AT1, 0.2 m bgl). The 95th percentile calculated for pH (9.92) is below the guideline value of 10.

- **Toxic and Phytotoxic Metals**

  Levels of toxic metals were found to be below guideline levels, with the exception of one elevated lead value (1,930 mg/kg – 2AB1A, 6.0 bgl). The 95th percentile calculated for lead (266.96 mg/kg) is well below the guideline value of 750 mg/kg.

  Concentrations of zinc exceeded guideline values in eight samples taken within Area 2, ranging between 772.0 mg/kg (2AT13, 4.0 m bgl) to 5,260 mg/kg (2AB1A, 6.0 m bgl). The 95th percentile calculated for zinc (740.1 mg/kg) exceeds the guideline value of 720 mg/kg.

Elevated levels of boron were detected in two samples across the Area 2; 4.6 mg/kg (2AB3 6.6 m bgl) to 6.3 mg/kg (2AB1A, 6.0 m bgl). The 95th percentile calculated for boron (1.4 mg/kg) is well below the guideline value of 3 mg/kg.

No other exceedences were observed.

- **Sulphide and sulphate**

Elevated levels of sulphide in excess of guideline values were detected in eight samples taken from within Area 2, ranging from 1,017.0 mg/kg (2AT8, 0.3 m bgl) to 9,270 mg/kg (2AT5, 0.4 m bgl). The 95th percentile for total sulphide (1742.77 mg/kg) across Area 2 exceeds the guideline value of 1,000 mg/kg.

Elevated levels of sulphate in excess of guideline values were detected in thirteen samples, ranging from 1,230 mg/l (2AT10, 3.9m bgl) to 2,100 mg/l (2AB1A, 6.0mbgl). The 95th percentile calculated for sulphate across Area 2 (1,099.13 mg/l) is below the guideline value of 1,200 mg/l.

- **Cyanide**

Elevated levels of free cyanide in excess of guideline values were detected in one sample, 79.0 mg/kg (2AT11, 0.1 m bgl). However the 95th percentile for free cyanide at the By Product area was below the guideline value of 20mg/kg.

- **Organics**

Levels of Total PAH in excess of guideline values were detected in fifteen samples ranging from 47mg/kg (2AB3, 2.5 m bgl) to 145,483 mg/kg (2AB2, 3.8 m bgl). The 95th percentile calculated for Total PAH (2,167 mg/kg) across all of Area 2 exceeds the guideline value of 40 mg/kg.

Levels of TPH exceeding guideline values (5,000 mg/kg) were identified in four samples ranging from 14,570 mg/kg (2AT11, 0.2 m bgl) to 266,000 mg/kg (2AT12, 0.55 m bgl). The 95th percentile calculated for TPH (4,637 mg/kg) across the Area was below the guideline value of 5,000 mg/kg.

Elevated concentrations of BTEX compounds were detected in five samples. Sample 2AB1A (6.0 m bgl) had elevated levels of benzene (1,040 mg/kg), toluene (242 mg/kg) and xylenes (474 mg/kg); sample 2AB1A (7.5 m bgl) had elevated levels of benzene (5,750 mg/kg), toluene (1,630 mg/kg), ethlybenzene (111 mg/kg) and xylene (2,330 mg/kg); sample 2AB2 (3.8m bgl) had elevated levels of benzene (16,200 mg/kg), toluene (24,400 mg/kg), ethylbenzene 2,020 mg/kg), and xylenes (41,200 mg/kg); sample 2AT11 (0.1m) had elevated levels of benzene (4,220 mg/kg), toluene (1,310 mg/kg), and xylenes (2,870 mg/kg); and sample 2AT12 had elevated levels of benzene (20,700 mg/kg), toluene (58,400 mg/kg) and xylenes (89,000 mg/kg).

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 8.

Summary of Results Showing Exceedances. Area: 2

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	2AB1A 6 - 05.05.04 CL0412691	2AB1A 7.5 - 05.05.04 CL0412692	2AB2 3.8 - 05.05.04 CL0412693	2AB3 2.5 - 13.05.04 CL0413427	2AB3 6.6 - 13.05.04 CL0413428	2AT01 0.2 - 17.05.04 CL0414021	2AT02 0.2 - 17.05.04 CL0414023	2AT02 3.7 - 17.05.04 CL0414024	2AT03 0.2 - 17.05.04 CL0414025	2AT03 2.5 - 17.05.04 CL0414026
ESV	<5 or >10	pH	pH	9.92	9.8	9.0	9.6	8.6	9.9	12.8	10.5	11.7	10.4	10.0
CLEA	500	mg/kg	Arsenic	45.41	135.0	27.8	13.1	27.1	46.2	9.4	21.6	43.9	70.0	68.0
CLEA	1,400	mg/kg	Cadmium	1.09	5.0	0.3	0.4	0.7	1.2	0.4	1.5	1.4	3.0	2.1
CLEA	5,000	mg/kg	Chromium	43.93	155.3	38.2	79.6	30.3	58.1	**502.1**	32.9	57.5	49.7	40.8
CLEA	750	mg/kg	Lead	266.96	1930.0	124.2	83.9	131.0	627.6	49.4	140.1	224.2	284.0	191.2
CLEA	480	mg/kg	Mercury	0.29	<0.10	<0.10	0.1	<0.10	0.7	<0.10	0.1	0.1	0.4	0.3
CLEA	8,000	mg/kg	Selenium	3.13	2.9	0.7	2.3	0.6	1.5	0.8	3.0	1.7	2.2	2.5
DIV	190	mg/kg	Copper	26.03	16.7	16.8	13.3	44.0	25.1	32.0	17.1	53.9	34.8	21.5
CLEA	5,000	mg/kg	Nickel	20.55	37.9	35.9	31.4	36.5	26.1	26.1	7.0	18.9	22.1	16.4
DIV	720	mg/kg	Zinc	740.10	5260.0	285.2	155.5	468.1	580.8	190.5	847.1	988.8	1120.0	810.4
ESV	3	mg/kg	Boron	1.40	**6.3**	<0.5	2.5	1.0	4.6	2.8	0.6	0.9	0.8	1.4
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	4637.47	14800.0	428.0	37200.0	275.0	108.0	417.0	215.0	308.0	207.0	95.0
DIV	5,000	mg/kg	GRO (C5 - C10)	2.93	1.8	4.5	14.0	<0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	1742.77	36.0	5.0	511.0	<5	97.0	115.0	591.0	95.0	556.0	448.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1099.13	2100.0	764.0	841.0	193.0	892.0	16.3	331.0	291.0	406.0	1370.0
ESV	5,000	mg/kg	Tot Cyanide	13.44	<1	<1	61.0	<1	12.0	<1	<1	<1	3.0	5.0
ESV	20,000	mg/kg	Total Sulphur	8073.55	13500.0	4900.0	4600.0	1500.0	11500.0	2800.0	7200.0	4100.0	7100.0	7900.0
DIV	20	mg/kg	Free Cyanide	1.44	<1	<1	6.0	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	2167.24	<7043	<166	20780.0	<47	<16	<72	<17	<18	<16	<16
DIV	1	mg/kg	Benzene	1744.76	1040.0	5750.0	16200.0	*<25*	*<10*	*<10*	*<10*	*<10*	*<10*	*<10*
DIV	130	mg/kg	Toluene	241.66	264.0	1630.0	**24400.0**	<25	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	69.07	19.0	111.0	**2020.0**	<25	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	435.57	474.0	2330.0	**41200.0**	*<50*	<20	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	2.96	8.7	3.9	11.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 2

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	2AT04	2AT05	2AT06	2AT07	2AT07	2AT08	2AT09	2AT09	2AT10	2AT10
			Depth m bgl		**0.4**	**4**	**0.2**	**0.2**	**3.9**	**0.3**	**0.15**	**3.8**	**0.15**	**3.9**
			Ground Type		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date		**04.05.04**			**28.04.04**	**28.04.04**	**28.04.04**	**28.04.04**	**28.04.04**	**28.04.04**	**28.04.04**
			Sample Number		**CL0412696**	**CL0412196**	**CL0412197**	**CL0411602**	**CL0411603**	**CL0411600**	**CL0411596**	**CL0411598**	**CL0411599**	**CL0411597**
ESV	<5 or >10	pH	pH	9.92	8.5	10.2	11.0	9.0	10.2	9.3	8.6	9.7	8.4	9.9
CLEA	500	mg/kg	Arsenic	45.41	195.2	6.5	2.7	161.1	8.3	30.2	4.1	10.1	6.9	10.9
CLEA	1,400	mg/kg	Cadmium	1.09	1.3	0.4	0.4	1.8	<0.10	0.8	0.1	0.1	0.2	0.3
CLEA	5,000	mg/kg	Chromium	43.93	53.7	12.4	9.9	51.5	8.1	94.2	11.4	11.3	6.0	17.5
CLEA	750	mg/kg	Lead	266.96	210.0	2.0	4.5	472.2	8.8	146.4	17.9	21.1	70.7	45.9
CLEA	480	mg/kg	Mercury	0.29	0.2	<0.10	<0.10	1.2	0.3	0.9	0.4	<0.10	<0.10	0.2
CLEA	8,000	mg/kg	Selenium	3.13	1.6	6.4	6.4	1.6	7.2	2.4	1.1	7.2	1.4	6.2
DIV	190	mg/kg	Copper	26.03	58.1	0.8	0.8	44.9	<0.50	20.7	17.2	0.8	21.8	4.4
CLEA	5,000	mg/kg	Nickel	20.55	43.4	1.7	0.8	35.2	0.9	12.3	7.7	1.7	11.5	3.1
DIV	720	mg/kg	Zinc	740.10	886.5	7.2	11.5	1090.0	30.8	312.5	61.2	79.3	60.9	192.3
ESV	3	mg/kg	Boron	1.40	0.8	0.6	1.2	1.3	1.3	0.8	<0.5	1.3	<0.5	1.3
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	4637.47	1090.0	<10.0	1280.0	118.0	508.0	539.0	698.0	261.0	2770.0	237.0
DIV	5,000	mg/kg	GRO (C5 - C10)	2.93	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<5.0	<0.5	6.3	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	1742.77	69.0	9270.0	4330.0	105.0	939.0	1017.0	6.0	5684.0	72.0	4261.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1099.13	1910.0	770.0	1650.0	1780.0	885.0	1530.0	75.6	1480.0	701.0	1230.0
ESV	5,000	mg/kg	Tot Cyanide	13.44	10.0	52.0	30.0	1.0	7.0	3.0	8.0	9.0	12.0	<1
ESV	20,000	mg/kg	Total Sulphur	8073.55	10800.0	13100.0	10300.0	3200.0	11000.0	5600.0	6500.0	12600.0	9600.0	9000.0
DIV	20	mg/kg	Free Cyanide	1.44	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	2167.24	<34	<16	<327	<18	<81	<62	<75	<39	418.0	<23
DIV	1	mg/kg	Benzene	1744.76	*<10*	*<10*	*<10*	*<10*	*<10*	*<10*	*<250*	*<25*	*<250*	*<10*
DIV	130	mg/kg	Toluene	241.66	<10	<10	<10	<10	<10	<10	*<250*	<25	*<250*	<10
DIV	50	mg/kg	Ethylbenzene	69.07	<10	<10	<10	<10	<10	<10	*<250*	<25	*<250*	<10
DIV	25	mg/kg	Xylenes	435.57	<20	<20	<20	<20	<20	<20	*<500*	*<50*	*<500*	<20
DIV	40	mg/kg	Phenol Index	2.96	<0.5	1.9	2.0	0.6	1.0	0.5	<0.5	0.5	4.3	<0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: 2

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	2AT11	2AT11	2AT12	2AT12	2AT12	2AT13	2AT14	2AT14
			Depth m bgl		**0.1**	**4**	**0.3**	**0.55**	**3.9**	**4**	**0.5**	**3**
			Ground Type		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date		**28.04.04**	**28.04.04**				**04.05.04**		
			Sample Number		**CL0411604**	**CL0411605**	**CL0412199**	**CL0412201**	**CL0412200**	**CL0412695**	**CL0412195**	**CL0412194**
ESV	<5 or >10	pH	pH	9.92	9.6	9.1	10.7	8.6	11.0	8.5	10.0	10.0
CLEA	500	mg/kg	Arsenic	45.41	7.9	21.2	3.6	14.6	7.1	22.8	29.5	12.7
CLEA	1,400	mg/kg	Cadmium	1.09	0.3	0.4	0.5	0.5	0.4	1.0	0.5	0.4
CLEA	5,000	mg/kg	Chromium	43.93	39.7	17.4	27.6	29.1	22.0	22.2	43.9	16.0
CLEA	750	mg/kg	Lead	266.96	44.2	175.3	26.0	151.9	51.6	76.6	71.5	48.8
CLEA	480	mg/kg	Mercury	0.29	**4.2**	<0.10	<0.10	0.2	<0.10	<0.10	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.13	1.3	4.1	4.4	1.5	1.9	3.4	1.2	2.8
DIV	190	mg/kg	Copper	26.03	8.7	11.2	4.2	23.2	26.4	7.3	71.4	18.8
CLEA	5,000	mg/kg	Nickel	20.55	3.0	7.2	1.3	18.6	7.1	7.2	42.1	7.5
DIV	720	mg/kg	Zinc	740.10	165.7	329.2	66.2	210.5	137.1	772.0	183.3	183.8
ESV	3	mg/kg	Boron	1.40	<0.5	1.1	0.7	<0.5	<0.5	0.5	0.9	0.7
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	4637.47	14570.0	85.0	3300.0	**266000.0**	465.0	145.0	709.0	219.0
DIV	5,000	mg/kg	GRO (C5 - C10)	2.93	16.0	1.2	<0.2	**345.0**	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	1742.77	437.0	1595.0	5207.0	55.0	674.0	1144.0	29.0	674.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1099.13	355.0	715.0	1630.0	250.0	1580.0	1240.0	1450.0	1590.0
ESV	5,000	mg/kg	Tot Cyanide	13.44	**671.0**	23.0	35.0	1.0	4.0	<1	<1	5.0
ESV	20,000	mg/kg	Total Sulphur	8073.55	7600.0	4500.0	11300.0	3400.0	8800.0	7900.0	3400.0	6900.0
DIV	20	mg/kg	Free Cyanide	1.44	**79.0**	2.0	1.0	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	2167.24	4196.0	<16	658.0	**145483.0**	<87	<16	<50	<16
DIV	1	mg/kg	Benzene	1744.76	4220.0	*<10*	*<10*	**20700.0**	*<10*	*<10*	*<10*	*<10*
DIV	130	mg/kg	Toluene	241.66	1310.0	<10	<10	**58400.0**	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	69.07	*<250*	<10	<10	***<5000***	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	435.57	2870.0	<20	<20	**89000.0**	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	2.96	8.3	<0.5	2.2	12.3	<0.5	<0.5	<0.5	0.6

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

5.6 Area 3 – Fuel Oil Storage Area next to Dolphin Wharf

5.6.1 Scope of Works

The site investigation in Area 3 comprised the following scope of works:

- excavation of six trial pits (3AT1-6) using a 20 tonne tracked excavator and breaker;
- Advancing six groundwater monitoring boreholes using a shell and auger (cable percussive) rig. Due to the hard ground only two boreholes were installed (3AB1 and 3AB3);
- Recovery of ten soil samples from Made Ground and natural strata (where encountered) and recovery of one groundwater sample from boreholes.

5.6.2 Ground Conditions

- Made Ground was found to comprise fine to coarse occasionally sandy angular gravel, cobbles and boulders of slag with ash to depths of up to 7.5m bgl. This was found to be underlain at one location by silty, gravelly fine to coarse sand with fragments of slag and clinker to a depth of 10.0m bgl;
- Groundwater was encountered in the Made Ground of 3AB2 at a depth of 7.5m bgl;
- Black odorous tar was observed between depths of 0.0 to 0.15m bgl in 3AT1 and a slight ammonia odour was noted in 3AB2 at a depth of between 9.0 to 10.0m bgl. No other visual or olfactory evidence of contamination was observed.

5.6.3 Chemical Analysis Results

- **Soil pH**

  Soil pH across the site was found to be alkaline to highly alkaline. Soil pH values range from 8.7 (3AT1B1, 0.1m bgl) to 11.4 (3AT6, 3.5 m bgl). The 95th percentile calculated for pH (11.06) exceeds the guideline value of 10.

- **Toxic and Phytotoxic Metals**

  Levels of toxic metals were found to be below respective guideline levels.

  Zinc guideline values were exceeded in only one sample 3AT1B1, 0.1 mbgl (730 mg/kg). Accordingly, the 95th percentile calculated for zinc (86.5 mg/kg) was well below the guideline value of 720 mg/kg.

  Elevated levels of boron in excess of guideline criteria were detected in three samples across the Area ranging from 3.7 mg/kg (3AB2, 9.5 m bgl) to 4.2 mg/kg (3AT3B3, 4.0 m bgl). The 95th percentile calculated for boron across Area 3 as a whole (3.13 mg/kg) slightly exceeded the guideline value of 3 mg/kg.

- **Sulphide and sulphate**

  Elevated levels of sulphide in excess of guideline criteria were detected in four samples ranging from 1270 mg/kg (3ATB3, 4.0 m bgl) to 2153 mg/kg (3AT5, 3.0m bgl). The 95th percentile calculated for sulphide (1,303 mg/kg) exceeds the guideline value of 1,000 mg/kg.

  Elevated levels of sulphate in excess of guideline criteria were detected in four samples, ranging from 1610 mg/l (93ATB3, 4.0 m bgl) to 3690 mg/l (3AB2, 9.5 m bgl). The 95th percentile calculated for sulphate across Area 3 (1,839 mg/l) exceeds the guideline value of 1,200 mg/l.

- **Organics**

  Elevated levels of Total PAH in excess of guideline criteria were detected in three samples; 400mg/kg (3ATB1, 0.1 m bgl), 89 mg/kg (3AT5, 0.1 m bgl), and 46 mg/kg (3AT6 (3.5 m bgl). The 95th percentile calculated for Total PAH (43.41 mg/kg) across the whole of Area 3 slightly exceeds the guideline value of 40 mg/kg.

  Levels of TPH were below guideline values with the exception of 3AT1B1 (0.1 m bgl), 90,900 mg/kg. The 95th percentile calculated for TPH across Area 3 (155.08 mg/kg) is well below the guideline value of 5,000 mg/kg.

  Elevated concentrations of BTEX compounds (xylenes) were detected in one sample, 3AT1B1 (0.1 m bgl), 304 mg/kg.

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 8.

Summary of Results Showing Exceedances. Area: 3

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	3AB2	3AT1	3AT1	3AT2	3AT3	3AT3	3AT5	3AT5	3AT6	3AT6
			Depth m bgl		**9.5**	**0.1**	**4**	**0.1**	**0.5**	**4**	**0.1**	**3**	**0.1**	**3.5**
			Ground Type		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date		**13.05.04**						**17.05.04**	**17.05.04**	**17.05.04**	**17.05.04**
			Sample Number		**CL0413429**	**CL0414949**	**CL0414950**	**CL0414951**	**CL0414952**	**CL0414953**	**CL0413993**	**CL0413994**	**CL0413991**	**CL0413992**
ESV	<5 or >10	pH	pH	11.06	9.9	8.7	11.0	11.2	10.0	10.8	10.9	11.2	10.7	11.4
CLEA	500	mg/kg	Arsenic	24.11	4.2	6.2	6.3	3.3	35.1	8.9	12.6	11.2	52.5	7.5
CLEA	1,400	mg/kg	Cadmium	0.26	0.3	**1.4**	<0.10	0.2	0.2	0.2	0.3	0.3	0.2	<0.10
CLEA	5,000	mg/kg	Chromium	43.39	10.2	69.7	24.6	12.9	35.3	16.1	40.0	27.5	58.7	26.0
CLEA	750	mg/kg	Lead	46.04	48.4	82.5	8.9	2.9	39.6	14.1	30.5	23.6	56.1	4.1
CLEA	480	mg/kg	Mercury	0.12	0.1	<0.10	0.2	<0.10	<0.10	<0.10	<0.10	<0.10	**0.2**	<0.10
CLEA	8,000	mg/kg	Selenium	4.91	2.5	1.1	5.7	6.1	3.5	5.5	2.9	4.6	3.8	4.2
DIV	190	mg/kg	Copper	9.41	2.9	**69.5**	4.4	2.3	14.7	3.7	8.1	6.0	13.5	3.2
CLEA	5,000	mg/kg	Nickel	7.77	2.3	**46.0**	2.5	1.4	14.6	2.4	5.4	3.7	10.1	2.7
DIV	720	mg/kg	Zinc	86.51	53.7	**729.8**	23.6	13.3	136.1	57.6	81.6	55.5	107.6	16.1
ESV	3	mg/kg	Boron	3.13	3.7	2.7	2.3	2.7	3.9	4.2	0.8	1.8	0.8	0.7
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	155.08	31.0	**90900.0**	193.0	21.0	19.0	27.0	177.0	155.0	219.0	93.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.20	<0.2	**1.5**	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	1302.90	290.0	11.0	812.0	1548.0	314.0	1270.0	639.0	2153.0	336.0	1569.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1839.48	3690.0	158.0	994.0	1690.0	1680.0	1610.0	412.0	1120.0	530.0	588.0
ESV	5,000	mg/kg	Tot Cyanide	4.26	9.0	<1	<1	<1	<1	<1	5.0	2.0	**29.0**	2.0
ESV	20,000	mg/kg	Total Sulphur	12029.52	4000.0	3900.0	17400.0	14400.0	9400.0	11700.0	5900.0	9500.0	7500.0	11200.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	43.41	<16	**<400**	<18	<17	<16	<16	<89	<18	<46	<16
DIV	1	mg/kg	Benzene	10.00	*<10*	***<25***	*<10*	*<10*	*<10*	*<10*	*<10*	*<10*	*<10*	*<10*
DIV	130	mg/kg	Toluene	10.00	<10	**<25**	<10	<10	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	10.00	<10	**<25**	<10	<10	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	20.00	<20	**304.0**	<20	<20	<20	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.53	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	**0.9**	<0.5	<0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

5.7 Area 4 – SLEMS Area

5.7.1 Scope of Works

The site investigation in Area 4 comprised the following scope of works:

- Excavation of two trial pits (4AT3-4) using a 20 tonne tracked excavator and breaker;
- Advancing four groundwater monitoring boreholes (4AB1-4) using a shell and auger (cable percussive) rig;
- Recovery of twelve soil samples from Made Ground and natural strata (where encountered) and recovery of four groundwater samples from boreholes.

5.7.2 Ground Conditions

- Made Ground was found to comprise fine to coarse angular sandy often clayey gravel, cobbles and boulders of slag. Made Ground generally became very clayey below 4.0m;
- Natural ground in the form of soft to firm gravelly clay was observed at three locations between depths of 4.6 to 7.1m bgl, although thicknesses were not fully proven;
- Groundwater was encountered in the Made Ground at three locations, between depths of 0.7 to 3.5m bgl;
- Thick black odorous hydrocarbon contamination was observed in 4AT3 at a depth of between 2.5 to 3.2m bgl. Hydrocarbon odours were also observed in 4AB1 and 4AB2 between depths of 3.0 to 6.5m bgl, and a strong solvent odour was observed in 4AB3 at depths of between 2.0 to 7.1m bgl.

5.7.3 Chemical Analysis Results

- **Soil pH**

  Soil pH across the site was found to be alkaline to highly alkaline. Soil pH values range from 8.4 (4AT3, 3.1 m bgl and 4AB3, 2.0 m bgl) to 12.8 (4AT4, 0.5 m bgl and 4AT4, 4.0 m bgl). The 95th percentile calculated for pH (11.25) exceeds the guideline value of 10.

- **Toxic and Phytotoxic Metals**

  Levels of lead above guideline values were identified at four locations ranging from 762.2 mg/kg (4AB1, 0.4 m bgl) to 5,970 mg/kg (4AT3, 3.1 m bgl). The 95th percentile calculated for lead (2,277 mg/kg) in excess of the guideline value of 750 mg/kg.

  Concentrations of copper exceeded guideline values at one location (259.1 mg/kg – 4AB3, 2.0 m bgl. The 95th percentile calculated for copper (92.63

mg/kg) was well below the guideline value of 190 mg/kg.

Concentrations of zinc exceeded guideline values in six of the samples taken within Area 4, ranging between 780.7 mg/kg (4AB4, 2.0 m bgl) to 15,700 mg/kg (4AB3, 2.0 m bgl). The 95th percentile calculated for zinc (5,666.88 mg/kg) was well in exceedence of the guideline value of 720 mg/kg.

Elevated levels of boron were detected in six samples across the Area ranging from 3.3 m/kg (4AB3, 6.3 m bgl) to 18.0 mg/kg (4AB2, 4.0 m bgl). The 95th percentile calculated for boron across Area 1 (9.64 mg/kg) was in excess of the guideline value of 3 mg/kg.

Other than the samples with elevated levels of copper, zinc, lead and boron, phytotoxic metals were found to be present at concentrations below guideline values.

- **Sulphide, sulphate and sulphur**

Elevated levels of sulphide in excess of guideline values were detected in two samples taken from within Area 4; 4AB1, 0.4 m bgl (1,085 mg/kg) and 4AB2, 4.0 m bgl (2,313 mg/kg). The 95th percentile calculated for sulphide (972 mg/kg) was below the guideline value of 1,000 mg/kg.

Elevated levels of sulphate in excess of guideline criteria were detected in four samples across the Area, ranging from 1,400 mg/l (4AB1, 0.4 m bgl) to 1,690 mg/l (4AT3, 0.5 m bgl). The 95th percentile calculated for sulphate across the whole of Area 4 (1,448 mg/l) exceeds the guideline value of 1,200 mg/l.

Only one sample (4AT3, 3.1 m bgl) exhibited an elevated concentration of total sulphur (47,600 mg/kg). The 95th percentile for total sulphur (15,775 mg/kg) across Area 4 is well below the guideline value of 20,000 mg/kg.

- **Organics**

Levels of Total PAH in excess of guideline criteria were detected in five samples ranging from 47 mg/kg (4AB3, 6.3 m bgl) to 470 mg/kg. The 95th percentile calculated for Total PAH (236.76 mg/kg) across Area 4 exceeded the guideline value of 40 mg/kg.

Levels of TPH exceeding guideline values 5,000 mg/kg) were identified in two samples 4AB2, 4.0m bgl (12,300 mg/kg) and 4AT3, 3.1m bgl (8,950 mg/kg). The 95th percentile calculated for TPH (4,307.6 mg/kg) across the Area was below the guideline value of 5,000 mg/kg.

Elevated concentrations of BTEX compounds were detected in four samples; 4AB2 (4.0 m bgl) had elevated levels of benzene (7,870 mg/kg), toluene (6,650 mg/kg), ethylbenzene (513 mg/kg) and xylenes (6,300 mg/kg), 4AB3, 2.0m had elevated levels of benzene (20.0 mg/kg), ethylbenzene (105 mg/kg) and xylenes (187 mg/kg), and 4AT3, 3.1 m bgl had elevated levels of ethylbenzene (173 mg/kg) and xylenes (177 mg/kg). Elevated levels of benzene were also observed in 4AB2, 5.2 m bgl (27 mg/kg).

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 8.

Summary of Results Showing Exceedances. Area: 4

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	4AB1 0.4 - 05.05.04 CL0412702	4AB2 4 - 05.05.04 CL0412704	4AB2 5.2 - 05.05.04 CL0412705	4AB3 2 - 05.05.04 CL0412706	4AB3 6.3 - 05.05.04 CL0412707	4AB4 2 - 05.05.04 CL0412708	4AB4 4.8 - 05.05.04 CL0412709	4AT3 0.5 - 04.05.04 CL0412698	4AT3 3.1 - 04.05.04 CL0412699	4AT4 0.5 - 04.05.04 CL0412701	4AT4 4 - 04.05.04 CL0412700
ESV	<5 or >10	pH	pH	11.25	10.0	10.6	9.9	8.4	8.6	11.8	11.2	11.6	8.4	12.8	12.8
CLEA	500	mg/kg	Arsenic	68.54	18.3	18.0	6.0	196.2	12.9	45.3	8.7	27.7	113.0	3.7	2.2
CLEA	1,400	mg/kg	Cadmium	21.30	6.9	7.6	0.5	76.0	1.8	3.2	0.4	3.0	21.3	0.2	<0.10
CLEA	5,000	mg/kg	Chromium	524.85	70.7	45.7	26.4	159.7	30.6	685.8	94.9	181.6	49.3	1430.0	768.2
CLEA	750	mg/kg	Lead	2277.15	762.2	1860.0	104.0	4710.0	222.5	555.5	48.5	489.1	5970.0	79.2	14.8
CLEA	480	mg/kg	Mercury	0.67	0.4	0.6	<0.10	1.8	0.3	0.6	0.1	0.2	**9.3**	0.2	0.1
CLEA	8,000	mg/kg	Selenium	3.28	4.6	3.7	<0.50	3.1	0.5	1.3	<0.50	4.1	4.8	2.8	2.6
DIV	190	mg/kg	Copper	92.63	18.0	41.5	15.4	259.1	20.0	58.8	126.8	9.7	70.2	14.5	8.9
CLEA	5,000	mg/kg	Nickel	32.45	9.0	18.5	27.3	52.4	29.8	34.0	26.8	7.0	46.1	19.4	9.8
DIV	720	mg/kg	Zinc	5666.88	3440.0	4800.0	311.0	15700.0	598.8	780.7	163.9	1130.0	10000.0	130.3	68.1
ESV	3	mg/kg	Boron	9.64	1.1	18.0	5.3	12.0	3.3	2.1	1.6	1.4	1.7	13.0	15.0
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	4307.60	1900.0	12300.0	178.0	1350.0	309.0	915.0	60.0	266.0	8950.0	128.0	115.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.40	0.3	**105.0**	0.2	0.7	0.3	<0.2	<0.2	<0.2	0.6	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	820.91	1805.0	2313.0	75.0	110.0	36.0	156.0	30.0	201.0	30.0	45.0	73.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1411.56	1400.0	523.0	325.0	2270.0	995.0	332.0	251.0	1690.0	2550.0	186.0	56.9
ESV	5,000	mg/kg	Tot Cyanide	24.57	33.0	47.0	6.0	55.0	4.0	3.0	<1	12.0	10.0	<1	2.0
ESV	20,000	mg/kg	Total Sulphur	15774.91	7400.0	10300.0	2300.0	15100.0	4400.0	3700.0	900.0	10500.0	47600.0	2100.0	2300.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	**11.0**	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	236.76	<16	<389	<17	<465	<47	179.0	<16	<17	<470	<16	<16
DIV	1	mg/kg	Benzene	15.56	*<10*	**7870.0**	27.0	20.0	*<10*	*<10*	*<10*	*<10*	*<10*	*<10*	*<10*
DIV	130	mg/kg	Toluene	17.94	<10	**6650.0**	18.0	38.0	<10	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	63.16	<10	**513.0**	<10	105.0	<10	<10	<10	<10	173.0	<10	<10
DIV	25	mg/kg	Xylenes	85.29	<20	**6300.0**	<20	187.0	<20	<20	<20	<20	177.0	<20	<20
DIV	40	mg/kg	Phenol Index	1.31	<0.5	2.1	<0.5	2.1	<0.5	<0.5	<0.5	<0.5	2.1	1.0	<0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

5.8 Area D – Western side of Pig Caster

5.8.1 Scope of Works

The site investigation in Area D comprised the following scope of works:

- Excavation of forty-two trial pits (DAT1-16, DBT17-42) using a 20 tonne tracked excavator and breaker;
- Advancing one groundwater monitoring borehole (DAB1) using a shell and auger (cable percussive) rig;
- Recovery of eighty-five soil samples from Made Ground and natural strata (where encountered) and recovery of one groundwater sample from boreholes.

5.8.2 Ground Conditions

- Made Ground comprising fine to coarse often sandy gravel, cobbles and boulders of slag and brick with occasional ferrous metal debris was encountered in the majority of exploratory locations to depths of up to 4.0m;
- Natural ground was encountered at two locations; DAT7 a brown, stiff laminated clay at depths of between 2.8 and 4.0m bgl, and DAB1B a laminated clay / silt. Full thicknesses of natural ground were not fully proven;
- Groundwater was encountered at one location, DAB1B, in the Made Ground at a depth of 6.0m bgl;
- Site observations and monitoring did not reveal the presence of visual and/or olfactory evidence of contamination.

5.8.3 Chemical Analysis Results

- **Soil pH**

  Soil pH across the site was found to be alkaline to highly alkaline. Soil pH values ranged from 7.5 (DBT36, 3.5 m bgl) to 12.9 (DBT42, 0.15 m bgl). The 95th percentile calculated for pH (10.46) slightly exceeds the guideline value of 10.

- **Toxic and Phytotoxic Metals**

  Levels of lead exceeded guideline levels in seven locations, ranging from 782 mg/kg (DBT25, 3.5 m bgl) to 11,800 mg/kg (DBT39, 0.2 m bgl). The 95th percentile calculated for lead (652.61 mg/kg) is below the guideline value of 750 mg/kg.

  Concentrations of copper exceeded guideline values in only one location, DBT25, 3.5m bgl (493.0 mg/kg). The 95th percentile calculated for copper (34.62 mg/kg) was well below the guideline value of 190 mg/kg.

Concentrations of zinc exceeded guideline criteria in eighteen samples taken within Area D, ranging between 767.4 mg/kg (DBT28, 4.0 m bgl) to 45,700 mg/kg (DBT39, 0.2 m bgl). The 95th percentile calculated for zinc (2,408 mg/kg) exceeded the guideline value of 720 mg/kg.

Elevated levels of boron in excess of guideline criteria were detected in four samples across Area D ranging from 3.2 mg/kg (DBT33, 3.5 m bgl) to 6.6 mg/kg (DAB1B (7.0 m bgl). The 95th percentile calculated for boron across Area D (1.65 mg/kg) was below the guideline value of 3 mg/kg.

- **Sulphide, sulphate and sulphur**

Elevated levels of sulphide in excess of guideline criteria were detected in thirty five samples taken from within Area D.

In Sub-Area A are fourteen samples with elevated levels of sulphide, ranging from 1026 mg/kg (DAT12, 0.2 m bgl) to 5,102 mg/kg (DAT4, 4.0 m bgl).

In Area B twenty one samples with elevated levels of sulphide ranging from 1,119 mg/kg – DBT39, 0.2 m bgl to 8,262 mg/kg (DBT20, 4.0 m bgl).

The 95th percentile calculated for sulphide across Area D (2,037 mg/kg) was in exceedence of the guideline value of 1,000 mg/kg.

Elevated levels of sulphate were detected in thirty two samples across the site.

In Sub-Area A twelve samples with elevated levels of sulphate ranging from 1,440 mg/kg (DAT2, 3.3 m bgl) to 3,890 mg/kg (DAT1, 4.0 m bgl) were identified.

In Sub-Area B twenty samples with elevated levels of sulphate ranging from 1,350 mg/kg (DBT22, 3.2 m bgl) to 3,280 mg/kg (DBT35, 3.5 m bgl) were identified.

The 95th percentile calculated for sulphate across the whole of Area D (1,332 mg/l) exceeds the guideline value of 1,200 mg/l.

One exceedence of total sulphur was observed within Area D, 20,400 mg/kg (DBT37, 4.0 m bgl).

- **Organics**

Elevated levels of PAH were observed in five samples across Area D ranging from 45 mg/kg (DBT40 (0.2 m bgl) to 120 mg/kg (DAT8, 0.4 m bgl).

Elevated concentrations of BTEX compounds were detected in two samples in Area D. Sample DAB1B (7.0 m bgl) had elevated levels of benzene (206 mb/kg) and xylenes (86 mg/kg) and sample DBT30 (0.2 m bgl) had elevated levels of toluene (311 mg/kg) and ethylbenzene (69 mg/kg).

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 8.

Summary of Results Showing Exceedances. Area: D

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	DAB1B 7 - 13.05.04 CL0413425	DAB1B 9.5 - 13.05.04 CL0413426	DAT1 0.2 - 12.05.04 CL0413437	DAT1 4 - 12.05.04 CL0413436	DAT10 0.3 - 13.05.04 CL0413779	DAT10 3.5 - 13.05.04 CL0413780	DAT11 0.3 - 13.05.04 CL0413781	DAT11 3.6 - 13.05.04 CL0413782	DAT12 0.2 - 13.05.04 CL0413790	DAT12 4 - 13.05.04 CL0413789
ESV	<5 or >10	pH	pH	10.46	8.6	8.4	9.4	9.7	10.1	10.2	10.7	10.4	10.6	9.9
CLEA	500	mg/kg	Arsenic	37.99	12.9	8.6	14.2	9.6	11.7	6.9	14.1	16.3	6.4	26.7
CLEA	1,400	mg/kg	Cadmium	2.27	2.4	0.4	0.2	1.0	0.3	2.1	0.7	0.8	0.7	5.0
CLEA	5,000	mg/kg	Chromium	140.07	35.7	26.2	21.8	17.4	33.4	9.0	14.0	59.2	13.8	11.9
CLEA	750	mg/kg	Lead	652.61	608.7	39.0	11.5	30.3	34.1	351.4	102.6	167.5	222.4	2490.0
CLEA	480	mg/kg	Mercury	0.17	0.3	<0.10	<0.10	<0.10	<0.10	<0.10	0.2	<0.10	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.99	1.7	0.5	3.1	3.4	0.8	4.4	6.5	6.6	4.1	6.8
DIV	190	mg/kg	Copper	34.62	12.1	17.9	3.3	4.2	22.7	3.3	5.3	7.9	3.3	2.5
CLEA	5,000	mg/kg	Nickel	21.71	9.1	30.6	7.5	5.6	41.4	5.3	3.1	8.6	3.3	3.2
DIV	720	mg/kg	Zinc	2408.27	395.2	130.2	41.1	145.3	131.8	1450.0	261.4	424.2	560.7	3636.0
ESV	3	mg/kg	Boron	1.65	**6.6**	2.6	1.2	1.7	0.6	1.9	0.8	1.4	2.0	2.3
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	198.20	170.0	33.0	48.0	89.0	84.0	82.0	273.0	109.0	89.0	32.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	0.6	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	2036.72	245.0	<5	1443.0	636.0	5.0	588.0	4964.0	2014.0	1026.0	2115.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1331.69	1050.0	749.0	2300.0	3890.0	229.0	945.0	460.0	1700.0	93.5	1830.0
ESV	5,000	mg/kg	Tot Cyanide	13.22	2.0	1.0	37.0	4.0	6.0	15.0	24.0	10.0	3.0	4.0
ESV	20,000	mg/kg	Total Sulphur	8900.14	7900.0	3700.0	10900.0	11800.0	1500.0	7300.0	9300.0	10000.0	8200.0	14400.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.07	<34	<18	<16	<16	<16	<16	<16	<16	<16	<16
DIV	1	mg/kg	Benzene	12.59	**206.0**	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	12.81	32.0	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.47	11.0	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	24.81	**86.0**	<20	<20	<20	<20	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.70	**3.7**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: D

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	DAT15	DAT16	DAT16	DAT2	DAT2	DAT3	DAT3	DAT4	DAT4	DAT5
			Depth m bgl		**4**	**0.3**	**3.5**	**0.15**	**3.2**	**0.25**	**4**	**0.3**	**4**	**0.2**
			Ground Type		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date		**13.05.04**	**13.05.04**	**13.05.04**	**17.05.04**	**17.05.04**	**12.05.04**	**12.05.04**	**12.05.04**	**12.05.04**	**12.05.04**
			Sample Number		**CL0413786**	**CL0413787**	**CL0413788**	**CL0414027**	**CL0414028**	**CL0413433**	**CL0413432**	**CL0413441**	**CL0413440**	**CL0413442**
ESV	<5 or >10	pH	pH	10.46	11.2	11.4	10.5	9.2	10.7	11.7	10.9	10.6	10.5	9.3
CLEA	500	mg/kg	Arsenic	37.99	1.8	6.6	4.6	10.4	2.0	30.0	7.1	3.9	1.5	15.7
CLEA	1,400	mg/kg	Cadmium	2.27	0.2	0.1	0.6	0.4	0.3	0.2	0.2	0.3	0.3	0.4
CLEA	5,000	mg/kg	Chromium	140.07	15.3	162.3	13.2	16.0	5.0	252.9	82.5	12.0	7.1	1550.0
CLEA	750	mg/kg	Lead	652.61	4.6	33.1	52.2	169.5	12.4	31.3	24.2	4.7	1.9	37.6
CLEA	480	mg/kg	Mercury	0.17	<0.10	<0.10	<0.10	0.2	<0.10	<0.10	<0.10	0.8	<0.10	0.2
CLEA	8,000	mg/kg	Selenium	3.99	7.1	0.7	5.8	2.0	5.8	2.1	1.2	5.1	4.9	1.4
DIV	190	mg/kg	Copper	34.62	1.1	16.4	4.3	7.1	<0.50	21.3	17.4	<0.50	<0.50	15.4
CLEA	5,000	mg/kg	Nickel	21.71	0.7	34.8	2.0	6.9	<0.50	21.7	14.5	<0.50	<0.50	169.4
DIV	720	mg/kg	Zinc	2408.27	45.1	110.4	599.3	161.0	14.1	45.9	59.6	31.7	11.7	98.4
ESV	3	mg/kg	Boron	1.65	1.6	0.9	2.5	0.9	2.2	0.7	0.8	1.5	2.4	1.3
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	198.20	<10.0	33.0	27.0	107.0	89.0	275.0	22.0	71.0	22.0	163.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	2036.72	4116.0	<5	2465.0	474.0	2229.0	355.0	<5	5068.0	5102.0	164.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1331.69	570.0	131.0	1820.0	103.0	1440.0	585.0	504.0	2250.0	2700.0	620.0
ESV	5,000	mg/kg	Tot Cyanide	13.22	66.0	2.0	7.0	<1	23.0	6.0	2.0	8.0	21.0	<1
ESV	20,000	mg/kg	Total Sulphur	8900.14	11700.0	600.0	11000.0	2600.0	9900.0	6300.0	2500.0	11200.0	10400.0	2200.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.07	<16	<16	<16	<16	<16	<38	<16	<16	<16	<20
DIV	1	mg/kg	Benzene	12.59	<10	<10	<10	<10	*<25*	<10	*<25*	<10	<10	<10
DIV	130	mg/kg	Toluene	12.81	<10	<10	<10	<10	<25	<10	<25	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.47	<10	<10	<10	<10	<25	<10	<25	<10	<10	<10
DIV	25	mg/kg	Xylenes	24.81	<20	<20	<20	<20	*<50*	<20	*<50*	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.70	1.9	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	**2.9**	1.3	<0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: D

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	DAT5 4 - 12.05.04 CL0413443	DAT6 0.2 - 12.05.04 CL0413439	DAT6 4 - 12.05.04 CL0413438	DAT7 0.2 - 12.05.04 CL0413431	DAT7 3 - 12.05.04 CL0413430	DAT8 0.4 - 13.05.04 CL0413775	DAT8 3 - 13.05.04 CL0413776	DAT9 0.3 - 13.05.04 CL0413777	DAT9 4 - 13.05.04 CL0413778	DBT17 0.2 - 17.05.04 CL0414011
ESV	<5 or >10	pH	pH	10.46	8.9	9.6	10.0	10.0	8.0	11.0	11.2	8.9	11.0	10.4
CLEA	500	mg/kg	Arsenic	37.99	9.6	7.3	3.1	41.3	20.6	16.3	17.0	20.9	18.6	8.1
CLEA	1,400	mg/kg	Cadmium	2.27	0.5	0.3	0.3	1.2	0.2	0.3	0.3	<0.10	0.2	0.6
CLEA	5,000	mg/kg	Chromium	140.07	55.3	12.3	6.6	173.8	27.5	44.1	22.7	5.4	14.1	8.3
CLEA	750	mg/kg	Lead	652.61	134.3	12.9	4.0	175.8	36.3	61.5	39.6	4.3	10.0	27.5
CLEA	480	mg/kg	Mercury	0.17	0.2	<0.10	0.1	0.4	0.1	0.2	<0.10	<0.10	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	3.99	2.8	3.0	4.3	1.8	<0.50	2.2	4.1	<0.50	5.1	5.5
DIV	190	mg/kg	Copper	34.62	5.1	2.0	<0.50	67.2	28.6	14.1	9.4	11.4	19.7	1.9
CLEA	5,000	mg/kg	Nickel	21.71	7.5	2.6	<0.50	30.4	34.3	15.5	11.4	8.1	6.1	0.8
DIV	720	mg/kg	Zinc	2408.27	299.5	33.5	11.7	392.6	114.5	166.3	138.4	25.9	14.9	138.0
ESV	3	mg/kg	Boron	1.65	2.2	1.2	1.6	<0.5	0.8	0.8	0.8	<0.5	1.2	1.1
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	198.20	113.0	59.0	59.0	244.0	33.0	443.0	134.0	22.0	17.0	408.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	<0.2	<0.2	<0.2	<0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	2036.72	859.0	1591.0	3162.0	90.0	<5	300.0	1723.0	<5	1578.0	5107.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1331.69	1830.0	2220.0	2660.0	500.0	594.0	864.0	702.0	78.9	1840.0	928.0
ESV	5,000	mg/kg	Tot Cyanide	13.22	2.0	18.0	12.0	4.0	<1	21.0	13.0	<1	17.0	6.0
ESV	20,000	mg/kg	Total Sulphur	8900.14	6700.0	9400.0	9700.0	3500.0	1300.0	3400.0	9100.0	<400	10600.0	12200.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.07	<16	<16	<16	<16	<16	**120.0**	<19	<16	<16	<17
DIV	1	mg/kg	Benzene	12.59	<10	<10	<10	*<25*	<10	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	12.81	<10	<10	<10	<25	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.47	<10	<10	<10	<25	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	24.81	<20	<20	<20	*<50*	<20	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.70	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	<0.5	<0.5	<0.5	0.9

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: D

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	DBT17	DBT18	DBT18	DBT19	DBT19	DBT20	DBT20	DBT21	DBT21	DBT22
			Depth m bgl		**4**	**0.2**	**2**	**0.2**	**4**	**0.2**	**4**	**0.2**	**3**	**0.2**
			Ground Type		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date		**17.05.04**	**17.05.04**	**17.05.04**	**17.05.04**	**17.05.04**	**17.05.04**	**17.05.04**	**17.05.04**	**17.05.04**	**17.05.04**
			Sample Number		**CL0414012**	**CL0414017**	**CL0414018**	**CL0414015**	**CL0414016**	**CL0414019**	**CL0414020**	**CL0414014**	**CL0414013**	**CL0414003**
ESV	<5 or >10	pH	pH	10.46	9.5	10.4	10.6	10.3	9.7	12.1	11.2	9.9	10.5	9.7
CLEA	500	mg/kg	Arsenic	37.99	28.5	6.3	0.8	5.9	5.2	22.7	1.0	55.7	7.6	24.5
CLEA	1,400	mg/kg	Cadmium	2.27	1.1	0.6	0.4	0.8	0.4	0.5	0.4	**64.6**	15.4	1.0
CLEA	5,000	mg/kg	Chromium	140.07	13.6	16.3	7.0	17.7	11.5	369.5	7.9	13.0	5.0	42.2
CLEA	750	mg/kg	Lead	652.61	77.7	22.6	1.4	122.7	33.8	41.4	1.4	3450.0	353.7	115.6
CLEA	480	mg/kg	Mercury	0.17	<0.10	<0.10	<0.10	0.2	<0.10	<0.10	<0.10	**1.4**	0.2	0.3
CLEA	8,000	mg/kg	Selenium	3.99	5.1	5.5	6.6	5.2	5.5	2.6	5.9	3.5	5.5	2.4
DIV	190	mg/kg	Copper	34.62	4.4	3.6	<0.50	4.0	1.4	15.3	<0.50	10.0	0.6	24.7
CLEA	5,000	mg/kg	Nickel	21.71	3.6	2.6	<0.50	1.6	1.5	11.7	<0.50	8.2	0.5	13.2
DIV	720	mg/kg	Zinc	2408.27	758.5	71.6	6.6	133.7	62.0	212.6	5.4	18400.0	4700.0	299.5
ESV	3	mg/kg	Boron	1.65	2.3	1.6	1.8	1.5	1.7	1.2	1.0	2.2	2.4	1.0
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	198.20	304.0	203.0	35.0	139.0	45.0	583.0	29.0	1610.0	45.0	662.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5
ESV	1,000	mg/kg	Acid Soluble Sulphide	2036.72	1791.0	4350.0	3945.0	5722.0	3541.0	400.0	8262.0	794.0	4281.0	397.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1331.69	1730.0	372.0	1500.0	512.0	1580.0	147.0	739.0	1120.0	1550.0	426.0
ESV	5,000	mg/kg	Tot Cyanide	13.22	5.0	4.0	<1	12.0	27.0	<1	10.0	9.0	9.0	12.0
ESV	20,000	mg/kg	Total Sulphur	8900.14	15000.0	9200.0	11100.0	9800.0	13500.0	4100.0	13500.0	8100.0	13400.0	6900.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.07	<18	<16	<16	<18	<16	<23	<16	<18	<16	**<58**
DIV	1	mg/kg	Benzene	12.59	<10	<10	<10	<10	<10	*<25*	<10	<10	<10	*<25*
DIV	130	mg/kg	Toluene	12.81	<10	<10	<10	<10	<10	<25	<10	<10	<10	<25
DIV	50	mg/kg	Ethylbenzene	12.47	<10	<10	<10	<10	<10	<25	<10	<10	<10	<25
DIV	25	mg/kg	Xylenes	24.81	<20	<20	<20	<20	<20	*<50*	<20	<20	<20	*<50*
DIV	40	mg/kg	Phenol Index	0.70	0.8	<0.5	2.5	<0.5	<0.5	<0.5	1.9	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value

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Summary of Results Showing Exceedances. Area: D

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	DBT22	DBT23	DBT23	DBT24	DBT24	DBT25	DBT25	DBT26	DBT27	DBT27
			Depth m bgl		**3.2**	**0.2**	**1.8**	**0.2**	**2.8**	**0.2**	**3.5**	**0.1**	**0.2**	**4**
			Ground Type		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date		**17.05.04**	**17.05.04**	**17.05.04**	**17.05.04**	**17.05.04**					
			Sample Number		**CL0414004**	**CL0414001**	**CL0414002**	**CL0413999**	**CL0414000**	**CL0413870**	**CL0413871**	**CL0413855**	**CL0413856**	**CL0413857**
ESV	<5 or >10	pH	pH	10.46	11.1	9.8	11.3	9.9	10.8	9.8	10.3	10.4	9.4	8.9
CLEA	500	mg/kg	Arsenic	37.99	2.8	4.7	2.2	18.7	13.9	24.0	78.8	14.2	58.4	21.1
CLEA	1,400	mg/kg	Cadmium	2.27	0.6	0.7	1.5	7.0	1.3	2.9	5.3	0.3	1.1	2.4
CLEA	5,000	mg/kg	Chromium	140.07	7.3	9.7	8.4	18.0	56.9	29.1	119.6	20.8	38.3	13.2
CLEA	750	mg/kg	Lead	652.61	11.9	34.7	52.9	649.8	143.7	404.9	782.0	29.6	130.7	239.6
CLEA	480	mg/kg	Mercury	0.17	<0.10	<0.10	<0.10	0.3	0.1	**1.2**	0.4	<0.10	0.1	<0.10
CLEA	8,000	mg/kg	Selenium	3.99	5.9	3.1	6.3	4.6	4.7	2.9	2.3	1.1	2.0	3.8
DIV	190	mg/kg	Copper	34.62	0.8	4.8	<0.50	7.1	5.9	178.4	493.0	21.4	63.5	26.6
CLEA	5,000	mg/kg	Nickel	21.71	<0.50	2.8	<0.50	3.5	3.4	23.3	59.5	16.8	42.0	11.4
DIV	720	mg/kg	Zinc	2408.27	43.4	350.6	927.1	4130.0	569.4	1330.0	2850.0	117.5	506.7	2560.0
ESV	3	mg/kg	Boron	1.65	1.9	1.2	1.6	2.2	2.2	1.3	1.2	0.5	0.6	1.0
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	198.20	134.0	882.0	124.0	252.0	94.0	181.0	71.0	148.0	257.0	73.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	<0.2	<0.5	<0.2	<0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	2036.72	5544.0	<5	6232.0	1585.0	3497.0	352.0	103.0	50.0	<5	185.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1331.69	1350.0	274.0	196.0	504.0	930.0	549.0	192.0	19.8	235.0	575.0
ESV	5,000	mg/kg	Tot Cyanide	13.22	33.0	<1	32.0	6.0	10.0	20.0	17.0	<1	<1	14.0
ESV	20,000	mg/kg	Total Sulphur	8900.14	9300.0	6100.0	12700.0	7200.0	8700.0	6100.0	3700.0	700.0	4500.0	4500.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.07	<20	**103.0**	<16	<19	<16	<19	<16	<16	<16	<16
DIV	1	mg/kg	Benzene	12.59	<10	*<25*	<10	*<25*	<10	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	12.81	<10	<25	<10	<25	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.47	<10	<25	<10	<25	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	24.81	<20	*<50*	<20	*<50*	<20	<20	<10	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.70	**4.1**	<0.5	1.1	0.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

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Values highlighted in yellow - Exceedances of guidance limits

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Summary of Results Showing Exceedances. Area: D

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	DBT28	DBT28	DBT29	DBT29	DBT30	DBT30	DBT31	DBT31	DBT32	DBT32
			Depth m bgl		0.15	4	0.25	3.8	0.2	3	0.25	4	0.2	3.8
			Ground Type		-	-	-	-	-	-	-	-	-	-
			Sample Date										13.05.04	13.05.04
			Sample Number		CL0413858	CL0413859	CL0413860	CL0413861	CL0413862	CL0413863	CL0413864	CL0413865	CL0413767	CL0413768
ESV	<5 or >10	pH	pH	10.46	10.0	10.2	9.4	11.1	9.2	10.6	10.8	10.5	9.4	11.2
CLEA	500	mg/kg	Arsenic	37.99	55.1	20.9	122.7	12.9	38.3	39.4	7.1	5.5	93.3	4.0
CLEA	1,400	mg/kg	Cadmium	2.27	1.6	1.5	5.4	0.3	0.6	17.6	0.4	1.1	0.4	0.3
CLEA	5,000	mg/kg	Chromium	140.07	47.2	26.4	130.6	39.9	41.2	15.3	7.4	9.4	164.8	11.4
CLEA	750	mg/kg	Lead	652.61	345.6	397.4	843.8	19.8	201.1	4070.0	53.2	53.5	63.8	5.0
CLEA	480	mg/kg	Mercury	0.17	<0.10	0.2	0.2	<0.10	0.7	<0.10	<0.10	<0.10	**1.6**	<0.10
CLEA	8,000	mg/kg	Selenium	3.99	2.6	4.6	2.4	6.1	1.2	7.2	6.7	5.5	3.2	6.2
DIV	190	mg/kg	Copper	34.62	49.5	18.6	81.9	25.1	66.4	13.4	8.9	8.8	23.6	1.0
CLEA	5,000	mg/kg	Nickel	21.71	41.6	13.3	69.3	5.0	55.5	5.4	2.9	3.2	28.5	1.0
DIV	720	mg/kg	Zinc	2408.27	673.6	767.4	3960.0	79.8	382.5	7400.0	137.6	306.0	298.4	65.4
ESV	3	mg/kg	Boron	1.65	0.6	1.4	1.4	1.4	1.6	1.8	0.8	1.2	1.8	1.2
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	198.20	167.0	253.0	107.0	<10.0	59.0	88.0	66.0	21.0	184.0	27.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	<0.2	<0.2	<0.2	<0.2	**3.4**	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	2036.72	144.0	724.0	19.0	648.0	7.0	3464.0	6982.0	3758.0	340.0	5736.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1331.69	219.0	2250.0	307.0	1820.0	323.0	1970.0	918.0	1860.0	2450.0	3080.0
ESV	5,000	mg/kg	Tot Cyanide	13.22	5.0	2.0	<1	2.0	5.0	12.0	35.0	20.0	10.0	59.0
ESV	20,000	mg/kg	Total Sulphur	8900.14	4700.0	7900.0	3300.0	18200.0	1500.0	13300.0	12100.0	13800.0	5700.0	12500.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.07	<18	<49	<16	<16	<16	<16	<16	<16	<18	<16
DIV	1	mg/kg	Benzene	12.59	<10	<10	<10	<10	*<20*	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	12.81	<10	<10	<10	<10	**311.0**	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.47	<10	<10	<10	<10	**69.0**	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	24.81	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.70	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	<0.5

DIV - Dutch Intervention Value
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Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
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Summary of Results Showing Exceedances. Area: D

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	DBT33	DBT33	DBT34	DBT34	DBT35	DBT35	DBT36	DBT36	DBT37	DBT37
			Depth m bgl		**0.25**	**3.5**	**3.5**	**4**	**0.15**	**3.5**	**0.3**	**3.5**	**0.2**	**4**
			Ground Type		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date		**13.05.04**	**13.05.04**	**13.05.04**	**13.05.04**	**13.05.04**	**13.05.04**				
			Sample Number		**CL0413769**	**CL0413770**	**CL0413771**	**CL0413772**	**CL0413773**	**CL0413774**	**CL0413866**	**CL0413867**	**CL0413868**	**CL0413869**
ESV	<5 or >10	pH	pH	10.46	11.6	11.0	9.4	11.2	11.4	10.5	8.6	7.5	11.5	9.1
CLEA	500	mg/kg	Arsenic	37.99	56.3	6.7	55.1	3.4	13.7	15.5	270.9	221.6	21.8	233.9
CLEA	1,400	mg/kg	Cadmium	2.27	0.7	0.3	1.6	0.2	0.3	0.2	2.2	8.2	0.6	0.7
CLEA	5,000	mg/kg	Chromium	140.07	142.5	8.8	21.4	8.7	315.9	58.8	43.9	29.7	421.0	93.9
CLEA	750	mg/kg	Lead	652.61	81.7	4.7	458.0	16.0	35.3	11.1	398.5	1280.0	80.3	121.8
CLEA	480	mg/kg	Mercury	0.17	<0.10	<0.10	**1.2**	<0.10	0.2	0.2	0.2	<0.10	<0.10	0.2
CLEA	8,000	mg/kg	Selenium	3.99	1.6	5.6	3.2	5.8	3.9	4.0	2.4	1.9	2.1	3.5
DIV	190	mg/kg	Copper	34.62	42.6	3.3	41.0	3.3	17.9	14.5	65.6	53.5	49.4	13.7
CLEA	5,000	mg/kg	Nickel	21.71	44.3	1.0	12.0	1.0	6.4	5.4	78.9	72.2	26.3	29.1
DIV	720	mg/kg	Zinc	2408.27	171.1	15.3	992.8	43.5	144.7	60.9	1450.0	4890.0	278.5	502.2
ESV	3	mg/kg	Boron	1.65	0.7	3.2	<0.5	1.1	3.4	4.9	0.7	2.1	1.5	2.3
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	198.20	220.0	50.0	147.0	<10.0	150.0	73.0	105.0	160.0	174.0	35.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	2036.72	241.0	1918.0	660.0	1892.0	775.0	883.0	27.0	<5	39.0	<5
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1331.69	904.0	2110.0	1060.0	2270.0	1770.0	3280.0	1360.0	2780.0	285.0	1800.0
ESV	5,000	mg/kg	Tot Cyanide	13.22	2.0	4.0	5.0	2.0	<1	5.0	2.0	<1	<1	<1
ESV	20,000	mg/kg	Total Sulphur	8900.14	3200.0	10000.0	8200.0	17900.0	5700.0	10500.0	9100.0	12100.0	2400.0	20400.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.07	<16	<16	<16	<16	<16	<16	<16	<16	<16	<16
DIV	1	mg/kg	Benzene	12.59	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	12.81	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.47	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	24.81	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.70	1.6	0.5	<0.5	<0.5	<0.5	1.8	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: D

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	DBT38 0.2 - 17.05.04 CL0414007	DBT38 3.6 - 17.05.04 CL0414008	DBT39 0.2 - 17.05.04 CL0413997	DBT39 3.9 - 17.05.04 CL0413998	DBT40 0.2 - 17.05.04 CL0413995	DBT40 3.4 - 17.05.04 CL0413996	DBT41 0.2 - 17.05.04 CL0414009	DBT41 2.8 - 17.05.04 CL0414010	DBT42 0.15 - 17.05.04 CL0414005	DBT42 3.9 - 17.05.04 CL0414006
ESV	<5 or >10	pH	pH	10.46	12.4	8.8	9.8	9.5	11.7	11.6	11.4	11.0	12.9	12.8
CLEA	500	mg/kg	Arsenic	37.99	8.5	0.9	47.1	17.2	16.2	18.3	16.7	18.8	1.0	47.0
CLEA	1,400	mg/kg	Cadmium	2.27	0.7	<0.10	20.1	1.6	0.7	0.7	0.6	0.4	<0.10	0.3
CLEA	5,000	mg/kg	Chromium	140.07	244.6	54.4	44.5	19.2	312.6	70.9	152.6	152.8	1050.0	920.9
CLEA	750	mg/kg	Lead	652.61	66.9	3.8	11800.0	662.6	96.1	59.6	84.5	53.4	3.9	58.4
CLEA	480	mg/kg	Mercury	0.17	<0.10	<0.10	0.1	<0.10	0.3	<0.10	<0.10	<0.10	0.2	<0.10
CLEA	8,000	mg/kg	Selenium	3.99	3.4	1.0	4.5	4.5	1.5	3.6	1.9	3.5	1.2	1.5
DIV	190	mg/kg	Copper	34.62	11.8	12.9	11.4	7.8	32.3	7.7	9.8	9.0	13.1	24.1
CLEA	5,000	mg/kg	Nickel	21.71	5.2	5.4	8.2	5.5	29.2	6.9	10.2	5.4	5.5	14.2
DIV	720	mg/kg	Zinc	2408.27	167.6	18.6	45700.0	2050.0	258.0	440.4	228.4	123.6	19.0	84.5
ESV	3	mg/kg	Boron	1.65	1.5	1.4	1.9	2.1	2.5	2.0	1.6	2.2	2.6	0.9
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	198.20	189.0	40.0	101.0	57.0	596.0	303.0	80.0	130.0	45.0	55.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5
ESV	1,000	mg/kg	Acid Soluble Sulphide	2036.72	942.0	700.0	1119.0	2104.0	157.0	2229.0	234.0	505.0	36.0	266.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1331.69	176.0	1600.0	537.0	1770.0	504.0	989.0	508.0	960.0	28.8	23.9
ESV	5,000	mg/kg	Tot Cyanide	13.22	11.0	12.0	23.0	17.0	13.0	<1	6.0	2.0	41.0	11.0
ESV	20,000	mg/kg	Total Sulphur	8900.14	6000.0	7100.0	7600.0	10700.0	2900.0	7600.0	5100.0	9800.0	1000.0	4400.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	**4.0**	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	19.07	<16	<16	<16	<16	<45	<36	<16	<16	<16	<16
DIV	1	mg/kg	Benzene	12.59	<10	<10	<10	<10	<10	<10	<10	<10	<10	*<25*
DIV	130	mg/kg	Toluene	12.81	<10	<10	<10	<10	<10	<10	<10	<10	<10	<25
DIV	50	mg/kg	Ethylbenzene	12.47	<10	<10	<10	<10	<10	<10	<10	<10	<10	<25
DIV	25	mg/kg	Xylenes	24.81	<20	<20	<20	<20	<20	<20	<20	<20	<20	*<50*
DIV	40	mg/kg	Phenol Index	0.70	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

5.9 Area E – Tarmac and Wharf Area

5.9.1 Scope of Works

The site investigation in Area E comprised the following scope of works:

- Excavation of forty-one trial pits (EAT1-5, EBT12-14, EBT19-22, EBT30, ECT10, ECT17, ECT27-28, ECT33-34, ECT37-39, ECT41, EDT6-9, EDT11, EDT15, 16, EDT23-26, EDT29, EDT31-32, EDT35-36, EDT40, EDT42) using a 20 tonne tracked excavator and breaker;
- Recovery of seventy nine soil samples from Made Ground and natural strata (where encountered).

5.9.2 Ground Conditions

- Made Ground was found to comprise fine to coarse angular often sandy gravel cobbles and boulders of slag, brick and ash to depths of up to 4.0m. Layers of fused bluish grey ‘pelite’ were encountered in sub-areas B and C. No natural strata were encountered;
- Groundwater was encountered at two locations, EAT2 and EDT40 at depths of 2.8m and 0.9m bgl respectively;
- Site observations and monitoring did not reveal the presence of visual and/or olfactory evidence of contamination.

5.9.3 /Chemical Analysis Results

- **Soil pH**

  Soil pH across the site was found to be alkaline to highly alkaline. Soil pH values ranged from 8.4 (EDT7, 4.0 m bgl) to 12.9 (EBT21, 0.2 m bgl and EBT21, 3.2 m bgl). The 95th percentile calculated for pH (11.38) slightly exceeds the guideline value of 10.

- **Toxic and Phytotoxic Metals**

  Levels of toxic metals were found to be below guideline levels, with the exception of four elevated lead values ranging from 793.9 mg/kg (EDT7, 4.0 m bgl) to 2,030 (EDT32, 0.2 m bgl). The 95th percentile calculated for lead (221.25 mg/kg) is well below the guideline value of 750 mg/kg.

  Concentrations of copper were below guideline values across Area E with the exception of one value (EDT42, 0.2 m bgl) of 17,900mg/kg. The 95th percentile calculated for copper (24.84 mg/kg) was well below the guideline value of 190 mg/kg.

  Concentrations of zinc exceeded guideline values in thirteen samples taken within Area E, ranging between 733.7 mg/kg (EAT4, 3.4 m bgl) to 11,800 mg/kg (EDT32, 0.2 m bgl). The 95th percentile calculated for zinc (1,007 mg/kg) was in exceedence of the guideline value of 720 mg/kg.

Elevated levels of boron in excess of guideline values were detected in twenty five samples across the Area E. Four samples from Sub-Area A contained elevated concentrations of boron ranging from 3.1 mg/kg (EAT3, 0.1 m bgl) to 3.9 mg/kg (EAT4, 3.4 m bgl).

Eight samples from Sub-Area B contained elevated concentrations of boron ranging from 3.2 mg/kg (EBT21, 3.2 m bgl) to 312.0 mg/kg (EBT13, 3.2 m bgl).

Seven samples from Sub-Area C contained elevated levels of boron, ranging from 3.9 mg/kg (ECT33, 2.2 m bgl) to 15.0 mg/kg (ECT27, 1.8 m bgl).

Seven samples from Sub-Area D contained elevated levels of boron, ranging from 3.2mg/kg (EDT15, 0.6 m bgl) to 12.0 mg/kg (EDT9, 3.2 m bgl).

The 95th percentile calculated for boron across Area E as a whole (3.68 mg/kg) exceeds the guideline value of 3 mg/kg.

- **Sulphide, sulphate and sulphur**

Elevated levels of sulphide were detected in twenty-six samples taken from within Area E.

In Sub-Area A there is only one sample with elevated levels of sulphide, 1,405 mg/kg – EAT1 (2.4 m bgl).

In Area B there are eight samples with elevated levels of sulphide ranging from 1,203 mg/kg (EBT12, 0.5 m bgl) to 7,512 mg/kg (EBT19, 0.2 m bgl).

In Area C there are eleven samples with elevated levels of sulphide ranging from 1,112 mg/kg (ECT41, 2.8 m bgl) to 6,304 mg/kg (ECT34, 0.2 m bgl).

In Area D there are six samples with elevated levels of sulphide, ranging from 1,053 mg/kg (EDT26, 2.6 m bgl) to 2023 mg/kg (EDT25, 3.6 m bgl).

The 95th percentile calculated for sulphide (1,542 mg/kg) exceeds the guideline value of 1,000 mg/kg.

Elevated levels of sulphate were detected in thirty-seven samples across the site.

In Sub-Area A there are five samples with elevated levels of sulphate ranging from 1,230 mg/kg (EAT5, 4.0 m bgl) to 1,630 mg/kg (EAT1, 2.4 m bgl).

In Sub-Area B there are eight samples with elevated levels of sulphate ranging from 1,390 (EBT20, 3.9 m bgl) to 1,860 mg/kg (EBT12, 4.0 m bgl).

In Sub-Area C there are eight samples with elevated levels of sulphate ranging from 1,400 mg/kg (ECT10, 2.4 m bgl) to 1,720 mg/kg (ECT39, 2.8 m bgl).

In Sub-Area D there are sixteen samples with elevated levels of sulphate, ranging from 1,610 mg/kg (EDT25, 0.25 m bgl) to 2,640 mg/kg (EDT7, 4.0 m bgl)

The 95th percentile calculated for sulphate across Area 15 (1,204 mg/l) slightly exceeds the guideline value of 1,200 mg/l.

- **Organics**

Levels of Total PAH in excess of guideline values were detected in ten samples across Area E. In sub-Area C there were four samples with elevated levels of Total PAH ranging from 41 mg/kg (ECT41, 0.6m bgl) to 209 mg/kg (ECT39, 2.0 m bgl).

In sub-Area D there were six samples with elevated levels of Total PAH ranging from 48 mg/kg (EDT7, 4.0 m bgl) to 241 mg/kg (EDT25, 0.25 m bgl).

Elevated concentrations of BTEX compounds were detected in four samples. Sample ECT28 (0.6 m bgl) had elevated levels of benzene (108 mg/kg) and xylenes (231 mg/kg); sample ECT28 (3.5 m bgl) had elevated levels of xylenes (36 mg/kg); sample ECT34 (0.2 m bgl) had elevated levels of xylenes (26.0 mg/kg); and sample EDT40 (3.0 m bgl) had elevated levels of benzene (56 mg/kg) and xylenes (29 mg/kg).

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 8.

Summary of Results Showing Exceedances. Area: E

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	EAT1	EAT2	EAT2	EAT3	EAT3	EAT4	EAT4	EAT5	EAT5	EBT12
			Depth m bgl		2.4	0.2	3	0.1	4	0.2	3.4	0.1	4	0.5
			Ground Type		-	-	-	-	-	-	-	-	-	-
			Sample Date		13.05.04							13.05.04	13.05.04	
			Sample Number		CL0413794	CL0414980	CL0414981	CL0414982	CL0414983	CL0414984	CL0414985	CL0413791	CL0413792	CL0414974
ESV	<5 or >10	pH	pH	11.38	9.8	10.5	9.9	9.2	11.2	10.5	11.2	12.0	10.6	12.1
CLEA	500	mg/kg	Arsenic	45.89	25.4	59.5	43.1	51.3	80.9	29.9	36.7	18.1	126.1	1.1
CLEA	1,400	mg/kg	Cadmium	1.29	0.7	2.1	1.7	4.2	8.4	0.9	0.8	0.6	1.4	0.2
CLEA	5,000	mg/kg	Chromium	249.05	19.8	72.3	62.1	34.8	252.7	45.0	58.6	348.7	27.7	33.4
CLEA	750	mg/kg	Lead	221.25	43.6	302.9	435.7	1230.0	1848.0	111.8	102.4	82.5	117.3	4.2
CLEA	480	mg/kg	Mercury	0.19	<0.10	0.2	0.5	0.2	0.3	<0.10	<0.10	0.2	0.2	<0.10
CLEA	8,000	mg/kg	Selenium	4.10	4.8	2.2	4.6	2.1	1.9	2.8	4.7	3.0	4.5	3.7
DIV	190	mg/kg	Copper	24.84	9.0	43.5	22.0	31.7	28.1	25.6	32.5	20.3	25.2	1.8
CLEA	5,000	mg/kg	Nickel	16.17	6.4	23.0	10.0	26.3	43.2	16.1	11.5	11.6	21.0	1.2
DIV	720	mg/kg	Zinc	1006.98	525.1	1010.0	1690.0	4356.0	5470.0	502.5	733.7	298.9	986.0	24.9
ESV	3	mg/kg	Boron	3.68	3.3	3.0	3.8	3.1	2.8	2.9	3.9	1.7	1.9	3.8
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	281.14	94.0	291.0	115.0	167.0	74.0	351.0	55.0	327.0	17.0	24.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	1541.86	1405.0	169.0	963.0	109.0	48.0	246.0	437.0	169.0	424.0	1203.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1203.56	1630.0	1320.0	1380.0	527.0	1590.0	587.0	1110.0	118.0	1230.0	1510.0
ESV	5,000	mg/kg	Tot Cyanide	11.96	10.0	<1	<1	<1	<1	<1	<1	18.0	8.0	<1
ESV	20,000	mg/kg	Total Sulphur	8614.68	8300.0	6000.0	8800.0	4900.0	4800.0	8200.0	12200.0	5900.0	6300.0	6500.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	25.30	<26	<40	<20	<16	<16	<32	<16	<16	<16	<16
DIV	1	mg/kg	Benzene	13.14	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	12.48	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.28	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	24.20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.87	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area:	E

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	EBT12	EBT13	EBT13	EBT14	EBT14	EBT19	EBT19	EBT20	EBT20	EBT21
			Depth m bgl		**4**	**2.5**	**3.2**	**1.2**	**4**	**0.2**	**3.9**	**0.2**	**3.9**	**0.2**
			Ground Type		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date					**06.05.04**	**06.05.04**	**06.05.04**	**06.05.04**	**06.05.04**	**06.05.04**	
			Sample Number		**CL0414975**	**CL0414976**	**CL0414977**	**CL0412710**	**CL0412711**	**CL0412712**	**CL0412713**	**CL0412714**	**CL0412715**	**CL0414978**
ESV	<5 or >10	pH	pH	11.38	11.1	11.0	11.3	10.2	11.0	11.8	11.1	11.4	11.1	12.9
CLEA	500	mg/kg	Arsenic	45.89	12.3	3.9	16.5	7.3	12.9	0.9	10.0	3.2	11.3	1.5
CLEA	1,400	mg/kg	Cadmium	1.29	0.2	0.2	<0.10	0.3	0.4	0.4	0.3	0.4	0.3	<0.10
CLEA	5,000	mg/kg	Chromium	249.05	94.1	23.5	143.0	23.6	66.1	11.3	10.4	8.8	7.3	749.1
CLEA	750	mg/kg	Lead	221.25	21.4	5.4	12.7	16.0	31.4	4.4	4.3	8.1	6.3	3.9
CLEA	480	mg/kg	Mercury	0.19	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	4.10	3.5	4.0	4.0	4.6	4.0	3.8	5.0	5.1	5.8	2.4
DIV	190	mg/kg	Copper	24.84	10.4	5.0	13.1	6.8	27.4	1.0	3.9	1.7	8.6	10.1
CLEA	5,000	mg/kg	Nickel	16.17	13.0	3.0	9.1	17.4	6.8	1.3	5.0	1.5	2.1	9.3
DIV	720	mg/kg	Zinc	1006.98	43.5	19.9	24.9	54.9	67.0	9.2	8.5	23.8	11.4	19.8
ESV	3	mg/kg	Boron	3.68	6.0	5.8	12.0	1.8	3.3	1.7	6.1	1.8	1.2	3.5
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	281.14	17.0	34.0	<10.0	173.0	103.0	77.0	47.0	122.0	38.0	48.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	1541.86	544.0	1786.0	613.0	642.0	638.0	7512.0	1852.0	3200.0	3387.0	48.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1203.56	1860.0	1810.0	1840.0	1820.0	1840.0	318.0	642.0	522.0	1390.0	47.1
ESV	5,000	mg/kg	Tot Cyanide	11.96	<1	<1	<1	3.0	8.0	67.0	20.0	32.0	5.0	<1
ESV	20,000	mg/kg	Total Sulphur	8614.68	9600.0	9500.0	12600.0	9800.0	8600.0	8200.0	8600.0	12800.0	12900.0	1500.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	25.30	<16	<16	<16	<16	<17	<16	<16	<18	<16	<16
DIV	1	mg/kg	Benzene	13.14	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	12.48	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.28	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	24.20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<10
DIV	40	mg/kg	Phenol Index	0.87	<0.5	<0.5	<0.5	<0.5	<0.5	2.0	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: E

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	EBT21	EBT22	EBT22	EBT30	EBT30	ECT10	ECT10	ECT17	ECT17	ECT27
			Depth m bgl		**3.2**	**0.2**	**3.9**	**0.2**	**2.5**	**0.2**	**2.4**	**0.2**	**2**	**0.7**
			Ground Type		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
			Sample Date			**06.05.04**	**06.05.04**	**07.05.04**	**07.05.04**	**11.05.04**	**11.05.04**	**11.05.04**	**11.05.04**	**11.05.04**
			Sample Number		**CL0414979**	**CL0412716**	**CL0412717**	**CL0412722**	**CL0413067**	**CL0413068**	**CL0413069**	**CL0413070**	**CL0413071**	**CL0413074**
ESV	<5 or >10	pH	pH	11.38	12.9	10.9	11.0	11.3	11.5	10.4	10.4	12.8	11.4	11.6
CLEA	500	mg/kg	Arsenic	45.89	1.0	16.2	15.9	0.7	0.9	1.8	14.6	7.6	9.0	41.3
CLEA	1,400	mg/kg	Cadmium	1.29	<0.10	0.4	0.5	<0.10	0.7	0.2	0.2	0.5	0.2	1.3
CLEA	5,000	mg/kg	Chromium	249.05	642.3	219.9	23.3	12.9	13.4	7.8	28.8	514.6	15.8	232.8
CLEA	750	mg/kg	Lead	221.25	7.9	66.0	36.4	4.3	10.5	2.6	4.4	57.7	62.7	159.6
CLEA	480	mg/kg	Mercury	0.19	<0.10	0.2	<0.10	0.1	**2.2**	0.3	0.1	0.1	0.2	0.3
CLEA	8,000	mg/kg	Selenium	4.10	2.4	3.2	5.6	4.2	4.6	6.0	4.6	1.3	4.2	4.1
DIV	190	mg/kg	Copper	24.84	11.3	30.7	9.0	<0.50	2.0	3.8	2.5	18.9	67.4	23.9
CLEA	5,000	mg/kg	Nickel	16.17	6.1	10.2	4.4	1.2	0.9	1.6	6.7	22.8	13.6	10.7
DIV	720	mg/kg	Zinc	1006.98	21.8	132.6	141.4	<3.00	24.4	11.9	11.2	251.4	95.6	447.2
ESV	3	mg/kg	Boron	3.68	3.2	2.9	1.8	1.4	2.6	5.5	7.2	1.2	1.2	1.8
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	281.14	55.0	342.0	60.0	<10.0	94.0	<10.0	<10.0	104.0	279.0	1170.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**5.1**	<0.5
ESV	1,000	mg/kg	Acid Soluble Sulphide	1541.86	79.0	730.0	1505.0	6772.0	4660.0	6160.0	3948.0	<5	731.0	519.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1203.56	32.8	1270.0	1680.0	421.0	726.0	1620.0	1400.0	16.1	896.0	859.0
ESV	5,000	mg/kg	Tot Cyanide	11.96	<1	5.0	19.0	66.0	29.0	24.0	26.0	3.0	6.0	15.0
ESV	20,000	mg/kg	Total Sulphur	8614.68	1800.0	4600.0	14600.0	6900.0	8500.0	10800.0	9000.0	1800.0	10500.0	6700.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	25.30	<16	<40	<18	<16	<16	<16	<16	<16	<37	<60
DIV	1	mg/kg	Benzene	13.14	*<20*	<10	<10	<10	<10	<10	<10	<10	***<250***	*<25*
DIV	130	mg/kg	Toluene	12.48	<10	<10	<10	<10	<10	<10	<10	<10	***<250***	<25
DIV	50	mg/kg	Ethylbenzene	12.28	<10	<10	<10	<10	<10	<10	<10	<10	***<250***	<25
DIV	25	mg/kg	Xylenes	24.20	<20	<20	<20	<20	<20	<20	<20	<20	***<500***	*<50*
DIV	40	mg/kg	Phenol Index	0.87	<0.5	<0.5	<0.5	<0.5	0.6	1.8	3.0	<0.5	0.8	<0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: E

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	ECT27	ECT28	ECT28	ECT33	ECT33	ECT34	ECT34	ECT38	ECT38	ECT39
			Depth m bgl		1.8	0.6	3.5	0.5	2.2	0.2	2	0.2	3	0.2
			Ground Type		-	-	-	-	-	-	-	-	-	-
			Sample Date		11.05.04	06.05.04	06.05.04	11.05.04	11.05.04	06.05.04	06.05.04	07.05.04	07.05.04	07.05.04
			Sample Number		CL0413075	CL0412720	CL0412721	CL0413072	CL0413073	CL0412718	CL0412719	CL0412723	CL0412724	CL0412725
ESV	<5 or >10	pH	pH	11.38	11.5	11.5	11.2	11.9	12.7	11.3	10.7	11.3	11.4	12.5
CLEA	500	mg/kg	Arsenic	45.89	16.4	0.7	3.1	6.0	3.9	<0.50	10.9	4.0	4.3	6.6
CLEA	1,400	mg/kg	Cadmium	1.29	0.4	0.3	0.4	0.2	0.2	0.2	0.3	<0.10	<0.10	<0.10
CLEA	5,000	mg/kg	Chromium	249.05	87.8	9.9	8.4	74.8	402.4	6.7	82.1	6.2	9.8	186.9
CLEA	750	mg/kg	Lead	221.25	42.6	1.8	1.8	11.9	14.8	1.3	33.2	4.6	1.6	6.7
CLEA	480	mg/kg	Mercury	0.19	0.1	<0.10	<0.10	0.1	0.1	<0.10	<0.10	<0.10	0.2	0.1
CLEA	8,000	mg/kg	Selenium	4.10	5.4	2.9	6.3	5.2	4.4	3.2	4.6	2.7	3.0	4.5
DIV	190	mg/kg	Copper	24.84	7.3	0.6	2.0	4.3	5.1	<0.50	7.8	<0.50	0.6	3.9
CLEA	5,000	mg/kg	Nickel	16.17	4.9	1.4	3.2	3.2	3.4	1.3	4.9	0.9	1.4	3.0
DIV	720	mg/kg	Zinc	1006.98	92.4	9.8	9.2	38.8	35.5	6.1	69.1	11.9	9.7	18.9
ESV	3	mg/kg	Boron	3.68	15.0	1.2	1.4	13.0	3.9	1.6	2.0	1.5	2.1	4.3
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	281.14	353.0	56.0	<10.0	108.0	243.0	<10.0	78.0	42.0	66.0	97.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	<0.5	0.6	<0.2	<0.2	<0.2	0.2	0.3	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	1541.86	162.0	5998.0	2739.0	1801.0	375.0	6304.0	1161.0	1496.0	1548.0	572.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1203.56	1660.0	317.0	1630.0	1670.0	1080.0	391.0	1680.0	376.0	946.0	1530.0
ESV	5,000	mg/kg	Tot Cyanide	11.96	6.0	6.0	6.0	4.0	28.0	6.0	13.0	2.0	<1	1.0
ESV	20,000	mg/kg	Total Sulphur	8614.68	11900.0	6900.0	15800.0	8900.0	7700.0	7900.0	9100.0	6300.0	6200.0	11800.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	25.30	<18	<16	<16	<16	<16	<16	<16	<16	<16	<16
DIV	1	mg/kg	Benzene	13.14	*<25*	**108.0**	<10	<10	<10	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	12.48	<25	38.0	<10	<10	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.28	<25	**48.0**	26.0	<10	<10	15.0	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	24.20	*<50*	**231.0**	36.0	<20	<20	26.0	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.87	<0.5	0.9	1.7	3.1	<0.5	1.0	<0.5	1.2	2.4	0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: E

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	ECT39 0.5 - 11.05.04 CL0413077	ECT39 2 - 11.05.04 CL0413076	ECT39 2.8 - 07.05.04 CL0412726	ECT41 0.6 - 11.05.04 CL0413078	ECT41 2.8 - 07.05.04 CL0412727	EDT11 0.35 - 11.05.04 CL0413081	EDT11 2.5 - 11.05.04 CL0413082	EDT15 0.6 - 11.05.04 CL0413090	EDT15 2.2 - 11.05.04 CL0413091	EDT16 0.5 - 11.05.04 CL0413088
ESV	<5 or >10	pH	pH	11.38	11.9	11.8	11.1	11.9	12.4	10.7	10.4	12.7	12.7	10.7
CLEA	500	mg/kg	Arsenic	45.89	39.1	47.3	5.1	19.7	16.5	2.5	2.1	3.1	9.1	32.7
CLEA	1,400	mg/kg	Cadmium	1.29	1.4	1.5	<0.10	0.2	<0.10	0.3	0.3	0.3	0.3	0.5
CLEA	5,000	mg/kg	Chromium	249.05	415.8	528.8	11.4	232.2	390.8	14.9	14.4	823.4	1270.0	355.0
CLEA	750	mg/kg	Lead	221.25	142.6	160.1	1.1	41.4	30.9	11.8	16.5	34.4	39.6	103.4
CLEA	480	mg/kg	Mercury	0.19	0.4	0.4	<0.10	0.1	0.1	<0.10	<0.10	0.2	0.2	0.2
CLEA	8,000	mg/kg	Selenium	4.10	2.7	2.9	4.7	2.9	3.1	5.0	4.5	1.9	2.8	2.2
DIV	190	mg/kg	Copper	24.84	44.2	54.5	0.6	17.8	10.5	3.1	2.0	29.1	28.8	33.3
CLEA	5,000	mg/kg	Nickel	16.17	21.1	25.4	0.6	13.1	7.1	1.5	1.4	37.3	12.2	22.5
DIV	720	mg/kg	Zinc	1006.98	365.5	410.5	3.4	60.3	41.9	70.0	79.3	163.3	123.1	190.2
ESV	3	mg/kg	Boron	3.68	2.8	2.6	10.0	2.0	1.5	5.3	6.6	3.2	1.0	1.0
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	281.14	803.0	1350.0	39.0	332.0	216.0	797.0	408.0	214.0	113.0	98.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	<0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	1541.86	233.0	251.0	3177.0	658.0	1112.0	832.0	1340.0	<5	20.0	164.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1203.56	481.0	440.0	1720.0	1100.0	636.0	1800.0	1820.0	13.6	37.8	640.0
ESV	5,000	mg/kg	Tot Cyanide	11.96	5.0	5.0	<1	4.0	2.0	3.0	6.0	3.0	13.0	11.0
ESV	20,000	mg/kg	Total Sulphur	8614.68	5100.0	4300.0	9600.0	4000.0	7200.0	7900.0	8300.0	1100.0	4400.0	3600.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	25.30	<77	**<209**	<16	<41	<26	<26	<18	<16	<18	<16
DIV	1	mg/kg	Benzene	13.14	*<25*	*<25*	<10	<10	<10	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	12.48	<25	<25	<10	<10	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.28	<25	<25	<10	<10	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	24.20	*<50*	*<50*	<20	<20	<20	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.87	<0.5	<0.5	<0.5	0.5	0.6	0.8	2.3	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: E

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	EDT16 4 - 11.05.04 CL0413089	EDT23 0.3 - 11.05.04 CL0413096	EDT23 2.8 - 11.05.04 CL0413097	EDT24 0.3 - 11.05.04 CL0413086	EDT24 3 - 11.05.04 CL0413087	EDT25 0.25 - 11.05.04 CL0413079	EDT25 3.6 - 11.05.04 CL0413080	EDT26 0.2 - 11.05.04 CL0413094	EDT26 2.6 - 11.05.04 CL0413095	EDT29 0.3 - 11.05.04 CL0413083
ESV	<5 or >10	pH	pH	11.38	9.0	12.1	11.7	12.8	11.3	11.4	11.2	11.8	9.8	11.6
CLEA	500	mg/kg	Arsenic	45.89	124.6	27.9	16.8	7.1	40.1	427.2	175.4	55.9	15.4	29.9
CLEA	1,400	mg/kg	Cadmium	1.29	0.7	1.9	1.1	2.8	0.7	0.7	0.7	3.1	0.5	1.9
CLEA	5,000	mg/kg	Chromium	249.05	54.2	163.4	429.9	645.0	446.6	218.0	236.1	560.4	25.2	379.7
CLEA	750	mg/kg	Lead	221.25	132.7	255.5	147.6	355.0	106.8	263.0	85.9	295.2	32.4	143.9
CLEA	480	mg/kg	Mercury	0.19	<0.10	0.2	0.2	0.1	0.3	**1.6**	0.6	0.4	<0.10	0.2
CLEA	8,000	mg/kg	Selenium	4.10	3.3	3.1	4.9	1.8	3.0	11.6	7.8	2.7	4.8	2.7
DIV	190	mg/kg	Copper	24.84	24.2	16.3	8.7	38.5	40.4	19.1	11.9	71.7	7.5	24.1
CLEA	5,000	mg/kg	Nickel	16.17	26.2	8.5	8.9	33.0	25.9	3.9	5.6	25.0	5.1	20.4
DIV	720	mg/kg	Zinc	1006.98	419.2	967.6	454.1	2420.0	349.9	185.6	229.9	585.7	150.9	508.8
ESV	3	mg/kg	Boron	3.68	0.8	1.5	1.7	1.5	2.0	1.3	1.7	0.6	2.8	4.5
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	281.14	327.0	219.0	112.0	80.0	166.0	1240.0	1040.0	289.0	86.0	274.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	1541.86	390.0	948.0	232.0	<5	298.0	1607.0	2023.0	287.0	1053.0	338.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1203.56	1730.0	420.0	1650.0	12.8	582.0	1610.0	1680.0	448.0	1960.0	596.0
ESV	5,000	mg/kg	Tot Cyanide	11.96	16.0	4.0	5.0	4.0	13.0	16.0	24.0	4.0	5.0	19.0
ESV	20,000	mg/kg	Total Sulphur	8614.68	11400.0	5800.0	11400.0	2200.0	6600.0	12600.0	17200.0	4900.0	9600.0	5400.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	<1	1.0	<1	<1	<1	<1	1.0	<1
DIV	40	mg/kg	PAH Total EPA16	25.30	<22	<29	<18	<16	<30	**241.0**	**237.0**	<55	<17	<37
DIV	1	mg/kg	Benzene	13.14	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	12.48	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.28	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	24.20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.87	<0.5	<0.5	<0.5	<0.5	<0.5	**5.8**	2.8	<0.5	<0.5	0.6

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

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Values in bold - Identified as an outlier in statistical analysis

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Summary of Results Showing Exceedances. Area: E

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	EDT31 0.3 - 11.05.04 CL0413092	EDT31 2.4 - 11.05.04 CL0413093	EDT32 0.2 - 11.05.04 CL0413084	EDT32 4 - 11.05.04 CL0413085	EDT36 0.3 - 12.05.04 CL0413421	EDT36 4 - 12.05.04 CL0413422	EDT40 0.2 - 12.05.04 CL0413419	EDT40 3 - 12.05.04 CL0413420	EDT42 0.2 - 12.05.04 CL0413423	EDT42 3.5 - 12.05.04 CL0413424
ESV	<5 or >10	pH	pH	11.38	11.8	11.4	11.0	10.0	11.5	11.4	9.6	9.8	10.5	10.3
CLEA	500	mg/kg	Arsenic	45.89	80.1	56.8	12.9	65.8	14.5	51.5	15.7	10.4	31.2	39.7
CLEA	1,400	mg/kg	Cadmium	1.29	4.8	2.5	**17.8**	5.2	0.4	0.4	0.3	0.1	0.9	0.5
CLEA	5,000	mg/kg	Chromium	249.05	449.4	320.5	232.9	57.7	564.3	384.8	34.1	47.5	187.7	229.8
CLEA	750	mg/kg	Lead	221.25	600.9	324.3	2030.0	403.2	34.4	69.8	27.3	8.0	108.9	84.9
CLEA	480	mg/kg	Mercury	0.19	0.7	0.4	0.2	<0.10	<0.10	0.1	<0.10	<0.10	0.1	<0.10
CLEA	8,000	mg/kg	Selenium	4.10	2.3	2.6	1.0	3.5	3.8	3.5	5.4	5.3	3.9	1.4
DIV	190	mg/kg	Copper	24.84	64.9	37.4	127.1	21.9	5.7	17.7	7.4	3.1	**17900.0**	85.2
CLEA	5,000	mg/kg	Nickel	16.17	26.7	18.9	59.1	18.1	5.7	14.0	6.6	4.6	73.7	30.4
DIV	720	mg/kg	Zinc	1006.98	1920.0	964.0	11800.0	3930.0	143.5	269.9	122.9	26.3	259.7	222.8
ESV	3	mg/kg	Boron	3.68	3.9	3.9	1.0	1.8	2.2	1.6	2.0	2.8	1.4	1.3
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	281.14	425.0	247.0	139.0	82.0	22.0	16.0	76.0	36.0	163.0	70.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	<0.2	<0.2	<0.2	<0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5
ESV	1,000	mg/kg	Acid Soluble Sulphide	1541.86	80.0	214.0	<5	431.0	608.0	786.0	769.0	1246.0	294.0	27.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1203.56	296.0	852.0	119.0	1910.0	683.0	1630.0	1670.0	1650.0	1020.0	1660.0
ESV	5,000	mg/kg	Tot Cyanide	11.96	6.0	8.0	4.0	23.0	4.0	4.0	2.0	<1	3.0	<1
ESV	20,000	mg/kg	Total Sulphur	8614.68	3700.0	4900.0	900.0	8000.0	9200.0	11000.0	11800.0	9500.0	5300.0	4100.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	**2.0**	<1	<1	<1	<1	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	25.30	<52	<29	<16	<16	<16	<16	<16	<16	<16	<16
DIV	1	mg/kg	Benzene	13.14	<10	<10	<10	*<25*	<10	<10	<10	56.0	<10	*<25*
DIV	130	mg/kg	Toluene	12.48	<10	<10	<10	<25	<10	<10	<10	11.0	<10	<25
DIV	50	mg/kg	Ethylbenzene	12.28	<10	<10	<10	<25	<10	<10	<10	<10	<10	<25
DIV	25	mg/kg	Xylenes	24.20	<20	<20	<20	*<50*	<20	<20	<20	29.0	<20	*<50*
DIV	40	mg/kg	Phenol Index	0.87	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.3	<0.5	<0.5

DIV - Dutch Intervention Value

CLEA - Industrial Guidance Limits

ESV - Enviros Screening Value

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

Summary of Results Showing Exceedances. Area: E

Guidance used	Guideline levels	Unit	Client Sample ID Depth m bgl Ground Type Sample Date Sample Number	95th Percentile (excluding outliers)	EDT6 0.1 - 13.05.04 CL0413801	EDT6 4 - 13.05.04 CL0413802	EDT7 4 - 13.05.04 CL0413796	EDT8 0.2 - 13.05.04 CL0413797	EDT8 3.2 - 13.05.04 CL0413798	EDT9 0.4 - 13.05.04 CL0413799	EDT9 3.2 - 13.05.04 CL0413800
ESV	<5 or >10	pH	pH	11.38	11.8	12.4	8.4	11.4	11.8	12.7	11.4
CLEA	500	mg/kg	Arsenic	45.89	26.8	13.2	159.2	151.3	55.0	3.4	3.4
CLEA	1,400	mg/kg	Cadmium	1.29	0.6	0.2	9.3	0.6	0.6	<0.10	0.1
CLEA	5,000	mg/kg	Chromium	249.05	194.1	310.3	60.1	413.6	152.9	469.0	40.3
CLEA	750	mg/kg	Lead	221.25	96.8	32.8	793.9	140.1	82.4	8.6	6.6
CLEA	480	mg/kg	Mercury	0.19	0.2	<0.10	0.1	0.1	<0.10	<0.10	<0.10
CLEA	8,000	mg/kg	Selenium	4.10	4.4	5.3	2.3	2.5	4.1	3.7	4.9
DIV	190	mg/kg	Copper	24.84	20.6	17.5	22.3	46.9	33.0	7.1	4.9
CLEA	5,000	mg/kg	Nickel	16.17	9.5	9.5	38.9	41.0	9.8	2.4	2.9
DIV	720	mg/kg	Zinc	1006.98	270.1	74.1	7160.0	312.9	385.2	61.6	36.7
ESV	3	mg/kg	Boron	3.68	1.8	1.1	2.8	1.2	1.3	2.2	12.0
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	281.14	91.0	34.0	400.0	535.0	314.0	340.0	224.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.25	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
ESV	1,000	mg/kg	Acid Soluble Sulphide	1541.86	519.0	<5	<5	96.0	829.0	936.0	1556.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	1203.56	1190.0	965.0	2640.0	1320.0	1740.0	36.1	2030.0
ESV	5,000	mg/kg	Tot Cyanide	11.96	16.0	<1	5.0	8.0	15.0	12.0	21.0
ESV	20,000	mg/kg	Total Sulphur	8614.68	7900.0	11000.0	9500.0	7300.0	13900.0	5000.0	12000.0
DIV	20	mg/kg	Free Cyanide	1.00	<1	<1	**2.0**	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	25.30	<16	<16	<48	<17	<16	<76	<18
DIV	1	mg/kg	Benzene	13.14	<10	<10	<10	<10	<10	<10	<10
DIV	130	mg/kg	Toluene	12.48	<10	<10	<10	<10	<10	<10	<10
DIV	50	mg/kg	Ethylbenzene	12.28	<10	<10	<10	<10	<10	<10	<10
DIV	25	mg/kg	Xylenes	24.20	<20	<20	<20	<20	<20	<20	<20
DIV	40	mg/kg	Phenol Index	0.87	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

5.10 Area H - Torpedo and Ladle Repair Shop

5.10.1 Scope of Works

The site investigation in Area H comprised the following scope of works:

- Excavation of two trial pits (HAT4, HAT6) using a 20 tonne tracked excavator and breaker;
- Advancing one groundwater monitoring borehole (HAB3) using a shell and auger (cable percussive) rig;
- Recovery of six soil samples from Made Ground and natural strata (where encountered) and recovery of one groundwater sample.

5.10.2 Ground Conditions

- Made Ground comprising sandy fine to coarse angular gravel, cobbles and boulders of slag and furnace bricks was observed in all locations to depths of up to 4.0m bgl;
- Natural ground underlying the slag and brick comprised soft to firm sandy clay with fine to medium gravel of mudstone, sandstone and siltstone;
- Groundwater was encountered at one location in clay at a depth of 5.0m bgl;
- Site observations and monitoring did not reveal the presence of visual or olfactory evidence of contamination.

5.10.3 Chemical Analysis Results

- **Soil pH**

  Soil pH across the area was found to be alkaline to highly alkaline. Soil pH values range from 8.6 (HAB3, 5.0 m bgl) to 11.1 (HAB3, 1.1 m bgl). The 95th percentile calculated for pH (11) exceeds the guideline value of 10.

- **Toxic and Phytotoxic Metals**

  Levels of toxic metals were found to be below guideline limits, with the exception of one lead value (951.9 mg/kg – HAT4, 3.8 m bgl). The 95th percentile calculated for lead (531 mg/kg) is below the guideline value of 750 mg/kg.

  Levels of phytotoxic metals were found to be below guideline limits, with the exception of one zinc value (2,960 mg/kg – HAT4, 3.8 m bgl). The 95th percentile calculated for zinc (105 mg/kg) is below the guideline value of 720 mg/kg.

- **Sulphide**

  Elevated levels of sulphide in excess of guideline values were detected in two locations (1,712 mg/kg – HAB3, 1.1 m bgl; 3,450 mg/kg – HAT6, 0.2 m bgl). The 95th percentile calculated for sulphide (2,099 mg/kg) is above the guideline value of 1,000 mg/kg.

  Levels of sulphate were found to be below guideline limits.

- **Organics**

  No other organic determinands were found at concentrations in excess of respective guideline values.

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 8.

Summary of Results Showing Exceedances. Area: H

Guidance used	Guideline levels	Unit	Client Sample ID	95th Percentile (excluding outliers)	HAB3	HAT4	HAT4	HAT6
			Depth m bgl		**1.1**	**0.3**	**3.8**	**0.2**
			Ground Type		**-**	**-**	**-**	**-**
			Sample Date		**28.04.04**	**26.04.04**	**26.04.04**	**26.04.04**
			Sample Number		**CL0411381**	**CL0411182**	**CL0411183**	**CL0411184**
ESV	<5 or >10	pH	pH	11.04	11.1	11.0	10.5	10.5
CLEA	500	mg/kg	Arsenic	17.42	8.7	9.8	25.7	3.5
CLEA	1,400	mg/kg	Cadmium	0.30	0.2	0.3	**11.6**	0.3
CLEA	5,000	mg/kg	Chromium	136.56	126.1	34.0	204.1	28.7
CLEA	750	mg/kg	Lead	531.13	32.1	279.7	951.9	49.9
CLEA	480	mg/kg	Mercury	0.25	0.3	<0.10	0.1	<0.10
CLEA	8,000	mg/kg	Selenium	4.18	2.9	2.1	1.9	6.3
DIV	190	mg/kg	Copper	34.91	10.6	21.4	54.6	3.3
CLEA	5,000	mg/kg	Nickel	25.60	7.5	12.2	21.6	1.9
DIV	720	mg/kg	Zinc	104.69	69.9	117.7	**2960.0**	36.5
ESV	3	mg/kg	Boron	2.27	0.6	1.7	2.7	1.9
DIV	5,000	mg/kg	Total Petroleum Hydrocarbons (C8 - C37)	244.91	100.0	219.0	361.0	94.0
DIV	5,000	mg/kg	GRO (C5 - C10)	0.43	<0.2	<0.5	<0.2	<0.5
ESV	1,000	mg/kg	Acid Soluble Sulphide	2099.28	1712.0	386.0	274.0	3450.0
BRE	1,200	mg/lt	Water Soluble Sulphate as SO4	444.64	400.0	635.0	201.0	87.6
ESV	5,000	mg/kg	Tot Cyanide	1.00	<1	<1	<1	**4.0**
ESV	20,000	mg/kg	Total Sulphur	5718.11	5200.0	1800.0	4500.0	7600.0
DIV	20	mg/kg	Free Cyanide	N/A	<1	<1	<1	<1
DIV	40	mg/kg	PAH Total EPA16	36.00	<16	<36	<39	<16
DIV	1	mg/kg	Benzene	21.37	<10	*<25*	<10	*<25*
DIV	130	mg/kg	Toluene	21.37	<10	<25	<10	<25
DIV	50	mg/kg	Ethylbenzene	21.37	<10	<25	<10	<25
DIV	25	mg/kg	Xylenes	42.74	<20	*<50*	<20	*<50*
DIV	40	mg/kg	Phenol Index	N/A	<0.5	<0.5	<0.5	<0.5

DIV - Dutch Intervention Value
CLEA - Industrial Guidance Limits
ESV - Enviros Screening Value
Values in bold - Identified as an outlier in statistical analysis
Values highlighted in yellow - Exceedances of guidance limits
Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

5.11 Groundwater Results

5.11.1 Groundwater Levels

5.11.2 Groundwater monitoring data for boreholes advanced across the Cleveland site are detailed in the table below:

Table 16 Groundwater Monitoring Results – Cleveland Site

Location	Groundwater (mAOD)	Groundwater (mbgl)	Borehole Depth (mAOD)	Borehole Depth (mbgl)	pH	EC (µS)
HAB3	6.854	3.38	2.114	8.12	8.16	1364
2AB1	4.459	4.80	0.929	6.91	8.42	1290
2AB2	4.891	3.40	3.651	4.64	8.49	1850
2AB3	3.082	4.45	-0.828	8.36	9.04	1460
3AB2	1.174	7.56	-0.306	9.04	9.14	1320
3AB3	5.206	4.45	5.206	4.45	-	-
4AB1	3.766	3.33	1.516	5.58	11.2	3090
4AB2	4.733	0.84	-0.003	4.82	12.01	4410
4AB3	4.633	2.54	2.393	4.78	2.54	2800
4AB4	2.194	2.73	0.344	6.30	12.52	1803
DAB1	3.806	4.45	-0.044	8.30	9.04	1460

5.11.3 Groundwater Analysis Results

- **pH**

  Groundwater pH values ranged from neutral (pH 6.9 – 2AB1) to highly alkaline (12.6 – 4AB2). The 95th percentile calculated for pH (9.8) in groundwater across the Cleveland site is just below the guideline value of 10.

- **Toxic Metals**

  Elevated levels of arsenic in excess of guideline values were found in samples 2AB2 (0.012 mg/l), DAB1 (0.012 mg/l), and 4AB4 (0.2 mg/l). The 95th percentile of 0.0102mg/l calculated for all Cleveland groundwater samples slightly exceeded the guideline value of 0.01 mg/l.

  Elevated lead concentrations were detected within 4AB2 (0.222 mg/l), exceeding the guideline value of 0.025 mg/l. However, the 95th percentile was below the guideline value.

  Slightly elevated levels of selenium were found in samples 3AB2 (0.013 mg/l) and 4AB3 (0.011 mg/l). The 95th percentile of 0.009mg/l for selenium calculated for all Cleveland groundwater samples is marginally below the guideline value of 0.01 mg/l.

- **Phytotoxic Metals**

  Levels of phytotoxic metals were found to be below guideline limits, with the exception of elevated concentrations of copper in two samples (0.005 mg/l – 4AB4 and 0.012 mg/l – 4AB2). The 95th percentile calculated for copper (0.0023 mg/kg) is marginally above the guideline value of 0.002 mg/l.

- **Total Cyanide**

  Elevated levels of total cyanide were detected in the groundwater sample from 2AB2 (14.6 mg/l), 4AB3 (0.4 mg/l), and 4AB4 (0.1 mg/l). Although all other samples contain levels of cyanide below guideline values, the 95th percentile calculated for total cyanide (0.18 mg/l) exceeds the guideline value of 0.05 mg/l.

- **Sulphate**

  Elevated levels of total sulphate above guideline values were detected in all but two (4AB4 and 4AB2) of the 10 groundwater samples, ranging between 856 mg/l (1AB1) and 2,910 mg/l (2AB1). The 95th percentile calculated for sulphur (1,860 mg/l) exceeds the guideline value of 250 mg/l.

- **Organics**

  Elevated concentrations of TPHs were detected in all but three of the ten samples (3AB2, 2AB3, and 1AB1), ranging between 0.7 mg/l (4AB4) and 247 mg/l (2AB1). The 95th percentile calculated for TPHs for all the groundwater samples (68.24 mg/l) far exceeds the guideline value of 0.6 mg/l.

  Elevated concentrations of GROs were also detected in 2AB1 (5.5 mg/l), 2AB2 (7.3 mg/l), and 4AB2 (0.8 mg/l), compared to the guideline value of 0.6 mg/l. The 95th percentile calculated for GROs of 2.71mg/l exceeds the guideline value of 0.6mg/l.

  Five groundwater samples contained PAHs in concentrations exceeding the guideline value (0.8 mg/l), ranging from 1.5 (4AB2) to 83.6 mg/l (2AB1). The 95th percentile calculated for PAHs of 2.95 mg/l exceeds the guideline value of 0.8mg/l.

  Elevated concentrations of benzene were recorded in samples 4AB3 (47 µg/l), 4AB2 (440 µg/l), 2AB1 (3,700 µg/l), and 2AB2 (7,150 µg/l). The 95th percentile calculated for benzene of 2,294 µg/l exceeds the guideline value of 1 µg/l.

  Sample 2AB1 further contained elevated concentrations of toluene (2,800 µg/l), and xylenes (1,837 µg/l), relative to the guideline values of 1,000 µg/l and 70 µg/l, respectively. Elevated levels of xylenes were also detected in samples 2AB2 (1,100 µg/l) and 4AB2 (96 µg/l). The 95th percentile for xylenes of 619 µg/l exceeds the guideline value of 70 µg/l. The 95th percentile for both ethylbenzene and toluene were below the guideline value.

The analytical results presented in the following table shows the locations where there is an exceedance of the Tier 1 screening criteria. Analytical certificates are presented in Appendix 9.

Summary of Water Results Showing Exceedances. **Cleveland GW**

Guidance used	Guideline levels	Unit	Client Sample ID Sample Date Sample Number	95th Percentile (excluding outliers)	2AB1 38124 W/EX/0411636	3AB2 38124 W/EX/041163	2AB3 38124 W/EX/041163	2AB2 38124 W/EX/041163	DAB1 38124 W/EX/041164	1AB1 38124 W/EX/041164	4AB3 38124 W/EX/041164	4AB1 38114 W/EX/041098	4AB4 38114 W/EX/041098	4AB2 38114 W/EX/041105	HAB3 06/05/2004 W/EX/[illegible]983
UKDWS	<6.5 or >10	pH	pH	9.80	6.9	7.6	7.6	7.0	7.3	7.6	7.8	10.9	11.8	12.6	8.3
UKDWS	0.01	mg/l	Arsenic	0.0102	0.012	0.004	0.002	0.002	0.012	0.004	0.009	0.008	0.020	0.003	<0.001
UKDWS	0.005	mg/l	Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.000	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
UKDWS	0.05	mg/l	Chromium	0.006	0.00	<0.001	0.01	0.01	0.00	0.01	0.00	<0.001	0.00	<0.001	0.01
UKDWS	0.025	mg/l	Lead	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	**0.222**	<0.001
UKDWS	0.001	mg/l	Mercury	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	**0.0002**	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001
UKDWS	0.01	mg/l	Selenium	0.009	0.003	0.013	0.006	0.008	0.007	0.003	0.011	0.009	0.003	0.007	0.00
UKDWS	0.002	mg/l	Copper	0.0023	0.002	<0.001	<0.001	0.001	0.001	0.002	<0.001	<0.001	0.005	**0.012**	0.001
UKDWS	0.02	mg/l	Nickel	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.00
DIV	0.8	mg/l	Zinc	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<0.002	<0.002	**0.2**	<0.002
UKDWS	1	mg/l	Boron	2.27	2.7	1.3	0.9	1.0	1.4	0.5	3.7	0.3	0.1	4.2	1
DIV	0.6	mg/l	TPH GC	68.24	247.0	0.2	<0.1	22.0	6.2	<0.1	10.0	4.6	0.7	21.0	<0.1
DIV	0.6	mg/l	Gasoline Range Organics	2.71	5.5	<0.1	<0.1	7.3	<0.1	0.1	0.2	<0.1	<0.1	0.8	<0.1
UKDWS	0.05	mg/l	Tot Cyanide	0.18	<0.1	<0.1	<0.1	**14.60**	<0.1	<0.1	0.40	<0.1	0.10	<0.1	*<0.1*
UKDWS	250	mg/l	Total Sulphur as S04	1,860.2	2910	2270	1030	1630	1390	856	2600	915	218	112	1030
UKDWS	-	mg/l	Acid Soluble Sulphide	3.46	<0.2	0.500	<0.2	1.300	9.500	<0.2	6.300	0.400	<0.2	<0.2	<0.2
UKDWS	0.05	mg/l	Free Cyanide	<0.1	-	<0.1	<0.1	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	*<0.1*
DIV	0.8	mg/l	PAH Total EPA16	2.95	**<83.55**	<0.21	<0.18	<7.11	<1.67	<0.17	<4.34	<0.33	<0.16	1.5	<0.16
UKDWS	1	ug/l	Benzene	2,294.2	3700	*<5*	*<5*	7150	*<5*	*<5*	37	*<5*	*<5*	440	*<5*
DIV	1000	ug/l	Toluene	137.30	2800	<5	<5	381	<5	<5	29	<5	<5	196	<5
DIV	150	ug/l	Ethylbenzene	44.64	91	<5	<5	108	<5	<5	23	<5	<5	6	<5
DIV	70	ug/l	Xylenes	619.23	1837	<10	<10	1100	<10	<10	57	<10	<10	96	<10
DIV	2	mg/l	Phenol Index	0.13	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05

DIV - Dutch Intervention Value

UKDWS - UK Drinking Water Standards

Values in bold - Identified as an outlier in statistical analysis

Values highlighted in yellow - Exceedances of guidance limits

Laboratory detection limits for BTEX compounds may increase depending on the type of matrix, these have not been included in the summary tables unless other parameters are in exceedance.

NB. DIV for PAH is for sum of ten

5.12 Summary of Results for Cleveland

5.12.1 Scope of Works

The site investigation at Cleveland comprised the following scope of works:

- Excavation of 116 trial pits and 14 groundwater monitoring boreholes;
- Recovery of 260 soil samples from Made Ground and natural strata (where encountered) and recovery of 15 groundwater samples from boreholes.

5.12.2 Ground Conditions

- Made Ground encountered across the Cleveland site generally comprised fine to coarse sandy angular gravel, cobbles and boulders of slag, brick, ash and ferrous metal debris with very occasional pockets of clay;
- Made Ground in the form of fused bluish grey 'pelite' was observed in Area E (sub-Areas B and C) to depths of up to 3.2m;
- Natural ground was encountered rarely (generally in the south western portion of the area) in the form of firm sandy clay with fine to medium gravel of mudstone, siltstone and sandstone;
- Groundwater was encountered infrequently across the site and was generally only found within the deeper groundwater monitoring boreholes. Groundwater generally appears to be shallower in the eastern areas of the site. Locally, groundwater flow directions across the site appear to be complex, though in broad terms our monitoring data suggests a general westward movement of groundwater towards the River Tees;
- An oily, tarry deposit and strong hydrocarbon odours were noted in the Made Ground and groundwater during monitoring near the benzol tanks and at the western side of the By Products area.

5.12.3 Chemical Analysis Results – Soil and Groundwater

- Across the Cleveland Works the soil was very alkaline and exceeded the guideline value of 10 at shallow and deep sampling locations. This is likely to be due to the alkalinity of widespread slag deposits. However, groundwater pH was only locally elevated.
- Sulphide and sulphate were frequently elevated above screening criteria at shallow and deep sampling locations at the Cleveland Works. Groundwater was also high in sulphate but sulphide levels were generally low.
- Phytotoxic metals (particularly zinc and boron) in the soil at the Cleveland Works were often in excess of guideline values. Toxic metals (principally lead) were also found to be locally elevated above screening levels. Within the groundwater metals were found to be elevated above screening criteria in the

SLEMS and By Products areas.

- Cyanide levels in groundwater were found to be elevated above screening levels in the SLEMS and By Products areas.

- Hydrocarbons including PAHs, BTEX Compounds and TPH were identified in soils in excess of screening criteria in samples recovered from locations from the By Products Plant (particularly the western side near the benzol tanks) and the SLEMS area. During our site investigation evidence of hydrocarbon contamination including staining of soils and vapours was also noted within several exploration locations advanced in both of these areas.

- Groundwater samples from the By Products Plant and SLEMS areas also indicated concentrations of hydrocarbon compounds in excess of screening criteria (PAH, BTEX Compounds, TPH and GROs). During our groundwater monitoring visit evidence of free product was identified within water samples taken from the west of the By Products Plant near the benzol tanks.

6. SUMMARY OF RESULTS

6.1.1 Ground Conditions

- Made Ground encountered across the three sites comprised layered deposits of slag with size fractions varying from loose gravel to fused boulders. Other constituents included brick, ash, ferrous metal and reworked clay.

- Made Ground thickness was found to be greater at both Redcar (max 7.6m, 15AB1) and Cleveland (max 10m 3AB2) close to the River Tees where historic infilling would have been deepest. Reduced thickness of Made Ground were found in both these sites toward the eastern sides where the requirement to reclaim land would have been reduced. Further inland at the Lackenby works there was a reduced thickness of Made Ground (Max 6.5m, GAB2 6.5m), Iron Granulation Plant);

- Beneath Made Ground natural ground varied from alluvial sands in Redcar, Boulder Clay at Lackenby and estuarine and marine alluvium at Cleveland. At Redcar the alluvial sand, characterised by the presence of shell fragments, was only encountered in a limited number of exploratory locations at an average depth of 5.9m bgl. The majority of exploratory locations encountered Boulder Clay at the Lackenby works at a shallow depth, averaging 2.5m bgl. Estuarine and marine alluvium at Cleveland was found at a limited number of exploratory locations at an average depth of was 5.2m bgl.

- Infrequent groundwater strikes were noted during trial pit excavations at Redcar and Cleveland contrasting with more frequent water strikes occurring between Made Ground and Boulder Clay at Lackenby. Groundwater was found between permeable Made Ground and less permeable estuarine and marine alluvium at Cleveland. At Redcar groundwater was encountered within permeable alluvial sands underlain by less permeable alluvial clays, however the latter strata were not encountered during the site investigation.

- At Redcar, groundwater monitoring data indicates flow toward the north and the South Gare and Coatham Sands SSSI. However groundwater flow was also directed east near the former Warrenby Works and may be influenced by Fleet Beck. At the By-Products area which is closer to the River Tees, groundwater flow was westward toward the Tees.

- At the Lackenby Works, groundwater flow appeared to be westward from the Iron Granulation Plant and the BOS Plant, however locally depressed groundwater was found in the vicinity of the BOS Stores, possibly indicating groundwater flow into the Boundary Beck Culvert.

- At the Cleveland Works, groundwater flow directions across the site appear to be complex, though in broad terms our monitoring data suggests a general westward movement of groundwater towards the River Tees.

- Across the works visual and olfactory evidence of hydrocarbon staining was found in a number of exploratory holes in Made Ground. Soil staining and odours were evident within soil samples in the SLEMS area. Some evidence of Heavy Fuel Oil staining and strong odours were found within Made Ground near the bulk oil storage tanks at the Redcar Blast Furnace. Visual evidence of staining in the soil, free product in groundwater samples and strong odours in soil and groundwater samples were also found at several locations at the western side of the By Products Plant near the benzol tanks.

6.1.2 Chemical Analysis Results – Soil and Groundwater

Table 17 provides a summary of soil and groundwater testing of data across the Teesside Works. Statistical analysis for each area was evaluated against the appropriate Tier 1 screening criteria (DIV, CLEA, ESV and UKDWS) and scored as follows:

- A score of 1 was given where the Mean Value Test (US95/95th Percentile) was not exceeded for the area and where there were no localised exceedances of the Tier 1 screening criteria.
- A score of 2 was given to areas where the Mean Value Test (US95/95th Percentile) was not exceeded for the area but where there were some samples exceeded the Tier 1 screening criteria.
- The highest score of 3 was given to areas where the Mean Value Test (US95/95th Percentile) exceeded the Tier 1 screening criteria.

Screening criteria for groundwater and surface water samples have been based on the use of stringent UKDWS or DIVs where no UK standard exists. This is a conservative approach given the Corus Teesside site is used for industrial purposes with no nearby groundwater abstraction for potable supply.

- Across Redcar, Lackenby and Cleveland the soil was very alkaline and exceeded the guideline value of pH 10 at shallow and deep sampling locations (Score 3, Table 17). This is likely to be due to the alkalinity of widespread slag deposits. However, groundwater pH was only locally elevated and did not exceed the Tier 1 screening values (Score 2, Table 17).
- Sulphide and sulphate were frequently elevated above Tier 1 screening criteria at shallow and deep exploratory locations across all three sites. Sulphate in groundwater exceeded the UKDWS at Redcar, Lackenby and Cleveland Works (Score 3, Table 17), but sulphide levels were generally low (Score 1, Table 17).
- Levels of phytotoxic metals in soils were below Tier 1 screening criteria and were only locally elevated above screening levels at Redcar and Lackenby. This contrasted with Cleveland soil samples which exceeded the guideline values for zinc and boron at the By Products Plant, Fuel Storage Area next to Dolphin Wharfe, SLEMS, Western Side of Pig Caster and the Tarmac and Wharfe Area (Score 2-3, Table 17). This may be due to differences primarily in the composition of Made Ground containing slag. In groundwater boron exceeded the Tier 1 screening criteria in the Cleveland Works (Score 3, Table 17) and copper was identified in concentrations in excess of guideline levels for all three sites including surface water for the South Gare and Coatham sands (Score 3, Table 17).
- Levels of toxic metals in soil were generally low with the exception of lead which was locally elevated above the Tier 1 screening criteria (Score 2, Table 17). The only area to exceed the guideline levels was the SLEMS area (Score 3, Table 17). Lead levels were also locally elevated in groundwater within the Cleveland works (Score 2, Table 17). Within the groundwater there were

localised elevated concentrations of selenium across the three sites including surface water in the South Gare and Coatham Sands SSSI (Score 2, Table 17). Chromium was also locally elevated but not in exceedance of the guideline values at the Redcar and Lackenby Works (Score 2, Table 17).

- Cyanide levels in groundwater exceeded the Tier 1 screening criteria at Redcar and Cleveland (Score 3, Table 17), particularly high levels were found in the vicinity of the benzol tanks at the South Bank By Products area.

- Locally elevated PAH levels in excess of guideline criteria were found predominantly in Made Ground in soils across the three sites (Score 2, Table 17). Three areas were notable for exceedance of hydrocarbon screening criteria as follows:

- *The bulk oil tanks near the Blast Furnace*; Elevated PAHs and BTEX occurred at this location at depth in soil with elevated TPHs in groundwater. Visual evidence of hydrocarbon contamination was also identified in this area. This is probably due to leakage of heavy fuel oil from the tanks. Several other locations were found to exceed the TPH screening criteria for groundwater at the northern side of the Redcar works (Score 3, Table 17). Groundwater flow from this area is predominantly in the direction of the South Gare and Coatham Sands SSSI.

- *The SLEMS area*; PAHs, and BTEX exceeded the Tier 1 soil screening criteria and TPHs and BTEX were also exceeded for groundwater in this area (Score 3, Table 17). This is due to the area being used as a treatment area for surface water prior to consented discharge in the River Tees.

- *The western side of the By Products area near the benzol tanks.* Concentrations of hydrocarbon compounds were in excess of screening criteria for soils (PAH, BTEX Compounds) (Score 3, Table 17). Additionally groundwater samples were in excess of screening values for BTEX, PAH, GRO and TPH (Score 3, Table 17). Visual and olfactory evidence of heavy hydrocarbon contamination were also noted at a number of exploratory locations in this area.

Table 17 **Summary of Tier 1 Screening for Soil and Groundwater at Redcar, Lackenby and Cleveland Works**

	Site	Area	Operations	pH	Sulphide and Sulphate		Toxic Metals						Phytotoxic Metals				Cyanide	Organics				
				pH	Sulphide	Sulphate	Arsenic	Cadmium	Chromium	Lead	Mercury	Selenium	Copper	Nickel	Zinc	Boron	Total Cyanide	TPH	GRO	PAH	BTEX	Phenol Index
Soil	Redcar Works	11	Former Warrenby Works	3	2	2	1	1	1	2	1	1	1	1	2	2	1	1	1	2	1	1
		12	Power Station and Surrounding Areas	3	3	2	1	1	1	1	1	1	1	1	2	1	1	1	1	2	1	1
		13	Sinter Plant	3	2	3	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1
		14	Blast Furnace	3	3	3	1	1	1	2	1	1	1	1	2	1	1	1	1	2	2	1
		15	Raw Coal and Ore Stocking Areas	3	2	3	1	1	1	2	1	1	2	1	2	2	1	1	1	2	2	1
		16	Coke Ovens	3	3	2	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1
		17	By-Products	3	2	2	1	1	1	2	1	1	2	1	2	2	1	1	1	2	1	1
	Lackenby Works	7	Concast and BOS Plant	3	2	2	1	1	1	2	1	1	2	1	2	2	1	1	1	2	1	1
		8	No. 2 Primary Mill	3	3	2	1	1	1	1	1	1	1	1	1	2	1	1	1	2	1	1
		G	Iron Granulation and Loco Repair Shop	3	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1
	Cleveland Works	1	By-Products Plant and Coke Ovens	3	3	2	1	1	1	1	1	1	1	1	2	1	1	1	1	3	1	1
		2	By-Products Plant	2	3	2	1	1	1	2	1	1	1	1	3	2	1	2	1	3	3	1
		3	Fuel Oil Storage Area next to Dolphin Wharfe	3	3	3	1	1	1	1	1	1	1	1	2	3	1	2	1	3	2	1
		4	SLEMS Area	3	2	3	1	1	1	3	1	1	2	1	3	3	1	2	1	3	3	1
		D	Western side of Pig Caster	3	3	3	1	1	1	2	1	1	2	1	3	2	1	1	1	2	2	1
		E	Tarmac and Wharfe Area	3	3	3	1	1	1	2	1	1	1	1	3	3	1	1	1	2	2	1
		H	Torpedo and Ladle Repair Shop	3	3	1	1	1	1	2	1	1	1	1	2	1	1	1	1	1	1	1
Groundwater and Surface Water			Redcar GW. Area 11,12,13,14,15,16,17	2	1	3	2	1	2	1	1	2	3	1	1	2	3	3	1	1	1	1
			Lackenby GW. Area 7,8,G	2	1	3	1	1	2	1	1	2	3	1	1	1	2	2	1	1	1	2
			Cleveland GW. Area 1,2,3,4, D,H	2	1	3	3	1	1	2	1	2	3	1	1	3	3	3	3	3	3	1
		F	SW. South Gare & Coatham Sands SSSI	2	1	3	1	1	1	1	1	2	3	1	1	1	1	1	1	1	1	1

Key	
1	95th percentile does not exceed Tier 1 screening criteria, no localised exceedences of Tier 1 screening criteria
2	95th percentile does not exceed Tier 1 screening criteria, some localised exceedances of Tier 1 screening criteria
3	95th percentile exceeds Tier 1 screening criteria
GW	Groundwater
SW	Surface water
TPH	Total Petroleum Hydrocarbons
GRO	Gasoline Range Organics
PAH	Polyaromatic Hydrocarbons
BTEX	Benzene, Toluene, Ethylbenzene, Xylene

References:

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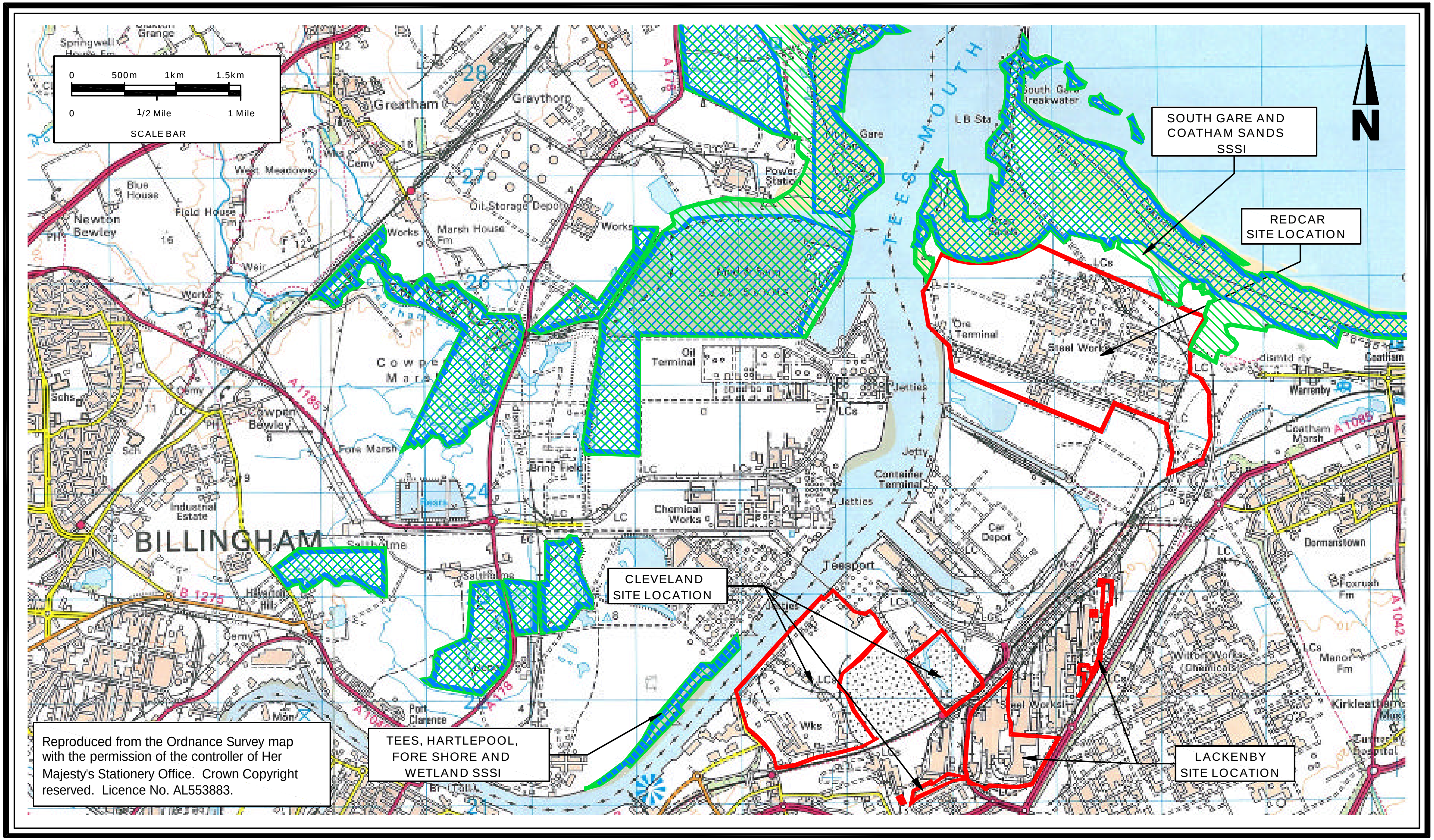
[1] British Geological Survey, 1:50,000 Sheet 33 Stockton (Solid & Drift).
[2] British Geological Survey, 1:50:000 Sheet 34 Guisborough (Solid & Drift).
[3] Environment Agency, Groundwater Vulnerability 1:100,000 map series, Sheet 5, Tyne & Tees.
[4] Corus, Site Condition Report. Corus Construction & Industrial – Teesside Installation, Supplementary Phase 1 Report, 31th March 2003.
[5] DEFRA and the Environment Agency, March 2002, Contaminated Land Reports CLR7 to 10
[6] Ministry of Housing, Spatial Planning and the Environment (VROM), February 4th , 2000 ANNEXES Circular on target values and intervention values for soil remediation
[7] Environment Agency, 1999, Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources, R&D Publication 20

FIGURES

Figure 1a Site Location Plan, Teesside

Ref: I:\DG\CADTEAM\new-cans\CO052\0017a\ Plot date: Jun 22, 2004 - 10:41am File name: JSF1824.dwg



KEY:

🟥	Site Boundarys
▨	Ramsar Boundary
▨	SSSI Boundary

CORUS

ENVIROS

SCALE 1:50,000

CAN CO0520017A

CONTENT RLP

DRAWN JSF

CHECKED

DATE JUNE 2004

CORUS TEESSIDE

FIGURE 1A

SITE LOCATION PLAN, TEESSIDE

Figure 1b Enviros Sampling Areas and Boundaries Between Corus and Proposed Teesco

Area	Operations
	REDCAR
11	Former Warrenby Works
12	Power Station and Surrounding Areas
13	Sinter Plant
14	Blast Furnace
15	Raw Coal and Ore Stocking Area
16	Coke Ovens
17	By-Products
F	South Gare and Coatham sands SSSI*
	LACKENBY
7	Concast and Bos Plant
8	No. 2 Primary Mill
G	Iron Granulation and Loco Repair Shop
	CLEVELAND
1	By-products Plant and Coke Ovens
2	By-products Plant
3	Fuel Oil Storage Area Next to Dolphin Wharfe
4	SLEMS Area
D	Western Side of Pig Caster
E	Tarmac and Wharfe Area
H	Torpedo and Ladle Repair Shop

NOTE:

1. Stores building to be maintained Through agreements
2. Based upon drawing Number A119972e supplied by Corus

KEY:

🟨	Redcar	🟩	Corus Retains	🟪	Teesco Own. Long Term Lease to Corus
🟦	Cleveland	🟥	Proposed Teesco		
🟩	Lackenby	🟦	Corus Own. Long Term Lease to Teesco		

CORUS

ENVIROS

SCALE SEE SCALE BAR	*CAN* CO0520017A
CONTENT RLP	*DRAWN* JSF
CHECKED	*DATE* JUNE 2004

CORUS TEESSIDE

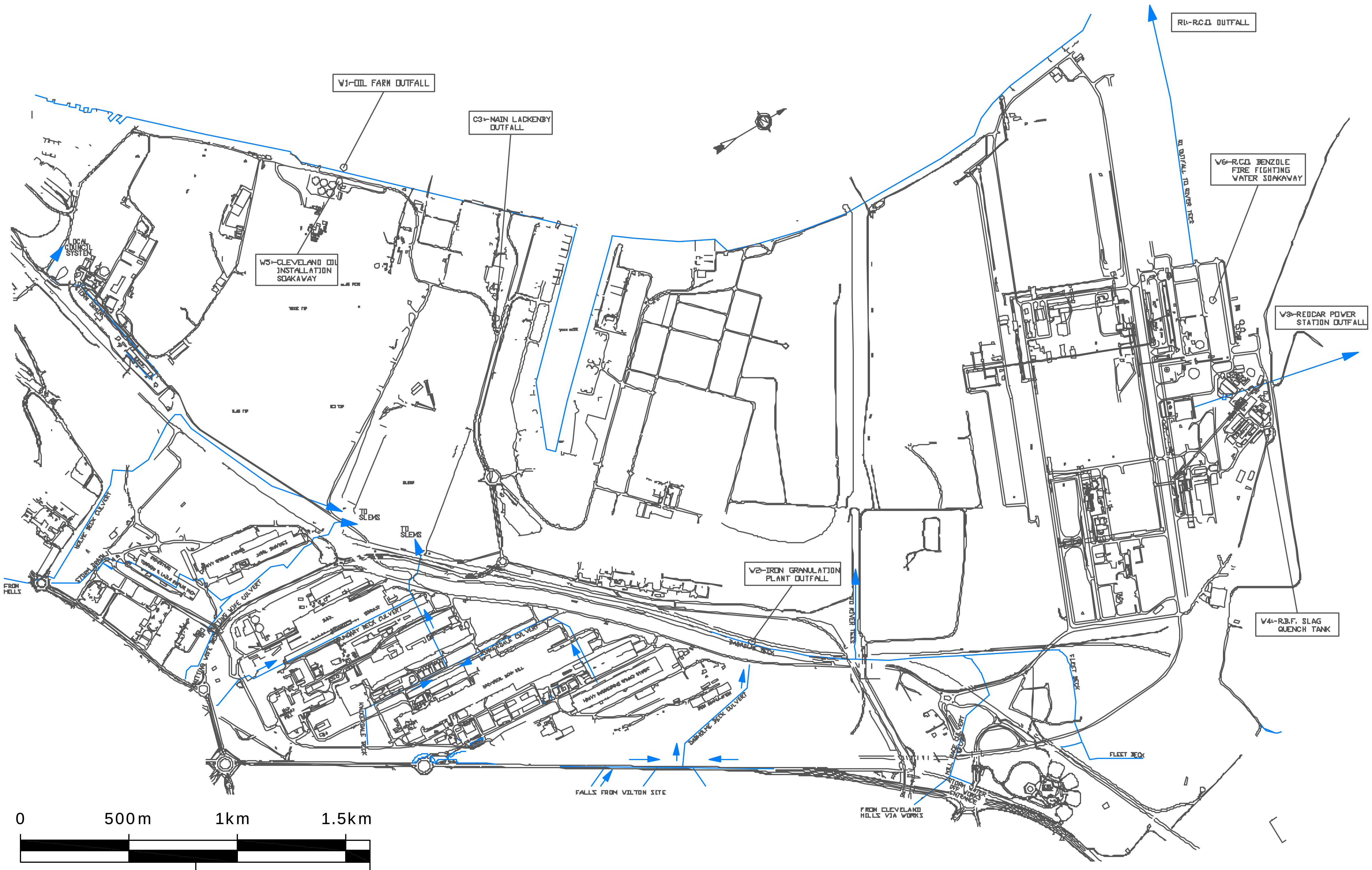
FIGURE 1B

ENVIROS SAMPLING AREAS AND BOUNDARIES BETWEEN CORUS AND TEESCO

Ref: I:\DG1\CADTEAM\new-cans\CO052\0017a\   Plot date: Jun 18, 2004 - 2:39pm   File name: JSF1837.dwg

Figure 2 Site Drainage Plan.

File name: JSF1835.dwg Plot date: Jun 22, 2004 - 10:43am Ref: I:\DG\CADTEAM\new-cans\CO052\0017a\



0 500m 1km 1.5km

0 ½ Mile 1 Mile

SCALE BAR

NOTE:

1. Based upon drawing Number A118726b supplied by Corus

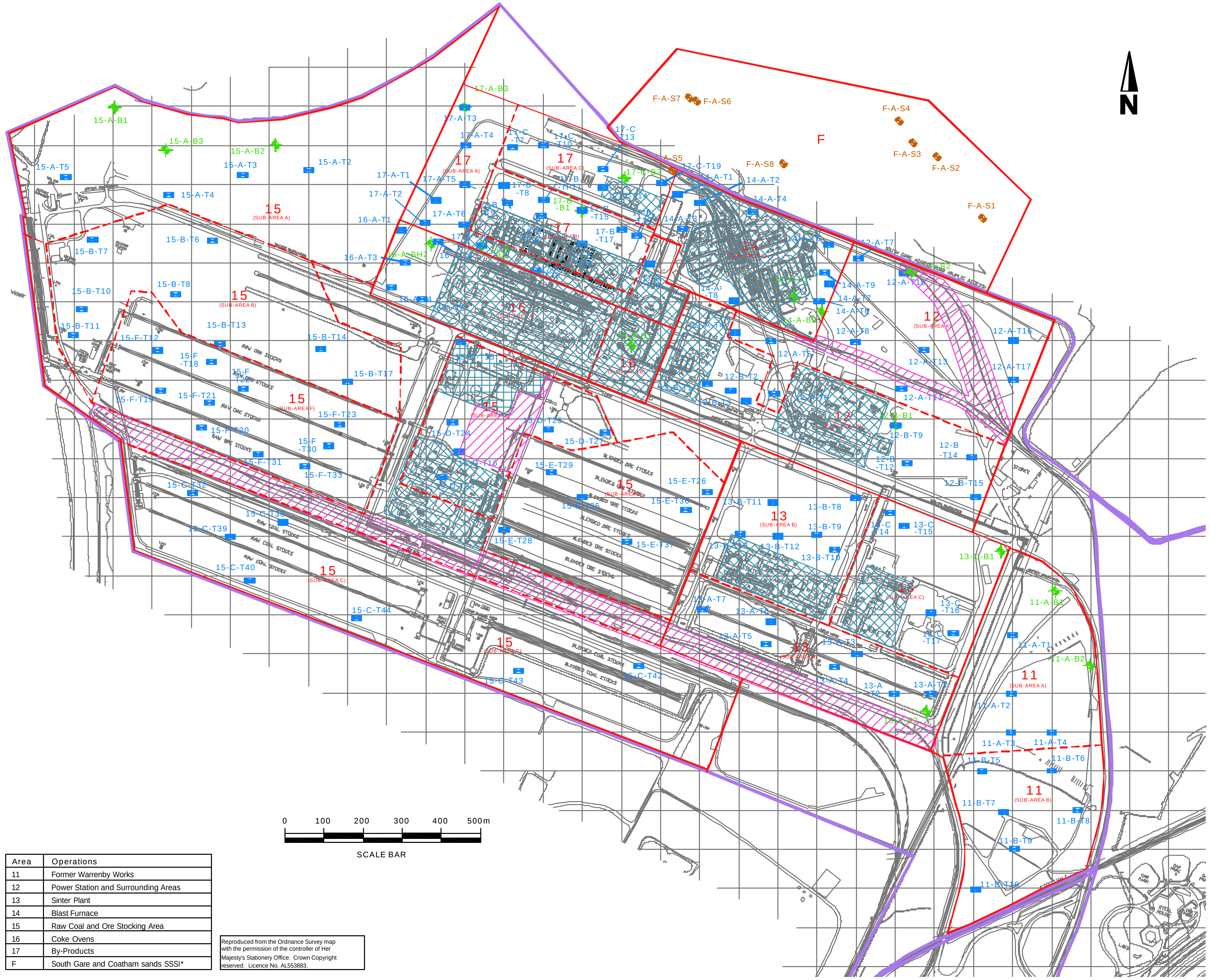
KEY:

CORUS

ENVIROS

SCALE SEE SCALE BAR	*CAN* CO00520017A		CORUS TEESSIDE
CONTENT RLP	*DRAWN* JSF		FIGURE 2 SITE DRAINAGE PLAN
CHECKED	*DATE* JUNE 2004		

Figure 3 Exploratory Hole Location Plan, Redcar



Area	Operations
11	Former Warrenby Works
12	Power Station and Surrounding Areas
13	Sinter Plant
14	Blast Furnace
15	Raw Coal and Ore Stocking Area
16	Coke Ovens
17	By-Products
F	South Gare and Coatham sands SSSI*

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KEY:

▬	Proposed Teesco Boundaries
- - -	Enviros Sampling Boundaries
✚	Borehole
●	Surface Water
▬	Trial Pit
▩	Area of Plant
▨	Area of Mobile Tools

NOTES:

1. Shaded zones indicate larger areas not accessible for sampling. Selected locations chosen on the the basis on Enviros sampling criteria and Corus health and safety considerations.

REV.	*DESCRIPTION*	*DATE*

CORUS

REDCAR

FIGURE 3

EXPLORATORY HOLE LOCATION PLAN

SCALE 1:6,500	*CAN* CO0520017A
CONTENT RLP	*DRAWN* JSF
CHECKED	*DATE* JUNE 2004

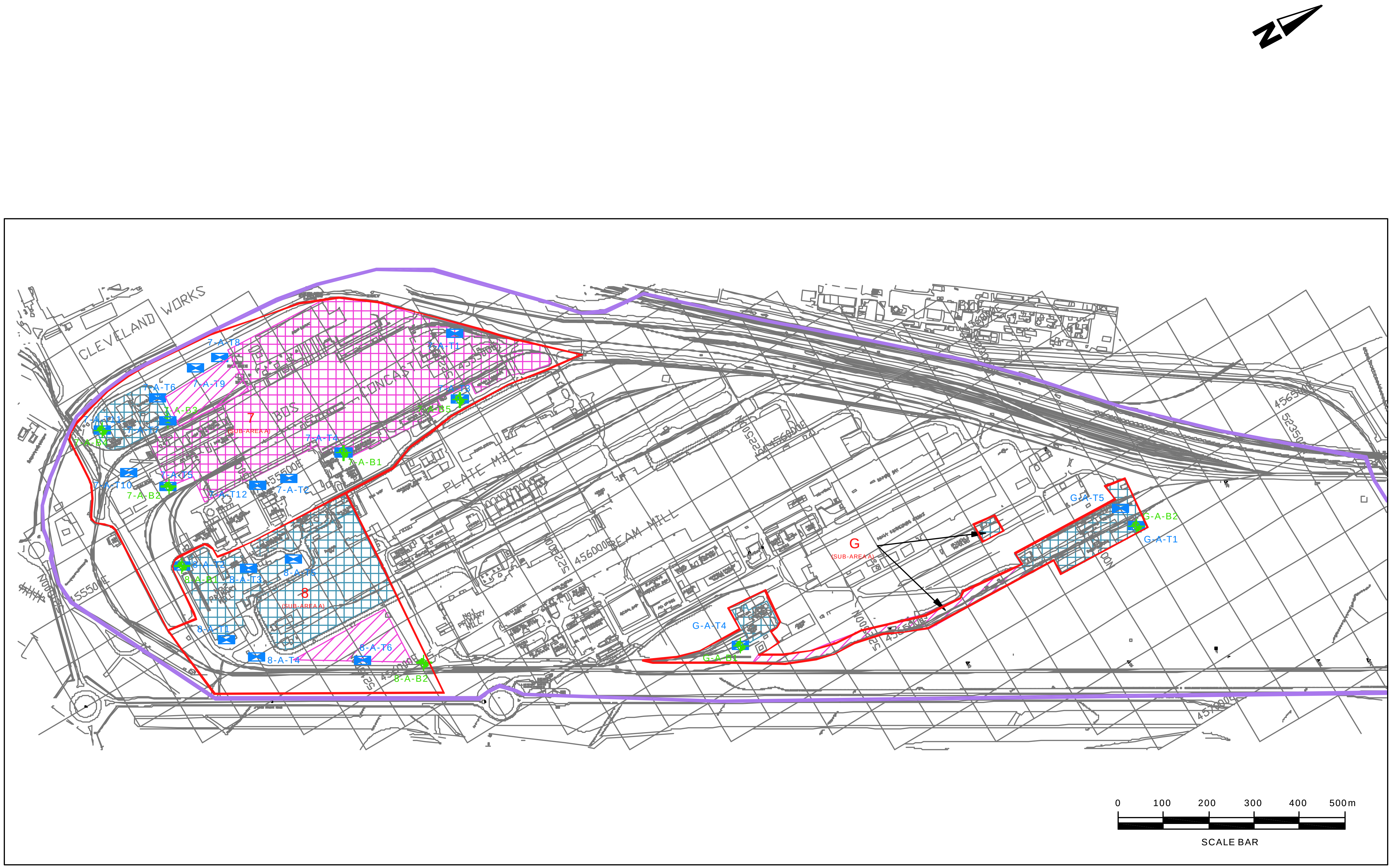
ENVIROS

Ref: I: \DG\CADTEAM \new-cans \CO052\0017a\

Plot date: Jun 22, 2004 - 10:44am

File name: JSF1823.dwg

Figure 4 Exploratory Hole Location Plan, Lackenby



KEY:

▬ Proposed Teesco Boundaries

▬ Enviros Sampling Boundaries

✦ Borehole

⊠ Trial Pit

▩ Area of Plant

▩ Area of Plant, Buildings and Mobile Tools

▨ Area of Mobile Tools and Stockpiles

NOTES:

1. Shaded zones indicate larger areas not accessible for sampling. Selected locations chosen on the the basis on Enviros sampling criteria and Corus health and safety considerations.

REV.	*DESCRIPTION*	*DATE*

CORUS

LACKENBY

FIGURE 4

EXPLORATORY HOLE LOCATION PLAN

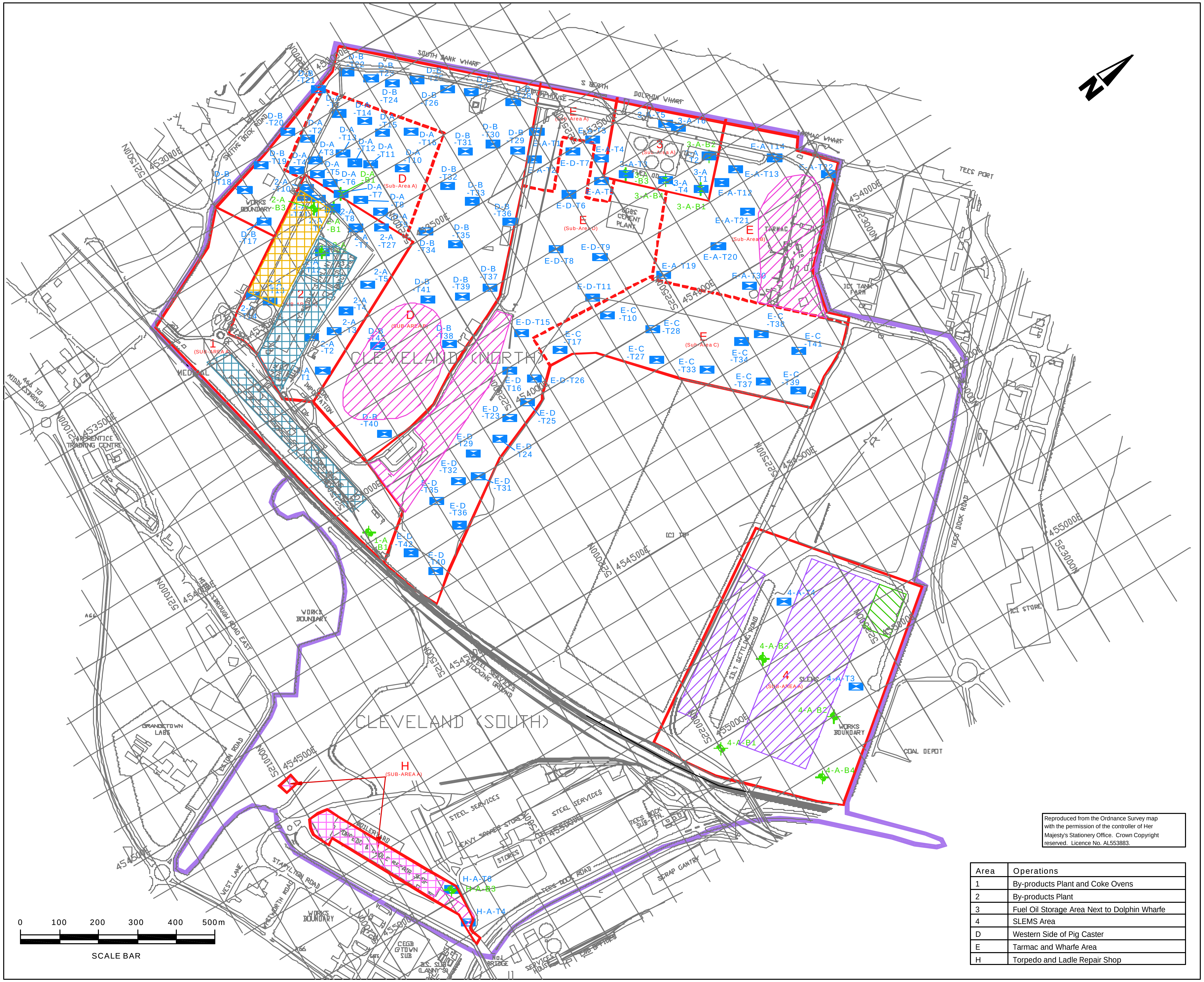
SCALE 1:6,500	*CAN* CO0520017A
CONTENT RLP	*DRAWN* JSF
CHECKED	*DATE* JUNE 2004

ENVIROS

Area	Operations
7	Concast and Bos Plant
8	No. 2 Primary Mill
G	Iron Granulation and Loco Repair Shop

File name: JSF1829.dwg Plot date: Jun 22, 2004 - 10:46am Ref: I:\DG\CADTEAM\new-cans\CO052\0017a\

Figure 5 Exploratory Hole Location Plan, Cleveland



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Area	Operations
1	By-products Plant and Coke Ovens
2	By-products Plant
3	Fuel Oil Storage Area Next to Dolphin Wharfe
4	SLEMS Area
D	Western Side of Pig Caster
E	Tarmac and Wharfe Area
H	Torpedo and Ladle Repair Shop

Ref: I:\DG\CADTEAM\new-cars\CO052\0017a\
Plot date: Jun 22, 2004 - 10:48am
File name: JSF1826.dwg
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KEY:

▬	Proposed Teesco Boundaries
╌	Enviros Sampling Boundaries
⊕	Borehole
⊠	Trial Pit
▨	Area of Plant
▨	Area of Plant, Buildings and Mobile Tools
▨	Area of Mobile Tools and Stockpiles
▨	Access Constricted
▨	Above ground services
▨	Concrete Hardstanding

NOTES:

REV. DESCRIPTION DATE

CORUS

CLEVELAND

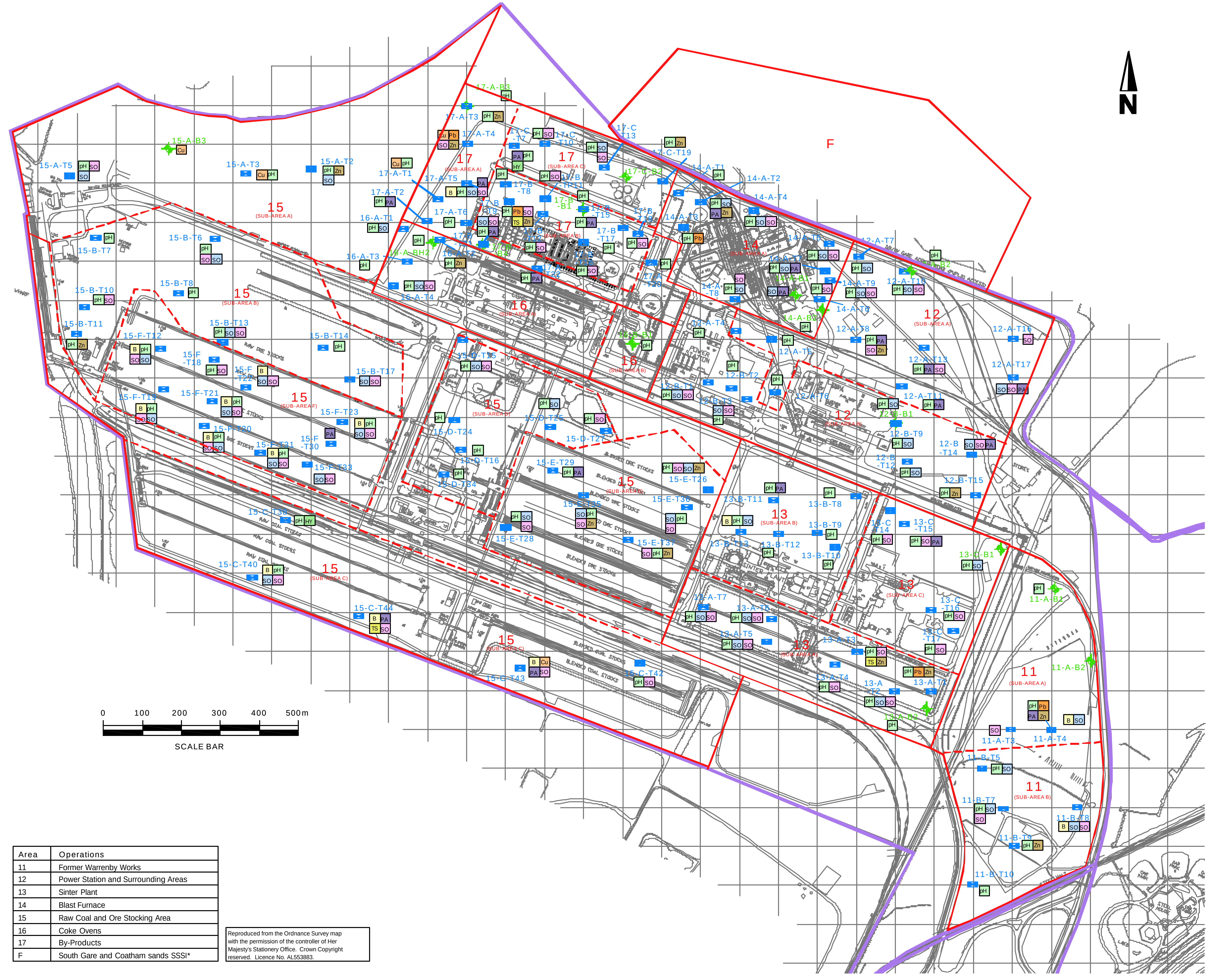
FIGURE 5

EXPLORATORY HOLE LOCATION PLAN

SCALE 1:6,500	CAN CO0520017A
CONTENT RLP	DRAWN JSF
CHECKED	DATE JUNE 2004

ENVIROS

Figure 6 Exceedance of Tier 1 Soil Screening Criteria, Redcar



Area	Operations
11	Former Warrenby Works
12	Power Station and Surrounding Areas
13	Sinter Plant
14	Blast Furnace
15	Raw Coal and Ore Stocking Area
16	Coke Ovens
17	By-Products
F	South Gare and Coatham sands SSSI*

KEY:

▬	Proposed Teesco Boundaries
- - -	Enviros Sampling Boundaries
✚	Borehole
▬	Trial Pit

B	Boron	ESV 3mg/kg
Cu	Copper	DIV 190mg/kg
HY	Total Petroleum Hydrocarbons (C8-C37)	DIV 5,000mg/kg
PA	PAH Total EPA16	DIV 40mg/kg
Pb	Lead	CLEA 750mg/kg
pH	pH	<5 or >10 pH
SO	Acid Soluble Sulphide	ESV 1,000mg/kg
SO	Water Soluble Sulphate as SO	BRE 1,200mg/kg
TS	Total Sulphur	ESV 20,000mg/kg
Zn	Zinc	DIV 720mg/kg

CLEA - Industrial Guidance Limits
DIV - Dutch Intervention Value
ESV - Enviros Screening Value

NOTES:

1. Locations only shown where exceedances have occurred

REV. *DESCRIPTION* *DATE*

CORUS

REDCAR

FIGURE 6

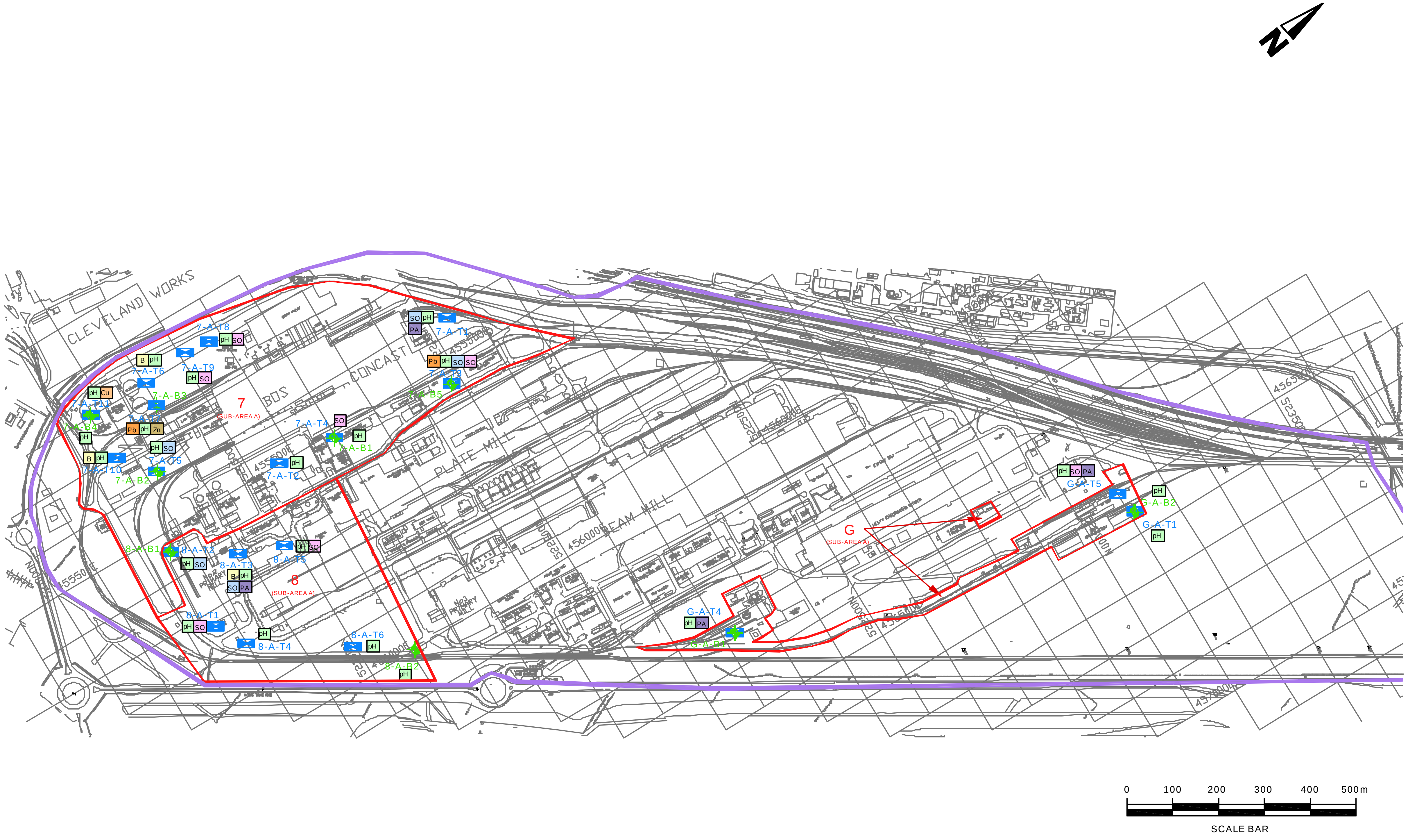
EXCEEDANCE OF TIER 1 SOIL SCREENING CRITERIA

SCALE	1:6,500	*CAN*	CO0520017A
CONTENT	RLP	*DRAWN*	JSF
CHECKED		*DATE*	JUNE 2004

ENVIROS

File name: JSF1822.dwg Plot date: Jun 22, 2004 - 10:49am Ref: I: \DG\CADTEAM \new-cans \CO052\0017a\

Figure 7 Exceedance of Tier 1 Soil Screening Criteria, Lackenby



KEY:

Proposed Teesco Boundaries

Enviros Sampling Boundaries

Borehole

Trial Pit

B	Boron	ESV 3mg/kg
Cu	Copper	DIV 190mg/kg
PA	PAH Total EPA16	DIV 40mg/kg
Pb	Lead	CLEA 750mg/kg
pH	pH	<5 or >10 pH
SO	Acid Soluble Sulphide	ESV 1,000mg/kg
SO	Water Soluble Sulphate as SO	BRE 1,200mg/kg
Zn	Zinc	DIV 720mg/kg

CLEA - Industrial Guidance Limits
DIV - Dutch Intervention Value
ESV - Enviros Screening Values

NOTES:

1. Locations only shown where exceedances have occurred

REV. *DESCRIPTION* *DATE*

CORUS

LACKENBY

FIGURE 7

EXCEEDANCE OF TIER 1 SOIL SCREENING CRITERIA

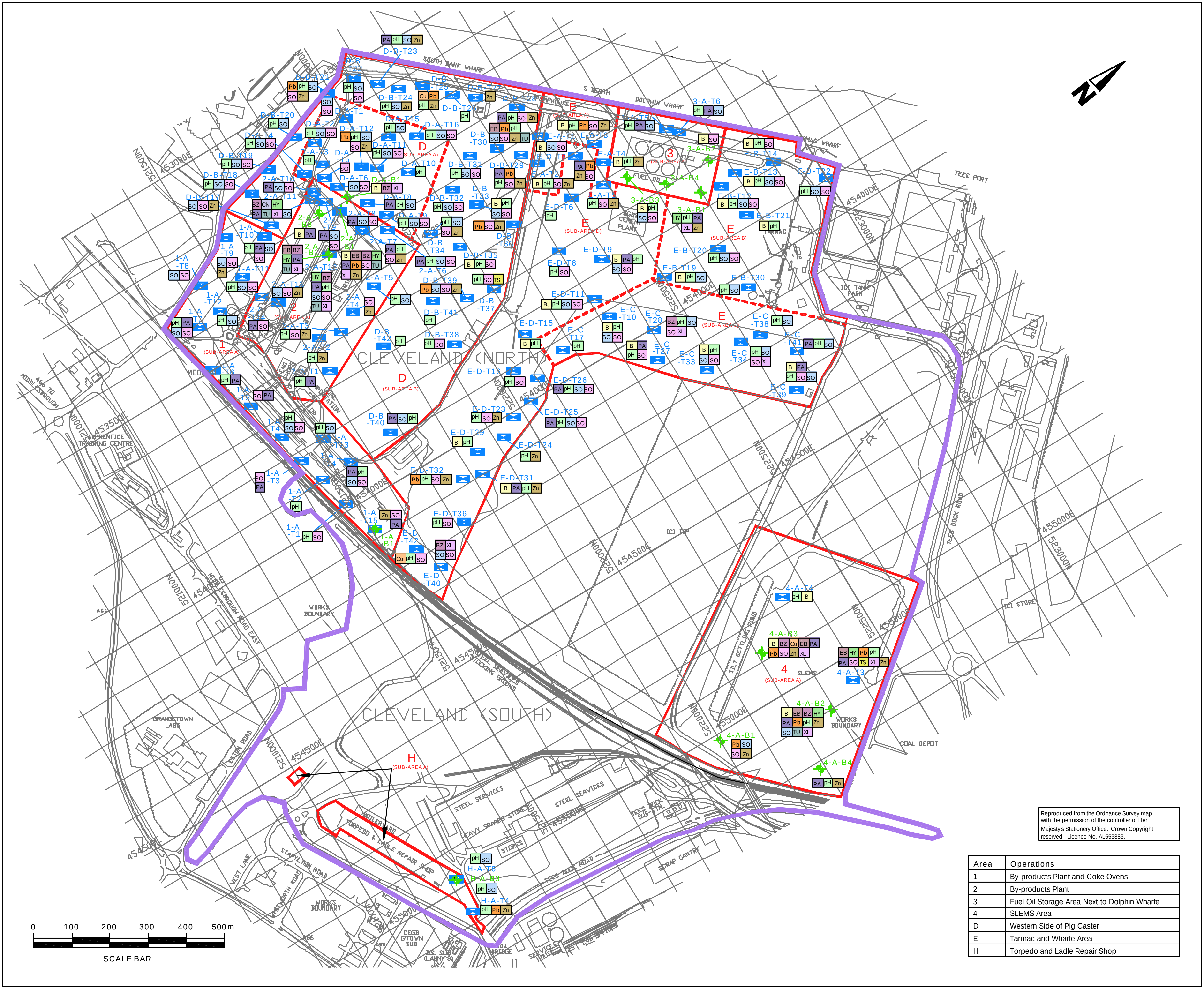
SCALE 1:6,500	*CAN* CO0520017A
CONTENT RLP	*DRAWN* JSF
CHECKED	*DATE* JUNE 2004

ENVIROS

Area	Operations
7	Concast and Bos Plant
8	No. 2 Primary Mill
G	Iron Granulation and Loco Repair Shop

File name: JSF1830.dwg Plot date: Jun 22, 2004 - 10:50am Ref: I:\DG\CADTEAM\new-cans\CO052\0017a\

Figure 8 Exceedance of Tier 1 Soil Screening Criteria, Cleveland



KEY:

▬ Proposed Teesco Boundaries

Enviros Sampling Boundaries

Borehole

Trial Pit

B	Boron	ESV 3mg/kg
Cu	Copper	DIV 190mg/kg
PA	PAH Total EPA16	DIV 40mg/kg
Pb	Lead	CLEA 750mg/kg
pH	pH	<5 or >10 pH
TS	Total Sulphur	ESV 20,000mg/kg
SO	Acid Soluble Sulphide	ESV 1,000mg/kg
SO	Water Soluble Sulphate as SO	BRE 1,200mg/kg
Zn	Zinc	DIV 720mg/kg

CLEA - Industrial Guidance Limits
DIV - Dutch Intervention Value
ESV - Enviros Screening Value

NOTES:

1. Locations only shown where exceedances have occurred

REV. DESCRIPTION DATE

CORUS

CLEVELAND

FIGURE 8

EXCEEDANCE OF TIER 1 SOIL SCREENING CRITERIA

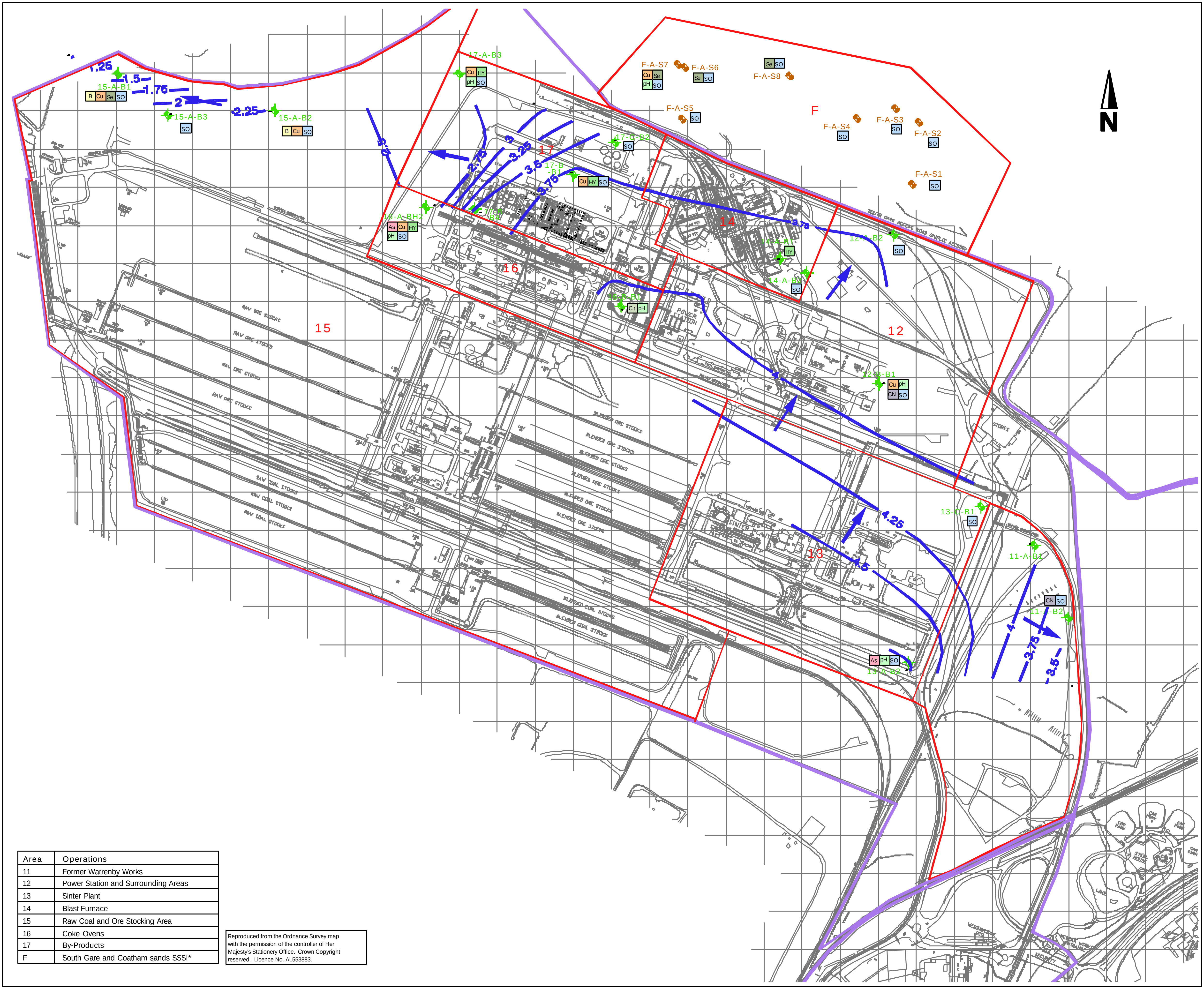
Area	Operations
1	By-products Plant and Coke Ovens
2	By-products Plant
3	Fuel Oil Storage Area Next to Dolphin Wharfe
4	SLEMS Area
D	Western Side of Pig Caster
E	Tarmac and Wharfe Area
H	Torpedo and Ladle Repair Shop

SCALE 1:6,500
CAN CO0520017A
CONTENT RLP
DRAWN JSF
CHECKED
DATE JUNE 2004

ENVIROS

File name: JSF1827.dwg Plot date: Jun 22, 2004 - 10:52am Ref: I:\DG\CADTEAM\new-cans\CO052\0017a\

Figure 9 Groundwater Flow Direction and Exceedance of Tier 1 Water Screening Criteria, Redcar



Area	Operations
11	Former Warrenby Works
12	Power Station and Surrounding Areas
13	Sinter Plant
14	Blast Furnace
15	Raw Coal and Ore Stocking Area
16	Coke Ovens
17	By-Products
F	South Gare and Coatham sands SSSI*

KEY:

▬	Proposed Teesco Boundaries
▬	Enviros Sampling Boundaries
⌒	Groundwater Contour
➡	Direction of Groundwater
✚	Borehole
●	Surface Water

As	Arsenic	UKDWS 0.01mg/l
B	Boron	UKDWS 1mg/l
CN	Total Cyanide	UKDWS 0.05mg/l
Cu	Copper	UKDWS 0.002mg/l
Cr	Chromium	UKDWS 0.002mg/l
HY	Total Petroleum Hydrocarbons GC	DIV 0.6mg/l
pH	pH	UKDWS <6.5 or >10
Se	Selenium	UKDWS 0.01mg/l
SO	Total Sulphur as SO_4	UKDWS 250mg/l

DIV - Dutch Intervention Value

UKDWS - United Kingdom Drinking Water Standard

NOTES:

1. Locations only shown where exceedance have occured.

REV. *DESCRIPTION* *DATE*

CORUS

REDCAR

FIGURE 9

EXCEEDANCE OF TIER 1 WATER SCREENING CRITERIA AND GROUNDWATER FLOW DIRECTION

SCALE 1:6,500	*CAN* CO0520017A
CONTENT RLP	*DRAWN* JSF
CHECKED	*DATE* JUNE 2004

ENVIROS

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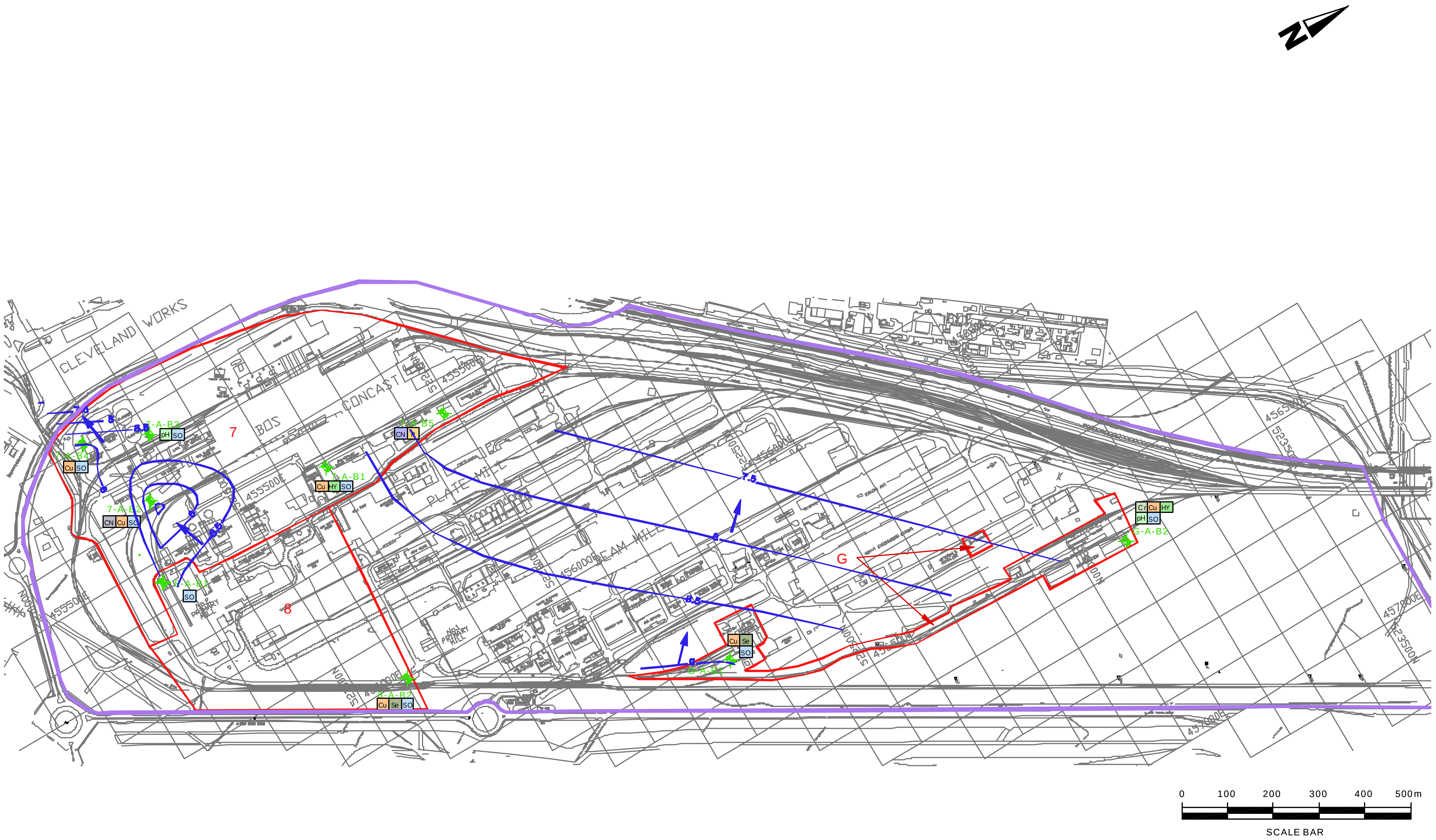
File name: JSF1825.dwg Plot date: Jun 22, 2004 - 10:51am Ref: I: \DG\CADTEAM \new-cans \CO052\0017a\

Figure 10 Groundwater Flow Direction and Exceedance of Tier 1 Water Screening Criteria, Lackenby



KEY:

Proposed Teesco Boundaries

Enviros Sampling Boundaries

Groundwater Contour

Direction of Groundwater

Borehole

CN	Total Cyanide	UKDWS 0.05mg/l
CN	Free Cyanide	UKDWS 0.05mg/l
Cu	Copper	UKDWS 0.002mg/l
Cr	Chromium	UKDWS 0.002mg/l
HY	Total Petroleum Hydrocarbons GC	DIV 0.6mg/l
pH	pH	UKDWS <6.5 or >10
P	Phenol Index	DIV 2mg/l
Se	Selenium	UKDWS 0.01mg/l
SO	Total Sulphur as SO 4	UKDWS 250mg/l

DIV - Dutch Intervention Value
UKDWS - United Kingdom Drinking Water Standard

NOTES:

1. Locations only shown where exceedances have occurred

REV.	*DESCRIPTION*	*DATE*

CORUS

LACKENBY

FIGURE 10

EXCEEDANCE OF TIER 1 WATER SCREENING CRITERIA AND GROUNDWATER FLOW DIRECTION

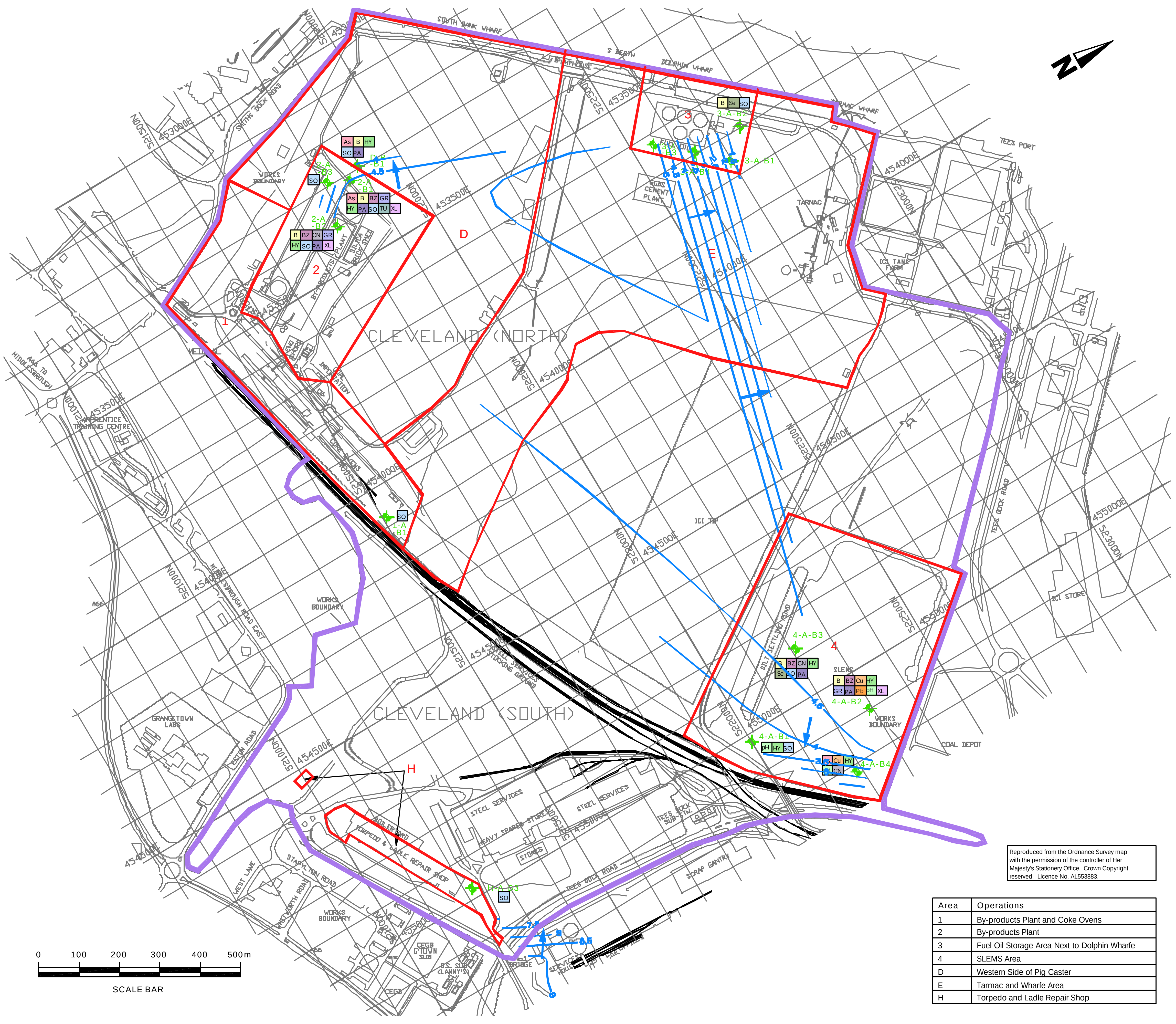
SCALE 1:6,500	*CAN* CO0520017A
CONTENT RLP	*DRAWN* JSF
CHECKED	*DATE* JUNE 2004

ENVIROS

Area	Operations
7	Concast and Bos Plant
8	No. 2 Primary Mill
G	Iron Granulation and Loco Repair Shop

Ref: I: \DG\CADTEAM \new-cans \CO052\0017a\
Plot date: Jun 22, 2004 - 10:53am
File name: JSF1836.dwg

Figure 11 **Groundwater Flow Direction and Exceedance of Tier 1 Water Screening Criteria, Cleveland**



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Area	Operations
1	By-products Plant and Coke Ovens
2	By-products Plant
3	Fuel Oil Storage Area Next to Dolphin Wharfe
4	SLEMS Area
D	Western Side of Pig Caster
E	Tarmac and Wharfe Area
H	Torpedo and Ladle Repair Shop

KEY:

- Proposed Teesco Boundaries
- Enviros Sampling Boundaries
- Groundwater Contour
- Direction of Groundwater
- Borehole

As	Arsenic	UKDWS 0.01mg/l
B	Boron	UKDWS 1mg/l
BZ	Benzene	UKDWS 1mg/l
CN	Total Cyanide	UKDWS 0.05mg/l
Cu	Copper	UKDWS 0.002mg/l
GR	Gasoline Range Organics	DIV 0.6mg/l
HY	Total Petroleum Hydrocarbons GC	DIV 0.6mg/l
PA	PAH Total EPA16	DIV 0.8mg/l
Pb	Lead	UKDWS 0.025mg/l
pH	pH	UKDWS <6.5 or >10
Se	Selenium	UKDWS 0.01mg/l
SO	Total Sulphur as SO_4	UKDWS 250mg/l
TU	Toluene	DIV 1000 ug/l
XL	Xylenes	DIV 70 ug/l

DIV - Dutch Intervention Value
UKDWS - United Kingdom Drinking Water Standard

NOTES:

1. Locations only shown where exceedances have occurred

REV. *DESCRIPTION* *DATE*

CORUS

CLEVELAND

FIGURE 11

EXCEEDANCE OF TIER 1 WATER SCREENING CRITERIA AND GROUNDWATER FLOW DIRECTION

SCALE 1:6,500	*CAN* CO0520017A
CONTENT RLP	*DRAWN* JSF
CHECKED	*DATE* JUNE 2004

ENVIROS

File name: JSF1838.dwg Plot date: Jun 22, 2004 - 10:55am Ref: I: \DG\CADTEAM \new-cans \CO052\0017a\

CORUS UK Ltd

Soil and Groundwater Baseline Characterisation Study

Teesside Works

Interpretive Report

Volume 2 of 3

June 2004

Redcar

Lackenby

Cleveland

corus

ENVIROS

QUALITY CONTROL SHEET

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APPENDICES

1. INTRODUCTION

1.1 Background

Corus are seeking to sell the majority of their landholding at the Teesside Works to a Joint Venture (JV) company[1]. The layout of the site and its surrounds and the extent of the Corus landholding is shown in Figures 1a and 1b. Enviros were instructed by Corus in April 2004 to carry out a baseline soil and groundwater quality assessment on those parts of the site included in the sale package.

Our assessment has been completed in accordance with our letter to Corus of 8th April 2004 (Ref. CO0520017p/mmcd/cons#1) and has been undertaken using an amended form of Corus Conditions of Contract for Professional Services (CC11) agreed between Enviros and Corus.

1.2 Objectives

The overall objective of this study has been to establish a baseline for soil and groundwater conditions across the Teesside Works. Based on the findings of our investigation an evaluation of environmental risks linked to identified soil and groundwater conditions has also been completed.

Our risk assessment has been completed on the basis that the Works will continue to be used for steelmaking purposes in its current form following transfer of the landholding to the JV Company. As such the assessment has not considered any form of future redevelopment of the site, or possible future change in land use.

1.3 Approach

In completing the baseline assessment the JV landholding has been divided into three sites (Redcar, Lackenby and Cleveland). For the purposes of the investigation, each of the three sites was further divided into sub-areas, each of which typically comprised an operational facility.

The risk assessment has been completed through consideration of each of the three sites separately. Risks arising from identified soil and groundwater conditions have been assessed using current UK guidance, which in this case has involved development of a conceptual model for the three sites representing the relationship between contamination source areas, migration pathways and receptors. Further details on the risk assessment methodology used is given in Appendix A.

1.4 Investigation Limitations

The investigation has been designed to provide broad characterisation of soil and groundwater conditions across each of the three sites. Areas likely to be impacted by contamination were targeted prior to commencement of investigation activities.

In addition, operational, infrastructure and access related issues in areas of plant limited accessibility in certain areas of the sites. Project timescales also allowed for only one round of groundwater sampling.

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[1] The extent of Corus landholding that will be transferred to the JV Company is defined on Corus Drawing No. A-119972.

1.5 Investigation Summary

Our investigation has comprised the following key activities:

1. Completion of a desk study involving a site reconnaissance visit, meeting with key Corus staff and review of information held by Corus, in particular the findings of an internal PPC report;

2. Site investigation comprising excavation of 264 trial pits and advancing 42 boreholes, with subsequent conversion to groundwater monitoring wells;

3. Soil and groundwater sampling and chemical testing of recovered soil and water samples for a comprehensive contaminant suite.

4. Baseline characterisation of soil and groundwater conditions across the works; and, review of chemical testing data against Tier 1 screening values[2] and completion of a qualitative risk assessment.

A summary of the investigation scope is provided in Table 1.

Table 1 Excavations and Boreholes Undertaken at Corus Teesside.

Site	Area	Operations	Area size (ha)	No. Trial Pits	No. Boreholes
Redcar Works	11	Former Warrenby Works	27	9	2
	12	Power Station and Surrounding Areas	42	17	2
	13	Sinter Plant	42	17	2
	14	Blast Furnace	12	9	2
	15	Raw Coal and Ore Stocking Areas	176	41	3
	16	Coke Ovens	15.5	5	2
	17	By-Products	25	22	3
	F	South Gare and Coatham Sands SSSI*	24.5		[3]
Lackenby Works	7	Concast and BOS Plant	36	12	5
	8	No. 2 Primary Mill	16.1	6	2
	G	Iron Granulation and Loco Repair Shop	4.66	4	2
Cleveland Works	1	By-Products Plant and Coke Ovens	13.9	15	1
	2	By-Products Plant	14.6	14	3
	3	Fuel Oil Storage Area next	3.2	6	6[4]

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[2] Screening criteria for soils have included published UK CLEA Soil Guideline Values and where values are not available for certain contaminants use has been made of Dutch Intervention Values (DIV) or internal Enviros guideline values. For water samples screening criteria have been based on the use of UK Drinking Water Guidelines and where values are not available DIVs. It is recognised that comparison against stringent Drinking Water Guidelines on an industrial complex such as the Teesside Works is a necessarily conservative approach.

[3] Eight surface water samples were taken in this area.

		to Dolphin Wharf			
	4	SLEMS Area	29	2	4
	D	Western side of Pig Caster	38	42	2[5]
	E	Tarmac and Wharf Area	36	41	-
	H	Torpedo and Ladle Repair Shop	3.4	2	1
Total			**560**	**264**	**42**

*The SSSI is located adjacent to Redcar Works and is analysed as part of the Redcar data set.

1.6 Previous Investigations

A number of previous site investigations have been undertaken at the Teesside Works mainly in relation to on-going development. These works are summarised within a Pollution Prevention and Control (PPC) report produced by Corus in 2003.

1.7 Report Structure

Information on identified soil and groundwater conditions is provided in our Volume 1 Factual Report. This Interpretative Report is presented as follows:

- Chapters 2, 3 and 4 present a summary of identified soil and groundwater conditions, a Conceptual Model identifying potential pollutant linkages and the findings of our Qualitative Risk Assessment for each of the three sites.

- Chapter 5 contains our conclusions relating to identified soil and groundwater conditions across the Teesside Works.

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[4] Two boreholes installed, four other attempts abandoned due to hard ground

[5] One borehole installed, one abandoned due to hard ground

2. REDCAR SITE - CONCEPTUAL MODEL AND RISK ASSESSMENT

2.1 Site Layout and History

2.1.1 Site Layout

Corus' Redcar site is located on a spur of land between the North Sea coast to the north-east and the River Tees estuary to the west. Extensive estuarine sands (Bran Sands) and the River Tees itself both abut onto the site. The sands of Tees Bay are separated from the site by a coastal wetland SSSI/Ramsar site[6]. The present steelworks at Redcar were constructed in the 1970's.

2.1.2 Site History

The Redcar site was originally developed between 1900 and 1914, when the Bran Sands area was reclaimed with steel slag and refractory materials. The "Warrenby Steelworks" and associated plate mills were then constructed in 1916 with steel manufacture commencing in 1917. In the 1970's the steelworks operation was replaced and significantly expanded with the construction of a marine ore reception terminal, ore unloading facilities, ore stockyard, blending facilities, sinter plant, pellet plant, coke ovens, blast furnace and power plant.

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[6] The SSSI is designated on the basis of the presence of dunes, little terns and colonies of orchids.

2.2 Summary of Ground Conditions

The Redcar Site is constructed on an area of reclaimed land comprising infilled material (Made Ground). Our site investigation encountered variable thicknesses of Made Ground across the site, which generally comprised reworked natural materials (clays etc) and a mixture of brick, slag and ash materials, which reached thicknesses of up to 10m. Made Ground appears to be thicker in the southern and eastern areas of the site and much shallower in the central northern areas.

Made Ground is underlain by variable thicknesses of unconsolidated alluvial deposits comprising sand and gravel deposits and estuarine clays. Fine to course grained alluvial sands were most commonly encountered during the investigation. Glacial till (or Boulder Clay) underlies these alluvial deposits at depth before rockhead is encountered comprising several hundred metres of predominantly mudstone horizons.

Groundwater was encountered across the site within the Made Ground and varied in elevation between c. 4.5m AOD in the south-eastern area of the site to 1.5m AOD in the north-western area near to the River Tees. Based on static levels recorded during our sampling visit groundwater appears to flow in a broad north, north-eastern and easterly and westerly direction across the Redcar Site. Based on our observations it is also possible that there is a mounding of groundwater in the central and southern portions of the site. this may be due to infiltration of surface water over relatively large areas of open permeable ground.

2.3 Soil and Groundwater Baseline Condition

2.3.1 Soil Quality

The investigation has identified fill material underlying the site with elevated concentrations of contaminants as shown in Figure 2 Elevated concentrations occur on a more widespread basis in the northern section of the site in Area 16 (Coke Ovens) and Area 17 (By Products Plant). In these areas toxic and phytotoxic metals, including lead, copper, zinc and boron, were found in excess of screening criteria. PAH concentrations were also elevated in soils from the eastern area of 12 (Power Station and surrounds), Area 14 (Blast Furnace) and Area 17 (By Products).

Evidence of hydrocarbon contamination in the form of strong odours and evidence of free product was identified within BH 14AB1 (located in the Blast Furnace Area) at depths from 3.4 to 5.5metres in Made Ground. In addition, hydrocarbon type odours were also noted in BH17AB3 at the base of the Made Ground in the northeast of the By Products Plant.

Alkaline soil pH, sulphide and sulphate levels were all elevated across the Redcar site reflecting the widespread presence of slag materials in the Made Ground fill.

2.3.2 Groundwater Quality

Site investigation locations where Tier 1 groundwater screening levels were exceeded are shown in Figure 3. Compared with UK Drinking Water Standards shallow groundwater beneath the site has widespread elevated concentrations of sulphate and cyanide in addition to isolated exceedances of heavy metallic contamination (principally copper). Total petroleum hydrocarbon (TPH) was also identified in excess of screening criteria in monitoring wells advanced in Areas 12, 14, 16 and 17 (Power Station, Blast Furnace, Coke Ovens and By-Products).

2.3.3 SSSI Water Quality

Surface water samples taken from the SSSI indicated elevated levels of sulphate and copper with sporadic elevated levels of selenium. No hydrocarbon contaminants were detected in surface water samples above screening levels.

2.4 Summary of site sensitivity

A summary of site sensitivity is provided below.

Groundwater – the alluvium in the vicinity of the site is classified as a Minor Aquifer by the Environment Agency. There are no licensed groundwater abstractions within 1km of the site and groundwater sensitivity is assessed as being ***low***.

Surface Water – the principal surface water feature is the adjacent River Tees (classified as a Class A watercourse under the CEWP[7] Scheme in the vicinity of Corus authorised discharges and towards the mouth of the estuary). There are no natural surface water features crossing the site and all surface water drains directly to ground and ultimately to the Tees. There are two authorised discharges from the works and two soakaways. Surface water sensitivity is assessed as being ***moderate***.

Ecology – the South Gare and Coatham Sands SSSI abuts part of the northern site boundary. The SSSI has been designated on the basis of the presence of sand dunes, little terns and orchid colonies. The majority of the SSSI is also designated a Ramsar site i.e. wetland of international importance. As the site borders an ecologically sensitive area the ecological sensitivity is assessed as being ***high***.

2.5 Conceptual Site Model

Our Conceptual Site Model for the Redcar Site is described below with a diagrammatic representation given in Figure 4.

2.5.1 Identified Sources

The following potential sources of contamination have been identified as being relevant to the site both from historic and current land use and also with respect to the use of adjoining land;

Historic

- Steel slag and refractory materials in Made Ground;
- Storage and use of oils, solvents and other hydrocarbons;
- Coal tar from gas producers;
- Coke, coal and iron ore stocking grounds.

Current

- Storage and use of oils, solvents and other hydrocarbons;

---

[7] Classification of Estuaries Working Party Classification Scheme.

- Coke, coal and iron ore stocking grounds;
- Steel slag and refractory materials in Made Ground.

2.5.2 Pathways & Receptors

Receptors relevant to the site and possible pathways are summarised as follows:

Identified Pathways

Potential environmental fate and exposure pathways specific to the site are:

- Direct contact, incidental ingestion / inhalation of hazardous materials;
- Migration of potential contaminants via permeable strata and site drainage.

Environmental Receptors

- Humans: site users;
- Surface water (River Tees);
- Groundwater (the underlying drift deposits are classified as a Minor Aquifer);
- Ecological receptors (South Gare and Coatham Sands SSSI).

2.6 Qualitative Risk Assessment

Our risk assessment findings are presented in Tables 1 to 7 and are summarised in the following section.

2.6.1 Risks to Human Receptors

Risks to human receptors (i.e. current and future site users) from the contaminants described above are assessed as ***low***. The principal exposure pathway for the identified contaminants would be through direct contact with and potential ingestion of with soils in areas where hardstanding is absent. In the course of normal site activities the potential for exposure is limited in view of the presence of extensive areas of hardstanding and building coverage.

A moderate risk potential is faced by maintenance workers engaged in excavation works leading to direct contact with fill materials where contamination has been identified. However, risks can be effectively mitigated during any such works through the use of good working practices and use of appropriate PPE.

2.6.2 Risks to Surface Waters

The River Tees is the principal surface water receptor in the vicinity of the site and risks are assessed as being ***low*** with the principal migration pathway from the site to the River Tees likely to be provided by migration of shallow groundwater through permeable deposits of Made Ground and shallow drift.

Monitoring data indicates that there is a general northwards flow of groundwater across the Redcar site. However, in the north-western portion of Area 15 (Ore Stocking Yards) there appears to be flow of shallow groundwater in the direction of the Tees. However, contamination levels in this area were generally lower than other areas of the Redcar site and it is unlikely that the Tees receives significant baseflow from the shallow aquifer identified in this area.

2.6.3 Risks to Groundwater Receptors

Risks to shallow groundwater within the drift and recent sand and gravel deposits (classified as a Minor Aquifer by the EA) are assessed as being ***low***. Our investigation has identified exceedances of metallic, inorganic and organic contaminants in shallow groundwater but the aquifer is likely to be of limited resource potential and is unlikely to provide significant recharge to underlying groundwater.

2.6.4 Risks to Corus Retained Land and Ecological Receptors

Risks to the land which will be retained by Corus and the adjoining SSSI, part of which borders the Redcar site (and which will be also be retained by Corus) are assessed as being ***low*** to ***moderate***. The main pathway for migration of contaminants onto the Corus retained land and the SSSI would be via the shallow aquifer identified beneath the site. Groundwater monitoring data indicates flow towards the north in the vicinity of the Power Station (Area 12), Area 14 (Blast Furnace) and the eastern portion of Area 17.

Groundwater analysis data shows levels of hydrocarbon contaminants (Total Petroleum Hydrocarbons) in excess of screening criteria in a number of monitoring wells advanced in the northern portion of the Redcar Site including the Blast Furnace, Coke Ovens and By Products Plant.

The potential for migration of contamination towards the SSSI is considered to be enhanced in view of the properties of the Made Ground and underlying natural ground which was found to comprise fine to course, occasionally gravelly sands in the Blast Furnace area. Similar ground conditions were identified beneath the By Products Plant, although monitoring data suggests an inflection in the groundwater contours in the western portion of this area, which flow directed towards the northwest and away from the SSSI.

3. LACKENBY SITE - CONCEPTUAL MODEL AND RISK ASSESSMENT

3.1 Site layout and history

3.1.1 Site layout

The Lackenby Site is located to the south of Redcar in a north-east/south-west trending stretch of land between the Teessport terminal to the north-west and the A1085/Wilton Chemical Works to the south-east.

The present steelworks infrastructure dates back to the 1950's with most of the operational facilities being constructed in the 1970's or more recently.

3.1.2 Site history

Steelworks were originally constructed on the Lackenby site in the 1950's by Dorman Long & Co. The operation has subsequently expanded (1960's: Plate Coil Mill and Electric Arc Furnaces; 1970's: BOS Plant, Continuous Casting Plant, 1990's Hot metal desulphurising facilities and second vacuum degasser at the BOS Plant). Decommissioning of various plant has also taken place over this period (1970's: 'open hearth' plant; Cleveland Steelworks; 1980's: Cleveland Engineering Shops and Mills No. 6, 7 and 8 and North Steel Plant; 2001/02: No.2 Primary Mill and Coil Plate Mills).

3.2 Summary of Ground Conditions

Lackenby Works is constructed on a platform of infill materials (Made Ground) up to 4m in thickness. Infilled material typically comprised slag and brick.

Made Ground is directly underlain by Glacial Till (or Boulder Clay); alluvial deposits being absent in the area of the landholding. The Glacial Till comprises soft to firm, occasionally sandy, clay with some gravel in places. The published geological map indicates this "Upper Boulder Clay" unit to be underlain by glacial clays with a "Lower Boulder Clay" unit beneath. Rockhead, at approximately 15 to 20m depth bgl, comprises several hundred metres of predominantly mudstone formations.

Groundwater levels across the site generally form a consistent pattern indicating groundwater flow in a north-westerly direction (towards the Tees). Levels range from 9.0mAOD in the south-east of the site to below 7mAOD in the north. Water levels in two boreholes do not conform to this flow pattern and possibly indicate localised flow influenced by a culvert or other drainage feature beneath the site.

3.3 Soil and Groundwater Baseline Condition

3.3.1 Soil Quality

Soils across Lackenby are characterised by uniformly alkaline pH conditions and occasionally elevated concentrations of sulphide and sulphate, reflecting the widespread presence of slag materials in the Made Ground. The investigation has identified fill material underlying the site with elevated concentrations of contaminants as shown in Figure 5.

Toxic and phytotoxic metals in the soils were below guideline values apart from locally elevated copper, lead, zinc and boron. Copper was slightly elevated with respect to the guideline values in shallow soils at the southern part of the Lackenby Works near the Slag Transporter Workshop.

Hydrocarbons were below guideline values in the soil at the Lackenby Works apart from isolated levels of PAHs in the shallow soils, which are most likely as a result of localised spillages. Localised black oily staining and hydrocarbon odours, indicative of localised spillages/loss of hydrocarbon, were observed near the north-western boundary in Area 7 (Concast and BOS Plant) and near the western boundary of Area 8 (No 2 Primary Mill).

3.3.2 Groundwater Quality

Site investigation locations where Tier 1 groundwater screening levels were exceeded are shown in Figure 6. Compared with UK Drinking Water Standards shallow groundwater beneath the site has widespread elevated concentrations of sulphate and copper in addition to isolated exceedances of other contaminants; some locations exhibit pH levels indicative of alkaline groundwater conditions.

3.4 Conceptual Model

Our Conceptual Site Model for the Lackenby Site is described below with a diagrammatic representation given in Figure 7.

3.5 Summary of site sensitivity

A summary of site sensitivity is provided below.

Groundwater – the glacial till and glacial clay deposits in the vicinity of the site are classified as Non Aquifers by the Environment Agency. There are no licensed groundwater abstractions within 1km of the site and groundwater sensitivity is assessed as being ***low***.

Surface Water – the principal surface water feature is the River Tees (classified as a Class A watercourse under the CEWP Scheme in the vicinity of Corus authorised discharges and towards the mouth of the estuary) and Teesport dock. There are three culverted watercourses across the site which collects surface water and discharge into the SLEMS facility. Surface water sensitivity is assessed as being ***low***.

Ecology – the majority of the site is covered by open ground, buildings and hardstanding assessed as being of ***low*** ecological sensitivity.

3.5.1 Identified Sources

The following potential sources of contamination have been identified to be relevant to the site from historic and current land use and with respect to the use of adjoining land;

Historic

- Steel slag and refractory materials in Made Ground;
- Storage and use of oils, solvents and other hydrocarbons;

Current

- Storage and use of oils, solvents and other hydrocarbons;
- Steel slag, refractory materials and railway ballast in Made Ground.

3.5.2 Pathways & Receptors

Receptors relevant to the site and possible pathways are summarised as follows:

Identified Pathways

Potential environmental fate and exposure pathways specific to the site are:

- Direct contact, incidental ingestion / inhalation of hazardous materials;
- Migration of potential contaminants via permeable strata and site drainage.

Environmental Receptors

- Site users;
- Surface water (River Tees);
- Groundwater (the Made Ground and Boulder Clay are classified as Non-Aquifers);
- Corus owned land.

3.6 Qualitative Risk Assessment

Our risk assessment findings are presented in Tables 8 to 10 and are summarised in the following section.

3.6.1 Risks to Human Receptors

Risks to human receptors (i.e. current and future site users) from the identified contaminants are assessed as being ***low***. The main exposure pathway for the identified contamination would be through direct contact with, and potential ingestion of, potentially contaminated soils in source areas where hardstanding is absent. In the course of normal site activities the potential for exposure is limited in view of the presence of extensive areas of hardstanding and building coverage.

A slightly greater risk potential is faced by maintenance workers engaged in excavation works leading to direct contact with fill materials where contamination has been identified. However, risks can be effectively mitigated during any such works through the use of good working practices and use of appropriate PPE.

3.6.2 Risks to Surface Waters

The River Tees is the principal surface water receptor in the vicinity of the site. Risks to surface water are assessed as being ***low***, with the principal migration pathway from the site to the River Tees likely to be provided by migration of shallow groundwater through permeable deposits of Made Ground which overlies less permeable Glacial Till (Boulder Clay).

Groundwater monitoring data indicates that there is a general north west to westerly flow direction across the Lackenby site. However, contamination levels in the site were generally low and it is unlikely that the Tees receives significant baseflow from the shallow aquifer identified in this area.

3.6.3 Risks to Groundwater Receptors

Risks to shallow groundwater within the Made Ground (classified as a Non Aquifer by the EA) are assessed as being ***low***. Our investigation has identified limited exceedances of metallic, inorganic and organic contaminants in shallow groundwater. However, the site was found to be underlain by Glacial Till, which is likely to be of relatively low permeability and thereby provide protection to deeper groundwater.

3.6.4 Corus Owned Land

The risk of contamination at the Lackenby site impacting on adjacent land remaining under Corus ownership is assessed as being ***low***. The main pathway for migration of contaminants into such land would be the shallow aquifer identified in the Made Ground. Although groundwater monitoring data indicates flow towards the west and north-west toward such land, levels of contaminants were generally low and therefore are unlikely to have a significant impact.

4. CLEVELAND SITE - CONCEPTUAL MODEL AND RISK ASSESSMENT

4.1 Site layout and history

4.1.1 Site Layout

The Cleveland Works are located adjacent to, and on the south banks of the River Tees immediately south-west of Teesport terminal. The main areas included in the investigation are located in Cleveland (North) and include the By-products Plant and Coke Ovens areas, the "Western side of Pig Caster" area, the Fuel Oil Storage Area next to Dolphin Wharf, the SLEMS area and the Tarmac and Wharf Area. The only area included in the Cleveland (South) works was the Torpedo and Ladle Repair Shop (Area H).

4.1.2 Site History

Cleveland has the longest history of iron and steelworks at the Teesside works. Low-lying land adjacent to the Tees estuary was reclaimed in around 1880 using slag to create a high water embankment. In 1881 the South Banks Iron Works were constructed and in 1906 further land was reclaimed and wharf areas constructed. At some point pre-1950's waste effluents were directed into the SLEMS area from the local ironworks. The South Banks Coke Ovens and other infrastructure were then constructed in the mid-1950's and the Power Station B and oil storage tanks commissioned in the mid-1960's. A number of facilities were designated as waste disposal sites in the 1970's and in 1999 Power Station B was decommissioned and demolished.

4.2 Summary of Ground Conditions

The Cleveland site is constructed on an area of reclaimed land comprising infilled material (Made Ground). This infilled material is consistently up to 4m in thickness across all areas investigated apart from the Dolphin Wharf area where up to 7.5m of Made Ground was encountered (to be expected immediately adjacent to the Tees). Made Ground comprises fragments of slag, brick, ash and ferrous metal debris with very occasional pockets of clay. Layers of fused 'pelite' were encountered in some parts of the site.

Made Ground is underlain by alluvial and marine deposits up to 9m in thickness according to the published geological map. Where encountered these deposits comprised sandy clay and gravel deposits. These are underlain by Glacial Till (or Boulder Clay), formations which in turn are underlain at depth by several hundred metres of predominantly mudstone formations.

Groundwater levels across the site do not conform to any consistent flow pattern although there is evidence for a broad flow direction towards the River Tees. As the borehole distribution is variable across such a large area it is not possible to draw any specific conclusions from the water levels observed and, in contrast with the more uniform water table condition across other sites, local flow conditions are complex and possibly localised. This may be due to local variations in the depth of Made Ground and variations in permeability of the underlying drift deposits.

4.3 Soil and Groundwater Baseline

4.3.1 Soil Quality

Fill materials across the site are typically characterised by alkaline pH and elevated concentrations of sulphide and sulphate. This is due to the widespread occurrence of slag within Made Ground deposits underlying the site. The phytotoxic metals zinc and boron are also often present in concentrations exceeding screening levels as is lead, although to a lesser degree. Figure 8 shows the distribution of exploration locations where exceedance of Tier 1 screening levels were identified.

Elevated concentrations of PAH, BTEX compounds and, to a lesser degree TPH, are also widespread in specific areas of the site namely Areas 1 (By-products Plant and Coke Ovens), 2 (By-Products Plant), 3 (Fuel Storage Area) and 4 (SLEMS area). Oily and tarry deposits and strong organic odours were noted at exploration locations located to the northwest of the By Products Plant (particularly near the benzol storage tanks).

4.3.2 Groundwater Quality

Site investigation locations where Tier 1 groundwater screening levels were exceeded are shown in Figure 9. Compared with UK Drinking Water Standards shallow groundwater beneath the site has widespread elevated concentrations of sulphate, cyanide, arsenic, copper and boron.

Groundwater samples from the By Products Plant and SLEMS areas also indicated concentrations of hydrocarbon compounds in excess of screening criteria (PAH, BTEX Compounds, TPH and GROs).

Free product was noted in groundwater monitoring wells in the By Products area, near the benzol storage tanks. Evidence of hydrocarbon contamination was also identified in several exploration locations in the SLEMS area.

4.4 Site Sensitivity

Groundwater – The Estuarine and Marine Alluvial deposits in the vicinity of the site are collectively classified as Minor Aquifers by the Environment Agency. There are no licensed groundwater abstractions within 1km of the site and groundwater sensitivity is assessed as being ***low***.

Surface Water – the principal surface water feature is the adjacent River Tees (classified as a Class A watercourse under the CEWP Scheme in the vicinity of Corus authorised discharges and towards the mouth of the estuary). There are no natural surface water features crossing the site. site drainage and discharge effluent entering the SLEMS goes into a series of open channels and lagoons; effluent is treated to meet consent limits before being discharged into the Tees. The SLEMS is unlined and some infiltration to ground is to be expected. A soakaway and a discharge to the Tees at Cleveland Oil Farm are both regulated under PPC. Overall, surface water sensitivity is assessed as being ***moderate***.

Ecology – the Cleveland site is on the opposite bank to a SSSI and Ramsar site. As the site is relatively close to this ecologically sensitive area the ecological sensitivity is assessed as being ***moderate***.

4.5 Conceptual Site Model

Our Conceptual Site Model for the Cleveland Site is described below with a diagrammatic representation given in Figure 10.

4.5.1 Identified Sources

4.5.2 The following potential sources of contamination have been identified as being relevant to the site both from historic and current land use and also with respect to the use of adjoining land;

Historic

- Steel slag and refractory materials in Made Ground;
- Storage and use of oils, solvents and other hydrocarbons;
- Coal tar from gas producers;

Current

- Storage and use of oils, solvents and other hydrocarbons;
- Heavy fuel oil, creosote, tar, benzole and ammoniacal liquor;
- Steel slag and refractory materials in Made Ground.

4.5.3 Pathways & Receptors

Receptors relevant to the site and possible pathways are summarised as follows:

Identified Pathways

Potential environmental fate and exposure pathways specific to the site are:

- Direct contact, incidental ingestion / inhalation of hazardous materials;
- Migration of potential contaminants via permeable strata and site drainage.

Environmental Receptors

- Site users;
- Surface water (River Tees);
- Groundwater (the underlying drift deposits are classified as a Minor Aquifer);
- Ecological receptors (Tees and Hartlepool Foreshore and Wetlands SSSI.).

4.6 Qualitative Risk Assessment

Our risk assessment findings are presented in Tables 11 to 16 and are summarised in the following section.

4.6.1 Risks to Human Receptors

Risks to human receptors (i.e. current and future site users) from the contaminants described above are assessed as low to moderate. The principal exposure pathway for the identified contaminants would be through direct contact with and potential ingestion of potentially contaminated soils in source areas where hardstanding is absent.

In the course of normal site activities the potential for exposure is limited however a slightly greater risk potential is faced by maintenance workers engaged in excavation works leading to direct contact with fill materials where contamination has been identified (e.g. in the area near to the By Products Plant where hydrocarbon contamination was identified).

4.6.2 Risks to Surface Waters

The River Tees is the principal surface water receptor in the vicinity of the site. Risks to surface water are assessed as being low, with the principal migration pathway from the site to the River Tees likely to be provided by migration of shallow groundwater through permeable deposits of Made Ground and shallow drift. However risks to surface water at the By-Products Plant were assessed to be moderate due to the proximity to the River Tees and the high levels of organic contamination in the groundwater including evidence of free product observed in exploration locations to the west of the plant. An additional pathway to the River Tees would be via a discharge of treated effluent from the SLEMS into the River Tees. However, effluent from the SLEMS is discharged via a consent.

Groundwater monitoring data indicates that there is a broad flow of groundwater across the Cleveland site toward the River Tees, although locally flow directions appear to be complex. Flow towards the west would be consistent with the generally higher ground levels with increased distance away from the wharfe area. However local variations in the depth of Made Ground and alluvium appear to have an effect on the local groundwater level such as at the eastern side of By Products area. Groundwater in SLEMS area would appear to be flowing south eastward away from the River Tees possibly under the influence of locally variable less permeable clays.

4.6.3 Risks to Groundwater Receptors

Risks to shallow groundwater within the drift and recent sand and gravel deposits (classified as a Minor Aquifer by the EA) are assessed as being low in most areas of the Cleveland site. However risks to groundwater at the By-Products Plant were assessed to be moderate due to the high levels of organic contamination and free product in the groundwater and the possibility for downwards migration via permeable horizons within the natural deposits. Risks to groundwater in the SLEMS were also found to be moderate due to exceedance of Tier 1 screening criteria. However, it should also be noted that the shallow aquifer within natural superficial deposits is likely to be of limited resource potential and is unlikely to provide significant recharge to deeper aquifer units such as the Sherwood Sandstone.

4.6.4 Risks to Ecological Receptors

Risks to surrounding the SSSI which is situated on the north bank of the Tees are assessed as being low. The main pathway for migration of contaminants onto the SSSI would be via surface water discharges into the River Tees and baseflow of contaminated shallow groundwater. However, it is unlikely that this would lead to significant impact due to dilution within the river.

4.6.5 Corus Owned Land

The risk of identified contamination at the Cleveland Works impacting on nearby Corus land is assessed as being low. The main pathway for migration of contaminants onto adjacent land would be the shallow aquifer identified in Made Ground. However, although groundwater monitoring around the SLEMS area suggests possible local flow towards the south-east, this area does not abut directly against land which will be retained by Corus.

5. SUMMARY OF FINDINGS

5.1 Ground Conditions

Ground conditions across the landholding comprise Made Ground underlain by a series of natural deposits including alluvial/estuarine and Glacial Till deposits. The solid geology beneath the site (which was not encountered during the investigation) comprises several hundred metres of mudstone.

Made Ground deposits constitutes infilled/reclaimed land which has provided a platform for the development of the steelworks. Infill typically comprises slag with fragments of ash, brick etc. In the Redcar site the Made Ground is more variable and includes reworked natural materials such as clay (which is likely to be Glacial Till). Made Ground reaches thicknesses of up to 10metres, but 4metres is more typical.

5.2 Groundwater Conditions

Shallow groundwater has been identified across the entire landholding within the Made Ground and where present in underlying alluvial deposits. Groundwater flow was generally observed to be towards the River Tees i.e. to the northwest and in the case of Redcar to the north and northeast also i.e. towards the SSSI. Groundwater levels at Cleveland do not conform to any consistent pattern suggesting local factors complicating the wider water table condition.

5.3 Baseline Soil and Groundwater Quality

Chemical analysis data has been screened against generic guideline values in order to place the results obtained into context. Overall, the results indicate elevated levels of sulphate and sulphide and alkaline pH conditions, reflecting the presence of slag materials across the landholding.

Elevated levels of the following contaminants were identified on a more localised basis: heavy metals (principally lead, copper, zinc and boron), organic contaminants (TPH, PAH and BTEX Compounds[8]). The occurrence of elevated levels of these contaminants is consistent with visual and olfactory identification of hydrocarbon contamination at several locations, particularly near the By Products Plant and the SLEMS. Contamination of groundwater by TPH was also identified within several monitoring boreholes on the Redcar site.

In broad terms the site wide land quality signature is characteristic of a steelworks environment of comparable history and complexity.

5.4 Summary of Risk Assessment

Our risk assessment indicates the majority of risks to identified receptors from identified soil and groundwater conditions are low. However, the following risks have been assessed as being Moderate:

- Redcar Site – potentially hydrocarbon contaminated shallow groundwater migrating from the site in a northerly direction onto the adjacent SSSI.

---

[8] TPH – Total Petroleum Hydrocarbons; PAH - Poly Aromatic Hydrocarbons; BTEX Compounds – Benzene, Toluene, Ethylbenzene and Xylene.

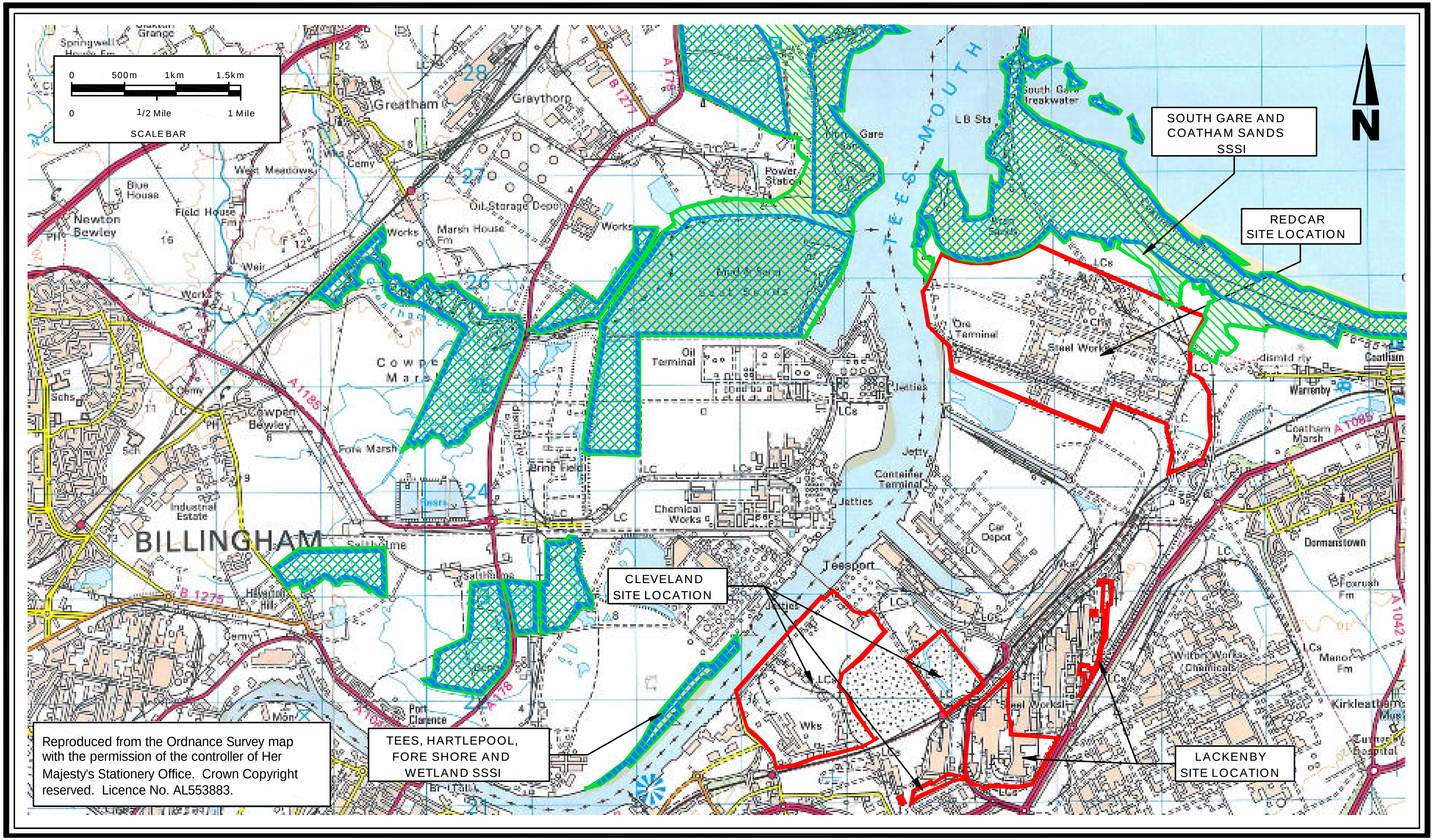
- Lackenby Site – Risks to identified environmental receptors were all assessed as being negligible to low.

- Cleveland Site – risks to the River Tees due to the high levels of organic contamination identified to the northwest of the By Products Plant. The associated risk to shallow groundwater is also assessed as being moderate.

FIGURES

Figure 1A Site Location Plan, Teeside

Ref: I:\DG\CADTEAM\new-cans\CO052\0017a\ Plot date: Jun 22, 2004 - 10:41am File name: JSF1824.dwg Copyright Enviros Ltd.



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KEY:

- 🟥 Site Boundarys
- ▨ Ramsar Boundary
- ▨ SSSI Boundary

CORUS

ENVIROS

SCALE 1:50,000	*CAN* CO0520017A
CONTENT RLP	*DRAWN* JSF
CHECKED	*DATE* JUNE 2004

CORUS TEESSIDE

FIGURE 1A

SITE LOCATION PLAN, TEESSIDE

Figure 1B Enviros Sampling Areas And Boundaries Between Corus And Teesco

File name: JSF1837.dwg   Plot date: Jun 18, 2004 - 2:39pm   Ref: I: \DG\CADTEAM\new-cans\CO052\0017a\

Area	Operations
	REDCAR
11	Former Warrenby Works
12	Power Station and Surrounding Areas
13	Sinter Plant
14	Blast Furnace
15	Raw Coal and Ore Stocking Area
16	Coke Ovens
17	By-Products
F	South Gare and Coatham sands SSSI*
	LACKENBY
7	Concast and Bos Plant
8	No. 2 Primary Mill
G	Iron Granulation and Loco Repair Shop
	CLEVELAND
1	By-products Plant and Coke Ovens
2	By-products Plant
3	Fuel Oil Storage Area Next to Dolphin Wharfe
4	SLEMS Area
D	Western Side of Pig Caster
E	Tarmac and Wharfe Area
H	Torpedo and Ladle Repair Shop

NOTE:

1. Stores building to be maintained Through agreements
2. Based upon drawing Number A119972e supplied by Corus

KEY:

🟨	Redcar	🟩	Corus Retains	🟪	Teesco Own. Long Term Lease to Corus
🟦	Cleveland	🟥	Proposed Teesco		
🟩	Lackenby	🟦	Corus Own. Long Term Lease to Teesco		

CORUS

ENVIROS

SCALE
SEE SCALE BAR

CAN
CO0520017A

CONTENT
RLP

DRAWN
JSF

CHECKED

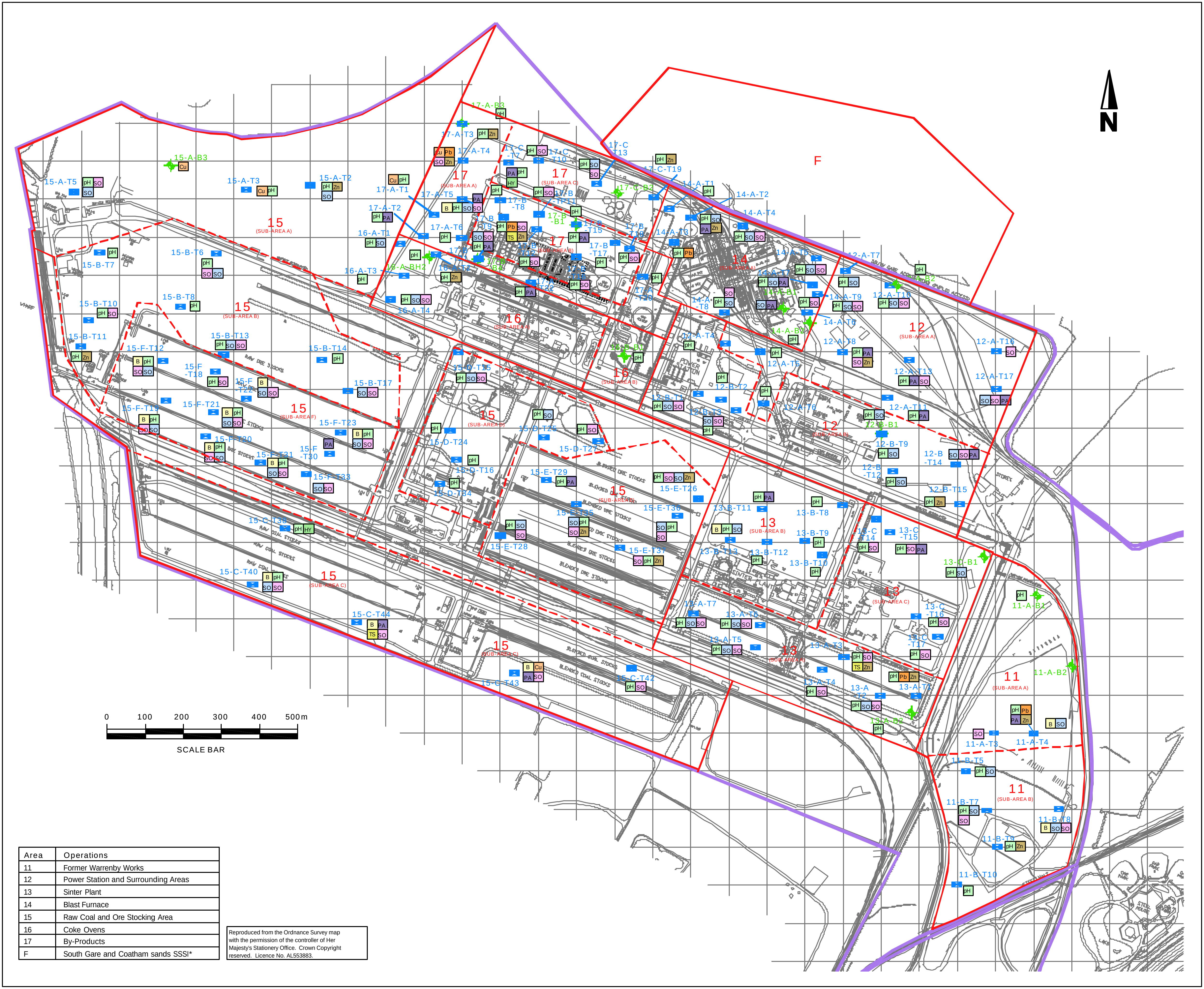
DATE
JUNE 2004

CORUS TEESSIDE

FIGURE 1B

ENVIROS SAMPLING AREAS AND BOUNDARIES BETWEEN CORUS AND TEESCO

Figure 2 Exceedance Of Tier 1 Soil Screening Criteria, Redcar



KEY:

▬ Proposed Teesco Boundaries

- - - Enviros Sampling Boundaries

✦ Borehole

▬ Trial Pit

B	Boron	ESV 3mg/kg
Cu	Copper	DIV 190mg/kg
HY	Total Petroleum Hydrocarbons (C8-C37)	DIV 5,000mg/kg
PA	PAH Total EPA16	DIV 40mg/kg
Pb	Lead	CLEA 750mg/kg
pH	pH	<5 or >10 pH
SO	Acid Soluble Sulphide	ESV 1,000mg/kg
SO	Water Soluble Sulphate as SO	BRE 1,200mg/kg
TS	Total Sulphur	ESV 20,000mg/kg
Zn	Zinc	DIV 720mg/kg

CLEA - Industrial Guidance Limits
DIV - Dutch Intervention Value
ESV - Enviros Screening Value

NOTES:

1. Locations only shown where exceedances have occurred

Area	Operations
11	Former Warrenby Works
12	Power Station and Surrounding Areas
13	Sinter Plant
14	Blast Furnace
15	Raw Coal and Ore Stocking Area
16	Coke Ovens
17	By-Products
F	South Gare and Coatham sands SSSI*

REV. DESCRIPTION DATE

CORUS

REDCAR

FIGURE 2

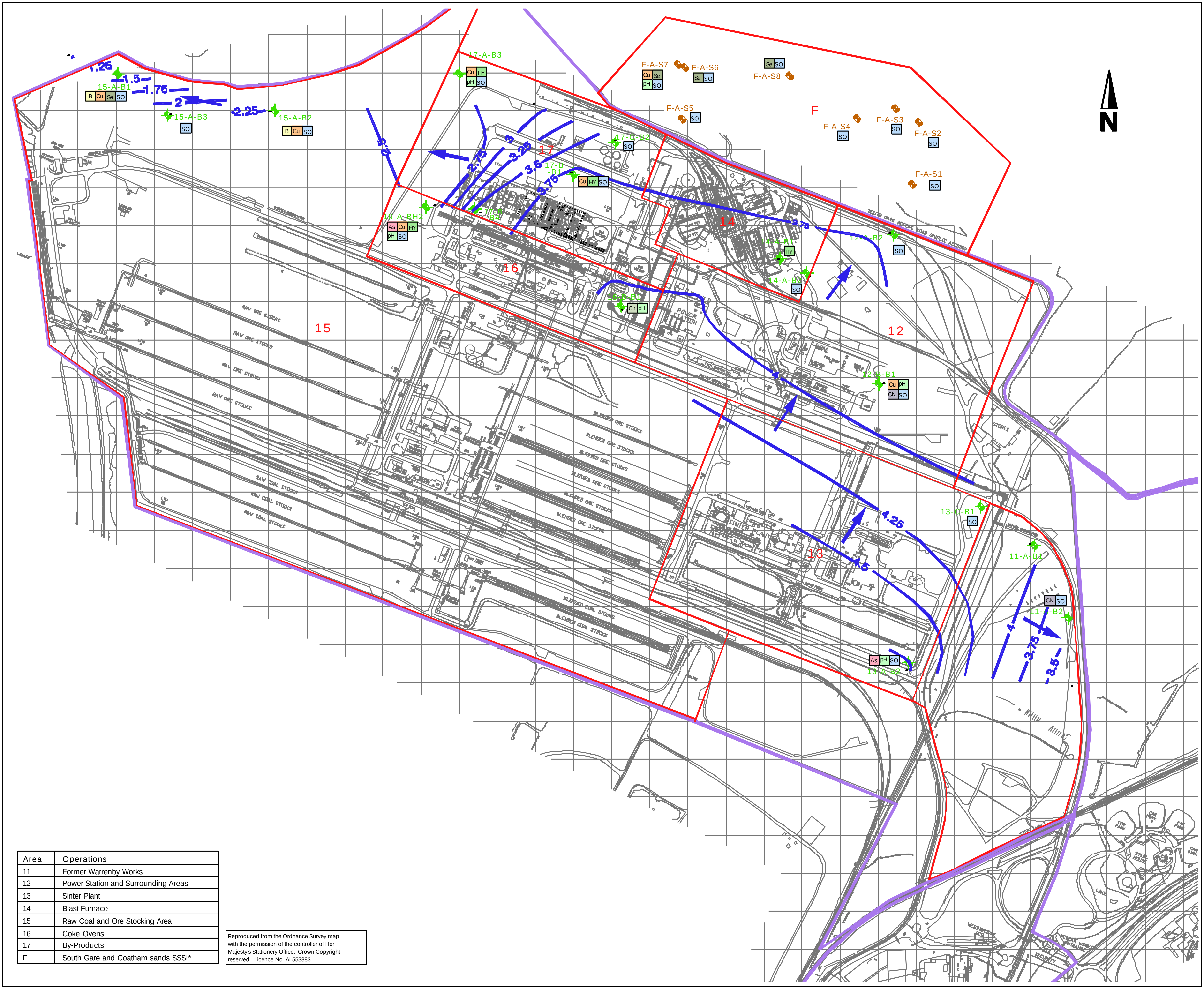
EXCEEDANCE OF TIER 1 SOIL SCREENING CRITERIA

SCALE 1:6,500	CAN CO0520017A
CONTENT RLP	DRAWN JSF
CHECKED	DATE JUNE 2004

ENVIROS

File name: JSF1822.dwg Plot date: Jun 22, 2004 - 2:50pm Ref: I:\DG\CADTEAM\new-cans\CO052\0017a\

Figure 3 Exceedance Of Tier 1 Water Screening Criteria And Groundwater Flow Direction, Redcar



Area	Operations
11	Former Warrenby Works
12	Power Station and Surrounding Areas
13	Sinter Plant
14	Blast Furnace
15	Raw Coal and Ore Stocking Area
16	Coke Ovens
17	By-Products
F	South Gare and Coatham sands SSSI*

KEY:

▬	Proposed Teesco Boundaries
═	Enviros Sampling Boundaries
⌒	Groundwater Contour
➜	Direction of Groundwater
✚	Borehole
●	Surface Water

As	Arsenic	UKDWS 0.01mg/l
B	Boron	UKDWS 1mg/l
CN	Total Cyanide	UKDWS 0.05mg/l
Cu	Copper	UKDWS 0.002mg/l
Cr	Chromium	UKDWS 0.002mg/l
HY	Total Petroleum Hydrocarbons GC	DIV 0.6mg/l
pH	pH	UKDWS <6.5 or >10
Se	Selenium	UKDWS 0.01mg/l
SO	Total Sulphur as SO_4	UKDWS 250mg/l

DIV - Dutch Intervention Value
UKDWS - United Kingdom Drinking Water Standard

NOTES:

1. Locations only shown where exceedance have occured.

REV.	*DESCRIPTION*	*DATE*

CORUS

REDCAR

FIGURE 3

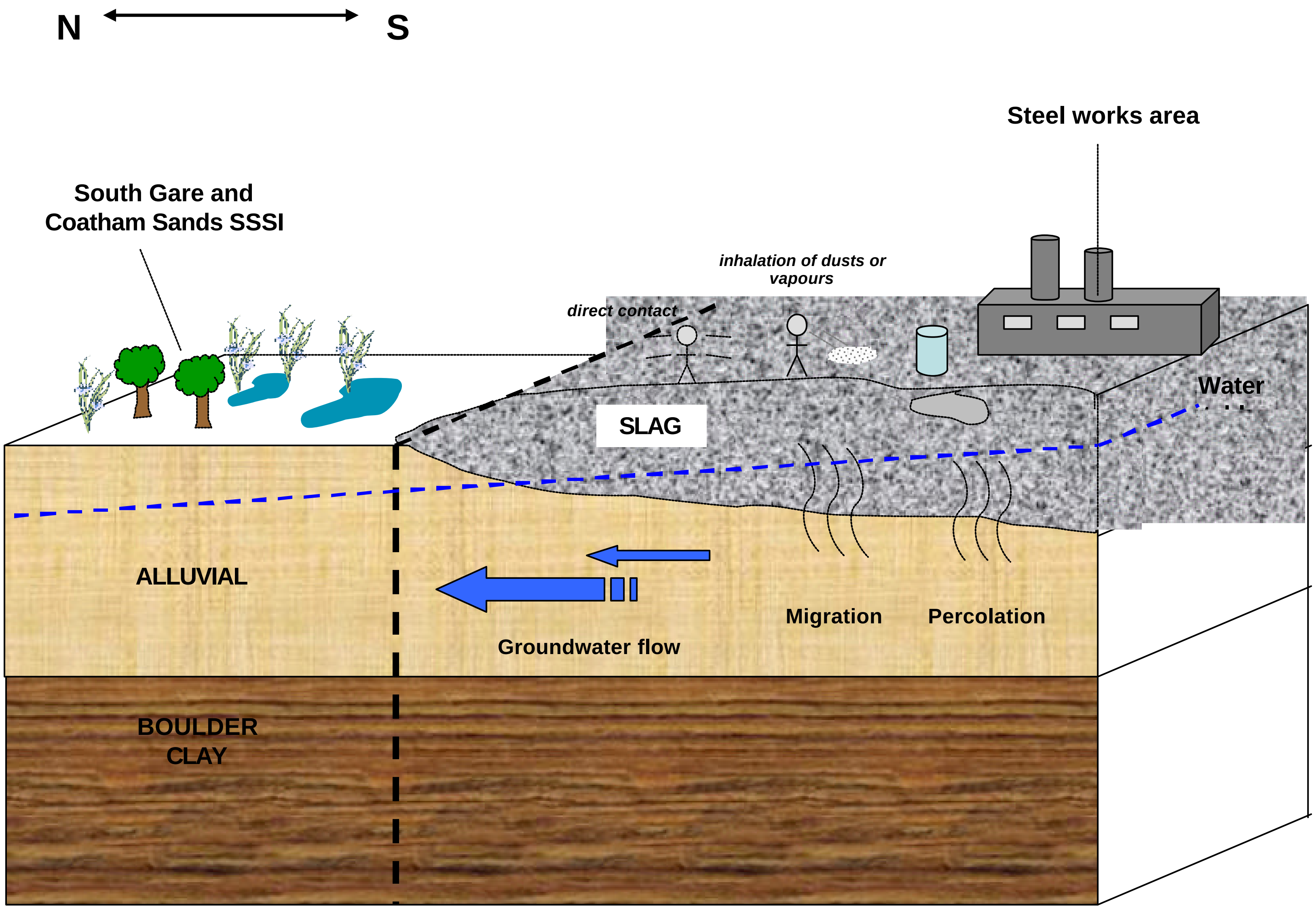
EXCEEDANCE OF TIER 1 WATER SCREENING CRITERIA AND GROUNDWATER FLOW DIRECTION

SCALE 1:6,500	*CAN* CO0520017A
CONTENT RLP	*DRAWN* JSF
CHECKED	*DATE* JUNE 2004

ENVIROS

File name: JSF1825.dwg Plot date: Jun 22, 2004 - 3:02pm Ref: I: \DG\CADTEAM \new-cans \CO052\0017a\

Figure 4 Conceptual Site Model, Redcar



KEY:

CLIENT

Corus plc

PROJECT

Soil and Groundwater Baseline SI

DRAWING

Figure 4 - Conceptual Site Model, Redcar

SCALE – NTS

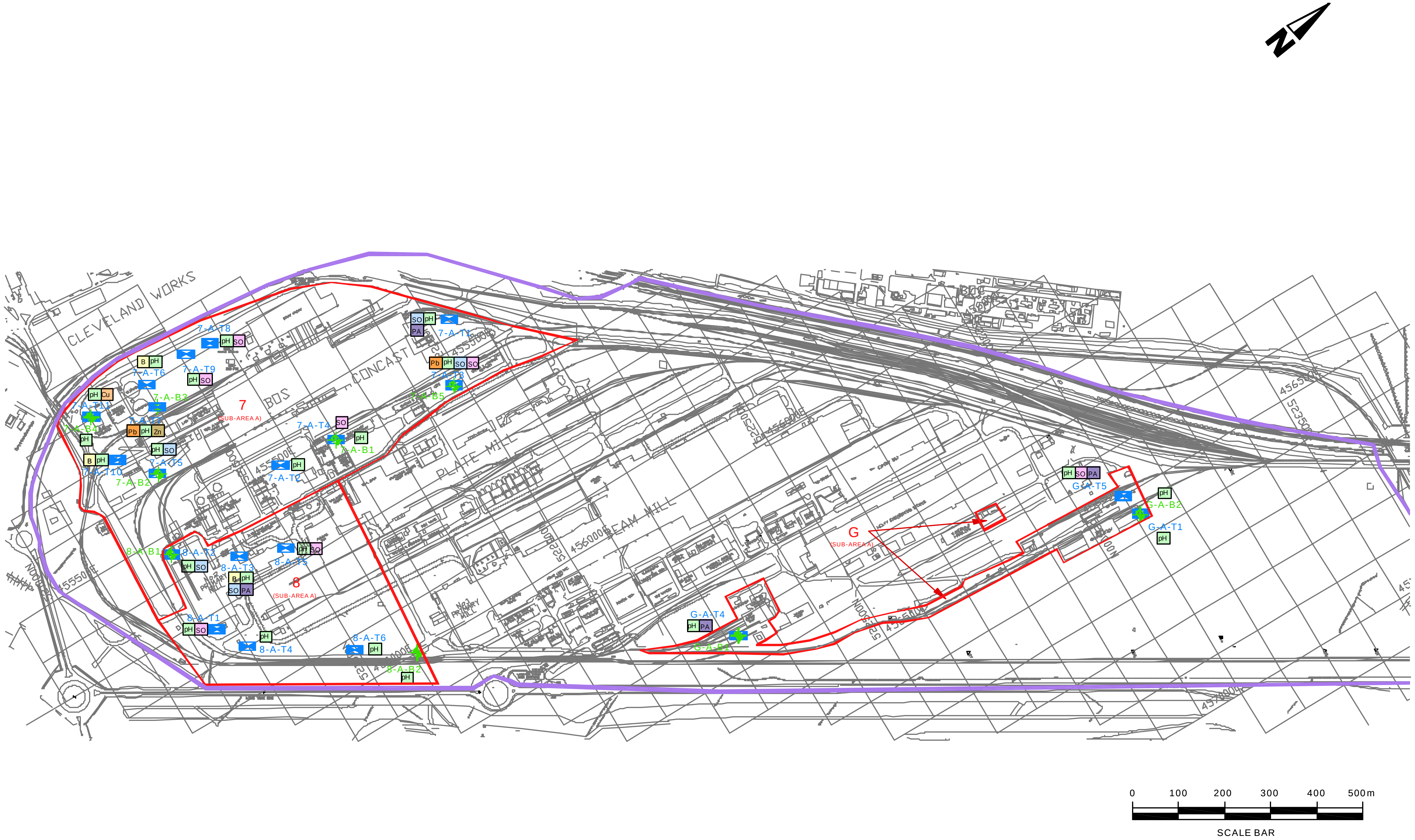
CHECKED – GAD

REF – CO0520017A

DATE – JUNE 2004

ENVIROS

Figure 5 Exceedance Of Tier 1 Soil Screening Criteria, Lackenby



KEY:

Proposed Teesco Boundaries

Enviros Sampling Boundaries

Borehole

Trial Pit

B	Boron	ESV 3mg/kg
Cu	Copper	DIV 190mg/kg
PA	PAH Total EPA16	DIV 40mg/kg
Pb	Lead	CLEA 750mg/kg
pH	pH	<5 or >10 pH
SO	Acid Soluble Sulphide	ESV 1,000mg/kg
SO	Water Soluble Sulphate as SO	BRE 1,200mg/kg
Zn	Zinc	DIV 720mg/kg

CLEA - Industrial Guidance Limits
DIV - Dutch Intervention Value
ESV - Enviros Screening Values

NOTES:

1. Locations only shown where exceedances have occurred

Area	Operations
7	Concast and Bos Plant
8	No. 2 Primary Mill
G	Iron Granulation and Loco Repair Shop

REV. *DESCRIPTION* *DATE*

CORUS

LACKENBY

FIGURE 5

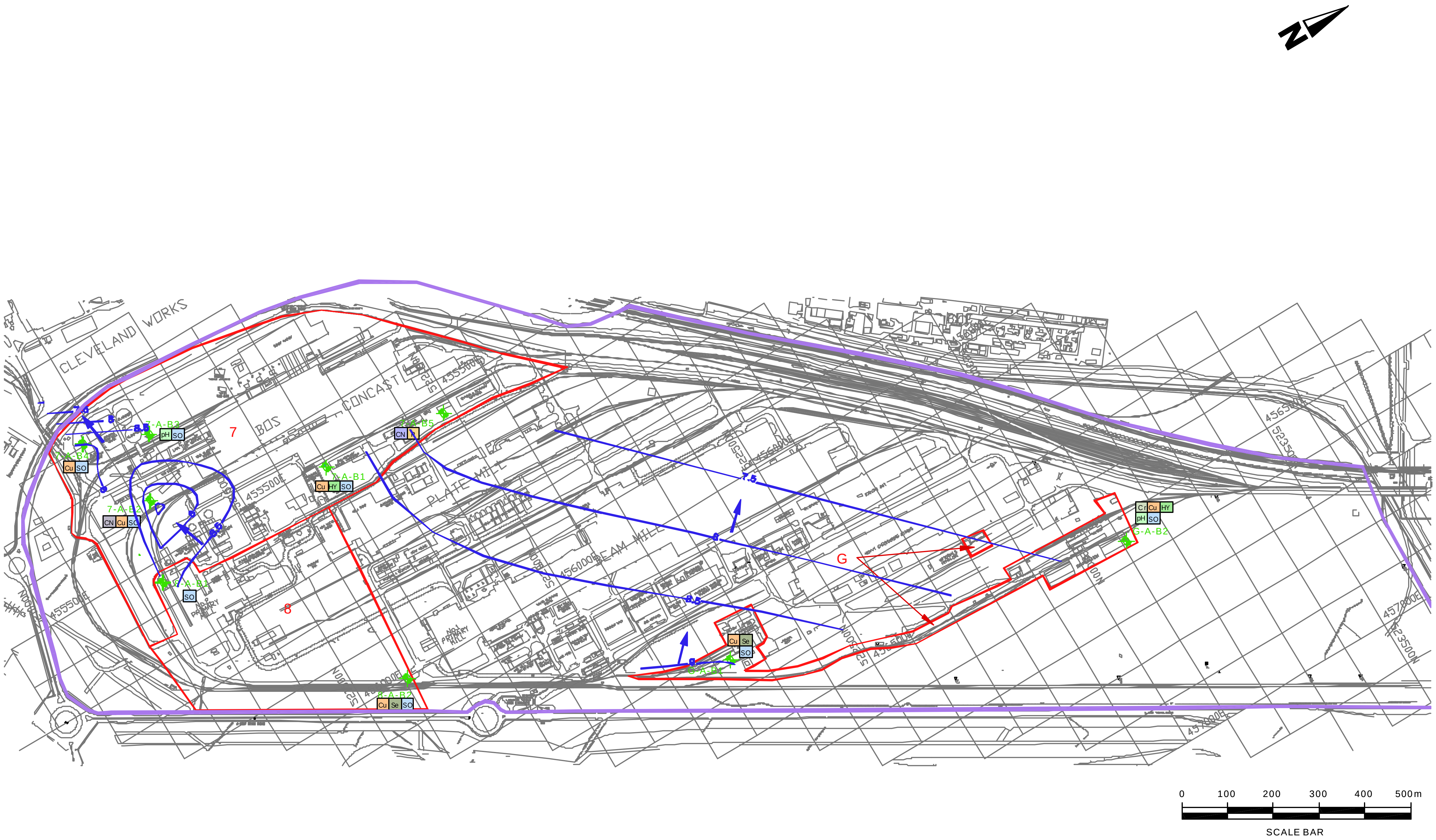
EXCEEDANCE OF TIER 1 SOIL SCREENING CRITERIA

SCALE 1:6,500
CAN CO0520017A
CONTENT RLP
DRAWN JSF
CHECKED
DATE JUNE 2004

ENVIROS

File name: JSF1830.dwg Plot date: Jun 22, 2004 - 2:53pm Ref: I:\DG\CADTEAM\new-cans\CO052\0017a\

Figure 6 Exceedance Of Tier 1 Water Screening Criteria And Groundwater Flow Direction, Lackenby



KEY:

Proposed Teesco Boundaries

Enviros Sampling Boundaries

Groundwater Contour

Direction of Groundwater

Borehole

CN	Total Cyanide	UKDWS 0.05mg/l
CN	Free Cyanide	UKDWS 0.05mg/l
Cu	Copper	UKDWS 0.002mg/l
Cr	Chromium	UKDWS 0.002mg/l
HY	Total Petroleum Hydrocarbons GC	DIV 0.6mg/l
pH	pH	UKDWS <6.5 or >10
P	Phenol Index	DIV 2mg/l
Se	Selenium	UKDWS 0.01mg/l
SO	Total Sulphur as SO_4	UKDWS 250mg/l

DIV - Dutch Intervention Value
UKDWS - United Kingdom Drinking Water Standard

NOTES:

1. Locations only shown where exceedances have occurred

REV.	*DESCRIPTION*	*DATE*

CORUS

LACKENBY

FIGURE 6

EXCEEDANCE OF TIER 1 WATER SCREENING CRITERIA AND GROUNDWATER FLOW DIRECTION

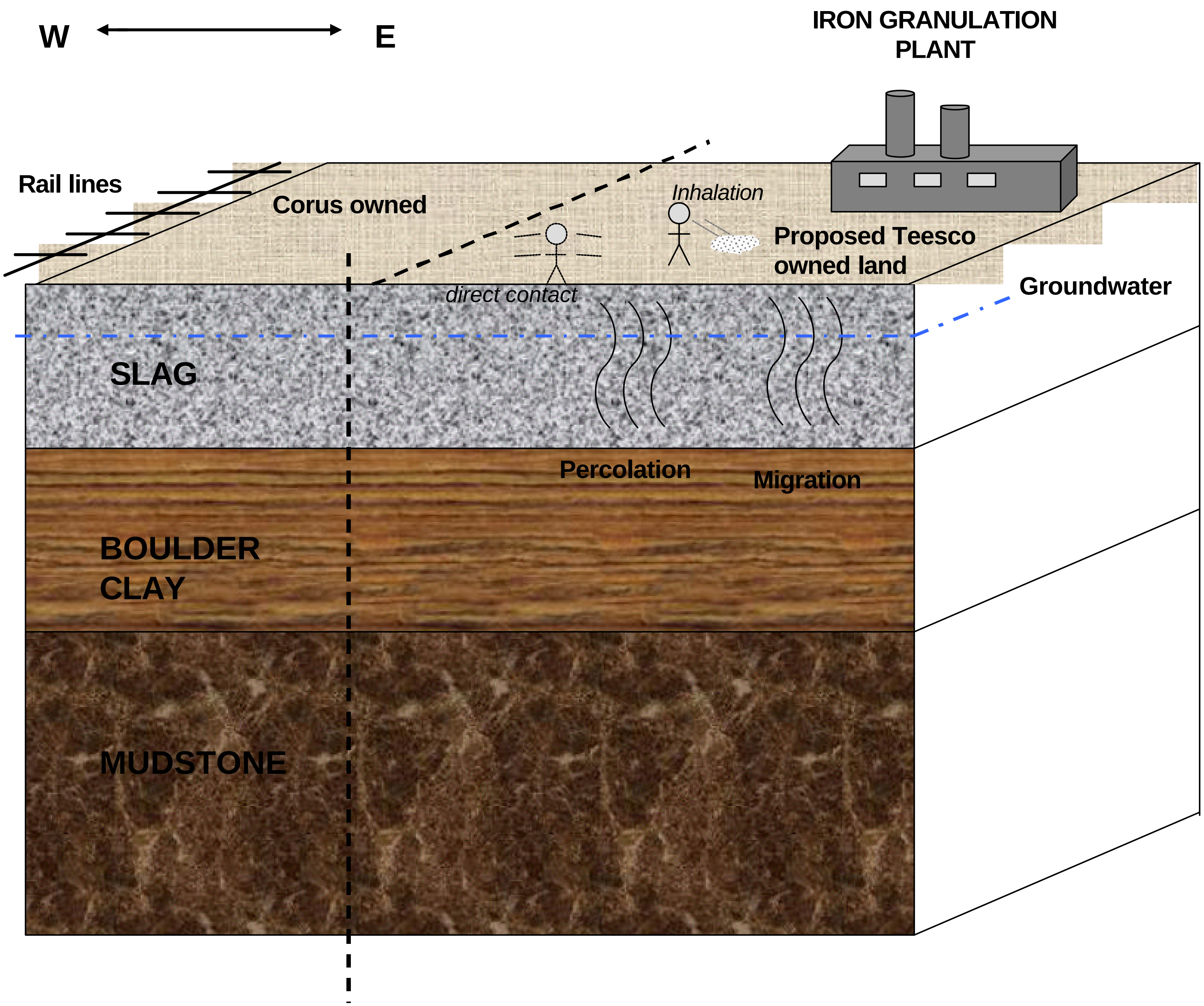
SCALE 1:6,500	*CAN* CO0520017A
CONTENT RLP	*DRAWN* JSF
CHECKED	*DATE* JUNE 2004

ENVIROS

Area	Operations
7	Concast and Bos Plant
8	No. 2 Primary Mill
G	Iron Granulation and Loco Repair Shop

File name: JSF1836.dwg Plot date: Jun 22, 2004 - 3:00pm Ref: I: \DG\CADTEAM \new-cans \CO052\0017a\

Figure 7 Conceptual Site Model, Lackenby



KEY:

CLIENT

Corus plc

PROJECT

Soil and Groundwater Baseline SI

DRAWING

Figure 7 - Conceptual Site Model, Lackenby

SCALE – NTS

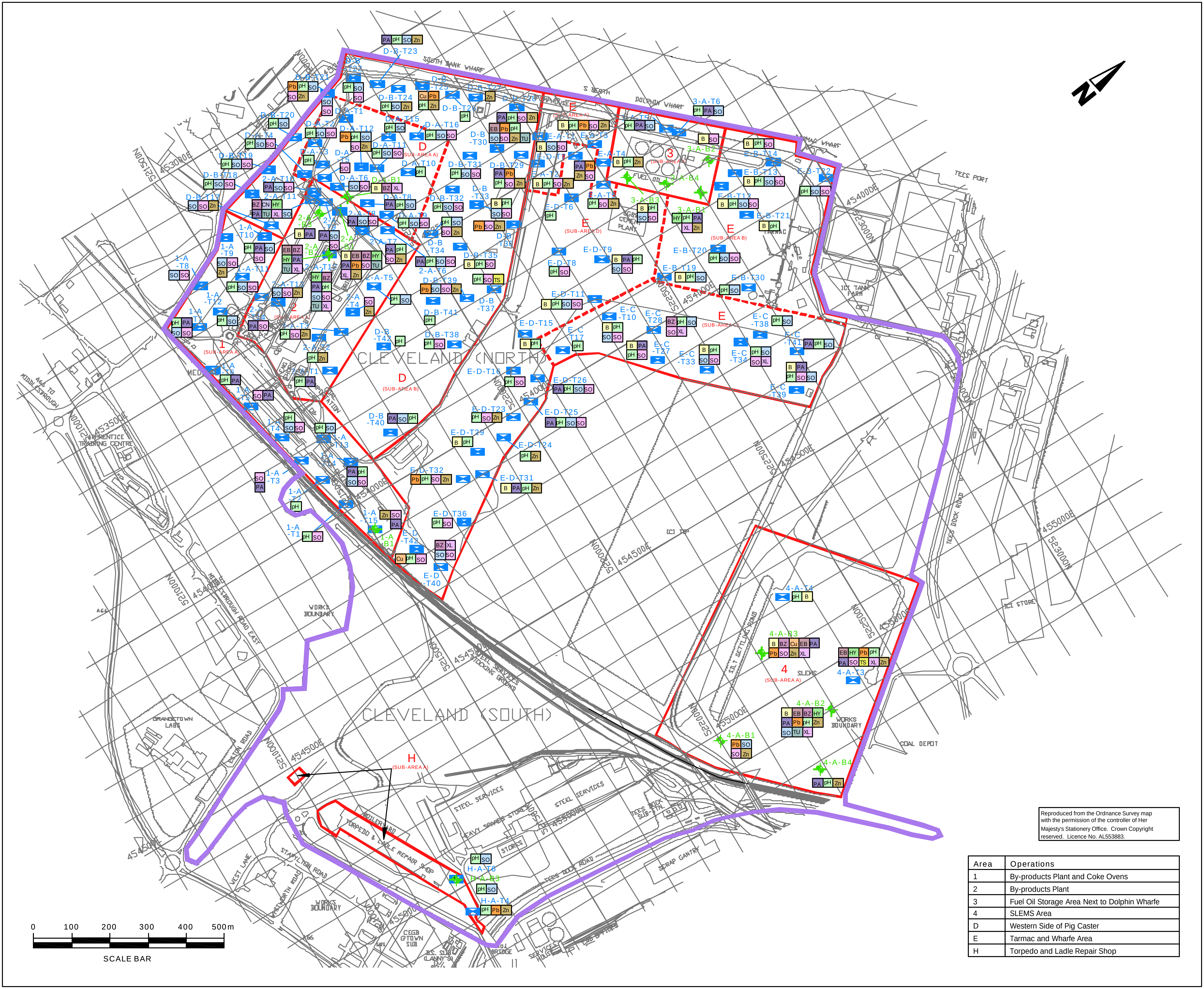
CHECKED – GAD

REF – CO0520017A

DATE – JUNE 2004

ENVIROS

Figure 8 Exceedance Of Tier 1 Soil Screening Criteria, Cleveland



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Area	Operations
1	By-products Plant and Coke Ovens
2	By-products Plant
3	Fuel Oil Storage Area Next to Dolphin Wharfe
4	SLEMS Area
D	Western Side of Pig Caster
E	Tarmac and Wharfe Area
H	Torpedo and Ladle Repair Shop

KEY:

Proposed Teesco Boundaries

Enviros Sampling Boundaries

Borehole

Trial Pit

B	Boron	ESV 3mg/kg
Cu	Copper	DIV 190mg/kg
PA	PAH Total EPA16	DIV 40mg/kg
Pb	Lead	CLEA 750mg/kg
pH	pH	<5 or >10 pH
TS	Total Sulphur	ESV 20,000mg/kg
SO	Acid Soluble Sulphide	ESV 1,000mg/kg
SO	Water Soluble Sulphate as SO	BRE 1,200mg/kg
Zn	Zinc	DIV 720mg/kg

CLEA - Industrial Guidance Limits
DIV - Dutch Intervention Value
ESV - Enviros Screening Value

NOTES:

1. Locations only shown where exceedances have occurred

REV. *DESCRIPTION* *DATE*

CORUS

CLEVELAND

FIGURE 8

EXCEEDANCE OF TIER 1 SOIL SCREENING CRITERIA

SCALE 1:6,500
CAN CO0520017A
CONTENT RLP
DRAWN JSF
CHECKED
DATE JUNE 2004

ENVIROS

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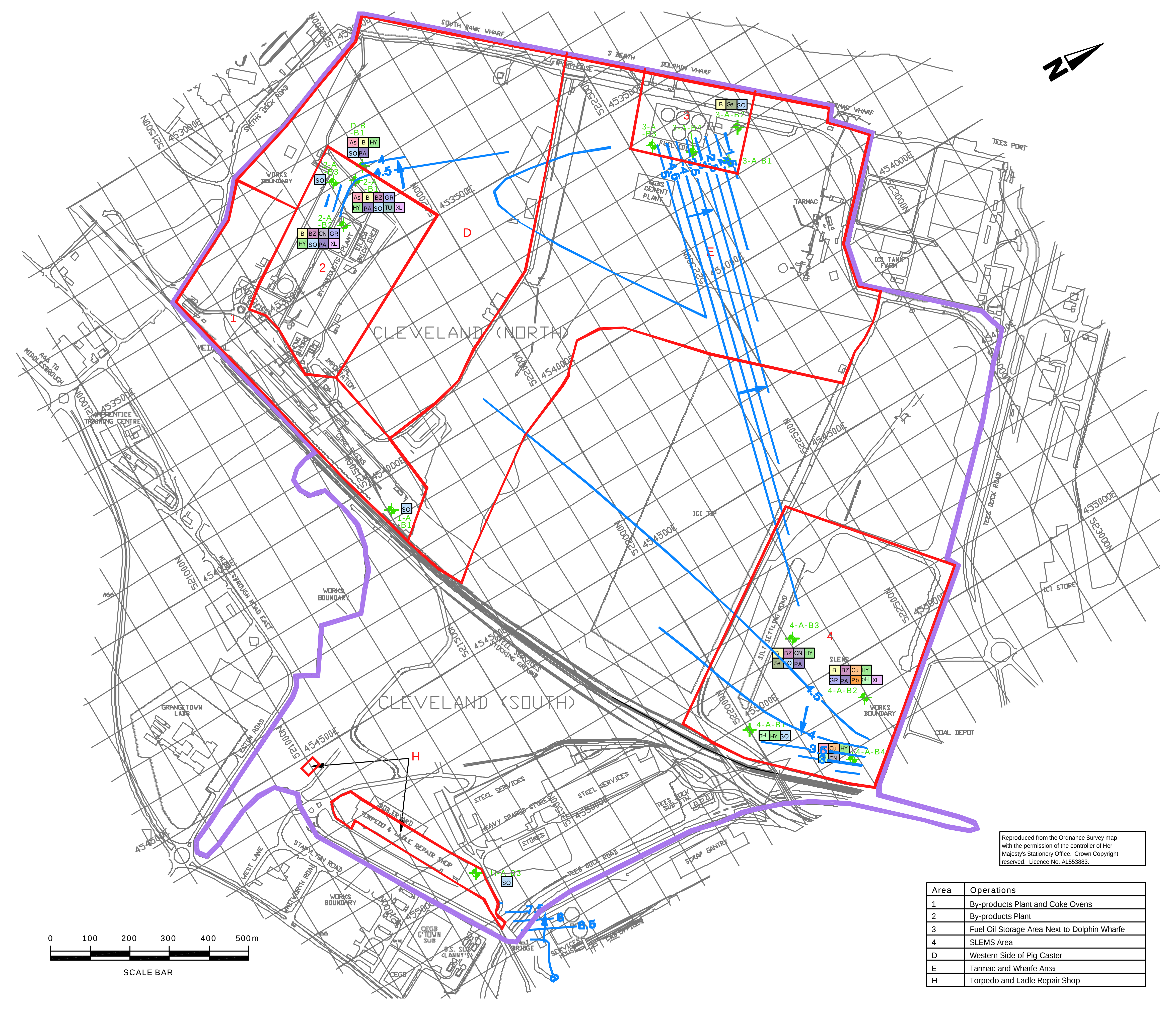
Figure 9 Exceedance Of Tier 1 Water Screening Criteria And Groundwater Flow Direction, Cleveland



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Area	Operations
1	By-products Plant and Coke Ovens
2	By-products Plant
3	Fuel Oil Storage Area Next to Dolphin Wharfe
4	SLEMS Area
D	Western Side of Pig Caster
E	Tarmac and Wharfe Area
H	Torpedo and Ladle Repair Shop

KEY:

▬	Proposed Teesco Boundaries
▬	Enviros Sampling Boundaries
⌒	Groundwater Contour
→	Direction of Groundwater
⊕	Borehole

As	Arsenic	UKDWS 0.01mg/l
B	Boron	UKDWS 1mg/l
BZ	Benzene	UKDWS 1mg/l
CN	Total Cyanide	UKDWS 0.05mg/l
Cu	Copper	UKDWS 0.002mg/l
GR	Gasoline Range Organics	DIV 0.6mg/l
HY	Total Petroleum Hydrocarbons GC	DIV 0.6mg/l
PA	PAH Total EPA16	DIV 0.8mg/l
Pb	Lead	UKDWS 0.025mg/l
pH	pH	UKDWS <6.5 or >10
Se	Selenium	UKDWS 0.01mg/l
SO	Total Sulphur as SO_4	UKDWS 250mg/l
TU	Toluene	DIV 1000 ug/l
XL	Xylenes	DIV 70 ug/l

DIV - Dutch Intervention Value
UKDWS - United Kingdom Drinking Water Standard

NOTES:

1. Locations only shown where exceedances have occurred

REV.	*DESCRIPTION*	*DATE*

CORUS

CLEVELAND

FIGURE 9

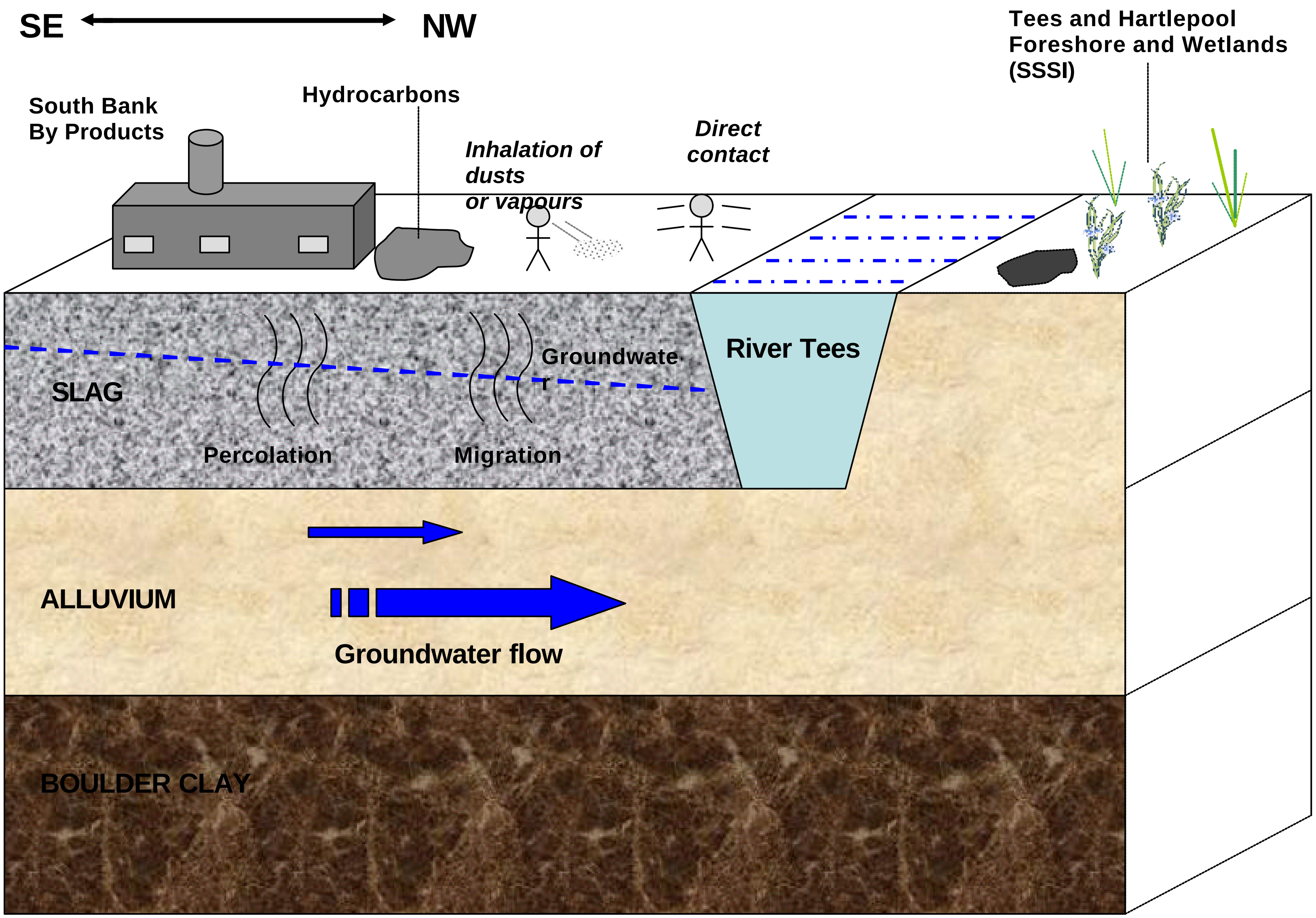
EXCEEDANCE OF TIER 1 WATER SCREENING CRITERIA AND GROUNDWATER FLOW DIRECTION

SCALE 1:6,500	*CAN* CO0520017A
CONTENT RLP	*DRAWN* JSF
CHECKED	*DATE* JUNE 2004

ENVIROS

File name: JSF1838.dwg   Plot date: Jun 23, 2004 - 9:52am   Ref: I: \DG\CADTEAM \new-cans \CO052\0017a\

Figure 10 Conceptual Site Model, Cleveland



KEY:

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PROJECT

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Figure 10 - Conceptual Site Model, Cleveland

SCALE – NTS

CHECKED – GAD

REF – CO0520017A

DATE – JUNE 2004

ENVIROS

APPENDICES

1. RISK ASSESSMENT METHODOLOGY

Qualitative Risk Assessment Methodology

Risk assessment is the process of collating known information on a hazard or set of hazards in order to estimate actual or potential risks to receptors. The receptor may be human health, a water resource, a sensitive local ecosystem or even future construction materials. Receptors can be connected with the hazard under consideration via one or several exposure pathways (e.g. the pathway of direct contact). Risks are generally managed by isolating or removing the hazard, isolating the receptor, or by intercepting the exposure pathway. Without the three essential components of a source (hazard), pathway and receptor, there can be no risk. Thus, the mere presence of a hazard at a site does not mean that there will necessarily be attendant risks. The following risk assessment thus focuses on those parts of the site where hazards or potential hazards have been identified and is not general to the whole site.

Hazards

Potential sources of contamination are identified for the site, based on a review of the current and previous site uses. Not only the nature but also the likely extent of any contamination is considered, e.g. whether such contamination is likely to be localised or widespread.

Receptors

The varying effects of a hazard on individual receptors depends largely on the sensitivity of the target. Receptors include any people, animal or plant population, or natural or economic resources within the range of the source which are connected to the source by the transport pathway. Receptors can, in addition, extend to remediation processes and future construction materials that may be adversely affected by on-site contamination. In general, however, receptors can be divided into a number of groups dependant on the final use of the site.

Pathways

The mere presence of contamination does not infer a risk. The exposure pathway determines the dose delivered to the receptor and the effective dose determines the extent of the adverse effect on the receptor. The pathway which transports the contaminants to the receptor or target generally involves conveyance via soil, water or air.

Exposure Assessment

By considering the source, pathway and receptor, an assessment is made for each contaminant on a receptor by receptor basis with reference to the significance and degree of the risk. In assessing this information, a measure is made of whether the source contamination can reach a receptor, determining whether it is of a major or minor significance. The exposure risks are assessed against the present site conditions.

The assessment of risk presented here has been based upon the procedure outlined in DETR Circular 02/2000. In addition DETR, with the Environment Agency and the Institute of Environment & Health, has published guidance on risk assessment (Guidelines for Environmental Risk Assessment and Management).

This guidance from DEFRA and CIRIA states that the designation of risk is based upon a consideration of both:

- The likelihood of an event (probability); [takes into account both the presence of the hazard and receptor and the integrity of the pathway].

Classification of Probability

(only applies if there is a possibility of a pollutant linkage being present)

Category	Definition
High likelihood	There is pollution linkage and an event would appear very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	There is pollution linkage and all the elements are present and in the right place which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low likelihood	There is pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a long period such an event would take place, and is less likely in the shorter term.
Unlikely	There is pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

- The severity of the potential consequence [takes into account both the potential severity of the hazard and the sensitivity of the receptor].

Classification of Consequence

Classification	Definition
Severe	Highly elevated concentrations **likely** to result in “significant harm” to human health as defined by the EPA 1990, Part IIA, if exposure occurs. Equivalent to EA **Category 1** pollution incident including persistent and/or extensive effects on water quality; leading to closure of a potable abstraction point; major impact on amenity value or major damage to agriculture or commerce. Major damage to aquatic or other ecosystems, which is likely to result in a substantial adverse change in its functioning or harm to a species of special interest that endangers the long term maintenance of the population. Catastrophic damage to crops, buildings or property.
Medium	Elevated concentrations which could result in “significant harm” to human health as defined by the EPA 1990, Part IIA if exposure occurs. Equivalent to EA **Category 2** pollution incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to agriculture or commerce. Significant damage to aquatic or other ecosystems, which may result in a substantial adverse change in its functioning or harm to a species of special interest that may endanger the long term maintenance of the population. Significant damage to crops, buildings or property.
Mild	Exposure to human health **unlikely** to lead to “significant harm”. Equivalent to EA **Category 3** pollution incident including minimal or short lived effect on water quality; marginal effect on amenity value, agriculture or commerce. Minor or short lived damage to aquatic or other ecosystems, which is unlikely to result in a substantial adverse change in its functioning or harm to a species of special interest that would endanger the long term maintenance of the population. Minor damage to crops, buildings or property.

Classification	Definition
Minor	No measurable effect on humans. Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems. Repairable effects of damage to buildings, structures and services.

The Classification of Risk

Probability (likelihood)		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
	High likelihood	Very high risk	High risk	Moderate risk	Low risk
	Likely	High risk	Moderate risk	Moderate/ Low risk	Low risk
	Low likelihood	Moderate risk	Moderate/ low risk	Low risk	Very low risk
	Unlikely	Moderate/ low risk	Low risk	Very low risk	Very low risk

Note: A pollution linkage must first be established before probability is classified. If there is no pollution linkage then there is no potential risk. If there is no pollution linkage then there is no need to apply tests for probability and consequence.

- Under such a classification system the following categorisation of risk has been developed and the terminology adopted as follows:

Classification of Risk

Term	Description
Very high risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without appropriate remedial action.
High risk	Harm is likely to arise to a designated receptor from an identified hazard at the site without appropriate remedial action.
Moderate risk	It is possible that without appropriate remedial action harm could arise to a designated receptor but it is relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely that such harm would be relatively mild.
Low risk	It is possible that harm could arise to a designated receptor from an identified hazard but it is likely that at worst, that this harm if realised would normally be mild.
Very low risk	The presence of an identified hazard does not give rise to the potential to cause significant harm to a designated receptor.

2. RISK ASSESSMENT TABLES, REDCAR WORKS

Table 2 Qualitative Risk Assessment for Redcar – Area 11

AREA 11 – FORMER WARRENBY WORKS						
Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
Made Ground	Steel slag containing phytotoxic and heavy metals, alkalinity, sulphide, sulphate	Site Users	Direct contact, ingestion, inhalation	Health Hazard [Mild]	Low Limited evidence of contamination observed Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via site drainage or via permeable strata	Pollution of surface water [Mild]	Low Open areas allow rainfall infiltration to ground with potential migration. Metals in slag not likely to be mobile and limited evidence of contamination observed in soil and groundwater samples, mitigated by distance to river.	Low
		Groundwater (drift and recent sand and gravel deposits classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Shallow groundwater frequently encountered within Made Ground. Limited evidence of contamination observed in soil and groundwater.	Low
		Ecological receptors (SSSI located at South Gare and Coatham Sands)	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Limited evidence of contamination identified in shallow groundwater. Monitoring data indicates flow of shallow groundwater to east away from SSSI.	Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible future impact soil and groundwater quality [Medium]	Low Monitoring data indicates groundwater flow to east towards Corus owned land. However, limited evidence of contamination identified in soil and groundwater.	Moderate to Low

Table 3 Qualitative Risk Assessment for Redcar – Area 12

AREA 12 – POWER STATION AND SURROUNDING AREAS						
Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
Made Ground	Steel slag and railway ballast containing phytotoxic and heavy metals, alkalinity, sulphide, sulphate, phenols	Site Users	Direct contact, ingestion, inhalation	Health hazard [Mild]	Low Evidence of limited sulphate and sulphide contamination across the area. Many plant and access areas covered by hardstanding. Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Open areas allow rainfall infiltration to ground with potential migration. Evidence of limited sulphate and sulphide contamination across the area. Migration via permeable Made Ground and underlying sands. However, River Tees is 2.5km distant, with no open surface water courses in vicinity of site.	Low
		Groundwater (drift and recent sand and gravel deposits classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Groundwater encountered frequently within Made Ground. Elevated copper and total cyanide detected in groundwater at one location.	Low
		Ecological receptors (SSSI located at South Gare and Coatham Sands)	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Low Portion of area located adjacent to SSSI. Elevated copper and total cyanide detected in groundwater. Monitoring data indicates flow towards SSSI, but copper and cyanide not detected in surface water samples.	Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible future impact soil and groundwater quality [Medium]	Low Area located adjacent to SSSI. Elevated copper and total cyanide detected in groundwater. Monitoring data indicates flow towards SSSI, but copper and cyanide not detected in surface water samples .	Low
Oil and fuel storage and use	Lubricating oils, hydraulic fluid, greases and solvents	Site Users	Direct contact, ingestion, inhalation	Health hazard [Medium]	Low Elevated soil PAH in north and eastern portions of the area, although source not proven. Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Moderate / Low
		Surface water (River Tees)	Migration via site drainage or via permeable strata	Pollution of surface water [Mild]	Low Open areas allow rainfall infiltration to ground with potential migration. Limited elevated soil PAH detected, although source not proven. River 2km distant.	Low
		Groundwater (drift and recent sand and gravel	Migration via permeable strata	Pollution of groundwater [Mild]	Low Limited evidence of soil contamination but absence of groundwater contamination. Source not proven.	Low

AREA 12 – POWER STATION AND SURROUNDING AREAS

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
		deposits classed as Minor Aquifer)				
		Ecological receptors (SSSI located at South Gare and Coatham Sands)	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Portion of area located adjacent to SSSI. Limited evidence of contamination identified in shallow groundwater. Monitoring data indicates flow of groundwater towards SSSI.	Low

Table 4 Qualitative Risk Assessment for Redcar – Area 13

AREA 13 – SINTER PLANT

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
Made Ground	Steel slag containing phytotoxic and heavy metals, alkalinity, sulphide, sulphate	Site Users	Direct contact, ingestion, inhalation	Health hazard [Mild]	Low Elevated levels of sulphate and sulphide detected across sub areas A and C, although areas used infrequently by site workers. Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Open areas allow rainfall infiltration to ground with potential migration. Elevated levels of sulphate and sulphide detected in soils. Possible migration via perched groundwater, however river over 2km distant and no open surface water courses in the vicinity.	Low
		Groundwater (drift and recent sand and gravel deposits classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Elevated levels of sulphate and sulphide detected in soils. Shallow groundwater encountered frequently within Made Ground. Limited protection from downward migration afforded by low permeability clay in some areas, but absence of widespread contamination detected in groundwater samples.	Low
		Ecological receptors (SSSI located at South Gare and Coatham Sands)	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Limited evidence of contamination identified in shallow groundwater. Monitoring data indicates groundwater flow to north east.	Low
Oil and fuel storage and use	Lubricating oils, hydraulic fluid, greases and solvents	Site Users	Direct contact, ingestion, inhalation	Health Hazard [Medium]	Unlikely Absence of proven contamination across area. Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low likelihood Open areas allow rainfall infiltration to ground with potential migration. Absence of proven contamination and risk mitigated by distance to Tees from site.	Low
		Groundwater (drift and recent sand and gravel deposits classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low likelihood Absence of contamination observed in soil and groundwater samples.	Low
		Ecological receptors (SSSI located at South Gare and Coatham	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Limited evidence of contamination identified in shallow groundwater and monitoring data indicates flow to north east.	Low

AREA 13 – SINTER PLANT

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
		Sands)				
Stocking Areas	Coke and coal	Site Users	Direct contact, inhalation or ingestion of dust	Health Hazard [Medium]	Unlikely Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low

Table 5 Qualitative Risk Assessment for Redcar – Area 14

AREA 14 – BLAST FURNACE						
Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
Made Ground	Steel slag, railway ballast, dust and slurries and refractory materials containing phytotoxic and heavy metals, alkalinity, sulphide, sulphate and hydrocarbons	Site Users	Direct contact, ingestion, inhalation	Health hazard [Mild]	Low Elevated levels of sulphate and sulphide detected in soil across the area. Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Open areas allow rainfall infiltration to ground with potential migration. Elevated levels of sulphate and sulphide detected in soil and groundwater, but no other proven contamination. Also mitigated by distance to Tees from site (2km).	Low
		Groundwater (drift and recent sand and gravel deposits classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Elevated levels of sulphate and sulphide detected in soil across the area. However, absence of contamination within groundwater samples.	Low
		Ecological receptors (SSSI located at South Gare and Coatham Sands)	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Area located adjacent to SSSI, monitoring data indicates flow to north east towards SSSI. Limited evidence of contamination identified in shallow groundwater.	Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible future impact soil and groundwater quality [Medium]	Unlikely Area located adjacent to Corus retained land. Monitoring data indicates flow to north east. However, limited evidence of contamination identified in shallow groundwater.	Low
Oil and fuel storage and use	Lubricating oils, hydraulic fluid, greases and solvents	Site Users	Direct contact, ingestion, inhalation	Health Hazard [Medium]	Unlikely Slightly elevated levels of PAH detected in soils, and elevated TPH and BTEX at 14AB1. HFO tank adjacent to borehole 14AB1. Exposure potential limited. Site workers would be appraised of potential risks and appropriate PPE utilised; precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Unlikely Open areas allow rainfall infiltration to ground with potential migration. Elevated levels of TPH and PAH identified in soil and groundwater. However, Tees situated approximately 2km from site.	Very Low
		Groundwater (drift	Migration via	Pollution of	Low	Low

AREA 14 – BLAST FURNACE

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
		and recent sand and gravel deposits classed as Minor Aquifer)	permeable strata	groundwater [Mild]	Locally elevated TPH in groundwater at borehole adjacent to storage tank. Possible downward migration through permeable Made Ground and gravely sands. Shallow groundwater encountered at two locations within Made Ground.	
		Ecological receptors (SSSI located at South Gare and Coatham Sands)	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Low Evidence of organic contamination identified in shallow groundwater. Monitoring data indicates flow to east towards SSSI. No organic contamination detected in surface water samples.	Moderate to Low
Blast Furnace and transport links	Coke and coal	Site Users	Direct contact, inhalation or ingestion of dust	Health Hazard [Mild]	Low Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low

Table 6 Qualitative Risk Assessment for Redcar – Area 15

AREA 15 – RAW COAL AND ORE STOCKING AREAS

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
Stocking Areas	Coke, coal and iron ore residues	Site Users	Direct contact, inhalation or ingestion of dust	Heath Hazard [Mild]	Low Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low
Made Ground	Steel slag, refractory materials, railway ballast containing phytotoxic and heavy metals, alkalinity, sulphide, sulphate and hydrocarbons	Site Users	Direct contact, ingestion, inhalation	Health hazard [Mild]	Low Elevated levels of boron, zinc, copper, sulphate and sulphide detected in soils across the area. Absence of hardstanding across majority of area. Normal precautions likely to be taken during any below ground works, and appropriate levels of PPE worn on site.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Open areas allow rainfall infiltration to ground with potential migration. Elevated levels of boron, zinc, copper, sulphate and sulphide across the area. Possibility of lateral migration via groundwater flow. River Tees adjacent to west.	Low
		Groundwater (drift and recent sand and gravel deposits classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Shallow groundwater encountered frequently within Made Ground, elevated boron, copper and sulphate detected within groundwater.	Low
		Ecological receptors (SSSI located at South Gare and Coatham Sands)	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Elevated boron, copper and sulphate detected within groundwater. Monitoring data indicates flow to east towards SSSI which lies approximately 800m distant.	Low
Oil and fuel storage and use	Lubricating oils, hydraulic fluid, greases and solvents	Site Users	Migration via permeable strata	Health Hazard [Medium]	Unlikely Limited soil contamination by hydrocarbons observed across the area. Site workers would be appraised of potential risks and appropriate PPE utilised; precautions taken during any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Open areas allow rainfall infiltration to ground with potential migration. Limited contamination detected across the area.	Low
		Groundwater (drift and recent sand and gravel	Migration via permeable strata	Pollution of groundwater	Low Limited evidence of soil contamination from hydrocarbons. Potential vertical migration through permeable Made Ground and	Low

AREA 15 – RAW COAL AND ORE STOCKING AREAS

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
		deposits classed as Minor Aquifer)		[Mild]	sands, although absence of groundwater contamination detected across the area.	
		Ecological receptors (SSSI located at South Gare and Coatham Sands)	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Limited evidence of contamination identified in shallow groundwater. Monitoring data indicates flow to east towards SSSI.	Low

Qualitative Risk Assessment for Redcar – Area 16

AREA 16 – COKE OVENS

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
Made Ground	Steel slag, railway ballast containing phytotoxic and heavy metals, alkalinity, sulphide, sulphate and hydrocarbons	Site Users	Direct contact, ingestion, inhalation	Health hazard [Mild]	Low Limited elevated levels of sulphide detected in soils. Site workers would be appraised of potential risks and appropriate PPE utilised; appropriate measures taken for any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Open areas allow rainfall infiltration to ground with potential migration. Limited evidence of soil contamination and River Tees 1km distant.	Low
		Groundwater (drift and recent sand and gravel deposits classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Limited elevated levels of arsenic, sulphate in groundwater. Absence of contamination in soil. Permeable Made Ground and sands offer little protection from downward migration of contaminants.	Low
		Ecological receptors (SSSI located at South Gare and Coatham Sands)	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Limited evidence of contamination identified in shallow groundwater. Groundwater flow indicated to north and west away from SSSI. Area 500m distant from SSSI.	Low
Stocking Areas	Coke and coal residues	Site Users	Direct contact, inhalation or ingestion of dust	Health Hazard [Mild]	Low Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low
Gas producers	Coal tar, spent oxide, ammoniacal liquor, foul lime, creosote	Site Users	Direct contact, ingestion, inhalation	Health hazard [Medium]	Unlikely No elevated levels of organic contaminants in soils. Site workers would be appraised of potential risks and appropriate PPE utilised; appropriate measures taken for any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Open areas allow rainfall infiltration to ground with potential migration. Limited evidence of contamination, mitigated by distance from river.	Low
		Groundwater (drift and recent sand and gravel deposits classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Locally elevated TPH in groundwater. Potential downward and lateral migration via permeable Made Ground and sands.	Low
		Ecological	Migration via site	Possible impact on	Unlikely	Low

AREA 16 – COKE OVENS

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
		receptors (SSSI located at South Gare and Coatham Sands)	drainage or permeable strata	sensitive SSSI [Medium]	Limited evidence of contamination identified in shallow groundwater.	
Oil and fuel storage and use	Lubricating oils, hydraulic fluid, greases and solvents	Site Users	Migration via permeable strata	Health Hazard [Mild]	Low Very limited soil contamination observed across the area. Site workers would be appraised of potential risks and appropriate PPE utilised; and precautions taken during any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Open areas allow rainfall infiltration to ground with potential migration. Limited contamination detected across the area.	Low
		Groundwater (drift and recent sand and gravel deposits classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Limited evidence of soil contamination. Potential downward migration through permeable Made Ground and sands.	Low
		Ecological receptors (SSSI located at South Gare and Coatham Sands)	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Limited evidence of contamination identified in shallow groundwater.	Low

Table 7 Qualitative Risk Assessment for Redcar – Area 17

AREA 17 – BY-PRODUCTS

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
Made Ground	Steel slag, railway ballast containing phytotoxic and heavy metals, alkalinity, sulphide, sulphate and hydrocarbons	Site Users	Direct contact, ingestion, inhalation	Health hazard [Mild]	Low Limited elevated levels of lead, copper, zinc, sulphate and sulphide. Majority of area not covered by hardstanding. Site workers would be appraised of potential risks and appropriate PPE utilised; appropriate measures taken for any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Open areas allow rainfall infiltration to ground with potential migration. Limited elevated levels of metals and PAH in groundwater and soils but river 1.25km distant.	Low
		Groundwater (drift and recent sand and gravel deposits classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Potential downward migration via permeable Made Ground and underlying sands. Limited elevated levels of metals and PAH in groundwater.	Low
		Ecological receptors (SSSI located at South Gare and Coatham Sands)	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Area adjacent to SSSI, monitoring data indicates flow to east and north west towards SSSI. Limited evidence of contamination identified in shallow groundwater.	Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible future impact soil and groundwater quality [Medium]	Unlikely Area located adjacent to Corus retained land. However, limited evidence of contamination identified in shallow groundwater.	Low
Stocking Areas	Coke and coal	Site Users	Direct contact, inhalation or ingestion of dust	Health Hazrd [Mild]	Low Site workers appraised of potential risk and appropriate PPE utilised. Normal precautions likely to be taken during any below ground works.	Low
Gas producers	Coal tar, spent oxide, ammoniacal liquor, foul lime, creosote	Site Users	Direct contact, ingestion, inhalation	Health hazard [Medium]	Unlikely No elevated levels of organic contaminants in soils. Site workers would be appraised of potential risks and appropriate PPE utilised; appropriate measures taken for any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Elevated TPH in groundwater in 2 monitoring boreholes. Open areas allow rainfall infiltration to ground with potential migration.	Low
		Groundwater (drift and recent sand and gravel	Migration via permeable strata	Pollution of groundwater	Low Elevated TPH in groundwater in 2 monitoring boreholes. Potential	Low

AREA 17 – BY-PRODUCTS

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
		deposits classed as Minor Aquifer)		[Mild]	downward and lateral migration via permeable Made Ground and sands.	
		Ecological receptors (SSSI located at South Gare and Coatham Sands)	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Low Elevated TPH in groundwater in 2 monitoring boreholes. Potential downward and lateral migration via permeable Made Ground and sands.	Moderate / Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible future impact soil and groundwater quality [Medium]	Low Elevated TPH in groundwater in 2 monitoring boreholes. Potential downward and lateral migration via permeable Made Ground and sands.	Moderate / Low

3. RISK ASSESSMENT TABLES, LACKENBY WORKS

Table 8 Qualitative Risk Assessment for Lackenby – Area 7

AREA 7 – CONCAST AND BOS PLANT						
Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
Made Ground	Steel slag, refractory waste and railway ballast containing phytotoxic and heavy metals, alkalinity, sulphide, sulphate, phenols	Site Users	Direct contact, ingestion, inhalation	Health Hazard [Mild]	Low Slightly elevated levels of phytotoxic metals, sulphate and sulphide detected in soils. Site workers appraised of potential risk and appropriate PPE utilised. Normal precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via site drainage or via permeable strata	Pollution of surface water [Mild]	Low likelihood Open areas allow rainfall infiltration to ground with potential migration. Metals in slag not likely to be mobile, limited evidence of contamination observed in soil and groundwater samples, also mitigated by distance to river. No open surface water courses in vicinity of area.	Low
		Groundwater (drift and recent sand and gravel deposits classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low likelihood Shallow groundwater encountered within Made Ground and underlying clay. Limited evidence of contamination observed in soil and low permeability clay underlying Made Ground likely to inhibit downward migration of contaminants. Limited evidence of contamination detected in groundwater.	Low
Oil and fuel storage and use	Lubricating oils, hydraulic fluid, greases and solvents	Site Users	Direct contact, ingestion, inhalation	Health hazard [Mild]	Unlikely No evidence of hydrocarbon contamination observed in soil. Site workers appraised of potential risks and appropriate PPE utilised. Normal precautions taken during any below ground works.	Negligible
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Likelihood Open areas allow rainfall infiltration to ground with potential migration. Negligible evidence of contamination detected in soil, but elevated phenols detected in groundwater at one borehole location. Impermeable clay underlying Made Ground likely to inhibit downward migration of contaminants. River 2km distant. No open surface water courses in vicinity of area.	Low
		Groundwater (drift and recent sand and gravel deposits classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Groundwater encountered within Made Ground and underlying clay. Elevated phenols detected at one location, although source not proven. Relatively impermeable clay likely to inhibit downward migration of contaminants.	Low

Table 9 Qualitative Risk Assessment for Lackenby - Area 8

AREA 8 – CONCAST AND BOS PLANT

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
Made Ground	Steel slag, refractory waste and railway ballast containing phytotoxic and heavy metals, alkalinity, sulphide, sulphate, phenols	Site Users	Direct contact, ingestion, inhalation	Health hazard [Mild]	Low Site workers appraised of potential risks and appropriate PPE utilised. Evidence of limited sulphate and sulphide contamination across the area. Precautions likely to be taken during any below ground works.	Lowe
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Open areas allow rainfall infiltration to ground with possible migration. Evidence of limited sulphate and sulphide soil contamination across the area and River Tees 1.5km distant. No open surface water courses in vicinity of area.	Low
		Groundwater (drift and recent sand and gravel deposits classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Shallow groundwater encountered within Made Ground and underlying clay. Downward migration of contaminants likely to be inhibited by low permeability clay. No significant groundwater contamination detected.	Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible impact on adjacent land values from pollution [Medium]	Unlikely No significant groundwater contamination detected. Groundwater flow appears to be towards west, away from adjacent Corus land.	Low
Oil and fuel storage and use	Lubricating oils, hydraulic fluid, greases and solvents	Site Users	Direct contact, ingestion, inhalation	Health hazard [Medium]	Unlikely Site workers appraised of potential risks and appropriate PPE utilised. Elevated PAH detected in one soil samples, although source not proven. Precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via site drainage or via permeable strata	Pollution of surface water [Mild]	Low Open areas allow rainfall infiltration to ground with potential migration. Limited elevated soil PAH detected, however no groundwater contamination detected, mitigated by distance from river. No open surface water courses in vicinity of area.	Low
		Groundwater (drift and recent sand and gravel deposits classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Unlikely Groundwater encountered within Made Ground and underlying clay, although no groundwater contamination detected. Relatively impermeable clay likely to inhibit downward migration of potential contaminants.	Negligible

Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible impact on adjacent land values from pollution [Medium]	Unlikely No groundwater contamination detected and groundwater flow towards west away from adjacent Corus land.	Low

Table 10 Qualitative Risk Assessment for Lackenby – Area G

AREA G – IRON GRANULATION AND LOCO REPAIR SHOP

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
Made Ground	Steel slag and railway ballast containing phytotoxic and heavy metals, alkalinity, sulphide, sulphate, phenols	Site Users	Direct contact, ingestion, inhalation	Health hazard [Mild]	Low Site workers appraised of potential risks and appropriate PPE utilised. Elevated levels of PAHs detected at two locations. Precautions likely to be taken during any below ground works.	Lowle
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Open areas allow infiltration of rainfall to ground with potential migration. Elevated levels of chromium and copper detected in soils. Possible migration via shallow groundwater, but metals in slag not likely to be mobile and river 2km distant. No open surface water courses in vicinity of area.	Low
		Groundwater (drift and recent sand and gravel deposits classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Isolated elevated levels of chromium and copper detected in groundwater. Low permeability clay likely to inhibit downward migration of potential contaminants.	Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible impact on adjacent land values from pollution [Medium]	Unlikely Groundwater flow direction towards Corus land, but limited contamination detected in groundwater. Low permeability clay likely to inhibit downward migration of potential contaminants.	Low
Oil and fuel storage and use	Lubricating oils, hydraulic fluid, greases and solvents	Site Users	Migration via permeable strata	Health Hazard [Medium]	Unlikely Site workers appraised of potential risks and appropriate PPE utilised. Elevated levels of PAHs detected at two locations. Appropriate PPE and precautions likely to be taken during underground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Open areas allow infiltration of rainfall to ground with potential migration. Limited contamination detected mitigated by distance of river from site. No open surface water courses in vicinity of area.	Low
		Groundwater (drift and recent sand and gravel deposits classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Limited contamination detected in soil and groundwater. Low permeability clay likely to inhibit any downward migration of potential contaminants.	Low
		Corus owned land (i.e. land which would be retained	Migration via site drainage or permeable strata	Possible impact on adjacent land values from pollution	Unlikely Limited contamination detected. Groundwater flow direction towards Corus land. Low permeability clay underlying Made	Low

AREA G – IRON GRANULATION AND LOCO REPAIR SHOP

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
		by Corus)		[Medium]	Ground likely to inhibit migration of potential contaminants.	

4. RISK ASSESSMENT TABLES, CLEVELAND WORKS

Table 11 Qualitative Risk Assessment for Cleveland – Area 1

AREA 1 – BY-PRODUCTS PLANT AND COKE OVENS

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
Made Ground	Steel slag containing phytotoxic and heavy metals, alkalinity, sulphide, sulphate	Site Users	Direct contact, ingestion, inhalation	Health Hazard [Mild]	Low Limited evidence of contamination. Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via site drainage or via permeable strata	Pollution of surface water [Mild]	Low Open areas allow rainfall infiltration to ground with potential migration. Metals in slag not likely to be mobile and limited evidence of contamination observed in soil and groundwater samples, mitigated by distance to river.	Low
		Groundwater (Estuarine and Marine Alluvium classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Shallow groundwater frequently encountered within Made Ground. Limited evidence of contamination observed in soil and groundwater.	Low
		Ecological receptors (Tees and Hartlepool Foreshore and Wetlands SSSI).	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Limited evidence of contamination identified in shallow groundwater. Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground.	Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible impact on adjacent land values from pollution [Medium]	Unlikely Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground. Limited evidence of contamination identified in soil and groundwater.	Low
Gas producers	Heavy fuel oil, creosote, tar, benzole, ammoniacal liquor	Site Users	Direct contact, ingestion, inhalation	Health hazard [Medium]	Unlikely Locally elevated soil PAH in shallow and deep soil, source not proven. Site workers would be appraised of potential risks and appropriate PPE utilised. Normal precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via site drainage or via permeable strata	Pollution of surface water [Mild]	Low Likelihood Open areas allow rainfall infiltration to ground with potential migration. Locally elevated soil PAH in shallow and deep soil, source not proven. Mitigated by distance from River of	Low

AREA 1 – BY-PRODUCTS PLANT AND COKE OVENS

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
					approximately 900m.	
		Groundwater (Estuarine and Marine Alluvium classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Likelihood Limited evidence of soil contamination but absence of groundwater contamination. Source not proven.	Low
		Ecological receptors (Tees and Hartlepool Foreshore and Wetlands SSSI).	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Limited evidence of contamination identified in shallow groundwater. Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground.	Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible impact on adjacent land values from pollution [Mild]	Low Monitoring data indicates groundwater flow to east away from Corus owned land. Limited evidence of contamination identified in soil and groundwater.	Low

Table 12 Qualitative Risk Assessment for Cleveland – Area 2

AREA 2 – BY PRODUCTS

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
Made Ground	Steel slag containing phytotoxic and heavy metals, alkalinity, sulphide, sulphate	Site Users	Direct contact, ingestion, inhalation	Health hazard [Mild]	Low Elevated levels of sulphate, sulphide, boron, zinc, and lead detected in soils. Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Open areas allow rainfall infiltration to ground with potential migration. Elevated levels of sulphate, sulphide, boron, zinc, and lead detected in soils. Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground.	Low
		Groundwater (Estuarine and Marine Alluvium classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Sulphate, boron, selenium, copper and cyanide locally elevated in groundwater. Estuarine alluvium and Boulder Clay may provide some protection from downward migration.	Low
		Ecological receptors (Tees and Hartlepool Foreshore and Wetlands SSSI).	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Sulphate, boron, selenium, copper and cyanide locally elevated in groundwater. Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground. However elevated levels are likely to be reduced by dilution in River Tees before they reach the SSSI on the adjacent north bank.	Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible impact on adjacent land values from pollution [Medium]	Unlikely Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground. Limited evidence of contamination identified in soil and groundwater.	Low
Gas producers	Heavy fuel oil, creosote, tar, benzole, ammoniacal liquor	Site Users	Direct contact, ingestion, inhalation	Health Hazard [Medium]	Low Locally elevated soil PAHs and BTEX compounds at eastern side of site. Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Moderate to Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Likely Locally elevated soil PAHs and BTEX compounds at eastern side of site. Open areas allow rainfall infiltration to ground with potential migration. Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of	Moderate to Low

AREA 2 – BY PRODUCTS

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
					Made Ground.	
		Groundwater (Estuarine and Marine Alluvium classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	High Locally elevated soil PAHs and BTEX compounds at eastern side of site. Similarly elevated hydrocarbons in groundwater; PAHs, BTEX, GRO, TPH. Estuarine alluvium and Boulder Clay may provide some protection from downward migration. Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground.	Moderate
		Ecological receptors (Tees and Hartlepool Foreshore and Wetlands SSSI).	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Elevated hydrocarbons in groundwater; PAHs, BTEX, GRO, TPH. Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground. However elevated levels are likely to be reduced by dilution in River Tees before they reach the SSSI on the adjacent north bank.	Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible impact on adjacent land values from pollution [Medium]	Unlikely Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground. Limited evidence of contamination identified in soil and groundwater.	Low

Table 13 Qualitative Risk Assessment for Cleveland – Area 3

AREA 3 - FUEL OIL STORAGE AREA NEXT TO DOLPHIN WHARFE

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
Made Ground	Steel slag containing phytotoxic and heavy metals, alkalinity, sulphide, sulphate	Site Users	Direct contact, ingestion, inhalation	Health hazard [Mild]	Low Limited evidence of contamination. Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Limited evidence of contamination. Open areas allow rainfall infiltration to ground with potential migration. Possible migration via groundwater to the River Tees bordering the wharfe.	Low
		Groundwater (Estuarine and Marine Alluvium classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Limited evidence of contamination. Estuarine alluvium and Boulder Clay may provide some protection from downward migration.	Low
		Ecological receptors (Tees and Hartlepool Foreshore and Wetlands SSSI).	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Limited evidence of contamination. Possible migration via groundwater to the River Tees bordering the wharfe. However elevated levels are likely to be reduced by dilution in River Tees before they reach the SSSI on the adjacent north bank.	Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible impact on adjacent land values from pollution [Mild]	Low Limited evidence of contamination. Monitoring data indicates groundwater flow to west away from Corus owned land. Limited evidence of contamination identified in soil and groundwater.	Low
Oil storage	Heavy Fuel Oil	Site Users	Direct contact, ingestion, inhalation	Health Hazard [Medium]	Unlikely Limited evidence of contamination. Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Limited evidence of contamination. Open areas allow rainfall infiltration to ground with potential migration. Migration via groundwater to the River Tees bordering the wharfe.	Low
		Groundwater (Estuarine and Marine Alluvium classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Limited evidence of contamination. Open areas allow rainfall infiltration to ground with potential migration. Migration via groundwater to the River Tees bordering the wharfe.	Low
		Ecological receptors (Tees	Migration via site drainage or	Possible impact on	Low	Low

AREA 3 - FUEL OIL STORAGE AREA NEXT TO DOLPHIN WHARFE						
Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
		and Hartlepool Foreshore and Wetlands SSSI).	permeable strata	sensitive SSSI [Medium]	Limited evidence of contamination.	
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible impact on adjacent land values from pollution [Mild]	Low Monitoring data indicates groundwater flow to west away from Corus owned land. Limited evidence of contamination identified in soil and groundwater.	Low

Table 14 Qualitative Risk Assessment for Cleveland – Area 4

AREA 4 – SLEMS AREA

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
Made Ground	Biological sludge, tar residue, lime slurry, ferromanganese dust, iron, lead, zinc, alkalis, oils, iron, calcium, silicon, magnesium, aluminium, Lackenby works effluent, oil mill scale.	Site Users	Direct contact, ingestion, inhalation	Health hazard [Medium]	Unlikely Elevated levels of toxic and phytotoxic metals and organics in soil and groundwater. Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata, consented discharge from SLEMS into River Tees	Pollution of surface water [Mild]	Low Elevated levels of toxic and phytotoxic metals and organics in soil and groundwater. Open areas allow rainfall infiltration with limited potential groundwater migration away from the River Tees. However treated effluent is discharged as per regulatory requirements.	Low
		Groundwater (Estuarine and Marine Alluvium classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Likely Elevated levels of toxic and phytotoxic metals and organics in groundwater. Clays beneath the Made Ground may provide some protection to downward migration of contaminants.	Moderate to Low
		Ecological receptors (Tees and Hartlepool Foreshore and Wetlands SSSI).	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Elevated levels of toxic and phytotoxic metals and organics in groundwater. Groundwater shows migration away from SSIS. Treated effluent is discharged as per regulatory requirements. . Elevated levels are likely to be reduced by dilution in River Tees before they reach the SSSI on the adjacent north bank.	Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible impact on adjacent land values from pollution [Mild]	Low Elevated levels of toxic and phytotoxic metals and organics in groundwater. Clays beneath the Made Ground may provide some protection to downward migration of contaminants. Likely migration is east to toward Teesco owned land.	Low

Table 15 **Qualitative Risk Assessment for Cleveland – Area D**

AREA D– WESTERN SIDE OF PIG CASTER

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
Made Ground	Steel slag containing phytotoxic and heavy metals, alkalinity, sulphide, sulphate	Site Users	Direct contact, ingestion, inhalation	Health hazard [Mild]	Low Elevated levels of sulphate, sulphide, boron, zinc, and lead detected in soils. Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Open areas allow rainfall infiltration to ground with potential migration. Elevated levels of sulphate, sulphide, boron, zinc, copper and lead detected in soils. Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground.	Low
		Groundwater (Estuarine and Marine Alluvium classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Sulphate, sulphide, arsenic, boron locally elevated in groundwater. However estuarine alluvium and Boulder Clay may provide some protection from downward migration.	Low
		Ecological receptors (Tees and Hartlepool Foreshore and Wetlands SSSI).	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Sulphate, boron, selenium, copper and cyanide locally elevated in groundwater. Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground. However elevated levels are likely to be reduced by dilution in River Tees before they reach the SSSI on the adjacent north bank.	Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible impact on adjacent land values from pollution [Mild]	Low Locally high phytotoxic and toxic metals. Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground.	Low
Gas producers (Area 2)	Heavy fuel oil, creosote, tar, benzole, ammoniacal liquor	Site Users	Direct contact, ingestion, inhalation	Health Hazard [Medium]	Low Locally elevated soil PAHs and BTEX compounds in soil. Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Moderate to Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Likely Locally elevated soil PAHs and BTEX in soil. Open areas allow rainfall infiltration to ground with potential migration Possible migration toward River Tees but groundwater flow shows local	Moderate to Low

AREA D– WESTERN SIDE OF PIG CASTER

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
					variations that may be influenced by the depth of Made Ground.	
		Groundwater (Estuarine and Marine Alluvium classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	High Locally elevated soil PAHs and BTEX compounds and slightly elevated hydrocarbons in groundwater. Estuarine alluvium and Boulder Clay may provide some protection from downward migration. Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground.	Moderate
		Ecological receptors (Tees and Hartlepool Foreshore and Wetlands SSSI).	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Locally elevated soil PAHs and BTEX compounds and slightly elevated hydrocarbons in groundwater. Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground. However elevated levels are likely to be reduced by dilution in River Tees before they reach the SSSI on the adjacent north bank.	Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible impact on adjacent land values from pollution [Mild]	Low Locally elevated soil PAHs and BTEX compounds and slightly elevated hydrocarbons in groundwater. Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground.	Low

Table 16 Qualitative Risk Assessment for Cleveland – Area E

AREA E – TARMAC AND WHARFE AREA						
Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
Made Ground	Steel slag containing phytotoxic and heavy metals, alkalinity, sulphide, sulphate	Site Users	Direct contact, ingestion, inhalation	Health hazard [Mild]	Low Elevated levels of sulphate, sulphide, boron, zinc, and lead detected in soils. Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Open areas allow rainfall infiltration to ground with potential migration. Elevated levels of sulphate, sulphide, boron, zinc, copper and lead detected in soils. Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground.	Low
		Groundwater (Estuarine and Marine Alluvium classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Elevated levels of sulphate, sulphide, boron, zinc, and lead detected in soils. No boreholes in this area. Estuarine alluvium and Boulder Clay may provide some protection from downward migration.	Low
		Ecological receptors (Tees and Hartlepool Foreshore and Wetlands SSSI).	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Elevated levels of sulphate, sulphide, boron, zinc, and lead detected in soils. No boreholes in this area.	Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible impact on adjacent land values from pollution [Mild]	Low Elevated levels of sulphate, sulphide, boron, zinc, and lead detected in soils. Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground.	Low
Oil and fuel storage and use	Lubricating oils, hydraulic fluid, greases and solvents	Site Users	Direct contact, ingestion, inhalation	Health Hazard [Medium]	Low Locally elevated soil PAHs and BTEX compounds in soil. Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Locally elevated soil PAHs and BTEX in soil. Open areas allow rainfall infiltration to ground with potential migration Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground.	Low
		Groundwater	Migration via	Pollution of	Low	Low

AREA E – TARMAC AND WHARFE AREA

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
		(Estuarine and Marine Alluvium classed as Minor Aquifer)	permeable strata	groundwater [Mild]	No boreholes in this area. Estuarine alluvium and Boulder Clay may provide some protection from downward migration. Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground.	
		Ecological receptors (Tees and Hartlepool Foreshore and Wetlands SSSI).	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely No boreholes in this area. Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground. However elevated levels are likely to be reduced by dilution in River Tees before they reach the SSSI on the adjacent north bank.	Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible impact on adjacent land values from pollution [Mild]	Low No boreholes in this area. Possible migration toward River Tees but groundwater flow shows local variations that may be influenced by the depth of Made Ground.	Low

Table 17 Qualitative Risk Assessment for Cleveland – Area H

AREA H – TORPEDO AND LADLE REPAIR SHOP

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
Made Ground	Steel slag containing phytotoxic and heavy metals, alkalinity, sulphide, sulphate	Site Users	Direct contact, ingestion, inhalation	Health hazard [Mild]	Low Limited evidence of contamination. Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Open areas allow rainfall infiltration to ground with potential migration. Limited evidence of contamination. Possible migration toward River Tees but mitigated by distance, approximately 2km.	Low
		Groundwater (Estuarine and Marine Alluvium classed as Minor Aquifer)	Migration via permeable strata	Pollution of groundwater [Mild]	Low Limited evidence of contamination. Estuarine alluvium and Boulder Clay may provide some protection from downward migration.	Low
		Ecological receptors (Tees and Hartlepool Foreshore and Wetlands SSSI).	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely. Limited evidence of contamination. . Possible migration toward River Tees but mitigated by distance, approximately 2km.	Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible impact on adjacent land values from pollution [Mild]	Low Limited evidence of contamination.	Low
Oil and fuel storage and use	Lubricating oils, hydraulic fluid, greases and solvents	Site Users	Direct contact, ingestion, inhalation	Health Hazard [Medium]	Unlikely Limited evidence of contamination. Site workers would be appraised of potential risks and appropriate PPE utilised; normal precautions likely to be taken during any below ground works.	Low
		Surface water (River Tees)	Migration via permeable strata	Pollution of surface water [Mild]	Low Limited evidence of contamination. Open areas allow rainfall infiltration to ground with potential migration. Possible migration toward River Tees but mitigated by distance, approximately 2km.	Low
		Groundwater (Estuarine and Marine Alluvium	Migration via permeable strata	Pollution of groundwater	Low Limited evidence of contamination. Possible migration toward River	Low

AREA H – TORPEDO AND LADLE REPAIR SHOP

Source	Pollutant	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence	Risk
		classed as Minor Aquifer)		[Mild]	Tees but mitigated by distance, approximately 2km.	
		Ecological receptors (Tees and Hartlepool Foreshore and Wetlands SSSI).	Migration via site drainage or permeable strata	Possible impact on sensitive SSSI [Medium]	Unlikely Limited evidence of contamination Possible migration toward River Tees but mitigated by distance, approximately 2km.	Low
		Corus owned land (i.e. land which would be retained by Corus)	Migration via site drainage or permeable strata	Possible impact on adjacent land values from pollution [Mild]	Low Limited evidence of contamination.	Low

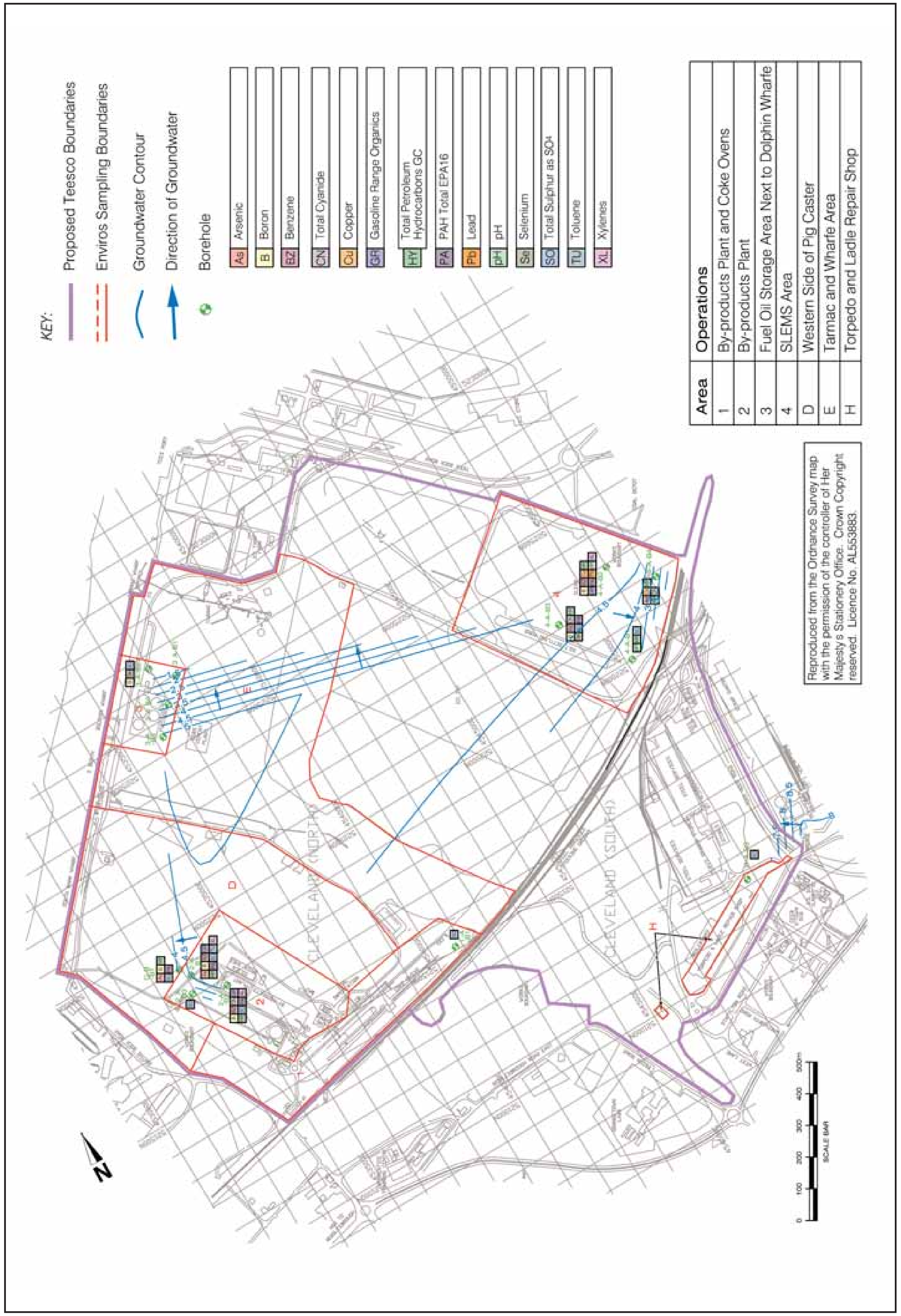

Figure 7 : Borehole Locations and Groundwater Contours, Cleveland

Redcar

Lackenby

Cleveland

CORUS UK Ltd

Soil and Groundwater Baseline Characterisation Study Teesside Works

Volume 3 of 3 : Summary Report

June 2004

EXECUTIVE SUMMARY

Context

Corus UK Ltd ("Corus") is seeking to sell the majority of its landholding at Teesside to a Joint Venture Company. The extent of the Teesside landholding showing those areas planned to be retained by Corus, those that will pass to the JV Company and those that will be leased to the JV Company are shown on Figure 1. Enviros were instructed by Corus in April 2004 to carry out a land quality baseline study on those parts of the site included in the sale package. The deadline for the work was 15th June, allowing a 13-week programme.

Summary of Objectives

The primary objective of the study was to provide a baseline survey of soil and groundwater quality of the landholding planned for transfer to the JV Company and the landholding planned for long term lease to this company[1].

Our risk assessment has been completed on the basis that the Works will continue to be used for steelmaking purposes in its current form following transfer of the landholding to the JV Company. As such the assessment has not considered any future form of redevelopment of the site, or possible future changes in land use.

Summary of Scope

- Review of information held by Corus, in particular a recently prepared PPC report.
- Site investigation across an area of approx. 560ha comprising 264 trial pit excavations and 42 boreholes.
- Soil and groundwater sampling and chemical testing of a comprehensive contaminant suite.
- Baseline characterisation of soil and groundwater quality.
- Tier 1 screening and initial qualitative risk assessment.

Summary of Findings

Ground Conditions

Ground conditions across the landholding comprise Made Ground underlain by a series of unconsolidated deposits including alluvial/estuarine and Glacial Till deposits. The solid geology at depth (not encountered in the investigation) comprises several hundred metres of predominantly mudstone.

The Made Ground deposits constitute infilled/reclaimed land to form a development platform for the steelworks. Infill typically comprises slag together with fragments of ash and brick etc. In the Redcar area the Made Ground is more variable and also includes reworked natural materials such as clays (likely to be Glacial Till). Thickness of up to 10m of Made Ground are present although 4m is more typical.

Soil and Groundwater Baseline Land Quality Condition

Chemical analysis data has been screened against generic guidance values[2] in order to place the chemical results obtained during the study into context. Overall the results indicate elevated concentrations of sulphate and sulphide on a widespread basis. Alkaline pH conditions in soils are similarly widespread across the landholding. This broad, site wide land quality signature is characteristic of a steelworks environment of comparable complexity and history.

Elevated concentrations of the following contaminants were identified on a more localised basis: metals - lead, copper, zinc, boron; organics - TPH, PAH and BTEX compounds[3]. The occurrence of elevated concentrations of these contaminants was more prevalent in the Cleveland site and, for the organic contaminants, supports the visual/olfactory identification of hydrocarbon contamination at several locations at this site namely the By-Products Plant area and the SLEMS area.

Groundwater Flow

Shallow groundwater was observed across the site within the Made Ground and, where present immediately beneath, in the underlying alluvial deposits. Groundwater flow in this shallow system was generally observed to be towards the River Tees i.e. to the north-west and, in the case of Redcar, to the north/north east also. Groundwater levels at Cleveland did not conform to any consistent flow pattern suggesting local factors complicating the more regional water table condition.

Preliminary Risk Assessment

A preliminary risk assessment indicates the majority of potential risks across the landholding to be low. The following risks have been assessed as Medium:

Redcar site: potentially contaminated shallow groundwater migrating from the site into the adjacent SSSI.

Lackenby site: risks to identified environmental receptors are assessed as being negligible to low.

Cleveland site: risk to the River Tees due to high levels of organic contamination to the north-west of the By-Products Plant. Associated risk to shallow groundwater impacted by the same.

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[1] The Site of Special Scientific Interest (SSSI) adjacent to and north-east of Redcar was included also.

[2] Screening criteria for soils have included published UK CLEA Soil Guideline Values and where values are not available for certain contaminants use has been made of Dutch Intervention Values (DIV) or internal Enviros guideline values. For water samples screening criteria have been based on the use of UK Drinking Water Guidelines and where values are not available DIVs. It is recognised that comparison against stringent Drinking Water Guidelines on an industrial complex such as the Teesside Works is a necessarily conservative approach.

[3] TPH: Total Petroleum Hydrocarbons; PAH: Poly-Aromatic Hydrocarbons: BTEX Compounds; Benzene, Toluene, Ethyl-benzene and Xylene.

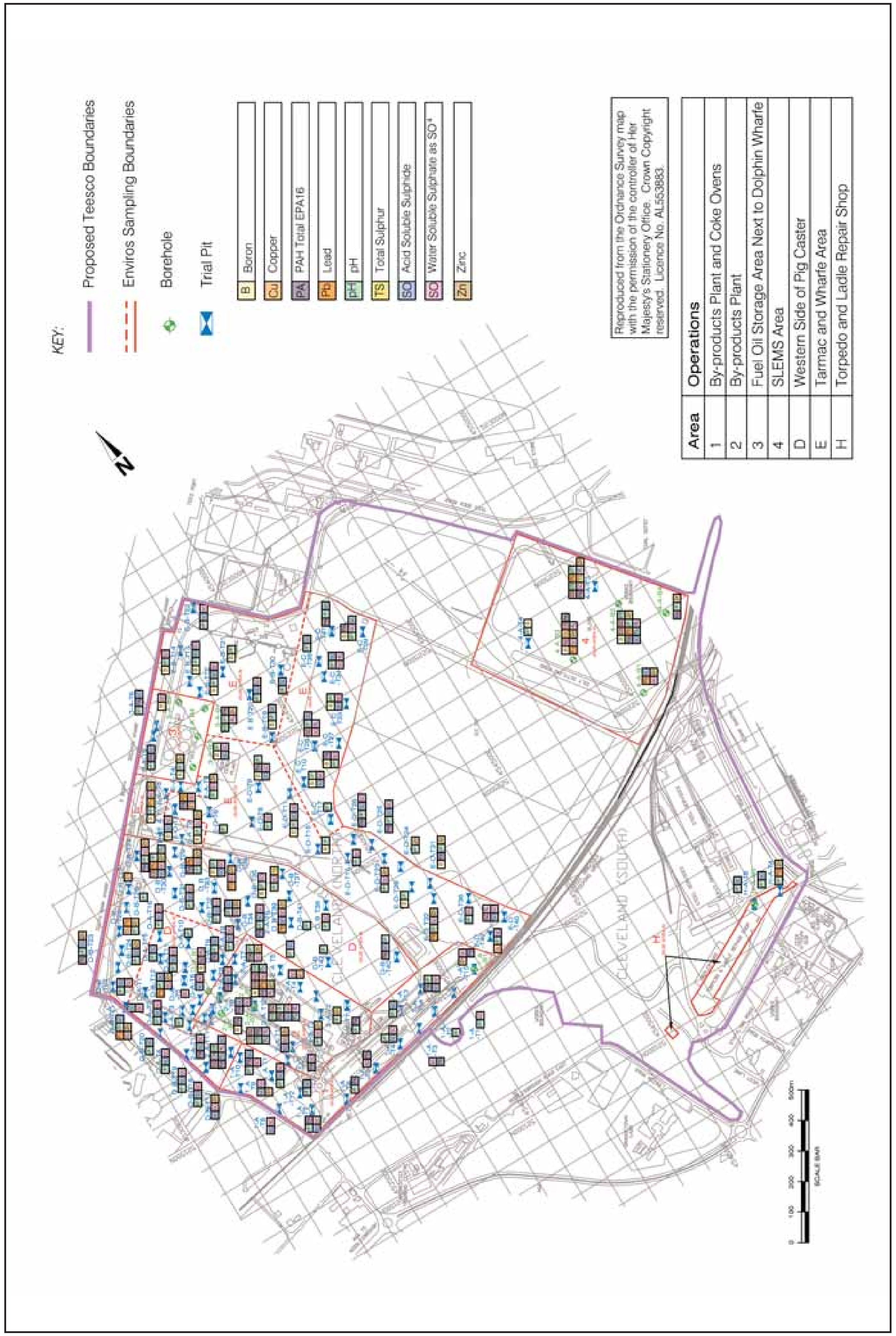


Figure 6 : Exploration Locations and Screening Level Exceedances, Cleveland

CLEVELAND cont.

Soil and Groundwater Baseline Condition

Soils: Fill materials across the site are typically characterised by alkaline pH and elevated concentrations of sulphide and sulphate. This is due to the widespread occurrence of slag within Made Ground deposits underlying the site. The phytotoxic metals zinc and boron are also often present in concentrations exceeding screening levels as is lead, although to a lesser degree.

Elevated concentrations of PAH, BTEX compounds and, to a lesser degree TPH, are also widespread in specific areas of the site namely Areas 1 (By-products Plant and Coke Ovens), 2 (By-Products Plant), 3 (Fuel Storage Area) and 4 (SLEMS area). Localised oily, tarry deposits and associated strong organic odours were observed in Made Ground in the area to the west and northwest of the By-Products Plant in the vicinity of the benzol storage tanks. This contamination may extend over an area of approximately 20,000m2 . Evidence of hydrocarbon contamination was also visually observed at several exploration locations in the SLEMS area.

Groundwater: compared with UK Drinking Water Standards shallow groundwater beneath the site has widespread elevated concentrations of sulphate, cyanide, arsenic, copper and boron.

Groundwater samples from the By Products Plant and SLEMS areas also indicated concentrations of hydrocarbon compounds in excess of screening criteria (PAH, BTEX Compounds, TPH and GROs). Evidence of free product was identified within water samples taken from monitoring wells installed near the Benzol storage tanks and the western boundary of the By Products sampling area.

Groundwater Levels: groundwater levels across the site do not conform to any consistent flow pattern although there is evidence for a broad flow direction towards the River Tees. As the borehole distribution is variable across such a large area it is not possible to draw any specific conclusions from the water levels observed (Figure 7) and, in contrast with the more uniform water table condition across other sites, local flow conditions are complex and possibly localised. This may be due to local variations in the depth of Made Ground, variations in permeability of the underlying drift deposits andor the effect of sub-surface drainage systems.

Multiple potential sources of contamination have been identified from both the historical land use and the current operations. Sources include: slag, oils, solvents, coal tars, heavy fuel oil, creosote, benzole and ammoniacal liquor. The tarry hydrocarbon contamination identified in soils and groundwater near to the Benzol storage tanks and the By-Products Plant area is considered a significant source, with the potential for future migration through the sub-surface. Principal pathways comprise direct human contact/ingestion/inhalation and migration via permeable strata and site drainage. Potential targets include humans i.e impact on human health to site workers, visitors and off-site residents, groundwater receptors (the Alluvium being classified as a Minor Aquifer), nearby surface waters i.e. the River Tees and ecological receptors i.e. the Tees and Hartlepool Foreshore and Wetlands SSSI.

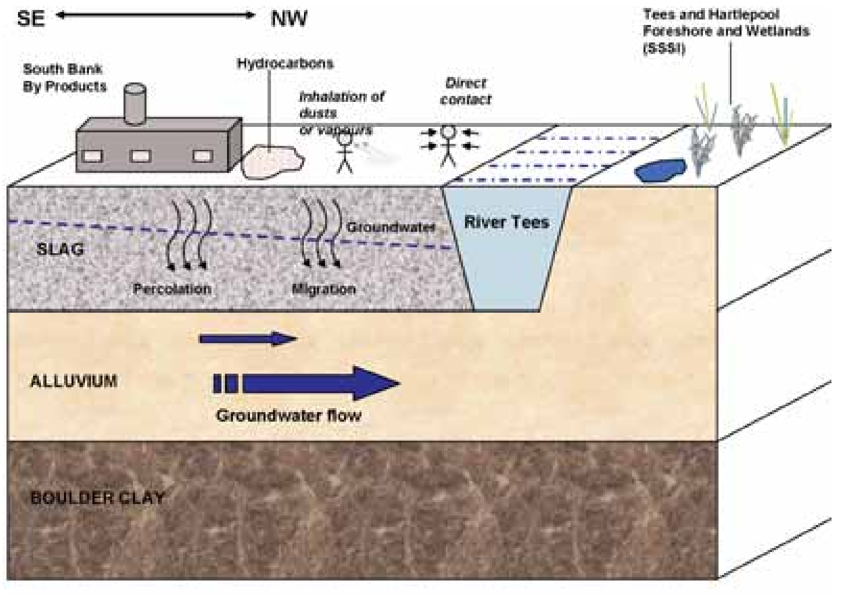
Summary Risk Assessment

Risk to:	Assessed Risk:	Comments:
Human Receptors (site users)	Low to Moderate	Principal potential exposure pathway is direct ingestion where hardstand absent, particularly in contaminated soils in the By-Products Plant area. Greatest risk faced by maintenance workers engaged in excavation works.
Surface Waters	Moderate (By Products Plant area)/ Low (all other areas)	River Tees is the principal receptor. Elevated risk (i.e. Moderate) to the north-west of the By-Products Plant due to the high levels of organic contamination in the soil and the proximity of the Tees.
Groundwater	Moderate (By Products Plant and SLEMS areas)/ Low (all other areas)	Aquifer of limited resource potential. However, organic contamination combined with free-product in By-Products Plant area and groundwater exceeding some screening criteria in the SLEMS area indicate a higher risk to groundwater in these area.
SSSI/Ramsar site	Low	Main pathway via discharges into the Tees; extent of impact likely to be limited.
Adjacent land remaining in Corus landholding	Low	Main pathway would be shallow groundwater. No evidence, based on observed flow directions, for Corus land to be impacted by potential off-site migration of contaminated groundwater.

Within the context of this study, the principal risk associated with the identified contamination at Cleveland relates to the potential for migration of hydrocarbon contamination away from the By Products Plant via the shallow aquifer towards nearby receptors i.e. the Tees.

Summary Conceptual Site Model

A schematic CSM is presented illustratively in the diagram below (not to scale):



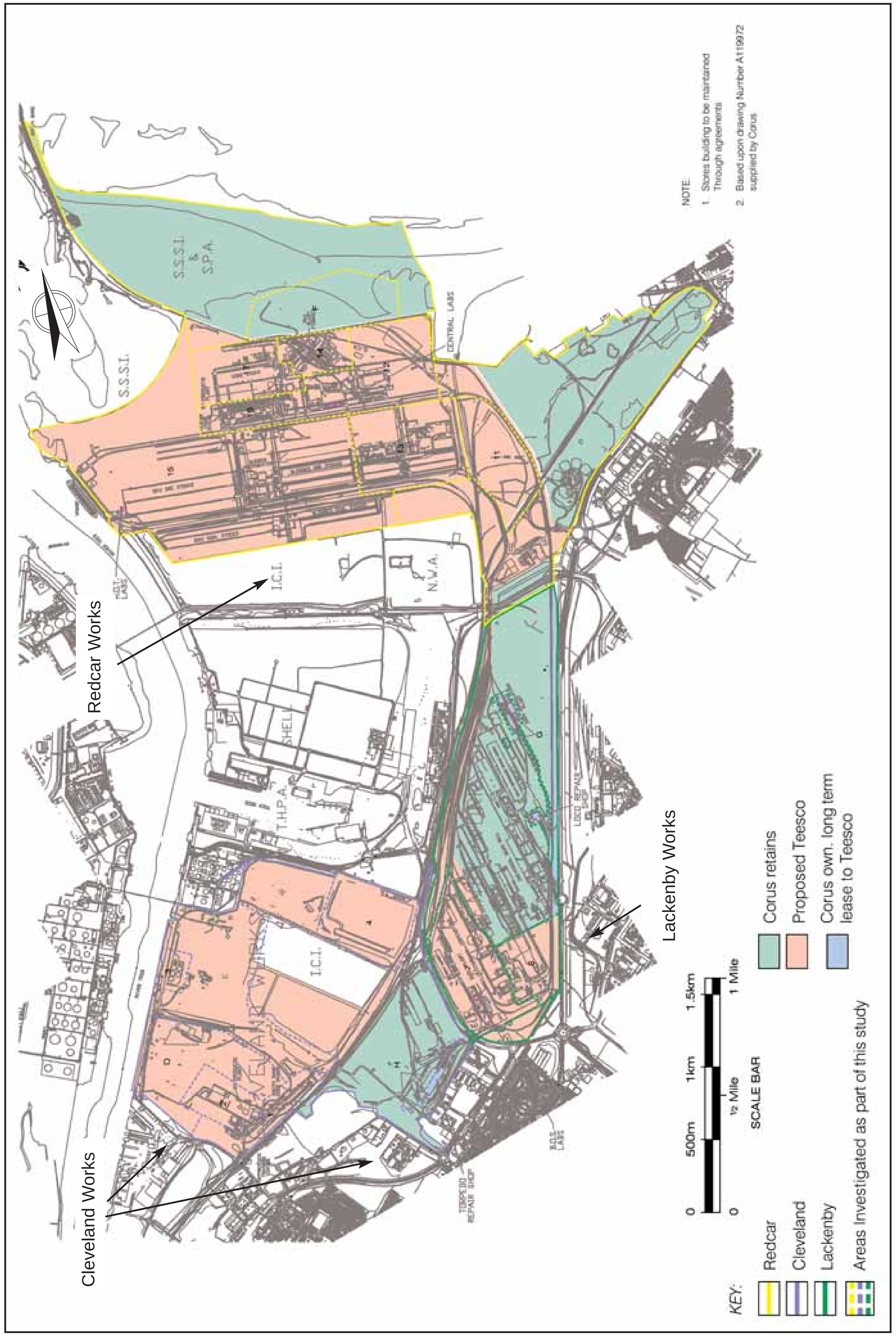


Figure 1: Proposed TEESCO landholding, longterm lease land to TEESCO and retained Corus land

OVERVIEW

Summary Description of Corus' Teesside Works

The Corus works at Teesside is located on land to the south of the River Tees Estuary towards Tees Mouth and occupies an area of approx. 700ha. There are three discrete sites; Redcar, Lackenby and Cleveland (Figure 1).

Cleveland	Lackenby	Redcar
South Bank coke ovens Former pig casting area SLEMS (Solid Liquid Effluent Management) Cleveland oil farm Torpedo Ladle Repair Shop	BOS/CONCAST plant Iron granulation plant Loco repair shop	Blast furnace Power station Coke Ovens By-products plant Burden preparation area Ore stocking grounds Sinter plant Wharf

History[4]

Redcar Works: between 1900 and 1914 the Bran Sands area was reclaimed with steel slag and refactory materials (made ground). The "Warrenby Steelworks" and associated plate mills were then constructed in 1916 with steel manufacture commencing in 1917. In the 1970s the steelworks operation was replaced and significantly expanded with the construction of a marine ore reception terminal, ore unloading facilities, ore stockyard, blending facilities, sinter plant, pellet plant, coke ovens, blast furnace and power plant.

Lackenby Works: steelworks were originally constructed on the Lackenby Works site in the 1950s by Dorman Long & Co. The operation has subsequently expanded (1960s: Plate Coil Mill and Electric Arc Furnaces; 1970s: BOS Plant, Continuous Casting Plant, 1990s Hot metal desulphurising facilities and second vacuum degaser at the BOS Plant). Decommissioning of various plant has also taken place over this period (1970s: 'open hearth' plant; Cleveland Steelworks; 1980s: Cleveland Engineering Shops and Mills No. 6, 7 and 8 and North Steel Plant; 2001/02: No.2 Primary Mill and Coil Plate Mills).

Cleveland Works: Cleveland has the longest history of iron and steelworks at the Teesside works. Low-lying land adjacent to the Tees estuary was reclaimed in around 1880 using slag to create a high water embankment. In 1881 the South Banks Iron Works were constructed and in 1906 further land was reclaimed and wharf areas constructed. At some point pre-1950s waste effluents were directed into the SLEMS area from the local ironworks. The South Banks Coke Ovens and other infrastructure were then constructed in the mid-1950s and the Power Station B and oil storage tanks commissioned in the mid-1960s. A number of facilities were designated as waste disposal sites in the 1970s and in 1999 Power Station B was decommissioned and demolished.

Previous Work

A number of previous investigations have been carried out at the Teesside Works, mainly in relation to ongoing development. These investigation reports are summarised within a Pollution Prevention and Control (PPC) report produced by Corus in 2003.

Approach

The JV landholding study area was divided into 3 "sites": Redcar, Lackenby and Cleveland. Each site was further sub-divided into "Areas", each Area typically comprising an operational facility (refer to Table 1 below and Figure 1).

Limitations

The site investigation was designed to provide broad characterisation of soil and groundwater conditions across the three sites. Operational, access and infrastructure-related restrictions limited access in places and the landfill areas were excluded from the scope of the study. One round of groundwater monitoring and sampling was performed.

Summary of Site Investigation

Table 1 below summarises the number and distribution of excavations and boreholes undertaken during the current study:

Table 1: Excavations and Boreholes undertaken at Corus Teesside

Site	Area	Operations	Area size (Ha)	No. Trial Pits	No. Bore holes
Redcar Works	11	Former Warrenby Works	27	9	2
	12	Power Station and Surrounding Areas	42	17	2
	13	Sinter Plant	42	17	2
	14	Blast Furnace	12	9	2
	15	Raw Coal and Ore Stocking Areas	176	41	3
	16	Coke Ovens	15.5	5	2
	17	By-Products	25	22	3
	F	South Gare and Coatham Sands SSSI*	24.5	-	[1]
Lackenby Works	7	Concast and BOS Plant	36	12	5
	8	No. 2 Primary Mill	16.1	6	2
	G	Iron Granulation and Loco Repair Shop	4.66	4	2
Cleveland Works	1	By-Products Plant and Coke Ovens	13.9	15	1
	2	By-Products Plant	14.6	14	3
	3	Fuel Oil Storage Area next to Dolphin Wharfe	3.2	6	6[2]
	4	SLEMS Area	29	2	4
	D	Western side of Pig Caster	38	42	2[3]
	E	Tarmac and Wharfe Area	36	41	-
	H	Torpedo and Ladle Repair Shop	3.4	2	1
Total			560	264	42

* The SSSI is located adjacent to Redcar Works and is analysed as part of the Redcar data set.

[1] Eight surface water samples were taken in this area·

[2] Two boreholes installed, four other attempts abandoned due to hard ground

[3] One borehole installed, one abandoned due to hard ground

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[4] Based on a study of available topographic maps and plans held in Corus archives

CLEVELAND

Summary

The Cleveland Works are located adjacent to, and on the south banks of, the River Tees Estuary immediately south-west of Teesport terminal. The main areas included in the investigation are located in Cleveland (North) and include the By-products Plant and Coke Ovens areas, the "Western side of Pig Caster" area, the Fuel Oil Storage Area next to Dolphin Wharf, the SLEMS area and the Tarmac and Wharf Area.

The only area included in the Cleveland (South) works was the Torpedo and Ladle Repair Shop (Area H) - refer to Figure 1. The aerial photograph below illustrates the principal features of the site and immediate surrounds.

Ground Conditions

The Cleveland site is constructed on an area of reclaimed land comprising infilled material (Made Ground). This infilled material is consistently up to 4m in thickness across all areas investigated apart from the Dolphin Wharf area where up to 7.5m of Made Ground was encountered (to be expected immediately adjacent to the Tees). Made Ground comprises fragments of slag, brick, ash and ferrous metal debris with very occasional pockets of clay. Layers of fused 'pelite' were encountered in some parts of the site.

Made Ground is underlain by alluvial and marine deposits up to 9m in thickness according to the published geological map. Where encountered these deposits comprised sandy clay and gravel deposits. These are underlain by Glacial Till, or "Boulder Clay", formations which in turn are underlain at depth by several hundred metres of predominantly mudstone formations.

Site Sensitivity

Groundwater: The Estuarine and Marine Alluvium deposits in the vicinity of the site are classified as a Minor Aquifer by the Environment Agency. There are no licensed abstractions within 1km of the site and Groundwater Sensitivity is assessed as being ***Low***.

Surface Water: The principal surface water feature is the adjacent River Tees (designated as a Class A watercourse under the CEWP Scheme). There are no natural surface water features crossing the site. Site drainage and discharge effluent entering the SLEMS goes into a series of open channels and lagoons; effluent is treated to meet consent limits before being discharged into the Tees. The SLEMS is unlined and some infiltration to ground is to be expected. A soakaway and a discharge to the Tees at Cleveland Oil Farm are both regulated under PPC consent. Overall surface water sensitivity is assessed as being ***Moderate***.

Ecology: the Cleveland site is on the opposite bank to a SSSI and Ramsar site. As the site is close to this ecologically sensitive area the ecological sensitivity is assessed as being ***Moderate***.

Aerial Photo - Cleveland

LACKENBY cont.

Soil and Groundwater Baseline Condition

Soils: soils across Lackenby are characterised by uniformly alkaline pH conditions and occasionally elevated concentrations of sulphide and sulphate, reflecting the widespread presence of slag materials in the Made Ground fill (Figure 5). Toxic and phytotoxic metals in the soils were below guideline values apart from locally elevated copper, lead, zinc and boron. Copper was slightly elevated with respect to the guideline values in shallow soils at the southern part of the Lackenby Works near the Slag Transporter Workshop. Hydrocarbons were below guideline values in the soil at the Lackenby Works apart from isolated levels of PAHs in the shallow soils, which are most likely as a result of localised spillages. Localised black oily staining and oily odours, indicative of localised spillages/loss of hydrocarbon, were observed near the north-western boundary in Area 7 (Concast and BOS Plant) and near the western boundary of Area 8 (No 2 Primary Mill).

Groundwater: compared with UK Drinking Water Standards shallow groundwater beneath the site has widespread elevated concentrations of sulphate and copper in addition to isolated exceedances of other contaminants; some locations exhibit pH levels indicative of alkaline groundwater conditions.

Groundwater Levels: groundwater levels across the site generally form a consistent pattern indicating groundwater flow in a north-westerly direction (towards the Tees). Water levels in two boreholes do not conform to this flow pattern and possibly indicate localised flow influenced by a culvert or other drainage feature beneath the site. Levels range from 9.0mAOD in the south-east of the site to below 7mAOD in the north (Figure 6).

Figure 5 : Borehole Locations and Groundwater Contours, Lackenby

Multiple potential sources of contamination have been identified from both the historical land use and the current operations. Sources include: slag, oils, solvents and other hydrocarbons. Principal pathways comprise direct human contact/ingestion/inhalation and migration via permeable strata and site drainage. Potential targets include humans i.e impact on human health to site workers, visitors and off-site residents, surface waters and groundwater.

Summary Risk Assessment

Risk to:	Assessed Risk:	Comments:
Human Receptors (site users)	Low	Principal potential exposure pathway is direct however hardstand and building coverage is extensive. Slightly increased risk faced by maintenance workers engaged in excavation works.
Surface Waters	Low	River Tees Estuary is the principal receptor. Baseflow from the site not considered significant and groundwater quality adequate.
Groundwater	Low	Aquifer of negligible resource potential.
Adjacent land remaining in Corus landholding	Low	Risk of any site-derived contamination impacting on adjacent land to be retained by Corus is considered low.

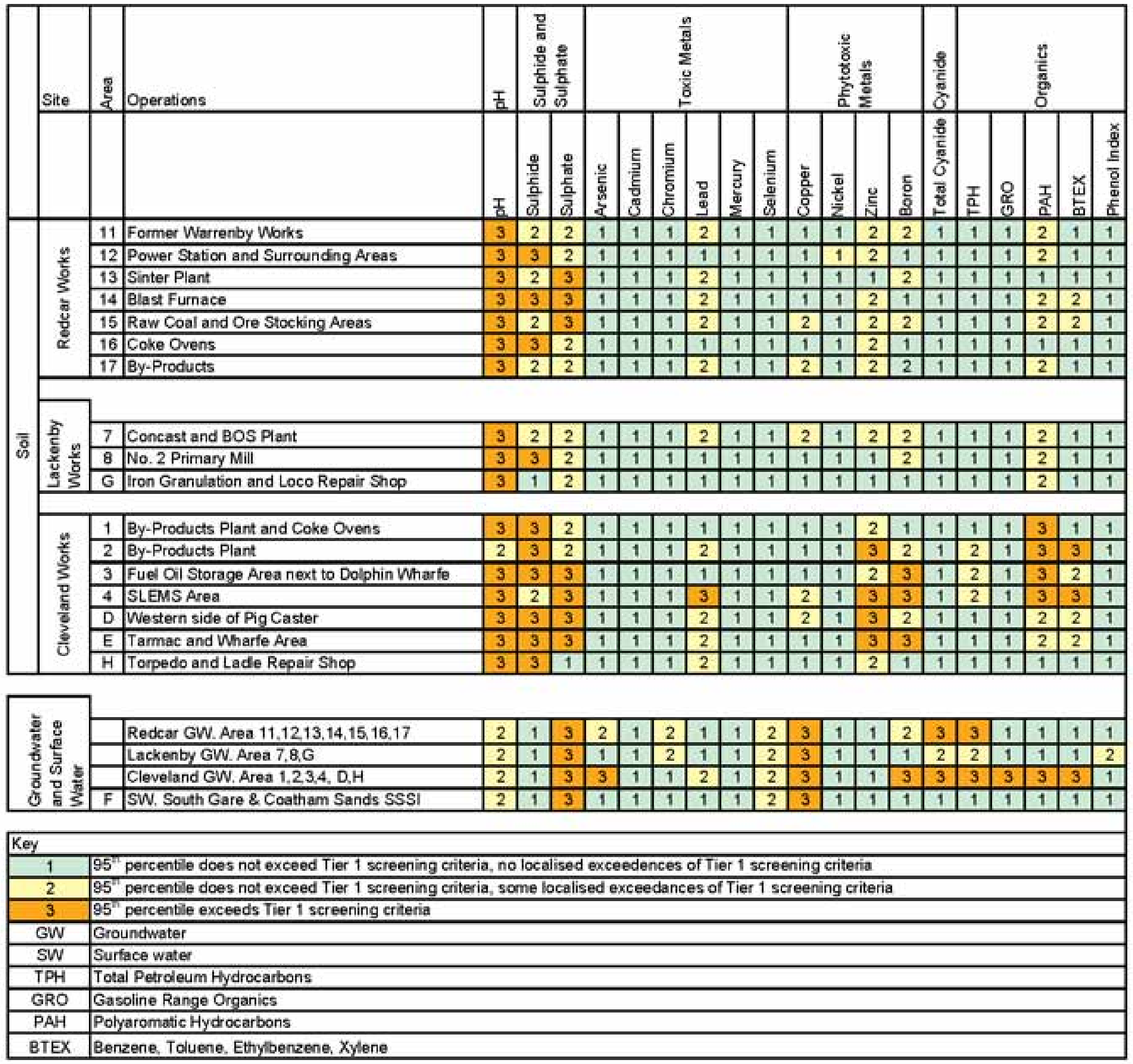
Risk Assessment Procedure

Risks arising from identified soil and groundwater conditions have been assessed using current UK guidance. ***The risk assessment has been completed on the basis that the Teesside Works will continue to be used for steelmaking purposes in its current form. Therefore, our evaluation has not considered any form of future redevelopment of the site, or future change in land use***.

Presentation of Results

In order to put the chemical results into context, chemical analysis data have been screened against generic guideline values: a Tier 1 Assessment. Exceedance of screening levels does not indicate that an unacceptable level of risk exists. A summary of exceedances is presented in Table 2 below:

Table 2: Summary of Tier 1 screening for soil and groundwater at Redcar, Lackenby and Cleveland



	Site	Area	Operations	pH	Sulphide and Sulphate		Toxic Metals						Phytotoxic Metals				Cyanide	Organics				
				pH	Sulphide	Sulphate	Arsenic	Cadmium	Chromium	Lead	Mercury	Selenium	Copper	Nickel	Zinc	Boron	Total Cyanide	TPH	GRO	PAH	BTEX	Phenol Index
Soil	Redcar Works	11	Former Warrenby Works	3	2	2	1	1	1	2	1	1	1	1	2	2	1	1	1	2	1	1
		12	Power Station and Surrounding Areas	3	3	2	1	1	1	1	1	1	1	1	2	1	1	1	1	2	1	1
		13	Sinter Plant	3	2	3	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1
		14	Blast Furnace	3	3	3	1	1	1	2	1	1	1	1	2	1	1	1	1	2	2	1
		15	Raw Coal and Ore Stocking Areas	3	2	3	1	1	1	2	1	1	2	1	2	2	1	1	1	2	2	1
		16	Coke Ovens	3	3	2	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1
		17	By-Products	3	2	2	1	1	1	2	1	1	2	1	2	2	1	1	1	2	1	1
	Lackenby Works	7	Concast and BOS Plant	3	2	2	1	1	1	2	1	1	2	1	2	2	1	1	1	2	1	1
		8	No. 2 Primary Mill	3	3	2	1	1	1	1	1	1	1	1	1	2	1	1	1	2	1	1
		G	Iron Granulation and Loco Repair Shop	3	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1
	Cleveland Works	1	By-Products Plant and Coke Ovens	3	3	2	1	1	1	1	1	1	1	1	2	1	1	1	1	3	1	1
		2	By-Products Plant	2	3	2	1	1	1	2	1	1	1	1	3	2	1	2	1	3	3	1
		3	Fuel Oil Storage Area next to Dolphin Wharfe	3	3	3	1	1	1	1	1	1	1	1	2	3	1	2	1	3	2	1
		4	SLEMS Area	3	2	3	1	1	1	3	1	1	2	1	3	3	1	2	1	3	3	1
		D	Western side of Pig Caster	3	3	3	1	1	1	2	1	1	2	1	3	2	1	1	1	2	2	1
		E	Tarmac and Wharfe Area	3	3	3	1	1	1	2	1	1	1	1	3	3	1	1	1	2	2	1
		H	Torpedo and Ladle Repair Shop	3	3	1	1	1	1	2	1	1	1	1	2	1	1	1	1	1	1	1
Groundwater and Surface Water			Redcar GW. Area 11,12,13,14,15,16,17	2	1	3	2	1	2	1	1	2	3	1	1	2	3	3	1	1	1	1
			Lackenby GW. Area 7,8,G	2	1	3	1	1	2	1	1	2	3	1	1	1	2	2	1	1	1	2
			Cleveland GW. Area 1,2,3,4, D,H	2	1	3	3	1	1	2	1	2	3	1	1	3	3	3	3	3	3	1
		F	SW. South Gare & Coatham Sands SSSI	2	1	3	1	1	1	1	1	2	3	1	1	1	1	1	1	1	1	1

Key	
1	95th percentile does not exceed Tier 1 screening criteria, no localised exceedences of Tier 1 screening criteria
2	95th percentile does not exceed Tier 1 screening criteria, some localised exceedances of Tier 1 screening criteria
3	95th percentile exceeds Tier 1 screening criteria
GW	Groundwater
SW	Surface water
TPH	Total Petroleum Hydrocarbons
GRO	Gasoline Range Organics
PAH	Polyaromatic Hydrocarbons
BTEX	Benzene, Toluene, Ethylbenzene, Xylene

The following sections of this Summary Report outline the key findings for each of the sites, Redcar, Lackenby and Cleveland. The Summary Report is one of three reports delivered as part of this study the other reports being a full Factual Report and an Interpretative Report.

REDCAR

Summary

Corus' Redcar Works is located on a spur of land between the North Sea coast to the north-east and the River Tees estuary to the west. Extensive estuarine sands (Bran Sands) and the River Tees itself both abut onto the site and the sands of Tees Bay are separated from the site by a coastal wetland SSSI/Ramsar site.

The present steelworks at Redcar were constructed in the 1970s. The aerial photograph below illustrates the principal features of the site and immediate surrounds.

Ground Conditions

Redcar Works is constructed on an area of reclaimed land comprising infilled material (Made Ground). This infilled material is variable in both nature and thickness and includes reworked natural materials (clays etc) and a mixture of brick, slag and ash materials up to a thickness of 10m.

Made Ground is underlain by variable thicknesses of unconsolidated alluvial deposits comprising sand and gravel deposits and estuarine clays. Fine to coarse-grained alluvial sands were most commonly encountered in the investigation.

Glacial Till, or "Boulder Clay", underlies these alluvial deposits at depth before "rockhead" is encountered comprising several hundred metres of predominantly mudstone formations.

Site Sensitivity

Groundwater: The alluvial deposits in the vicinity of the site are classified as a Minor Aquifer by the Environment Agency. There are no licensed abstractions within 1km of the site and Groundwater Sensitivity is assessed as being ***Low***.

Surface Water: The principal surface water feature is the adjacent River Tees (classified as a Class A watercourse under the CEWP[5] Scheme in the vicinity of Corus authorised discharges and towards the mouth of the estuary). There are no surface water features crossing the site and all surface water drains directly to ground and ultimately to the Tees. There are 2 authorised discharges from the Works and 2 soakaways. Surface water sensitivity is assessed as being ***Moderate***.

Ecology: the South Gare and Coatham Sands SSSI (designated on the basis of the presence of sand dunes, little terns and orchid colonies) abuts part of the northern boundary of the site. The majority of the SSSI is also designated a Ramsar site i.e a wetland of international importance. As the site borders an ecologically sensitive area the ecological sensitivity is assessed as being ***High***.

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[5] Classification of Estuaries Working Party Classification Scheme.

Aerial Photo - Redcar

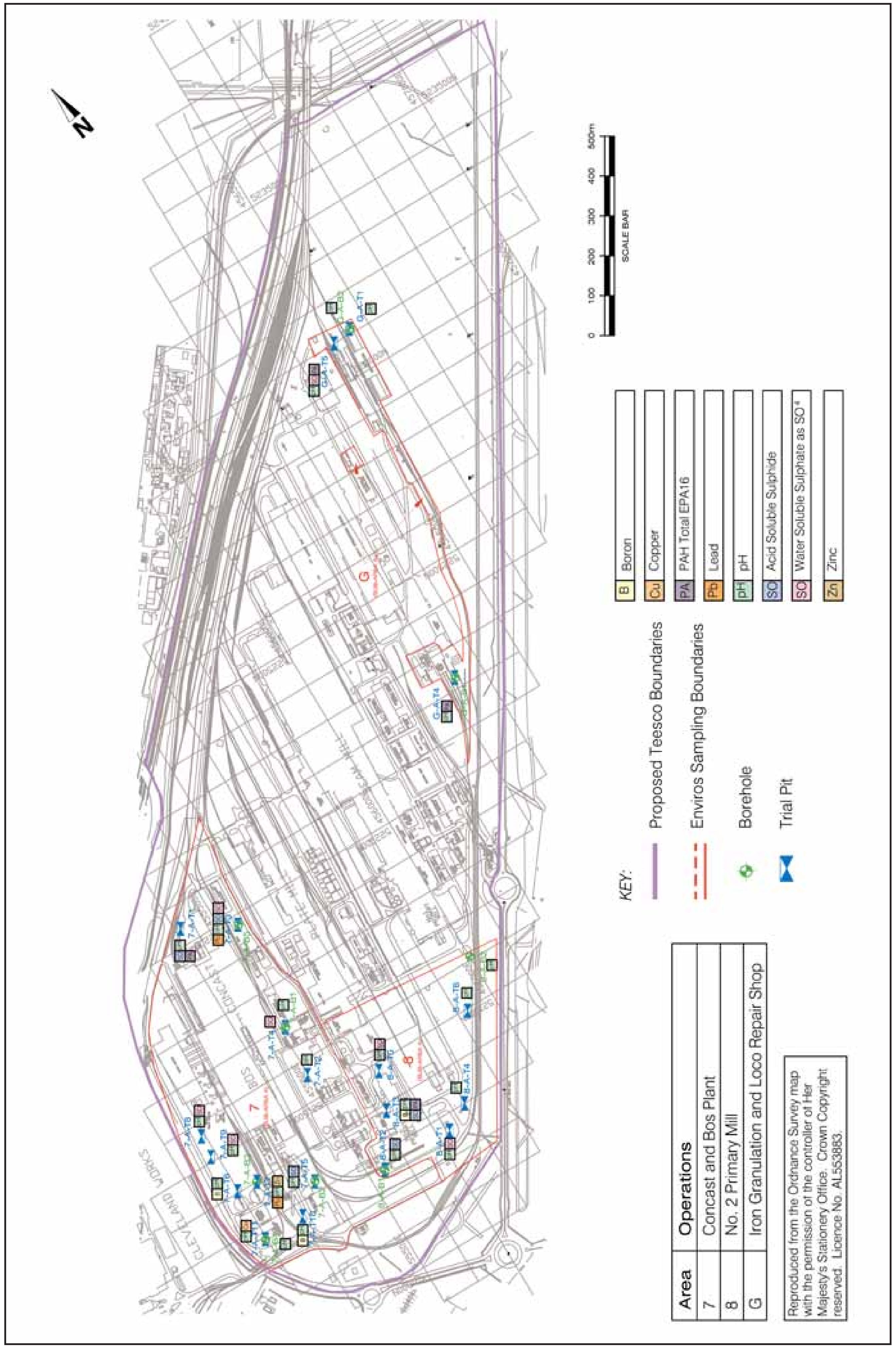


Figure 4 : Exploration Locations and Screening Level Exceedences, Lackenby

LACKENBY

Summary

The Lackenby Works are located to the south of Redcar in a north-east/south-west trending stretch of land between the Teessport terminal to the north-west and the A1085/Wilton Chemical Works to the south-east.

The present steelworks infrastructure dates back to the 1950's with most of the operational facilities being constructed in the 1970's or more recently. The aerial photograph below illustrates the principal features of the site and immediate surrounds.

Ground Conditions

Lackenby Works is constructed on a platform of infill materials (Made Ground) up to 4m in thickness. Infilled material typically comprised slag and brick.

Made Ground is directly underlain by Glacial Till, or "Boulder Clay"; alluvial deposits being absent in the area of the landholding. The Glacial Till comprises soft to firm, occasionally sandy, clay with some gravel in places. The published geological map indicates this "Upper Boulder Clay" unit to be underlain by glacial clays with a "Lower Boulder Clay" unit beneath. Rockhead, at approximately 15 to 20m depth bgl, comprises several hundred metres of predominantly mudstone formations.

Site Sensitivity

Groundwater: The Glacial Till and glacial clay deposits in the vicinity of the site are classified as Non-Aquifers by the Environment Agency. There are no licensed abstractions within 1km of the site and Groundwater Sensitivity is assessed as being ***Low***.

Surface Water: The principal surface water feature is the River Tees Estuary (designated as a Class A watercourse under the CEWP Scheme) and Teesport dock. There are three culverted watercourses across the site which collect surface water from the site and discharge into the SLEMS facility. Surface water sensitivity is assessed as being ***Low***.

Ecology: The majority of the site is covered by open ground, buildings and hardstanding assessed as being of ***Low*** ecological sensitivity.

Aerial Photo - Lackenby

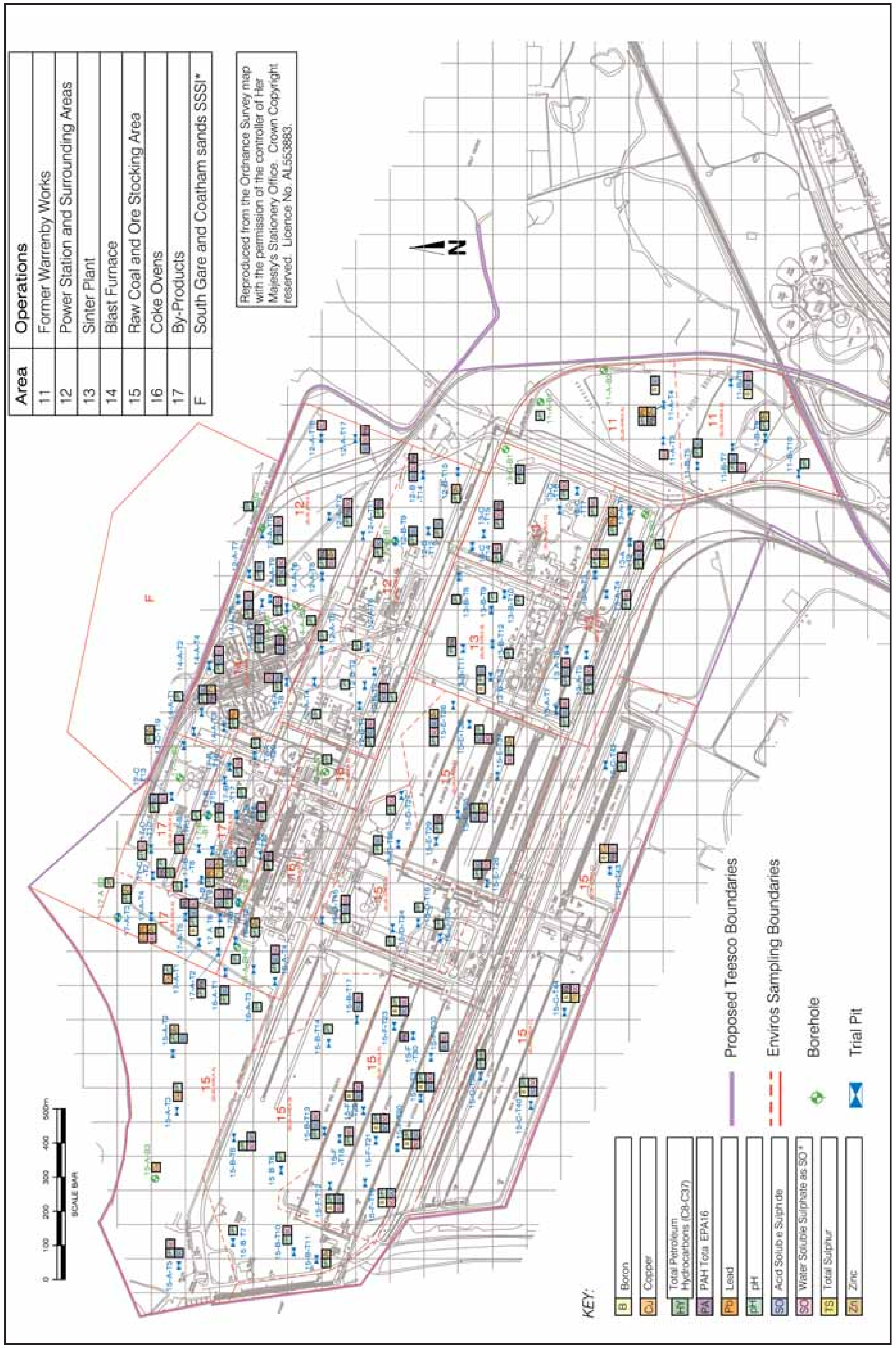


Figure 2 : Exploration Locations and Screening Level Exceedances, Redcar

REDCAR cont.

Soil and Groundwater Baseline Condition

Soils: The investigation has identified fill material underlying the site with elevated concentrations of contaminants (refer to Figure 2). Elevated concentrations occur on a more widespread basis in the northern section of the site in Area 16 (Coke Ovens) and Area 17 (By Products Plant). In these areas toxic and phytotoxic metals, including lead, copper, zinc and boron, were found in excess of screening criteria. PAH concentrations were also elevated in soils from the eastern area of 12 (Power Station and surrounds), Area 14 (Blast Furnace) and Area 17 (By Products).

Alkaline soil pH, sulphide and sulphate levels were all elevated across the Redcar site reflecting the widespread presence of slag materials in the Made Ground fill.

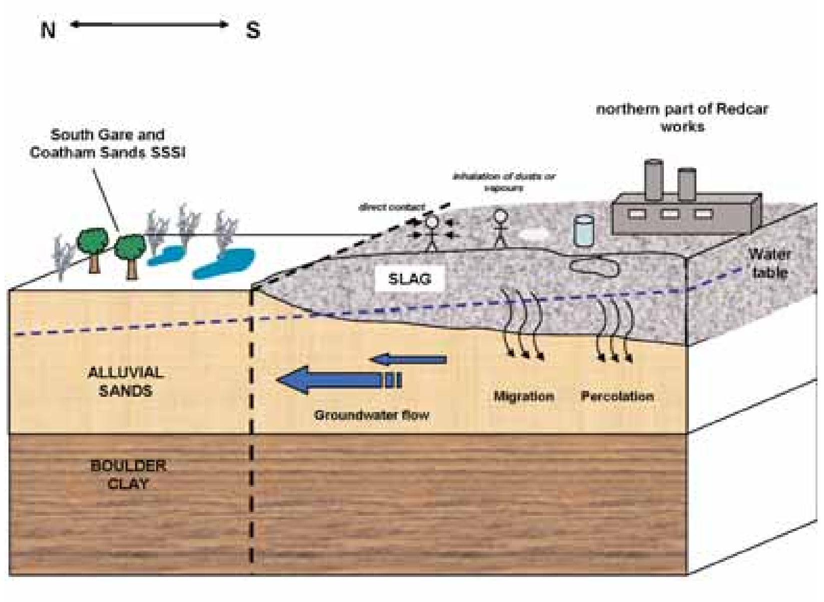
Groundwater: compared with UK Drinking Water Standards shallow groundwater beneath the site has widespread elevated concentrations of sulphate and cyanide in addition to isolated exceedances of heavy metallic contamination (principally copper). Total petroleum hydrocarbon (TPH) was also identified in excess of screening criteria in monitoring wells advanced in Areas 12, 14, 16 and 17 (Power Station, Blast Furnace, Coke Ovens and By-Products).

SSSI water quality: surface water samples taken from the SSSI indicated elevated levels of sulphate and copper with sporadic elevated levels of selenium. No hydrocarbon contamination above screening levels was identified within surface water samples.

Groundwater Levels: groundwater levels across the site form a consistent flow pattern which indicates the likelihood of a single, continuous water table as opposed to perched, discrete lenses of groundwater. Levels range from 4.5mAOD in the south-east of the site to below 1.5mAOD in the north-west, adjacent to the Tees (Figure 3). The levels indicate a slight mound of groundwater beneath the site with flow directions off the site to the north, north-east and east.

Summary Conceptual Site Model

A schematic CSM is presented illustratively in the diagram below (not to scale):



Multiple potential sources of contamination have been identified from both the historical land use and the current operations. Sources include: slag, oils, solvents, coal tars, coke, coal and iron ore. Principal pathways comprise direct human contact/ingestion/inhalation and migration via permeable strata and site drainage. Potential targets include humans i.e impact on human health to site workers, visitors and off-site residents, groundwater receptors (the Alluvium being classified as a Minor Aquifer), nearby surface waters and the adjacent SSSI/Ramsar site.

Summary Risk Assessment

Risk to:	Assessed Risk:	Comments:
Human Receptors (site users)	Low	Principal potential exposure pathway is direct ingestion where hardstand absent. Greatest risk faced by maintenance workers engaged in excavation works.
Surface Waters	Low	River Tees is the principal receptor. Baseflow from the site not considered significant and groundwater quality adequate.
Groundwater	Low	Aquifer of limited resource potential.
SSSI/Ramsar site	Low to Moderate	Shallow groundwater with elevated concentrations of contaminants is potentially migrating from the site into the SSSI.

The risk assessment has identified a potential pollutant linkage between the northern area of the Redcar site, via migration of shallow groundwater and the SSSI.

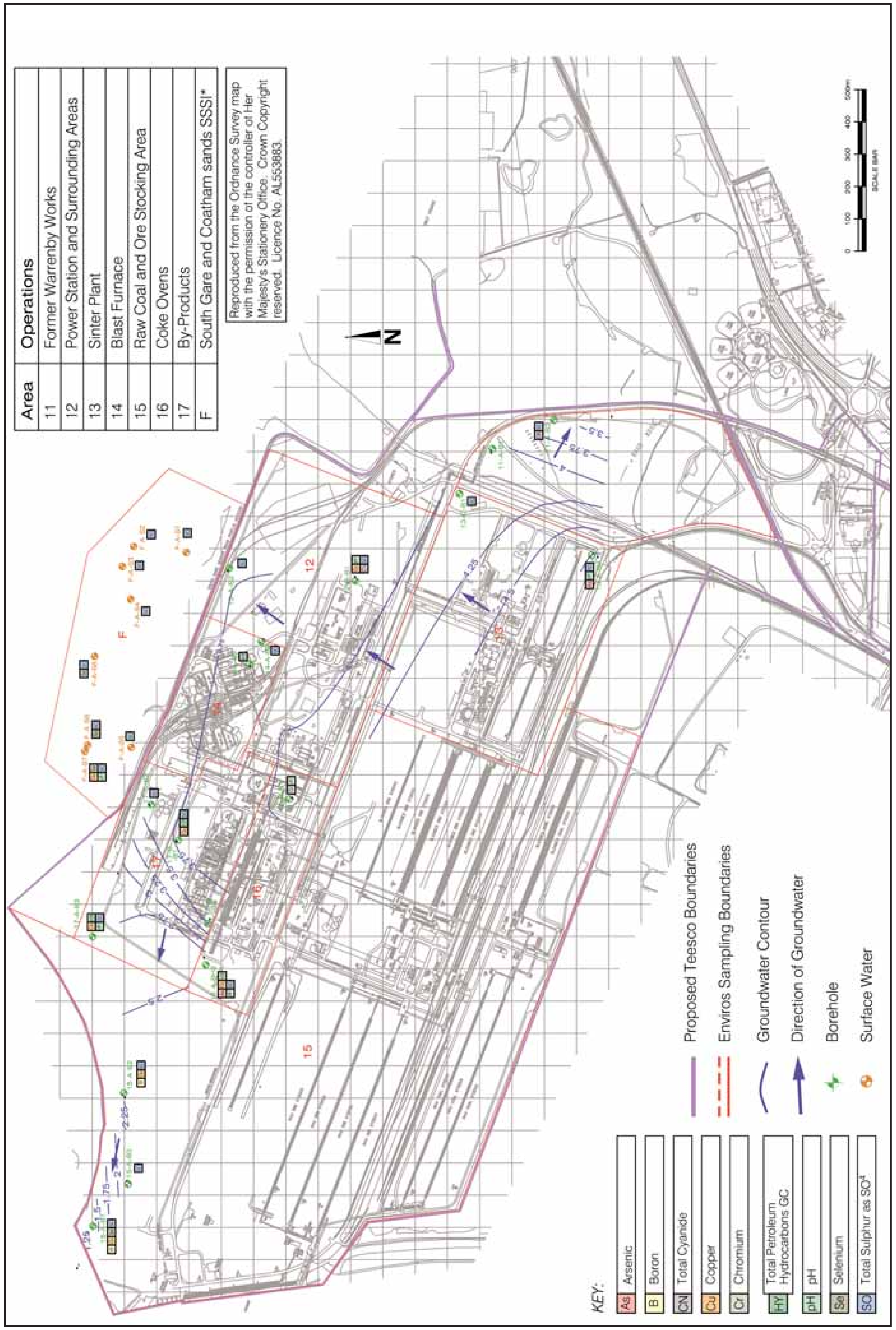


Figure 3 : Borehole Locations and Groundwater Contours, Redcar

Appendix H10: South Tees Industrial Area – Site C – Ground Investigation

Ground Investigation Report

Control Sheet

Contract Title:	South Tees Industrial Area – Site C – Ground Investigation
Location:	Teesside
AEG Contract Number:	1715H
Report Status:	**DRAFT**
Volume Number:	1 of 1
Copy Number:	2 of 2
Issued to:	Allied Exploration & Geotechnics Limited
Client:	English Partnerships St George's House Kingsway Team Valley Gateshead NE11 0NA
Consultant:	Halcrow Crouch Victoria House Pearson Court Thornaby Stockton-on-Tees TS17 6PT

Signed

For Allied Exploration and Geotechnics Limited

R. Hudson

Geotechnical Engineer ____________________ Date: ________________

H. E. Rowshanaei BSc, MSc, PhD, CEng, CGeol

Technical Director ____________________ Date: ________________

Quality Assurance Controlled ____________________ Date: ________________

SOUTH TEES INDUSTRIAL AREA – SITE C – GROUND INVESTIGATION

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SOUTH TEES INDUSTRIAL AREA – SITE C – GROUND INVESTIGATION

1. INTRODUCTION

It is proposed to reclaim and redevelop an area of land at Teesside Industrial Park, Middlesbrough. An investigation was undertaken to obtain information on the ground and groundwater conditions and determine the types and levels of contamination present on site.

Allied Exploration & Geotechnics Limited (AEG) were contracted by English Partnerships with Halcrow Crouch acting in the capacity of Consulting Engineers to perform a ground investigation at this site in order to provide information on subsurface ground conditions and samples for geotechnical and chemical testing.

The site works consisted of the sinking of six light cable percussive boreholes and the mechanical excavation of thirty-three trial pits with associated sampling and *in-situ* testing.

Site work was carried out between the 28th September and 7th October 1999. A factual report only was requested.

The comments and opinions expressed in this report are based on the ground conditions encountered during the site work and on the results of tests carried out in the field and in the laboratory. There may, however, be special conditions prevailing on the site which have not been disclosed by this investigation and which have not been taken into account by this report.

2. THE SITE

2.1 Location

The National Grid Reference of the approximate centre of the site is NZ 531 214. This can be found on Ordnance Survey 1:50,000 Sheet Number 93 (Middlesbrough and Darlington area). Part of this sheet is reproduced as Figure 1, the Site Location Plan.

The site is located approximately 3km east of Middlesbrough town centre.

2.2 Site Description and Topography

The site comprises approximately thirty acres of flat grassed land and is bounded by Smith's Dock Road, Tees Dock Road and the River Tees.

3. SITE OPERATIONS

3.1 General

All exploratory hole work, associated sampling, *in-situ* testing and logging was carried out in accordance with techniques outlined in BS 5930:1981 or BS 1377:1990 as appropriate, at positions as near as practicable to those supplied by the Engineer. These are shown on the Exploratory Hole Location Plan, Figure 2.

The depths of all exploratory holes, descriptions of the material encountered, details of any groundwater encountered, samples taken, together with any other relevant information can be found in the Borehole and Trial Pit Records, Figures 4 and 5 respectively. A key to all symbols and abbreviations used throughout the report is included in the Key Sheets, Figure 3.

3.2 Exploratory Holes

A total of six boreholes were sunk to depths of between 18.70m BGL (BH-C04) and 22.00m BGL (BH-C03) by a Pilcon Wayfarer 1500 drilling rig utilising light cable percussive techniques.

All boreholes were grouted upon completion.

Thirty-three trial pits were mechanically excavated to depths of between 1.80m BGL (TP-C21) and 8.00m BGL (TP-BHC05) using a 360° tracked excavator.

All trial pits were backfilled with spoil on completion.

3.3 Samples

Representative disturbed and undisturbed samples of the made ground, natural ground and groundwater were obtained from the boreholes and trial pits and were taken to the laboratory for geotechnical and chemical testing.

3.4 *In-situ* Standard Penetration Testing

Standard Penetration Testing (SPT) was carried out in the boreholes in accordance with techniques outlined in BS 1377:Part 9:1990 in order to assess the relative density of the soils encountered. The 'N' value (number of blows per 300mm penetration) or the blow count/penetration was recorded for each test. These are listed on the Borehole Records and a breakdown of blows for each 75mm penetration given in Table 1.

3.5 Groundwater

The comments on groundwater conditions are based on the observations made at the time of investigation. It should be noted that groundwater levels may vary due to seasonal and other effects.

Groundwater was encountered in a number of exploratory holes during the site works operation. Details are given on the relevant Exploratory Hole Records.

3.6 Instrumentation

No instrumentation was required under this contract.

4. LABORATORY TESTING

4.1 General

Laboratory testing as scheduled by AEG with additional tests by the Engineer was carried out on selected samples in accordance with techniques outlined in BS 1377:1990, AEG Laboratory Quality Procedures or other appropriate standard as quoted. The results are presented in the Laboratory Enclosures.

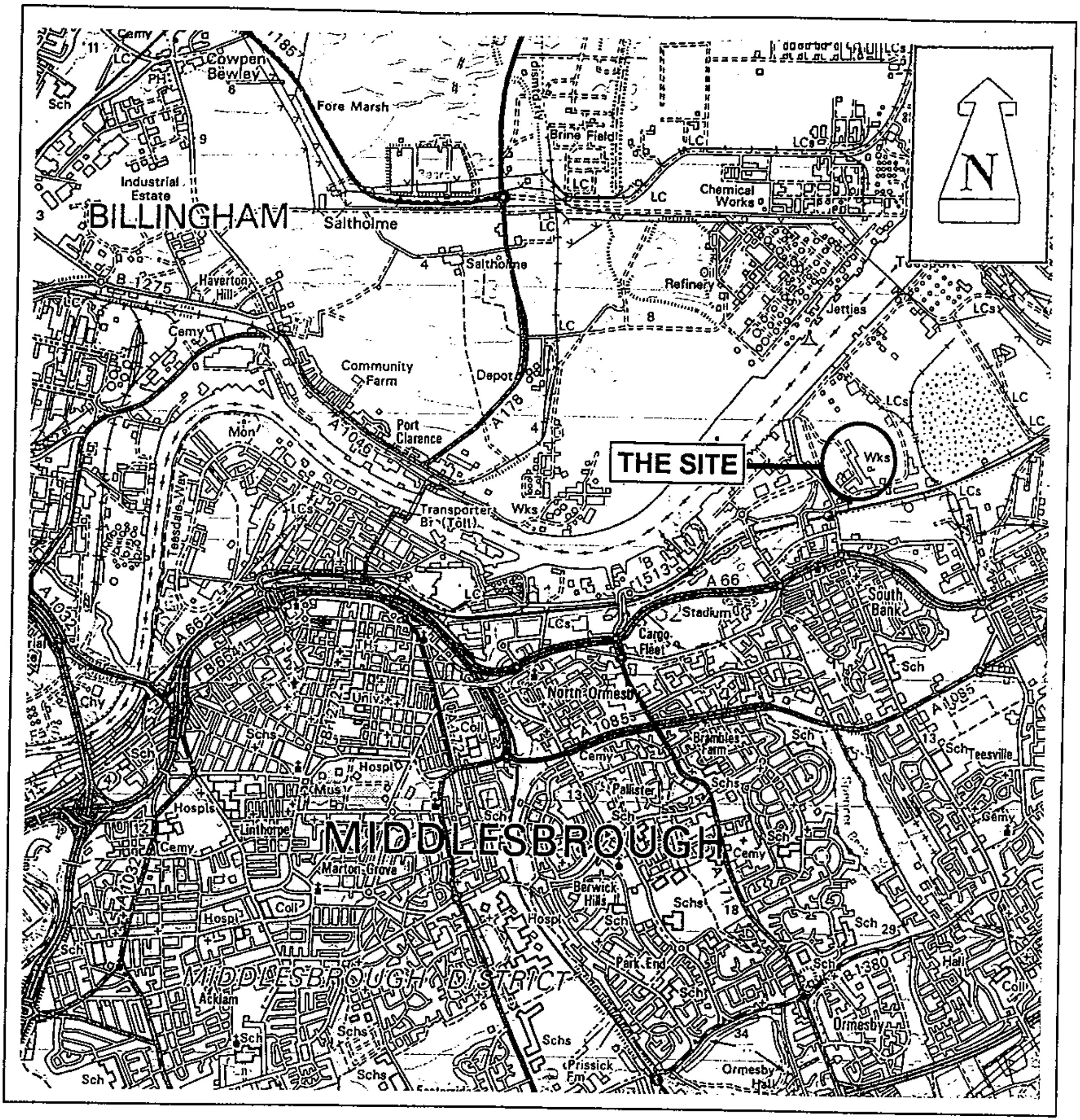
4.2 Specialist Chemical Testing

Selected soil and groundwater samples have been screened for a range of contaminants specified by AEG and the Engineer. The results of these analyses, conducted under a subcontract arrangement with Ecos, are presented as Appendix I.

FIELD DATA ENCLOSURES

FIGURE 1

Site Location Plan



SOUTH TEES INDUSTRIAL AREA – SITE C – GROUND INVESTIGATION TEESSIDE

Reproduced from the Ordnance Survey 1:50,000 scale Landranger map with the permission of The Controller of Her Majesty's Stationery Office, Crown Copyright.

Contract No: 1715H

Figure 1

FIGURE 2

Exploratory Hole Location Plan

FIGURE 3

Key Sheets

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KEY SHEET

INTRODUCTION

The following explanatory notes define the terminology's, abbreviations and symbols pertaining to each individual column or section of the exploratory hole records. 'Exploratory Hole' is used as a general term in this report to comprise borehole, drillhole, and trial pit. All exploratory hole records have been produced using '[1]gINT', which is an integrated software environment for the storage and manipulation of subsurface data.

INFORMATION COMMON TO ALL EXPLORATORY HOLE RECORDS

Status Box
The status box in the top right hand corner of each exploratory hole record gives the status of each individual record i.e. PRELIM1, PRELIM2, FINAL etc. The date shown relates to the last instance the data was revised. This information is for AEG Quality Assurance only.

Borehole/Trial Pit/Drillhole No
The exploratory hole identity number used throughout the report.

Project
The ground investigation project name. Occasionally the project name may be shortened or abbreviated due to string length restraints imposed by the gINT computer programme.

Client
Clients name who is responsible for funding the ground investigation project. The Clients name may be shortened or abbreviated due to string length restraints imposed by the gINT computer programme.

Location
The precise exploratory hole position given as either national grid co-ordinates, local grid if specified, or a reference name normally pertaining to the area of investigation.

Method & Equipment
Represents the drilling, excavation or boring method(s) or equipment used.

Ground Level (m(AOD))
The precise ground level of the exploratory hole location from which the reduced level for each stratigraphic junction is calculated.

Date
The date relating to the start of the exploratory hole excavation.

Sheet
The sheet number and total number of sheets for the particular record.

Checked By
Signature of the person who has carried out a technical quality check on the log.

Logged By
The name of the engineer who has carried out the logging of the exploratory hole.

Contract No.
The Allied Exploration & Geotechnics Limited reference number for this project.

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[1] gINT is a registered trademark of Salvatore Caronna of GCA

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KEY SHEET

INFORMATION RELEVANT TO BOREHOLE RECORDS

Sample & Tests Columns

Depth	The depth over which a sample or test is taken is shown in depth column of the exploratory hole record in a "from…to" format.
Type No	Indicates the type of sample/test and number given by the driller.
Test Result	Result of the test given in the applicable units.

Water Column

Level of groundwater strike within an exploratory hole. The symbol ▼ denotes a water strike and is suffixed with a number, which indicates the strike order. The unfilled symbol ▽ is the depth the strike rose to.

Strata Columns

Reduced Level	The corresponding reduced level of each soil or rock boundary in metres ordnance datum.
Legend	A graphical representation of the materials encountered using BS 5930:1999 recommended symbols for soil and rock.
Depth (Thickness)	The depth below ground level of each soil or rock boundary in metres and the thickness of each individual stratigraphic unit (given in brackets).
Description	Engineering description of each individual soil or rock type following recommendations outlined in Section 6 of BS 5930:1999.
Instrument/backfill	Graphical representation of the type of installation installed or the type of backfill used.

Instrument/Backfill Column

A graphical representation of backfill material or instrumentation detail using graphic legends. Its placement in the column is relative to depth in metres and corresponds to the exploratory hole in scale.

Boring Progress and Water Observations Columns

This section provides information on each days production as a daily log.

Date	Date of shift.
Depth	Depth of hole at the start of the shift.
Casing	Casing depth at start of shift.
Casing Dia	Casing diameter at the start of shift.
Water Depth	Water level within the borehole at the start and end of shift.

Chiselling Columns

Indicates where hard strata has occurred in the borehole and breaking out was carried out to advance the borehole.

From	The depth commenced.
To	The depth finished.
Hours	Total time taken for breaking out.

Water Added Columns

Indicates the depth range where water was added to the borehole to facilitate boring or to prevent stress relief disturbance "blowing/boiling" in granular soils.

From	Depth in metres from where water was added.
To	Depth in metres to where water was added.

General Remarks

Any remarks believed to be relevant to the exploratory hole.

KEY SHEET

INFORMATION RELEVANT TO TRIAL PIT RECORDS

The trial pit records follow the same format as the borehole records for the Samples & Tests, Water and Strata columns. However, in addition to these there are the following:

Trial Pit Sketch Column
Where applicable a trial pit sketch may be included here for completeness.

Plan Column
A schematic plan view of the trial pit showing its excavated dimensions together with its orientation, given as a compass bearing to magnetic north.

Groundwater Column
Notes on water bearing horizons.

Remarks Column
The engineer's comments outlining the stability of the sides during trial pit excavation together with any other information relevant to construction of the exploratory hole.

INFORMATION RELEVANT TO DRILLHOLE RECORDS

Run Details Columns

Depth	Each drill run is highlighted by a horizontal line with a top and bottom depth shown in metres.
TCR(SCR)RQD	Information provided on the total core recovery and rock quality designation. Refer to Abbreviations for further details.
(SPT)Fracture Index	Information given relating to any SPT test carried out and/or a value for the fracture index of the rock.

Strata Columns
As the strata columns for borehole records except for description which is as follows:

Discontinuities /Detail	Information on core discontinuities, localised variations in weathering, lithology, strength and structure following recommendations outlined in Section 6 BS 5930:1999:Clause 44.
Main	Engineering description of each individual soil or rock type following recommendations outlined in Section 6 of BS 5930:1999.

Instrument/Backfill Column
A graphical representation of backfill material or instrumentation detail using graphic legends. Its placement in the column is relative to depth in metres and corresponds to the exploratory hole in scale.

Drilling Progress and Water Observations Columns

Date	Date of shift
Depth	Depth of hole at the start of the shift
Casing	Casing depth at start of shift
Core Dia mm	Diameter of core
Water Strike	Depth at which water was encountered
Water Standing	Depth at which water in the borehole levelled off
Flush Type	Details of the type of flush being used
Flush returns	An indication of the percentage of flush material being returned

Abbreviations

SAMPLES

B	Bulk disturbed sample generally representative of the soil type for cohesive and fine granular soils.
G	Gas sample.
J	Small disturbed jar sample normally taken at intermediate depth between other sampling or testing operations. The sample is stored in an airtight container.
Ch	Sample of potentially contaminated materials. If prefixed by G, the sample is contained in a glass jar or prefixed by a J, the sample is contained in a plastic air-tight container and if prefixed with a W the sample is a potentially contaminated water sample (ie GCh, JCh, WCh).
P	Undisturbed piston sample normally used in low strength fine grained soils to reduce the level of disturbance.
P*	An attempted but failed undisturbed piston sample.
U	General purpose 102mm diameter undisturbed sample.
U*	An attempted but failed general purpose undisturbed sample.
W	Water sample.

IN-SITU TESTS

CBR	California Bearing Ratio mould sample or test.
HSV	*In-situ* hand shear vane.
HP	Hand penetrometer test.
K (F)	Falling permeability test.
K (R)	Rising permeability test.
K (C)	Constant head permeability test.
K (P)	Packer permeability test.
PT	Pressuremeter test.
S	Standard Penetration Testing (SPT) using the split barrel sampler (shoe). The corresponding 'N' value is given in the test result column.
S*	Denotes where full penetration has not been achieved in an SPT test. In such cases the number of blows against the amount of penetration is reported.
C	In coarse granular soils a solid cone is used in preference to the split barrel sampler.

SV	*In-situ* down the hole shear vane test. The remoulded shear strength is given in brackets.

ROCK QUALITY & CORE RECOVERY

TCR	Total Core Recovery - the length of the recovered core expressed as a percentage of the length of core run.
SCR	Solid Core Recovery – the length of core recovered as solid cylinders, expressed as a percentage of the length of core run.
RQD	Rock Quality Designation – The sum length of all core pieces that are 100mm or longer (measured along the centre of the core), expressed as a percentage of the length of core run.
IF	Fracture Index – The number of fractures per 1000mm length of solid core.
NI	Non-intact – The material recovered was in a non-intact state.
NR	No recovery from the core run.

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Key Sheet

Symbols and Abbreviations : Explanation Of Legends Used

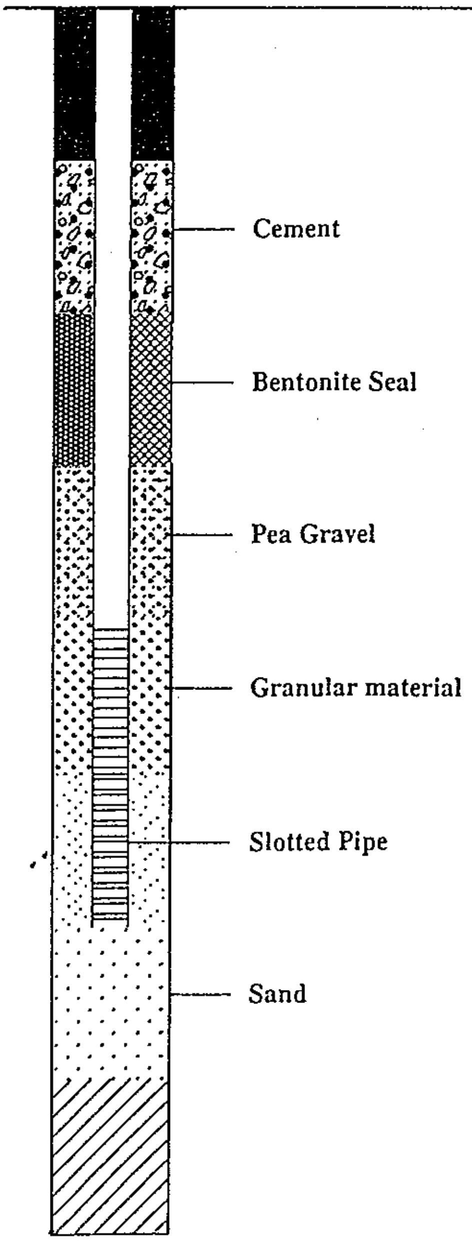
Soils	*Rocks*		
	Sedimentary	*Metamorphic*	*Igneous*
▨ Made Ground	▨ Chalk		
▨ Boulders & Cobbles	▨ Limestone	▨ Coarse grained	▨ Coarse grained
▨ Gravel	▨ Conglomerate		
▨ Sand	▨ Breccia	▨ Medium grained	▨ Medium grained
▨ Silt	▨ Sandstone		
▨ Clay	▨ Siltstone	▨ Fine grained	▨ Fine grained
▨ Peat	▨ Mudstone		
□ Topsoil	▨ Shale		
Note:- Composite soil types will be signified by combined symbols e.g.	■ Coal		
▨ Silty sand	▨ Pyroclastic		
	▨ Gypsum		

Allied Exploration & Geotechnics Limited

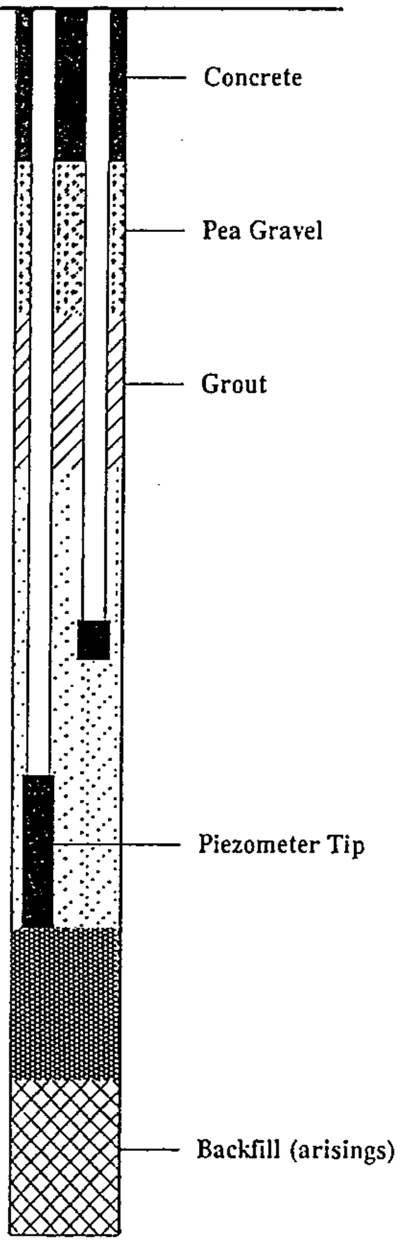
Key Sheet

Symbols and Abbreviations : Explanation Of Instrumentation Legends

Single Instrument



Double Instrument



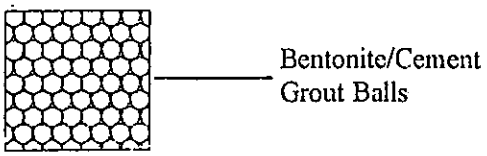


FIGURE 4

Borehole Records

ALLIED EXPLORATION & GEOTECHNICS LTD

BOREHOLE RECORD

Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				BOREHOLE No BH-C01
Client: English Partnerships	Location: Teesside E453303.05 N522314.63			
Method & Equipment: Cable Percussion using a Pilcon Wayfarer 1500	Ground Level(m(AOD)): 6.97	Date: 06-10-99		Sheet: 1 of 3

SAMPLES & TESTS			Water	STRATA				Instru-ment/Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
				-0.03		(7.00) 7.00	As TP-BHC01.	▨
					▨		Medium dense grey brown very clayey slightly gravelly SAND. Gravel is fine to medium subangular to subrounded and consists consists of sandstone.	▨

Boring Progress and Water Observations

Date		Depth	Casing	Casing Dia	Water Depth
06/10/99		7.00	8.00	150mm	5.67
06/10/99		15.50	14.29	150mm	dry
07/10/99		15.50	14.29	150mm	dry
07/10/99		21.25	14.29	150mm	dry

Chiselling			Water Added	
From	To	Hours	From	To
21.05	21.25	0.75	0.00	21.25

GENERAL REMARKS

(1) No inspection pit required.

All dimensions in metres Scale 1:50	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: S. Grieves	Contract No. **1715H**

Date Printed:- 09/12/99

ALLIED EXPLORATION & GEOTECHNICS LTD

BOREHOLE RECORD

Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				BOREHOLE No BH-C01
Client: English Partnerships	Location: Teesside E453303.05 N522314.63			
Method & Equipment: Cable Percussion using a Pilcon Wayfarer 1500		Ground Level(m(AOD)): 6.97	Date: 06-10-99	Sheet: 2 of 3

SAMPLES & TESTS			Water	STRATA				Instru-ment/Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
							(As sheet 1 of 3) Medium dense grey brown very clayey slightly gravelly SAND. Gravel is fine to medium subangular to subrounded and consists consists of sandstone.	
8.50-8.95	SJ10	N13						
8.51-8.95	B11							
						(3.80)		
9.50	J12							
10.00-10.45	SJ13	N12						
10.01-10.45	B14							
				-3.83		10.80		
10.80-11.20	B15						Stiff red brown sandy gravelly CLAY of low plasticity. Gravel is fine to coarse angular to subangular and consists of sandstone and quartzite.	
11.50-11.95	B16 U*	(91)						
12.00-12.45	U17	(125)						
12.50	J18							
13.00	J19							
13.50-13.95	U20	(96)						
14.00	J21							
14.50	J22							
15.00-15.45	U23	(125)						
						(9.15)		
15.50	J24							

Boring Progress and Water Observations					
Date		Depth	Casing	Casing Dia	Water Depth
06/10/99		7.00	8.00	150mm	5.67
06/10/99		15.50	14.29	150mm	dry
07/10/99		15.50	14.29	150mm	dry
07/10/99		21.25	14.29	150mm	dry

Chiselling			Water Added	
From	To	Hours	From	To
21.05	21.25	0.75	0.00	21.25

GENERAL REMARKS

(1) No inspection pit required.

All dimensions in metres Scale 1:50	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: S. Grieves	Contract No. **1715H**

Date Printed:- 09/12/99

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BOREHOLE RECORD

Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				BOREHOLE No BH-C01
Client: English Partnerships	Location: Teesside E453303.05 N522314.63			
Method & Equipment: Cable Percussion using a Pilcon Wayfarer 1500		Ground Level(m(AOD)): 6.97	Date: 06-10-99	Sheet: 3 of 3

SAMPLES & TESTS			Water	STRATA				Instru-ment / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
16.00	J25						(As sheet 2 of 3) Stiff red brown sandy gravelly CLAY of low plasticity. Gravel is fine to coarse angular to subangular and consists of sandstone and quartzite.	
16.50-16.90	U26	(120)						
17.00	J27							
17.50-17.85	SJ28	50 for 185mm						
17.51-17.85	B29							
18.00-18.35	B30 U*	(120)						
19.00	J31							
19.50-19.90	U32	(120)						
				-12.98		19.95		
19.95	J33						Red brown and green grey highly weathered MUDSTONE weak.	
						(1.30)		
20.80-21.05	SJ34	50 for 110mm						
20.81-21.05	B35							
				-14.28		21.25		
							Borehole complete at 21.25m BGL.	

Boring Progress and Water Observations					
Date		Depth	Casing	Casing Dia	Water Depth
06/10/99		7.00	8.00	150mm	5.67
06/10/99		15.50	14.29	150mm	dry
07/10/99		15.50	14.29	150mm	dry
07/10/99		21.25	14.29	150mm	dry

Chiselling			Water Added	
From	To	Hours	From	To
21.05	21.25	0.75	0.00	21.25

GENERAL REMARKS

(1) No inspection pit required.

All dimensions in metres Scale 1:50	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: S. Grieves	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG21/2

ALLIED EXPLORATION & GEOTECHNICS LTD

BOREHOLE RECORD

Status:- **PRELIM2**
Date:- 09/12/99

Project: **South Tees Industrial Area, Site C - Ground Investigation**				BOREHOLE No BH-C02
Client: English Partnerships	Location: Teesside E453246.19 N522185.77			
Method & Equipment: Cable Percussion using a Pilcon Wayfarer 1500	Ground Level(m(AOD)): 7.84	Date: 06-10-99		Sheet: 1 of 3

SAMPLES & TESTS			Water	STRATA				Instrument/Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
							As TP-BHC02.	▨
1.00	J16							
						(8.00)		
6.30	W11							
				-0.16		8.00		

Boring Progress and Water Observations					
Date		Depth	Casing	Casing Dia	Water Depth
06/10/99		8.00	8.00	150mm	6.30
06/10/99		13.50	13.50	150mm	10.60
07/10/99		13.50	13.50	150mm	8.75
07/10/99		21.60	21.40	150mm	17.40

Chiselling			Water Added	
From	To	Hours	From	To
21.50	21.60	0.50		

GENERAL REMARKS

(1) No inspection pit required.

All dimensions in metres Scale 1:50	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: S. Grieves	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG21/2

ALLIED EXPLORATION & GEOTECHNICS LTD

BOREHOLE RECORD

Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation		BOREHOLE No BH-C02
Client: English Partnerships	Location: Teesside E453246.19 N522185.77	
Method & Equipment: Cable Percussion using a Pilcon Wayfarer 1500	Ground Level(m(AOD)): 7.84	Date: 06-10-99
		Sheet: 2 of 3

SAMPLES & TESTS

Depth	Type No	Test Result	Water
8.00-9.50	B12		
9.50-10.00	B13		
10.00-10.45	SJ14	N15	
10.01-10.50	B15		
11.50-11.95	SJ17	N7	
11.51-12.00	B18		
12.30	J19		
12.50-13.00	B20		
13.00-13.40	U21	(55)	
13.50	J22		
14.00	J23		
14.50-14.90	U24	(85)	
15.00	J25		
15.40-15.90	B26		

STRATA

Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instru-ment/ Backfill
-1.66		(1.50) 9.50	Grey brown clayey sandy GRAVEL. Gravel is fine to medium subangular to subrounded and consists of sandstone.	
-2.16		(0.50) 10.00	Grey brown silty SAND.	
-4.46		(2.30) 12.30	Loose to medium dense grey brown very clayey slightly gravelly SAND.	
			Stiff (in places firm) red brown sandy gravelly CLAY of low plasticity. Gravel is fine to coarse subangular and consists of sandstone, quartzite and mudstone.	

Boring Progress and Water Observations

Date		Depth	Casing	Casing Dia	Water Depth
06/10/99		8.00	8.00	150mm	6.30
06/10/99		13.50	13.50	150mm	10.60
07/10/99		13.50	13.50	150mm	8.75
07/10/99		21.60	21.40	150mm	17.40

Chiselling

From	To	Hours
21.50	21.60	0.50

Water Added

From	To

GENERAL REMARKS

(1) No inspection pit required.

All dimensions in metres Scale 1:50	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: S. Grieves	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG21/2

ALLIED EXPLORATION & GEOTECHNICS LTD

BOREHOLE RECORD

Status:- **PRELIM2**
Date:- 09/12/99

Project: **South Tees Industrial Area, Site C - Ground Investigation**				BOREHOLE No BH-C02
Client: English Partnerships	Location: Teesside E453246.19 N522185.77			
Method & Equipment: Cable Percussion using a Pilcon Wayfarer 1500	Ground Level(m(AOD)): 7.84	Date: 06-10-99		Sheet: 3 of 3

SAMPLES & TESTS			Water	STRATA				Instru-ment/Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
16.00-16.35	U27	(90)				(8.40)	(As sheet 2 of 3) Stiff (in places firm) red brown sandy gravelly CLAY of low plasticity. Gravel is fine to coarse subangular and consists of sandstone, quartzite and mudstone.	
16.50	J28							
17.00	J29							
17.50	U30*	(95)						
18.50	J31							
19.00-19.35	U32	(100)						
19.50	J33							
20.00	J34							
20.50-20.95	U35	(100)		-12.86		20.70	at c.20.00m BGL ... firm.	
						(0.40)	Very stiff brown sandy gravelly CLAY. Gravel is fine to coarse subangular to subrounded and consists of sandstone.	
21.00	J36			-13.26		21.10		
21.10-21.50	B37					(0.50)	Red brown highly weathered MUDSTONE weak with occasional white deposits of gypsum.	
21.50	SJ38	100 for 20mm		-13.76		21.60		
							Borehole complete at 21.60m BGL.	

Boring Progress and Water Observations					
Date		Depth	Casing	Casing Dia	Water Depth
06/10/99		8.00	8.00	150mm	6.30
06/10/99		13.50	13.50	150mm	10.60
07/10/99		13.50	13.50	150mm	8.75
07/10/99		21.60	21.40	150mm	17.40

Chiselling			Water Added	
From	To	Hours	From	To
21.50	21.60	0.50		

GENERAL REMARKS

(1) No inspection pit required.

All dimensions in metres Scale 1:50	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: S. Grieves	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG21/2

ALLIED EXPLORATION & GEOTECHNICS LTD

BOREHOLE RECORD

Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation			BOREHOLE No BH-C03
Client: English Partnerships	Location: Teesside E453132.34 N522018.92		
Method & Equipment: Cable Percussion using a Pilcon Wayfarer 1500	Ground Level(m(AOD)): 7.99	Date: 08-10-99	Sheet: 1 of 3

SAMPLES & TESTS			Water	STRATA				Instru-ment/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
							As TP-BHC03.	▨
						(8.20)		
6.30	W12							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date		Depth	Casing	Casing Dia	Water Depth	From	To	Hours	From	To	
08/10/99		8.20	8.70	150mm	6.30	16.60	16.90	0.75			(1) No inspection pit required.
08/10/99		14.00	13.50	150mm	10.70	21.90	22.00	0.50			
11/10/99		14.00	13.50	150mm	6.40						
11/10/99		19.50	19.40	150mm	12.80						
12/10/99		19.50	19.40	150mm	6.80						
12/10/99		22.00	21.00	150mm	8.90						

All dimensions in metres Scale 1:50	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: M. Riggs	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG21/2

ALLIED EXPLORATION & GEOTECHNICS LTD

BOREHOLE RECORD

Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation			BOREHOLE No BH-C03
Client: English Partnerships	Location: Teesside E453132.34 N522018.92		
Method & Equipment: Cable Percussion using a Pilcon Wayfarer 1500	Ground Level(m(AOD)): 7.99	Date: 08-10-99	Sheet: 2 of 3

SAMPLES & TESTS

Depth	Type No	Test Result
8.50-9.00	B13	
9.00-9.45	SJ14	N6
9.01-9.50	B15	
10.00	J16	
10.50-10.95	SJ17	N8
10.51-11.00	B18	
11.50	J19	
11.90	J20	
12.00-12.40	U21	(30)
12.50	J22	
13.00	J23	
13.50-13.95	U24	(45)
14.00	J25	
14.50	J26	
15.00	U27*	(100)

STRATA

Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument/Backfill
	-0.21		8.20	(As sheet 1 of 3)	
				Loose grey brown clayey SAND.	
			(3.70)		
	-3.91		11.90		
				Firm red brown sandy gravelly CLAY of low plasticity. Gravel is fine to coarse subangular to subrounded and consists of sandstone, mudstone and quartzite.	
			(2.10)		
	-6.01		14.00		
				Stiff to very stiff red brown sandy gravelly CLAY. Gravel is fine to coarse subangular to subrounded and consists of sandstone, quartzite and mudstone.	

Boring Progress and Water Observations

Date		Depth	Casing	Casing Dia	Water Depth
08/10/99		8.20	8.70	150mm	6.30
08/10/99		14.00	13.50	150mm	10.70
11/10/99		14.00	13.50	150mm	6.40
11/10/99		19.50	19.40	150mm	12.80
12/10/99		19.50	19.40	150mm	6.80
12/10/99		22.00	21.00	150mm	8.90

Chiselling

From	To	Hours
16.60	16.90	0.75
21.90	22.00	0.50

Water Added

From	To

GENERAL REMARKS

(1) No inspection pit required.

All dimensions in metres Scale 1:50	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: M. Riggs	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG21/2

ALLIED EXPLORATION & GEOTECHNICS LTD

BOREHOLE RECORD

Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				BOREHOLE No BH-C03
Client: English Partnerships	Location: Teesside E453132.34 N522018.92			
Method & Equipment: Cable Percussion using a Pilcon Wayfarer 1500		Ground Level(m(AOD)): 7.99	Date: 08-10-99	Sheet: 3 of 3

SAMPLES & TESTS			Water	STRATA				Instru-ment/Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
16.00	J28						(As sheet 2 of 3) Stiff to very stiff red brown sandy gravelly CLAY. Gravel is fine to coarse subangular to subrounded and consists of sandstone, quartzite and mudstone.	
16.50	U29*	(100)						
17.00-17.35	U30	(100)						
17.50	J31					(7.20)		
18.00	J32							
18.50-18.95	U33	(95)						
19.00	J34							
19.50	J35							
20.00-20.45	U36	(95)						
20.50	J37							
20.90	J38			-13.21		21.20		
21.30-21.80	B39					(0.80)	Red brown highly weathered MUDSTONE very weak with occasional white gypsum veins.	
21.90	SJ40	100 for 182mm		-14.01		22.00		
							Borehole complete at 22.00m BGL.	

Boring Progress and Water Observations

Date		Depth	Casing	Casing Dia	Water Depth
08/10/99		8.20	8.70	150mm	6.30
08/10/99		14.00	13.50	150mm	10.70
11/10/99		14.00	13.50	150mm	6.40
11/10/99		19.50	19.40	150mm	12.80
12/10/99		19.50	19.40	150mm	6.80
12/10/99		22.00	21.00	150mm	8.90

Chiselling

From	To	Hours
16.60	16.90	0.75
21.90	22.00	0.50

Water Added

From	To

GENERAL REMARKS

(1) No inspection pit required.

All dimensions in metres Scale 1:50	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: M. Riggs	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG21/2

ALLIED EXPLORATION & GEOTECHNICS LTD

BOREHOLE RECORD

Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation			BOREHOLE No BH-C04
Client: English Partnerships	Location: Teesside E453428.38 N522185.36		
Method & Equipment: Cable Percussion using a Pilcon Wayfarer 1500	Ground Level(m(AOD)): 7.41	Date: 04-10-99	Sheet: 1 of 3

SAMPLES & TESTS			Water	STRATA				Instru-ment / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
				0.41		(7.00) 7.00	As TP-BHC04.	▨
					▩	(1.50)	MADE GROUND (Grey sandy gravel. Gravel is fine to coarse angular to subangular and consists of slag).	▨

Boring Progress and Water Observations					
Date		Depth	Casing	Casing Dia	Water Depth
04/10/99		8.00			
04/10/99		15.50	15.50	150mm	dry
05/10/99		15.50	15.50	150mm	5.60
05/10/99		18.70	18.10	150mm	8.90

Chiselling			Water Added	
From	To	Hours	From	To
16.70	16.90	0.50		
18.40	18.70	1.00		

GENERAL REMARKS

(1) No inspection pit required.

All dimensions in metres Scale 1:50	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: S. Grieves	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG21/2

ALLIED EXPLORATION & GEOTECHNICS LTD

BOREHOLE RECORD

Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				BOREHOLE No BH-C04
Client: English Partnerships	Location: Teesside E453428.38 N522185.36			
Method & Equipment: Cable Percussion using a Pilcon Wayfarer 1500		Ground Level(m(AOD)): 7.41	Date: 04-10-99	Sheet: 2 of 3

SAMPLES & TESTS				STRATA				
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument/Backfill
8.00-8.45	SJ11	N18		-1.09		8.50	(As sheet 1 of 3)	
8.75	J12						Medium dense grey brown clayey SAND with occasional fine to medium gravel of sandstone.	
9.00-9.45	SJ13	N17						
9.01-9.45	B14					(3.10)		
10.50-10.95	SJ15	N21		-4.19		11.60		
11.70	J16						Soft grey brown sandy CLAY.	
12.00-12.45	SJ17	N13				(0.90)		
12.01-12.45	B18			-5.09		12.50		
12.60-13.00	B19						Stiff red brown sandy gravelly CLAY of low plasticity. Gravel is fine to coarse subangular and consists of sandstone.	
13.20-13.65	U20	(90)						
13.70	J21					(3.00)		
14.30	J22							
14.70-15.15	U23	(100)					at c.14.70m ... thinly laminated.	
15.20	J24			-8.09		15.50		
							Stiff red brown sandy gravelly CLAY. Gravel is fine to coarse subangular to subrounded and consists of sandstone.	

Boring Progress and Water Observations					
Date		Depth	Casing	Casing Dia	Water Depth
04/10/99		8.00			
04/10/99		15.50	15.50	150mm	dry
05/10/99		15.50	15.50	150mm	5.60
05/10/99		18.70	18.10	150mm	8.90

Chiselling			Water Added	
From	To	Hours	From	To
16.70	16.90	0.50		
18.40	18.70	1.00		

GENERAL REMARKS

(1) No inspection pit required.

All dimensions in metres Scale 1:50	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: S. Grieves	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG21/2

ALLIED EXPLORATION & GEOTECHNICS LTD

BOREHOLE RECORD

Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				BOREHOLE No BH-C04
Client: English Partnerships	Location: Teesside E453428.38 N522185.36			
Method & Equipment: Cable Percussion using a Pilcon Wayfarer 1500		Ground Level(m(AOD)): 7.41	Date: 04-10-99	Sheet: 3 of 3

SAMPLES & TESTS			Water	STRATA				Instru-ment/Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
16.20-16.65	U25	(130)					(As sheet 2 of 3) Stiff red brown sandy gravelly CLAY. Gravel is fine to coarse subangular to subrounded and consists of sandstone.	
16.60	J26					(2.50)		
17.00-17.50	B27							
17.70-17.80	B28	(100)		-10.59		18.00		
18.10	J29					(0.70)	Grey green and red brown highly weathered MUDSTONE very weak with some gypsum deposits.	
18.50	SJ30	50 for 67mm		-11.29		18.70		
							Borehole complete at 18.70m BGL.	

Boring Progress and Water Observations

Date		Depth	Casing	Casing Dia	Water Depth
04/10/99		8.00			
04/10/99		15.50	15.50	150mm	dry
05/10/99		15.50	15.50	150mm	5.60
05/10/99		18.70	18.10	150mm	8.90

Chiselling

From	To	Hours
16.70	16.90	0.50
18.40	18.70	1.00

Water Added

From	To

GENERAL REMARKS

(1) No inspection pit required.

All dimensions in metres Scale 1:50	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: S. Grieves	Contract No. **1715H**

Date Printed:- 09/12/99

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ALLIED EXPLORATION & GEOTECHNICS LTD

BOREHOLE RECORD

Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				BOREHOLE No BH-C05
Client: English Partnerships	Location: Teesside E453362.65 N521971.68			
Method & Equipment: Cable Percussion using a Pilcon Wayfarer 1500		Ground Level(m(AOD)): 8.24	Date: 01-10-99	Sheet: 1 of 3

SAMPLES & TESTS			Water	STRATA				Instru-ment/Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	
							As TP-BHC05.	
						(8.00)		
				0.24		8.00		

Boring Progress and Water Observations

Date		Depth	Casing	Casing Dia	Water Depth
01/10/99		8.00			
01/10/99		11.50	11.50	150mm	dry
04/10/99		11.50	11.50	150mm	4.30
04/10/99		16.00	16.00	150mm	8.40
05/10/99		16.00	16.00	150mm	8.30
05/10/99		21.70	21.40	150mm	14.40

Chiselling

From	To	Hours
17.70	18.00	0.75
21.50	21.70	0.50

Water Added

From	To
0.00	21.70

GENERAL REMARKS

(1) No inspection pit required.

All dimensions in metres Scale 1:50	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: S. Grieves	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG21/2

ALLIED EXPLORATION & GEOTECHNICS LTD

BOREHOLE RECORD

Status:- **PRELIM2**	Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation			BOREHOLE No BH-C05
Client: English Partnerships	Location: Teesside E453362.65 N521971.68		
Method & Equipment: Cable Percussion using a Pilcon Wayfarer 1500	Ground Level(m(AOD)): 8.24	Date: 01-10-99	Sheet: 2 of 3

SAMPLES & TESTS			Water	STRATA				Instru-ment / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
8.30	W26						Soft to firm thinly laminated grey brown sandy CLAY of high plasticity with silt dustings on laminae.	
9.50	U14*					(3.50)		
10.50	J15							
11.00-11.45	SJ16	N14						
11.01-11.50	B17							
				-3.26		11.50		
12.00	J18						Stiff thinly laminated grey brown CLAY of high plasticity with silt dustings on laminae.	
12.50-12.95	U19	(30)				(1.90)		
13.00	J20							
				-5.16		13.40		
13.40-13.90	B21						Stiff to very stiff red brown sandy gravelly CLAY. Gravel is fine to coarse subangular and consists of sandstone and quartzite.	
14.00-14.45	U22	(55)						
14.50	J23					(2.60)		
15.00	J24							
15.50	U25*	(80)						
				-7.76		16.00		

Boring Progress and Water Observations

Date		Depth	Casing	Casing Dia	Water Depth
01/10/99		8.00			
01/10/99		11.50	11.50	150mm	dry
04/10/99		11.50	11.50	150mm	4.30
04/10/99		16.00	16.00	150mm	8.40
05/10/99		16.00	16.00	150mm	8.30
05/10/99		21.70	21.40	150mm	14.40

Chiselling

From	To	Hours
17.70	18.00	0.75
21.50	21.70	0.50

Water Added

From	To
0.00	21.70

GENERAL REMARKS

(1) No inspection pit required.

All dimensions in metres Scale 1:50	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: S. Grieves	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG21/2

ALLIED EXPLORATION & GEOTECHNICS LTD

BOREHOLE RECORD

Status:-	PRELIM2
Date:-	09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				BOREHOLE No BH-C05
Client: English Partnerships	Location: Teesside E453362.65 N521971.68			
Method & Equipment: Cable Percussion using a Pilcon Wayfarer 1500	Ground Level(m(AOD)): 8.24	Date: 01-10-99		Sheet: 3 of 3

SAMPLES & TESTS

Depth	Type No	Test Result
16.50	J27	
17.00-17.35	U28	(90)
17.50	J29	
18.00	J30	
18.50-18.85	U31	(100)
19.00	J32	
19.50	J33	
20.00-20.35	U34	(100)
20.50	J35	
20.90-21.40	B36	
21.50	SJ37	50 for
21.51-21.70	B38	66mm

STRATA

Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instru-ment/Backfill
	-12.36		(4.60) 20.60	Stiff to very stiff grey brown sandy gravelly CLAY. Gravel is fine to coarse subangular to subrounded and consists of sandstone and quartzite.	
	-13.16		(0.80) 21.40	Grey and red brown highly weathered MUDSTONE very weak.	
	-13.46		(0.30) 21.70	Grey with orange mottling highly weathered MUDSTONE very weak.	
				Borehole complete at 21.70m BGL.	

Boring Progress and Water Observations

Date		Depth	Casing	Casing Dia	Water Depth
01/10/99		8.00			
01/10/99		11.50	11.50	150mm	dry
04/10/99		11.50	11.50	150mm	4.30
04/10/99		16.00	16.00	150mm	8.40
05/10/99		16.00	16.00	150mm	8.30
05/10/99		21.70	21.40	150mm	14.40

Chiselling

From	To	Hours
17.70	18.00	0.75
21.50	21.70	0.50

Water Added

From	To
0.00	21.70

GENERAL REMARKS

(1) No inspection pit required.

All dimensions in metres Scale 1:50	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: S. Grieves	Contract No. 1715H

Date Printed:- 09/12/99

Form AEG21/2

ALLIED EXPLORATION & GEOTECHNICS LTD

BOREHOLE RECORD

Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				BOREHOLE No BH-C06
Client: English Partnerships	Location: Teesside E453537.71 N522067.54			
Method & Equipment: Cable Percussion using a Pilcon Wayfarer 1500		Ground Level(m(AOD)): 8.06	Date: 30-09-99	Sheet: 1 of 3

SAMPLES & TESTS			Water	STRATA				Instru-ment/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
						(7.00)	As TP-BHC06.	▨
				1.06		7.00		▨
					▦		MADE GROUND (Medium dense grey slightly clayey gravel. Gravel is fine to coarse subangular and consists of slag).	▨

Boring Progress and Water Observations					
Date		Depth	Casing	Casing Dia	Water Depth
30/09/99		7.00	6.00	150mm	dry
30/09/99		15.50	15.50	150mm	dry
01/10/99		15.50	15.50	150mm	13.00
01/10/99		21.50	21.10	150mm	16.30

Chiselling			Water Added	
From	To	Hours	From	To
14.80	15.00	0.50		
21.30	21.50	0.50		

GENERAL REMARKS

(1) No inspection pit required.

All dimensions in metres Scale 1:50	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: S. Grieves	Contract No. 1715H

Date Printed:- 09/12/99

Form AEG21/2

ALLIED EXPLORATION & GEOTECHNICS LTD

BOREHOLE RECORD

Status:- **PRELIM2**	Date:- **09/12/99**

Project: South Tees Industrial Area, Site C - Ground Investigation				BOREHOLE No BH-C06
Client: English Partnerships	Location: Teesside E453537.71 N522067.54			
Method & Equipment: Cable Percussion using a Pilcon Wayfarer 1500		Ground Level(m(AOD)): 8.06	Date: 30-09-99	Sheet: 2 of 3

SAMPLES & TESTS

Depth	Type No	Test Result
9.00-9.45	CB8	N19
10.00	J9	
10.50-10.95	SJ10	N38
10.51-10.95	B11	
11.60	J12	
12.00-12.45	U13	(55)
12.50	J14	
13.20	J15	
13.50-13.95	U16	(110)
14.00	J17	
14.30-14.70	B18	
15.00-15.45	U19	(90)
15.50	J20	

Water

STRATA

Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instru-ment / Backfill
-1.94		(3.00) 10.00	(As sheet 1 of 3) MADE GROUND (Medium dense grey slightly clayey gravel. Gravel is fine to coarse subangular and consists of slag).	
-3.44		(1.50) 11.50	Dense grey brown SAND with occasional pockets of soft thinly laminated grey sandy brown clay. at c.10.50m BGL ... sandy clay.	
-4.94		(1.50) 13.00	Soft thinly laminated grey brown CLAY of intermediate to high plasticity with silt dustings on laminae.	
-7.44		(2.50) 15.50	Firm red brown sandy gravelly CLAY. Gravel is fine to coarse subangular and consists mudstone and sandstone.	
		(1.00)	Firm grey brown sandy gravelly CLAY. Gravel is fine to coarse subangular and consists of mudstone and sandstone.	

Boring Progress and Water Observations

Date		Depth	Casing	Casing Dia	Water Depth
30/09/99		7.00	6.00	150mm	dry
30/09/99		15.50	15.50	150mm	dry
01/10/99		15.50	15.50	150mm	13.00
01/10/99		21.50	21.10	150mm	16.30

Chiselling

From	To	Hours
14.80	15.00	0.50
21.30	21.50	0.50

Water Added

From	To

GENERAL REMARKS

(1) No inspection pit required.

All dimensions in metres Scale 1:50	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: S. Grieves	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG21/2

ALLIED EXPLORATION & GEOTECHNICS LTD

BOREHOLE RECORD

Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation			BOREHOLE No BH-C06
Client: English Partnerships	Location: Teesside E453537.71 N522067.54		
Method & Equipment: Cable Percussion using a Pilcon Wayfarer 1500	Ground Level(m(AOD)): 8.06	Date: 30-09-99	Sheet: 3 of 3

SAMPLES & TESTS

Depth	Type No	Test Result	Water
16.00	J21		
16.50-16.95	U22	(130)	
17.00	J23		
17.20-17.60	B24		
18.00-18.45	B25 U*	(110)	
18.40	J26		
18.50-18.95	SJ27	N66	
18.51-18.95	B28		
19.50	J29		
20.00-20.45	SJ30	N61	
20.60	J31		
21.00-21.50	SJ32	25 for 21mm*	
21.50	C	50 for 39mm*	

STRATA

Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instru-ment/ Backfill
-8.44		16.50	(As sheet 2 of 3)	
-10.24		(1.80) 18.30	Stiff indistinctly thinly laminated grey brown sandy SILT of low plasticity with occasional pockets/lenses of sand.	
-12.44		(2.20) 20.50	Very stiff grey brown sandy gravelly CLAY of low plasticity. Gravel is subangular to subrounded and consists of mudstone and sandstone.	
-13.44		(1.00) 21.50	Red brown and grey highly weathered MUDSTONE very weak.	
			Borehole complete at 21.50m BGL.	

Boring Progress and Water Observations

Date		Depth	Casing	Casing Dia	Water Depth
30/09/99		7.00	6.00	150mm	dry
30/09/99		15.50	15.50	150mm	dry
01/10/99		15.50	15.50	150mm	13.00
01/10/99		21.50	21.10	150mm	16.30

Chiselling

From	To	Hours
14.80	15.00	0.50
21.30	21.50	0.50

Water Added

From	To

GENERAL REMARKS

(1) No inspection pit required.

All dimensions in metres Scale 1:50	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: S. Grieves	Contract No. 1715H

Date Printed:- 09/12/99

Form AEG21/2

FIGURE 5

Trial Pit Records

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

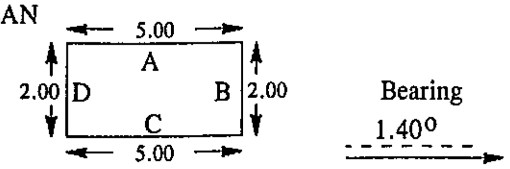
Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				TRIAL PIT No TP-BHC01
Client: English Partnerships	Location: Teesside E453303.05 N522314.63			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.		Ground Level(m(AOD)): 6.97	Date: 01-10-99	Sheet: 1 of 2

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.50	B1 J2			5.87	▨	1.10	MADE GROUND (Black gravelly silty sand. Sand consists of ash with occasional metal fragments. Gravel is fine to coarse angular to subangular and consists of clinker and slag). (Assessed as loose)
1.50	B3				▨		MADE GROUND (Grey sandy gravelly angular cobbles and boulders of slag. Gravel is fine to coarse angular to subangular and consists of slag). (Assessed as very dense)
2.50	B4						
3.50	B5						

TRIAL PIT SKETCH

PLAN



Groundwater: Water strike at 5.30m BGL.

Remarks: Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

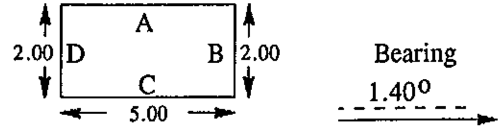
Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				TRIAL PIT No TP-BHC01
Client: English Partnerships	Location: Teesside E453303.05 N522314.63			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.		Ground Level(m(AOD)): 6.97	Date: 01-10-99	Sheet: 2 of 2

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
5.00	B6		▼1		▨		(As sheet 1 of 2) MADE GROUND (Grey sandy gravelly angular cobbles and boulders of slag. Gravel is fine to coarse angular to subangular and consists of slag). (Assessed as very dense)
6.50	B7				▨		
				-0.13	▨	7.10	
7.10	B8 J9			-0.43	×	7.40	Brown with dark grey mottling silty fine to medium SAND with some shell fragments. (Assessed as loose)
							Trial pit complete at 7.40m BGL and casing installed for borehole BHC01.

TRIAL PIT SKETCH

PLAN



Groundwater	Water strike at 5.30m BGL.
Remarks	Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

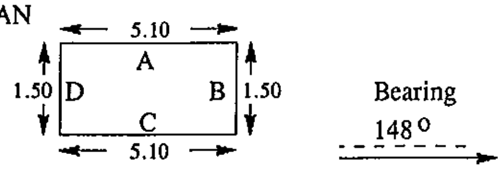
Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				TRIAL PIT No TP-BHC02
Client: English Partnerships	Location: Teesside E453246.19 N522185.77			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.		Ground Level(m(AOD)): 7.84	Date: 04-10-99	Sheet: 1 of 2

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.20	B1 J2			7.54	▨	0.30	Grass over MADE GROUND (Black silty sandy gravel with occasional metal and timber fragments. Sand consists of ash. Gravel is fine to coarse and consists of clinker, slag and brick). (Assessed as dense)
1.00	B3				▨		MADE GROUND (Grey sandy gravelly angular cobbles and boulders of slag. Gravel is fine to coarse angular to subangular and consists of slag). (Assessed as very dense)
2.00	B4				▨		
3.00	B5				▨		
4.00	B6				▨		

TRIAL PIT SKETCH

PLAN



Groundwater
Water strike at 6.10m BGL.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

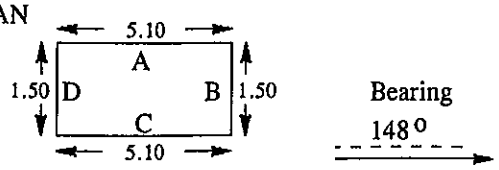
Status:-	**PRELIM2**
Date:-	09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				TRIAL PIT No TP-BHC02
Client: English Partnerships	Location: Teesside E453246.19 N522185.77			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.		Ground Level(m(AOD)): 7.84	Date: 04-10-99	Sheet: 2 of 2

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
5.00	B7				▨		(As sheet 1 of 2) MADE GROUND (Grey sandy gravelly angular cobbles and boulders of slag. Gravel is fine to coarse angular to subangular and consists of slag). (Assessed as very dense)
			▼ 1				
6.50	B8						
				0.24		7.60	
7.80	B9 J10			-0.06		7.90	Brown with dark grey mottling silty fine to medium SAND with some shell fragments.
							Trial pit complete at 7.90m BGL and casing installed for borehole BHC02.

TRIAL PIT SKETCH

PLAN



Groundwater

Water strike at 6.10m BGL.

Remarks

Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

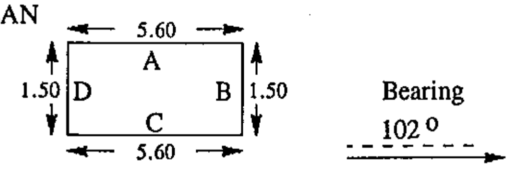
Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				TRIAL PIT No TP-BHC03
Client: English Partnerships	Location: Teesside E453132.34 N522018.92			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.		Ground Level(m(AOD)): 7.99	Date: 06-10-99	Sheet: 1 of 2

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.10	B1			7.79	▨	0.20	Grass over MADE GROUND (Black silty gravelly sand. Sand consists of ash. Gravel is fine to coarse angular and consists of clinker). (Assessed as loose)
1.00	B2			5.89	▨	2.10	MADE GROUND (Black and dark brown clayey sandy gravel with some angular cobbles of slag and occasional timber fragments. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subangular and consists of clinker, brick and slag). (Assessed as loose)
2.50	B3 J4				▨		MADE GROUND (Firm brown with orange mottling sandy gravelly clay with some pockets/bands of black fine to coarse sand consisting of ash and occasional metal, rubber, plastic and timber fragments. Gravel is fine to coarse angular and consists of slag, brick and fire brick).
3.50	B5 J6				▨		

TRIAL PIT SKETCH

PLAN



Groundwater
Water strike at 7.10m BGL.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. 1715H

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

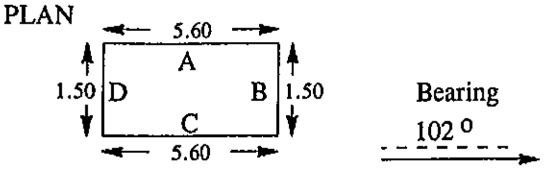
Status:- **PRELIM2**
Date:- 09/12/99

Project: **South Tees Industrial Area, Site C - Ground Investigation**	TRIAL PIT No TP-BHC03
Client: English Partnerships	Location: Teesside E453132.34 N522018.92
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 7.99
Date: 06-10-99	Sheet: 2 of 2

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
5.00	B7 J8			1.59	▨	6.40	(As sheet 1 of 2) MADE GROUND (Firm brown with orange mottling sandy gravelly clay with some pockets/bands of black fine to coarse sand consisting of ash and occasional metal, rubber, plastic and timber fragments. Gravel is fine to coarse angular and consists of slag, brick and fire brick).
7.00	B9			0.59	▨	7.40	MADE GROUND (Black and dark grey sandy gravel with some angular cobbles of slag. Gravel is fine to coarse angular and consists of slag). (Assessed as dense)
7.40	B10 J11			0.29	×	7.70	Brown and dark grey silty fine to medium SAND with occasional shell fragments.
							Trial pit complete at 7.70m BGL and casing installed for borehole BHC03.

TRIAL PIT SKETCH

PLAN



Groundwater
Water strike at 7.10m BGL.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

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ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

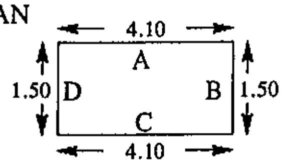
Status:- **PRELIM2**
Date:- **09/12/99**

Project: **South Tees Industrial Area, Site C - Ground Investigation**	TRIAL PIT No TP-BHC04
Client: English Partnerships	Location: Teesside E453428.38 N522185.36
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 7.41
Date: 30-09-99	Sheet: 1 of 2

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.30	B1 J2			6.41	▨	1.00	Rough grass over MADE GROUND (Black sandy gravel with occasional metal, plastic and timber fragments. Sand is fine to coarse and consists of ash. Gravel is fine to coarse predominantly angular and consists of dolerite, clinker and slag). (Assessed as loose)
1.50	B3				▨		MADE GROUND (Grey gravelly angular cobbles and boulders of slag. Gravel is fine to coarse predominantly angular and consists of slag and fire brick). (Assessed as very dense)
2.50	B4				▨		
3.50	B5				▨		
4.50	B6				▨		

TRIAL PIT SKETCH

PLAN



Bearing
290°

Groundwater
Water strike at 5.40 BGL.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

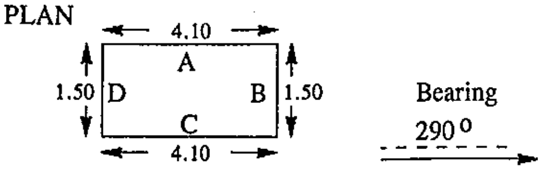
Status:-	**PRELIM2**
Date:-	09/12/99

Project: **South Tees Industrial Area, Site C - Ground Investigation**			TRIAL PIT No TP-BHC04
Client: English Partnerships	Location: Teesside E453428.38 N522185.36		
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 7.41	Date: 30-09-99	Sheet: 2 of 2

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
5.50	B7						
6.50	B8			0.61	▨	6.80	(As sheet 1 of 2) MADE GROUND (Grey gravelly angular cobbles and boulders of slag. Gravel is fine to coarse predominantly angular and consists of slag and fire brick). (Assessed as very dense)
7.00	B9 J10			0.31	⁙	7.10	Brown and dark grey silty gravelly fine to medium SAND with some shell fragments. (Assessed as loose)
							Trial pit complete at 7.10m BGL and casing installed for borehole BHC04.

TRIAL PIT SKETCH

PLAN



Groundwater

Water strike at 5.40 BGL.

Remarks

Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

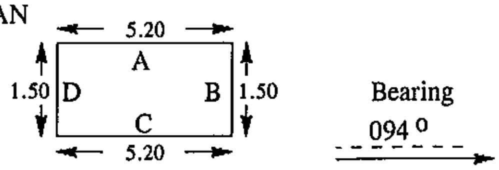
Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation			TRIAL PIT No TP-BHC05
Client: English Partnerships	Location: Teesside E452262.65 N521971.68		
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 8.24	Date: 29-09-99	Sheet: 1 of 2

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.40	B1 J2			7.44	▨	0.80	Grass over MADE GROUND (Dark grey and brown gravelly fine to coarse sand consisting of ash with occasional metal, glass and timber fragments. Gravel is fine to coarse predominantly angular and consists of clinker, slag, fire brick and slag). (Assessed as loose)
1.20	B3 J4			6.54	▨	1.70	MADE GROUND (Red brown gravelly fine to coarse sand consisting of ash with occasional angular cobbles of slag. Gravel is fine to coarse angular to subangular and consists of slag). (Assessed as dense)
2.50	B5				▨		MADE GROUND (Grey sandy gravel with many cobbles and boulders of slag with occasional metal fragments. Gravel is fine to coarse angular and consists of slag). (Assessed as very dense)
3.50	B6				▨		
4.50	B7				▨		

TRIAL PIT SKETCH

PLAN



Groundwater	Water strike at 6.10m BGL.
Remarks	Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

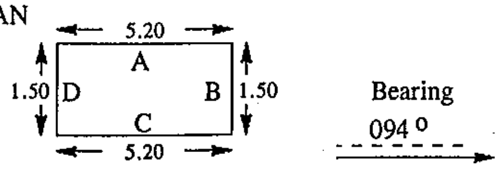
Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation			TRIAL PIT No TP-BHC05
Client: English Partnerships	Location: Teesside E452262.65 N521971.68		
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 8.24	Date: 29-09-99	Sheet: 2 of 2

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
					▨		(As sheet 1 of 2) MADE GROUND (Grey sandy gravel with many cobbles and boulders of slag with occasional metal fragments. Gravel is fine to coarse angular and consists of slag). (Assessed as very dense)
5.50	B8				▨		
6.10	W13		▼		▨		
6.50	B9				▨		
7.50	B10				▨		
				0.44	▨	7.80	
				0.24	∴	8.00	Grey brown silty gravelly fine to medium SAND with some shell fragments.
8.00	J11 B12						Trial pit complete at 8.00m BGL and casing installed for borehole BHC05.

TRIAL PIT SKETCH

PLAN



Groundwater

Water strike at 6.10m BGL.

Remarks

Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

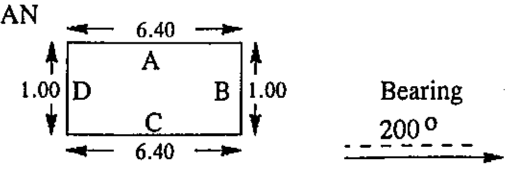
Status:- **PRELIM2**
Date:- 09/12/99

Project: **South Tees Industrial Area, Site C - Ground Investigation**				TRIAL PIT No TP-BHC06
Client: English Partnerships	Location: Teesside E453537.71 N522067.54			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.		Ground Level(m(AOD)): 8.06	Date: 28-09-99	Sheet: 1 of 2

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.50	B1			7.26	▨	0.80	Grass over MADE GROUND (Dark grey silty sandy gravel. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subangular and consists of clinker and slag). (Assessed as loose)
1.00	B2				▨		MADE GROUND (Grey brown angular cobbles and boulders of slag. Gravel is fine to coarse angular and consists of slag). (Assessed as dense to very dense)
2.50	B3						
4.00	B4						

TRIAL PIT SKETCH

PLAN



Groundwater	Water strike at 5.80m BGL.
Remarks	Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

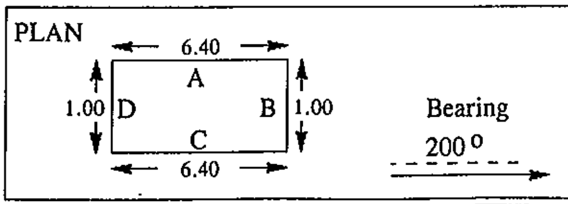
Status:-	**PRELIM2**
Date:-	09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation			TRIAL PIT No TP-BHC06
Client: English Partnerships	Location: Teesside E453537.71 N522067.54		
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 8.06	Date: 28-09-99	Sheet: 2 of 2

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
7.00	B5		▼	0.56	▨	7.50	(As sheet 1 of 2) MADE GROUND (Grey brown angular cobbles and boulders of slag. Gravel is fine to coarse angular and consists of slag). (Assessed as dense to very dense)
7.50	J6			0.26	× × ×	7.80	Soft black organic SILT. at c.7.80m BGL ... brown gravelly fine to medium sand with occasional shell fragments.
7.80	B7						Trial pit complete at 7.80m BGL and casing installed for borehole BHC06.

TRIAL PIT SKETCH

PLAN



Groundwater	Water strike at 5.80m BGL.
Remarks	Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

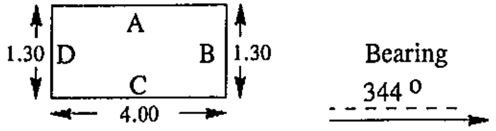
Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				TRIAL PIT No TP-BHC07
Client: English Partnerships	Location: Teesside E453640.06 N521967.65			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.		Ground Level(m(AOD)): 7.96	Date: 07-10-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.10	J1			7.66	▨	0.30	Grass over MADE GROUND (Black gravelly fine to coarse sand consisting of ash. Gravel is fine to coarse angular to subangular and consists of clinker). (Assessed as loose)
0.50	B2				▨		MADE GROUND (Grey gravelly angular cobbles and boulders of slag. Gravel is fine to coarse angular and consists of slag).
1.00	B3				▨		
2.00	B4				▨		
3.00	B5				▨		
4.00	B6			3.66	▨	4.30	
							Trial pit complete at 4.30m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater	No groundwater inflow observed.
Remarks	Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

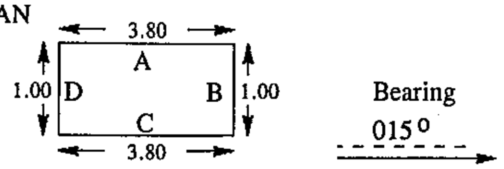
Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				TRIAL PIT No TP-C01
Client: English Partnerships	Location: Teesside E453007.39 N522029.19			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 6.33	Date: 05-10-99		Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.10	B1 J2			6.13	▨	0.20	Grass over MADE GROUND (Black and dark grey sandy gravel. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subrounded and consists of clinker and slag). (Assessed as loose)
1.00	B3				▨		MADE GROUND (Grey gravelly angular cobbles and boulders consisting of slag. Gravel is fine to coarse angular to subangular and consists of slag). (Assessed as dense)
2.00	B4				▨		
3.00	B5x2				▨		
4.00	B6			2.13	▨	4.20	
							Trial pit complete at 4.20m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

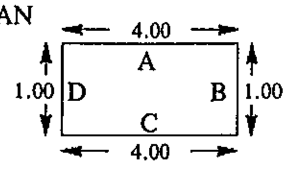
Status:-
PRELIM2
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation			TRIAL PIT No TP-C02
Client: English Partnerships	Location: Teesside E453081.92 N522127.94		
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 6.10	Date: 28-09-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.10	B1 J2			5.80	▨	0.30	Grass over MADE GROUND (Black sandy gravel. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular and consists of clinker, slag and brick). (Assessed as loose)
1.00	B3				▨		MADE GROUND (Light grey and grey angular cobbles and boulders consisting of slag with some fine to coarse angular to subangular gravel of slag). (Assessed as dense to very dense)
2.00	B4				▨		
3.00	B5				▨		
4.00	B6			1.70	▨	4.40	
							Trial pit complete at 4.40m BGL.

TRIAL PIT SKETCH

PLAN



Bearing
002 °

Groundwater	No groundwater inflow observed.
Remarks	Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

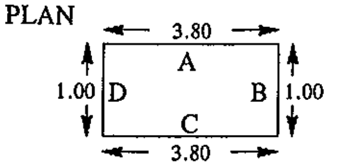
Status:- **PRELIM2**	Date:- **09/12/99**

Project: **South Tees Industrial Area, Site C - Ground Investigation**				TRIAL PIT No TP-C03
Client: English Partnerships	Location: Teesside E453124.73 N522176.91			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.		Ground Level(m(AOD)): 6.19	Date: 28-09-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.20	B1 J2			5.89	▨	0.30	Grass over MADE GROUND (Dark grey black silty sandy gravel. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subangular and consists of slag, cinders and brick). (Assessed as loose)
1.00	B3				▨		MADE GROUND (Grey angular cobbles and boulders consisting of slag with some fine to coarse angular gravel of slag). (Assessed as dense to very dense)
2.00	B4				▨		
3.00	B5				▨		
4.10	B6			1.69	▨	4.50	
							Trial pit terminated at 4.50m BGL.

TRIAL PIT SKETCH

PLAN



Bearing 222 °

Groundwater: No groundwater inflow observed.

Remarks: Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

Status:- **PRELIM2**
Date:- **09/12/99**

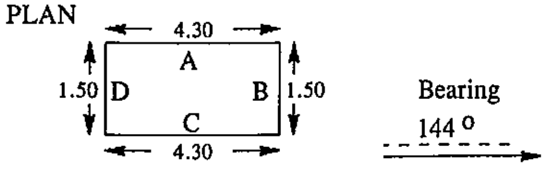
Project: **South Tees Industrial Area, Site C - Ground Investigation**				TRIAL PIT No TP-C04
Client: English Partnerships	Location: Teesside E453194.60 N522210.66			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 6.87	Date: 04-10-99		Sheet: 1 of 1

SAMPLES & TESTS / STRATA

Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth	DESCRIPTION
				6.27	▨	0.60	Rough Grass over MADE GROUND (Black and purple brown sandy gravel. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subrounded and consists of clinker, slag, brick and fire brick). (Assessed as loose)
				2.97	▨	3.90	MADE GROUND (Grey gravelly angular cobbles and boulders of slag. Gravel is fine to coarse angular to subangular and consists of slag and fire brick). (Assessed as very dense)
							Trial pit terminated at 3.90m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

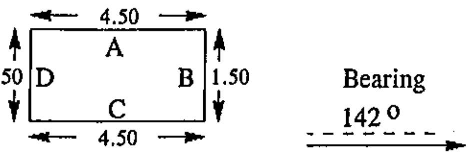
Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				TRIAL PIT No TP-C05
Client: English Partnerships	Location: Teesside E453268.01-N522298.26			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.		Ground Level(m(AOD)): 7.06	Date: 04-10-99	Sheet: 1 of 1

SAMPLES & TESTS				STRATA			
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth	DESCRIPTION
0.10	J1				▨		MADE GROUND (Black and brown silty sandy gravel with occasional pockets of firm brown gravelly clay. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subrounded and consists of clinker and slag). (Assessed as loose)
0.60	B2 J3			5.86	▨	1.20	
1.20	B4				▨		MADE GROUND (Grey brown gravelly angular cobbles and boulders of slag. Gravel is fine to coarse angular and consists of slag). (Assessed as very dense)
2.00	B5x2				▨		
3.00	B6				▨		
4.10	B7x2			2.66	▨	4.40	
							Trial pit complete at 4.40m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

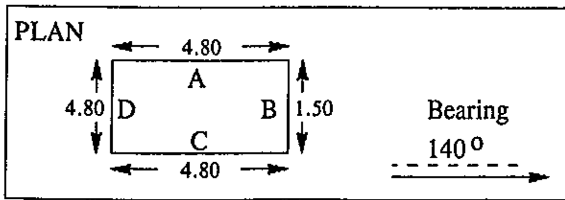
Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation			TRIAL PIT No TP-C06
Client: English Partnerships	Location: Teesside E453341.18 N522364.26		
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 7.84	Date: 04-10-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
				7.74	▨	0.10	Grass over MADE GROUND (Black gravelly silty fine to coarse sand. Sand consists of ash. Gravel is fine to coarse angular to subangular and consists of clinker and slag). (Assessed as loose)
0.50	B1						
				6.64	▨	1.20	MADE GROUND (Black sandy gravel with occasional fragments of timber and metal. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular and consists of clinker, brick and slag). (Assessed as dense)
				6.34	▨	1.50	MADE GROUND (Concrete).
1.50	B2 J3						
				6.04	▨	1.80	MADE GROUND (Firm brown and red brown with grey mottling sandy gravelly clay. Gravel is fine to coarse angular to subrounded and consists of sandstone and mudstone).
2.00	B4						
3.00	B5						
4.20	B6						
				3.44	▨	4.40	MADE GROUND (Grey gravelly angular cobbles and boulders of slag. Gravel is fine to coarse angular to subangular and consists of slag). (Assessed as very dense)
							Trial pit complete at 4.40m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

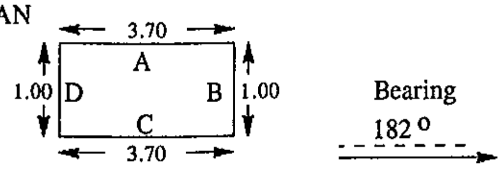
Status:- **PRELIM2**
Date:- 09/12/99

Project: **South Tees Industrial Area, Site C - Ground Investigation**	TRIAL PIT No TP-C07
Client: English Partnerships	Location: Teesside E453046.22 N521956.00
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 7.50
Date: 05-10-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.30	B1 J2			6.90	▨	0.60	Rough vegetation over MADE GROUND (Black and dark brown sandy gravel with occasional fragments of metal. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subrounded and consists of clinker, slag and brick).
1.00	B3				▨		MADE GROUND (Dark grey brown silty sandy gravel with occasional fragments of timber, metal, rubber and glass and with occasional cobbles of slag. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subrounded and consists of slag, brick and clinker). (Assessed as loose)
2.30	B4 J5				▨		
3.50	B6			3.20	▨	4.30	
4.50	B7 J8			2.50	▨	5.00	MADE GROUND (Firm brown (locally thinly laminated) sandy clay with occasional bands/lenses of fine to medium sand). (Possibly reworked clay)
							Trial pit complete at 5.00m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

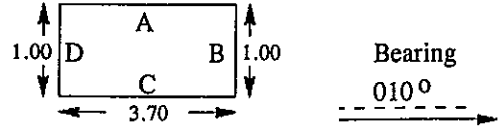
Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				TRIAL PIT No TP-C08
Client: English Partnerships	Location: Teesside E453121.33 N522037.22			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.		Ground Level(m(AOD)): 7.88	Date: 28-09-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.30	B1 J2			7.48	▨	0.40	Grass over MADE GROUND (Dark grey silty sandy gravel with occasional fragments of metal. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subangular and consists of slag and clinker). (Assessed as loose)
1.00	B3			6.58	▨	1.30	MADE GROUND (Firm friable sandy gravelly clay with occasional cobbles of fire brick and fragments of metal. Gravel is fine to coarse angular to subangular and consists of clinker, coke, fire brick and slag).
2.00	B4 J5				▨		MADE GROUND (Black sandy gravel with occasional cobbles of slag. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subangular and consists of brick, clinker and slag).
3.20	B6 J7				▨		at c.3.20m BGL ... pocket of firm brown with grey mottling sandy gravelly clay. Gravel is fine to coarse angular and consists of slag and sandstone.
4.20	B8 J9			3.38	▨	4.50	
							Trial pit complete at 4.50m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

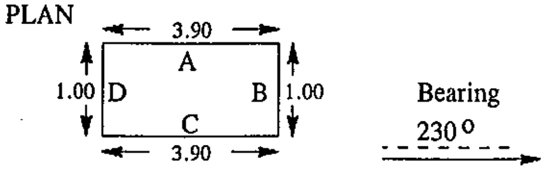
Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation	TRIAL PIT No TP-C09
Client: English Partnerships	Location: Teesside E453183.22 N522132.71
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 7.00
Date: 28-09-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.20	B1 J2			6.70	▨	0.30	Grass over MADE GROUND (Black clayey very sandy gravel. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subangular and consists of clinker, coke and slag). (Assessed as loose)
1.00	B3 J4			5.80	▨	1.20	MADE GROUND (Firm brown sandy gravelly clay with some bands of black sand consisting of ash. Gravel is fine to coarse and consists of sandstone).
2.00	B5 J6				▨		MADE GROUND (Firm (locally thinly laminated) brown with grey mottling clay with some bands of black gravelly sand consisting of ash. Gravel is fine to coarse angular and consists of slag and clinker).
3.70	B7 J8			2.50	▨	4.50	
							Trial pit complete at 4.50m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

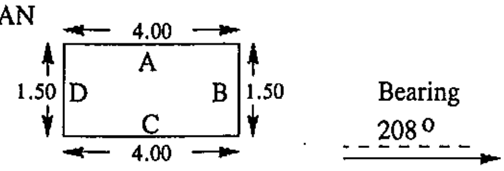
Status:- **PRELIM2**
Date:- **09/12/99**

Project: **South Tees Industrial Area, Site C - Ground Investigation**			TRIAL PIT No TP-C10
Client: English Partnerships	Location: Teesside E453294.66 N522215.59		
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 6.85	Date: 04-10-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.10	B1			6.65	▨	0.20	Rough grass over MADE GROUND (Black gravelly silty sand consisting of ash. Gravel is fine to coarse angular to subangular and consists of clinker and slag). (Assessed as loose)
1.00	B2x2			2.25	▨	4.60	MADE GROUND (Dark grey and grey sandy gravel with some angular cobbles and boulders of slag. Gravel is fine to coarse angular to subangular and consists of slag). (Assessed as very dense)
2.00	B3						
3.00	B4x2						
4.00	B5						
							Trial pit complete at 4.60m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater
No groundwater inflow observed.

Remarks
Trial pit sides unstable during excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

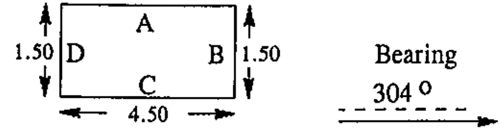
Status:- **PRELIM2**
Date:- 09/12/99

Project: **South Tees Industrial Area, Site C - Ground Investigation**				TRIAL PIT No TP-C11
Client: English Partnerships	Location: Teesside E453327.05 N255515.59			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.		Ground Level(m(AOD)): 7.04	Date: 04-10-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.40	B1 J2			6.24	▨	0.80	MADE GROUND (Brown sandy gravel. Sand consists of ash. Gravel is fine to coarse predominantly angular and consists of clinker and slag). (Assessed as dense)
1.00	B3				▨		MADE GROUND (Grey brown sandy gravel with some angular cobbles and boulders of slag. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subangular and consists of slag). (Assessed as dense)
2.00	B4				▨		
3.00	B5				▨		
4.00	B6			2.84	▨	4.20	
							Trial pit complete at 4.20m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

Status:-	**PRELIM2**
Date:-	**09/12/99**

Project:	**South Tees Industrial Area, Site C - Ground Investigation**
TRIAL PIT No	TP-C12
Client:	English Partnerships
Location:	Teesside E453400.58 N522318.69
Method & Equipment:	Machine Excavated using a 360 Tracked Exc.
Ground Level(m(AOD)):	7.67
Date:	04-10-99
Sheet:	1 of 1

SAMPLES & TESTS

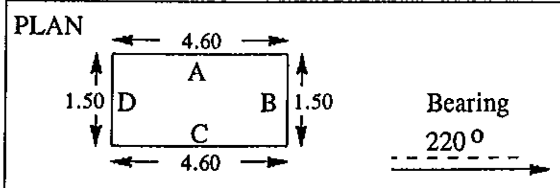
Depth	Type No	Test Result	Water
0.20	B1		
0.60	B2 B3		
1.20	B4x2		
2.00	B5		
3.00	B6x2		
4.00	B7		

STRATA

Reduced Level	Legend	Depth	DESCRIPTION
7.27	▨	0.40	MADE GROUND (Grey sandy gravel. Sand is fine to coarse angular and consists of slag). (Assessed as loose)
6.67	▨	1.00	MADE GROUND (Black sandy gravel with occasional pockets of firm grey brown and red brown sandy gravelly clay. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subangular and consists of clinker, brick, slag, sandstone and mudstone). (Assessed as dense)
3.37	▨	4.30	MADE GROUND (Grey gravelly angular cobbles and boulders consisting of slag. Gravel is fine to coarse angular to subangular and consists of slag). (Assessed as dense)
			Trial pit complete at 4.30m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater	No groundwater inflow observed.
Remarks	Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

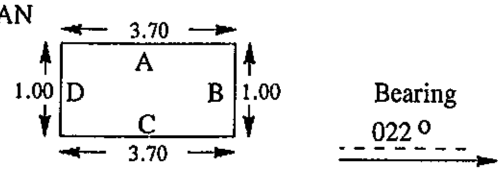
Status:- **PRELIM2**
Date:- 09/12/99

Project: **South Tees Industrial Area, Site C - Ground Investigation**	TRIAL PIT No TP-C13
Client: English Partnerships	Location: Teesside E453058.74 N521857.16
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 8.04
Date: 05-10-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.10	J1			7.84	▨	0.20	MADE GROUND (Grass over brown clayey topsoil).
				7.64	▨	0.40	MADE GROUND (Black and dark brown sandy gravel with occasional angular cobbles of slag and occasional fragments of metal. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subangular and consists of slag, fire brick and brick). (Assessed as loose)
0.60	B2 J3			4.64	▨	3.40	MADE GROUND (Grey sandy gravelly angular cobbles and boulders of slag. Gravel is fine to coarse angular and consists of slag). (Assessed as very dense)
1.50	B4						
2.50	B5						
3.40	B6						Trial pit complete at 3.40m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

Status:- **PRELIM2**
Date:- 09/12/99

Project: **South Tees Industrial Area, Site C - Ground Investigation**				TRIAL PIT No TP-C14
Client: English Partnerships	Location: Teesside E453137.42 N521948.43			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.		Ground Level(m(AOD)): 7.02	Date: 05-10-99	Sheet: 1 of 1

SAMPLES & TESTS

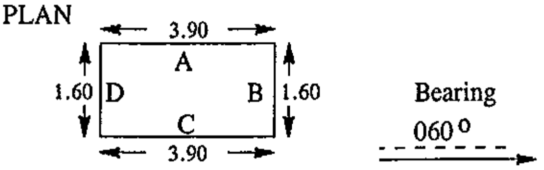
Depth	Type No	Test Result	Water
0.10	J1		
0.50	B2		
1.50	B3x2		
2.50	B4		
3.70	B5x2		
4.10	B6 J7		

STRATA

Reduced Level	Legend	Depth	DESCRIPTION
6.82	▨	0.20	Grass over MADE GROUND (Red brown gravelly silty sand. Sand consists of ash. Gravel is fine to coarse subrounded and consists of clinker). (Assessed as loose)
3.62	▨	3.40	MADE GROUND (Grey (predominantly coarse) angular gravel consisting of slag with occasional cobbles and boulders of slag). (Assessed as dense)
2.72	▨	4.30	MADE GROUND (Grey gravelly angular cobbles of slag with some pockets of firm orange brown clay. Gravel is fine to coarse and consists of slag).
			Trial pit complete at 4.30m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater

No groundwater inflow observed.

Remarks

Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

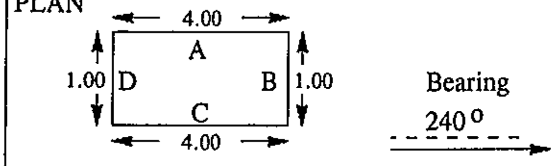
Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				TRIAL PIT No TP-C15
Client: English Partnerships	Location: Teesside E453193.77 N521985.12			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 8.18	Date: 05-10-99		Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.20	B1 J2			7.68	▨	0.50	Grass over MADE GROUND (Black silty sandy gravel. Sand is fine to coarse and consists of ash. Gravel is fine to coarse and consists of slag and clinker). (Assessed as loose)
1.50	B3				▨		MADE GROUND (Black and dark brown sandy gravel with occasional pockets of firm grey brown gravelly clay. Gravel is fine to coarse angular and consists of clinker and slag). (Assessed as loose to dense)
3.50	B4			4.18	▨	4.00	
4.20	B5 J6			3.68	▨	4.50	MADE GROUND (Firm thinly laminated grey brown sandy clay with some lenses of fine to medium sand). (Possibly reworked)
							Trial pit complete at 4.50m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

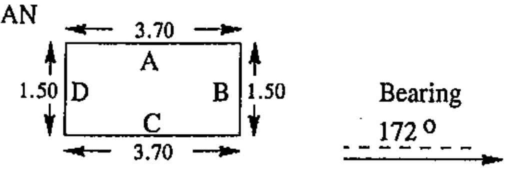
Status:-	**PRELIM2**
Date:-	09/12/99

Project: **South Tees Industrial Area, Site C - Ground Investigation**				TRIAL PIT No TP-C16
Client: English Partnerships	Location: Teesside E453285.26 N522079.29			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.		Ground Level(m(AOD)): 7.80	Date: 05-10-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.10	B1 J2			7.70	▨	0.10	Grass over MADE GROUND (Black gravelly silty fine to medium sand consisting of ash. Gravel is fine to coarse angular to subangular and consists of clinker and slag). (Assessed as loose)
0.50	B3x2				▨		MADE GROUND (Grey brown gravelly angular cobbles and boulders of slag. Gravel is fine to coarse angular and consists of slag). (Assessed as dense)
1.50	B4				▨		
2.50	B5x2				▨		
3.50	B6			4.00	▨	3.80	
							Trial pit complete at 3.80m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater	No groundwater inflow observed.
Remarks	Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

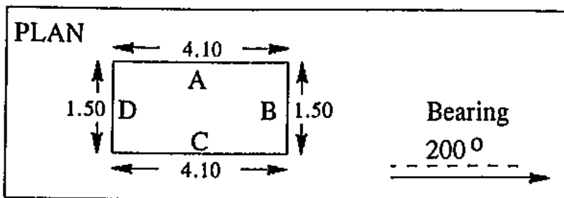
Status:- **PRELIM2**
Date:- 09/12/99

Project:	**South Tees Industrial Area, Site C - Ground Investigation**
TRIAL PIT No	TP-C17
Client:	English Partnerships
Location:	Teesside E453362.19 N522124.74
Method & Equipment:	Machine Excavated using a 360 Tracked Exc.
Ground Level(m(AOD)):	7.94
Date:	06-10-99
Sheet:	1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.20	B1			7.74	▨	0.20	Grass over MADE GROUND (Black gravelly sand with occasional fragments of metal and rubber. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular and consists of clinker and coke). (Assessed as loose)
0.50	B2 J3			6.04	▨	1.90	MADE GROUND (Grey brown sandy gravelly cobbles of slag. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subrounded and consists of slag, brick and fire brick). (Assessed as dense)
1.50	B4						
2.00	B5x2			3.54	▨	4.40	MADE GROUND (Grey brown gravelly angular cobbles and boulders of slag. Gravel is fine to coarse angular to subangular and consists of slag). (Assessed as dense)
3.00	B6x2						
4.00	B7						
							Trial pit complete at 4.40m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater	No groundwater inflow observed.
Remarks	Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

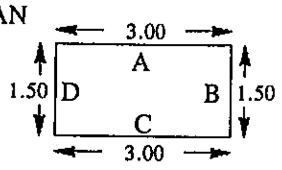
Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				TRIAL PIT No TP-C18
Client: English Partnerships	Location: Teesside E453448.67 N522244.14			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.		Ground Level(m(AOD)): 8.11	Date: 06-10-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.20	J1				▨		MADE GROUND (Black and dark grey gravelly sand. Sand consists of ash. Gravel is fine to coarse angular to subangular and consists of clinker). (Assessed as loose)
0.50	B2			7.41	▨	0.70	
					▨		MADE GROUND (Grey gravelly angular cobbles and boulders of slag. Gravel is fine to coarse with occasional timber sleepers. Gravel is fine to coarse angular and consists of slag). (Assessed as dense to very dense)
1.00	B3x2				▨		
2.00	B4				▨		
3.00	B5			5.01	▨	3.10	
							Trial pit terminated at 3.10m BGL.

TRIAL PIT SKETCH

PLAN



Bearing
270°

Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

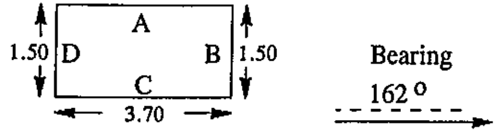
Status:- **PRELIM2**
Date:- **09/12/99**

Project: **South Tees Industrial Area, Site C - Ground Investigation**	TRIAL PIT No TP-C19
Client: English Partnerships	Location: Teesside E453259.75 N521898.53
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 7.78
Date: 05-10-99	Sheet: 1 of 1

SAMPLES & TESTS				STRATA			
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth	DESCRIPTION
0.10	J1			7.58	▨	0.20	MADE GROUND (Black gravelly silty fine to medium sand consisting of ash. Gravel is fine to coarse angular to subangular and consists of clinker). (Assessed as loose)
0.40	B2			6.98	▨	0.80	MADE GROUND (Red brown sandy gravel with occasional cobbles. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subangular and consists of slag). (Assessed as dense)
1.00	B3			3.98	▨	3.80	MADE GROUND (Grey gravel with occasional angular cobbles of slag. Gravel is fine to coarse angular and consists of slag. (Assessed as dense to very dense)
3.00	B5 J6						
							Trial pit terminated at 3.80m BGL.

TRIAL PIT SKETCH

PLAN



Bearing
162 °

Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation			TRIAL PIT No TP-C20
Client: English Partnerships	Location: Teesside E453344.76 N521953.10		
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 8.06	Date: 05-10-99	Sheet: 1 of 1

SAMPLES & TESTS

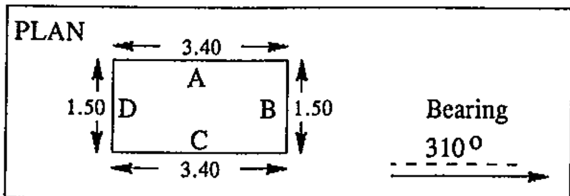
Depth	Type No	Test Result	Water
0.20	B1 J2		
0.50	B3		
1.00	B4		
2.00	B5		
3.00	B6		

STRATA

Reduced Level	Legend	Depth	DESCRIPTION
7.56	▨	0.50	MADE GROUND (Black and red brown gravelly sand. Sand consists of ash. Gravel is fine to coarse angular and consists of slag). (Assessed as loose)
4.46	▨	3.60	MADE GROUND (Grey sandy gravel with some angular cobbles of slag. Gravel is fine to coarse angular to subangular and consists of slag). (Assessed as very dense)
			Trial pit terminated at 3.60m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. 1715H

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

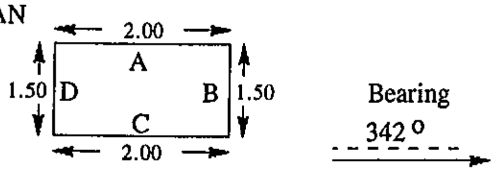
Status:- **PRELIM2**
Date:- 09/12/99

Project: **South Tees Industrial Area, Site C - Ground Investigation**			TRIAL PIT No TP-C21
Client: English Partnerships	Location: Teesside E453405.51 N522040.90		
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 7.49	Date: 06-10-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.50	B1 J2			6.29	▨	1.20	Grass over MADE GROUND (Black gravelly sand. Sand consists of ash. Gravel is fine to coarse angular and consists of clinker). (Assessed as loose)
1.40	J3			5.69	▨	1.80	MADE GROUND (Red brown clayey gravelly fine to coarse sand consisting of ash. Gravel is fine to coarse angular and consists of slag). (Assessed as loose) at c.1.80m BGL ... MADE GROUND (Concrete).
							Trial pit terminated at 1.80m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

Status:- **PRELIM2**
Date:- **09/12/99**

Project: **South Tees Industrial Area, Site C - Ground Investigation**

TRIAL PIT No: TP-C22

Client: English Partnerships

Location: Teesside E453456.56 N522090.81

Method & Equipment: Machine Excavated using a 360 Tracked Exc.

Ground Level(m(AOD)): 6.97

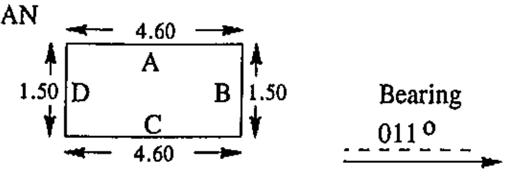
Date: 06-10-99

Sheet: 1 of 1

SAMPLES & TESTS				STRATA			
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth	DESCRIPTION
0.20	B1 J2			6.47	▨	0.50	Grass over MADE GROUND (Black and red brown gravelly sand. Sand consists of ash. Gravel is fine to coarse angular and consists of clinker). (Assessed as loose)
1.00	B3x2			2.47	▨	4.50	MADE GROUND (Grey gravelly angular cobbles and boulders of slag. Gravel is fine to coarse angular to subangular and consists of slag).
2.00	B4x2						
3.00	B5x2						
4.00	B6						
							Trial pit complete at 4.50m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

Status:-	**PRELIM2**
Date:-	09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				TRIAL PIT No TP-C23
Client: English Partnerships	Location: Teesside E453514.28 N522121.82			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 7.70	Date: 06-10-99		Sheet: 1 of 1

SAMPLES & TESTS

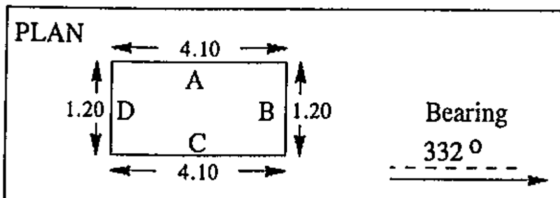
Depth	Type No	Test Result	Water
0.10	J1		
0.20	J2		
0.50	B3		
1.50	B4		
2.50	B5		
3.50	B6		
4.10	B7		

STRATA

Reduced Level	Legend	Depth	DESCRIPTION
7.50	▨	0.20	MADE GROUND (Black gravelly sand. Sand consists of ash. Gravel is fine to medium angular to subangular and consists of clinker). (Assessed as loose)
7.40	▨	0.30	MADE GROUND (Brown sandy gravel with occasional fragments of metal. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subangular and consists of clinker and slag). (Assessed as dense)
3.40	▨	4.30	MADE GROUND (Grey brown gravelly angular cobbles and boulders of slag. Gravel is fine to coarse angular to subangular and consists of slag).
			Trial pit complete at 4.30m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater	No groundwater inflow observed.
Remarks	Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. 1715H

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

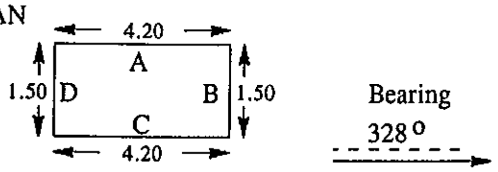
Status:-	**PRELIM2**
Date:-	09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation			TRIAL PIT No TP-C24
Client: English Partnerships	Location: Teesside E453322.37 N521874.95		
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 8.06	Date: 05-10-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.20	B1 J2			7.56	▨	0.50	Grass over MADE GROUND (Black gravelly sand. Sand consists of ash with occasional fragments of timber. Gravel is fine to coarse angular to subangular and consists of slag). (Assessed as loose)
0.70	B3 J4			6.96	▨	1.10	MADE GROUND (Red brown very sandy gravel. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subrounded and consists of slag). (Assessed as dense)
2.00	B5 J6			5.46	▨	2.60	MADE GROUND (Black and dark grey silty gravelly fine to medium sand consisting of ash with occasional fragments of metal. Gravel is fine to coarse angular to subangular and consists of slag). (Assessed as dense)
3.50	B7 J8			3.56	▨	4.50	MADE GROUND (Brown sandy gravel intermixed with firm brown sandy gravelly clay with occasional cobbles of slag and occasional fragments of metal. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subangular and consists of slag and clinker). (Assessed as dense)
							Trial pit complete at 4.50m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

Status:-	**PRELIM2**
Date:-	09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				TRIAL PIT No TP-C25
Client: English Partnerships	Location: Teesside E453435.50 N521967.41			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 8.32	Date: 06-10-99		Sheet: 1 of 1

SAMPLES & TESTS

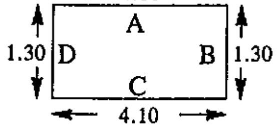
Depth	Type No	Test Result	Water
0.20	B1 J2		
0.50	B3		
1.20	B4		
2.00	B5		
3.00	B6		

STRATA

Reduced Level	Legend	Depth	DESCRIPTION
8.02	▨	0.30	MADE GROUND (Black and red brown gravelly fine to coarse sand consisting of ash. Gravel is fine to coarse angular to subangular and consists of clinker). (Assessed as loose)
6.52	▨	1.80	MADE GROUND (Black sandy gravel with occasional fragments of metal and timber. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular and consists of slag, brick and fire brick). (Assessed as fire brick)
4.42	▨	3.90	MADE GROUND (Grey gravelly cobbles and boulders of slag. Gravel is fine to coarse angular to subangular and consists of slag).
			Trial pit complete at 3.90m BGL.

TRIAL PIT SKETCH

PLAN



Bearing

324°

Groundwater	No groundwater inflow observed.
Remarks	Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

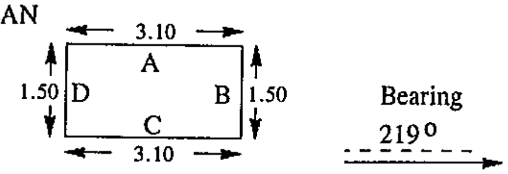
Status:- **PRELIM2**
Date:- 09/12/99

Project:	**South Tees Industrial Area, Site C - Ground Investigation**
Client:	English Partnerships
Location:	Teesside E453466.33 N522024.56
TRIAL PIT No	TP-C26
Method & Equipment:	Machine Excavated using a 360 Tracked Exc.
Ground Level(m(AOD)):	7.81
Date:	06-10-99
Sheet:	1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.20	J1 J2			7.41	▨	0.40	Grass over MADE GROUND (Black and dark grey sandy gravel. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subangular and consists of clinker). (Assessed as loose)
0.70	B3x2			3.91	▨	3.90	MADE GROUND (Grey sandy gravelly angular cobbles and boulders of slag. Gravel is fine to coarse angular and consists of slag).
1.50	B4x2						
2.50	B5						
3.60	B6						
							Trial pit terminated at 3.90m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

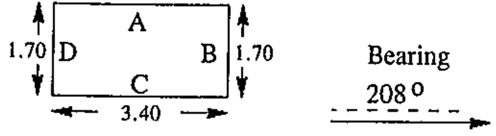
Status:- **PRELIM2**
Date:- 09/12/99

Project:	South Tees Industrial Area, Site C - Ground Investigation
TRIAL PIT No	TP-C27
Client:	English Partnerships
Location:	Teesside E453578.39 N522114.00
Method & Equipment:	Machine Excavated using a 360 Tracked Exc.
Ground Level(m(AOD)):	7.86
Date:	07-10-99
Sheet:	1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.20	B1 J2			7.46	▨	0.40	Grass over MADE GROUND (Black and brown clayey very sandy gravel. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular and consists of clinker). (Assessed as loose)
0.50	B3			4.36	▨	3.50	MADE GROUND (Grey gravelly angular cobbles and boulders consisting of slag. Gravel is fine to coarse angular and consists of slag). (Assessed as very dense)
1.50	B4						
2.50	B5						
3.20	B6						
							Trial pit terminated at 3.50m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

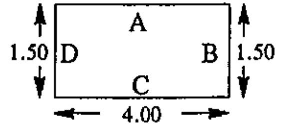
Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation	TRIAL PIT No TP-C28
Client: English Partnerships	Location: Teesside E453475.03 N521895.14
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 8.47
Date: 07-10-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.20	B1 J2			7.97	▨	0.50	Grass over MADE GROUND (Black sandy gravel. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subangular and consists of clinker and coke). (Assessed as loose)
1.00	B3 J4			6.07	▨	2.40	MADE GROUND (Brown silty sandy gravel with occasional fragments of metal, plastic and timber. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subrounded and consists of clinker, slag and brick. Occasional angular cobbles of brick). (Assessed as loose)
2.00	B5 J6						
2.50	B7			4.17	▨	4.30	MADE GROUND (Grey gravelly angular cobbles and boulders consisting of slag. Gravel is fine to coarse angular to subangular and consists of slag). (Assessed as dense)
3.00	B8						
4.00	B9						
							Trial pit complete at 4.30m BGL.

TRIAL PIT SKETCH

PLAN



Bearing
268°

Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

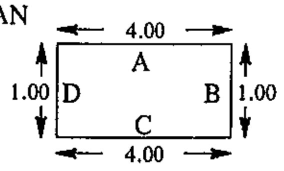
Status:- **PRELIM2**
Date:- 09/12/99

Project: **South Tees Industrial Area, Site C - Ground Investigation**	TRIAL PIT No TP-C29
Client: English Partnerships	Location: Teesside E453559.18 N521948.76
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 7.99
Date: 28-09-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.10	B1 J2			7.79	▨	0.20	Grass over MADE GROUND (Black silty sandy gravel. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular to subangular and consists of clinker and slag). (Assessed as loose)
1.00	B3				▨		MADE GROUND (Grey angular cobbles and boulders consisting of slag with some fine to coarse angular gravel of slag). (Assessed as very dense)
2.00	B4				▨		
3.00	B5			4.39	▨	3.60	
3.60	B6						Trial pit complete at 3.60m BGL.

TRIAL PIT SKETCH

PLAN



Bearing
210°

Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

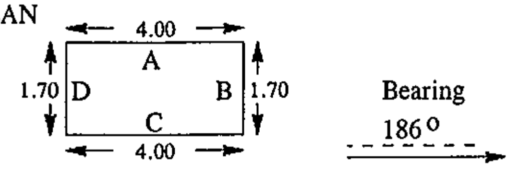
Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation			TRIAL PIT No TP-C30
Client: English Partnerships	Location: Teesside E453700.21 N521986.46		
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 8.83	Date: 07-10-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.20	J1				▨		Grass over MADE GROUND (Black and brown gravelly fine to coarse sand consisting of ash. Gravel is fine to coarse angular to subangular and consists of clinker). (Assessed as loose)
0.50	B2 J3			8.23	▨	0.60	
1.00	B4				▨		MADE GROUND (Grey gravelly angular cobbles and boulders of slag. Gravel is fine to coarse angular and consists of slag). (Assessed as dense)
2.00	B5x2				▨		
3.00	B6				▨		
4.00	B7			4.53	▨	4.30	
							Trial pit complete at 4.30m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater	No groundwater inflow observed.
Remarks	Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

Status:-	**PRELIM2**
Date:-	09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation				TRIAL PIT No TP-C31
Client: English Partnerships	Location: Teesside E453498.49 N521965.42			
Method & Equipment: Machine Excavated using a 360 Tracked Exc.		Ground Level(m(AOD)): 8.25	Date: 07-10-99	Sheet: 1 of 1

SAMPLES & TESTS

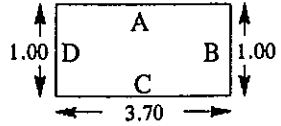
Depth	Type No	Test Result	Water
0.20	B1 J2		
1.00	B3 J4		
1.70	B5 J6		
2.00	B7		
3.00	B8x2		
4.10	B9x2		

STRATA

Reduced Level	Legend	Depth	DESCRIPTION
7.85	▨	0.40	Grass over MADE GROUND (Black silty gravelly fine to medium sand consisting of ash. Gravel is fine to coarse angular to subangular and consists of clinker). (Assessed as loose)
6.45	▨	1.80	MADE GROUND (Brown clayey sandy gravel with some pockets/bands of firm grey brown sandy gravelly clay, occasional fragments of timber, metal and plastic and occasional angular cobbles of slag. Sand is fine to coarse angular to subangular and consists of ash. Gravel is fine to coarse angular to subangular and consists of slag, brick, fire brick and clinker). (Assessed as loose to dense)
3.85	▨	4.40	MADE GROUND (Grey gravelly angular cobbles and boulders of slag. Gravel is fine to coarse angular and consists of slag). (Assessed as dense)
			Trial pit complete 4.40m BGL.

TRIAL PIT SKETCH

PLAN



Bearing 356°

Groundwater	No groundwater inflow observed.
Remarks	Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

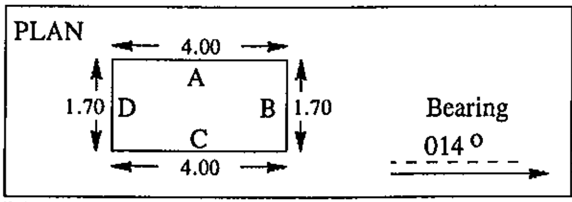
Status:- **PRELIM2**
Date:- **09/12/99**

Project: **South Tees Industrial Area, Site C - Ground Investigation**	TRIAL PIT No TP-C32
Client: English Partnerships	Location: Teesside E453700.70 N521775.60
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 14.43
Date: 07-10-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.10	B1			14.03	▨	0.40	MADE GROUND (Grey sandy gravel. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular and consists of clinker and slag). (Assessed as loose)
0.80	B2 J3			12.93	▨	1.50	MADE GROUND (Red brown clayey sandy gravel with occasional fragments of timber and metal and occasional angular cobbles of slag. Sand is fine to coarse angular and consists of clinker, slag, brick and fire brick). (Assessed as loose to dense)
1.80	B4			12.13	▨	2.30	MADE GROUND (Orange brown and grey clayey gravelly angular cobbles and boulders of slag. Gravel is fine to coarse angular and consists of slag). (Assessed as dense)
3.00	B5			10.03	▨	4.40	MADE GROUND (Grey gravelly angular cobbles and boulders of slag. Gravel is fine to coarse angular and consists of slag). (Assessed as dense)
4.00	B6						
							Trial pit complete at 4.40m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater
No groundwater inflow observed.

Remarks
Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

ALLIED EXPLORATION & GEOTECHNICS LTD

TRIAL PIT RECORD

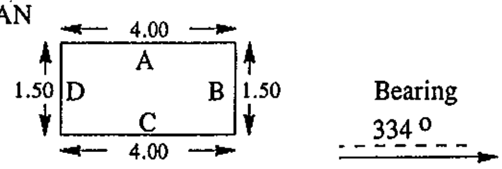
Status:- **PRELIM2**
Date:- 09/12/99

Project: South Tees Industrial Area, Site C - Ground Investigation			TRIAL PIT No TP-C33
Client: English Partnerships	Location: Teesside E453751.61 N521819.09		
Method & Equipment: Machine Excavated using a 360 Tracked Exc.	Ground Level(m(AOD)): 12.66	Date: 07-10-99	Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth	DESCRIPTION
0.10	J1			12.36	▨	0.30	Grass over MADE GROUND (Black sandy gravel. Sand is fine to coarse and consists of ash. Gravel is fine to coarse angular and consists of clinker). (Assessed as loose)
0.70	B2 J3			11.06	▨	1.60	MADE GROUND (Brown sandy gravel with occasional cobbles concrete and slag. Sand is fine to coarse and consists predominantly of ash. Gravel is fine to coarse angular to subangular and consists of slag, brick, concrete and clinker). (Assessed as loose to dense)
1.50	B4x2			8.66	▨	4.00	MADE GROUND (Grey gravelly angular cobbles and boulders. Gravel is fine to coarse angular and consists of slag). (Assessed as dense)
2.50	B5x2						
3.50	B6						
							Trial pit complete at 4.00m BGL.

TRIAL PIT SKETCH

PLAN



Groundwater	No groundwater inflow observed.
Remarks	Pit sides stable throughout excavation.

All dimensions in metres	For Explanation of Symbols and Abbreviations see Key Sheets	Checked By:	Logged By: R. Hudson	Contract No. **1715H**

Date Printed:- 09/12/99

Form AEG23/2

TABLE 1

In-situ Standard Penetration Test Results

Standard Penetration Test Results
(BS 1377:Part 9:Clause 3.3:1990)

BH No.	Depth (mBGL)	Seating Drive						Test Drive											Shoe or Cone
		Pen (mm)	Blows (No.)	Pen (mm)	Blows (No.)	Total Pen (mm)	Total Blows (No.)	Pen (mm)	Blows (No.)	Pen (mm)	Blows (No.)	Pen (mm)	Blows (No.)	Pen (mm)	Blows (No.)	Total Pen (mm)	Total Blows (No.)	SPT 'N' Value	
BH-C01	8.50	75	3	75	2	150	5	75	2	75	3	75	4	75	4	300	13	13	S
	10.00	75	2	75	2	150	4	75	3	75	2	75	4	75	3	300	12	12	S
	17.50	140	25			140	25	75	19	75	21	35	10			185	50	-	S
	20.80	75	8	75	16	150	24	75	31	35	19					110	50	-	S
BH-C02	10.00	75	2	75	1	150	3	75	3	75	4	75	5	75	3	300	15	15	S
	11.50	75	1	75	1	150	2	75	2	75	1	75	2	75	2	300	7	7	S
	21.50	40	25			40	25	20	100							20	100	-	S
BH-C03	9.00	75	1	75	2	150	3	75	2	75	1	75	2	75	1	300	6	6	S
	10.50	75	2	75	3	150	5	75	2	75	2	75	3	75	1	300	8	8	S
	21.90	75	16	25	9	100	25	75	33	75	38	32	29			182	100	-	S
BH-C04	8.00	75	21	75	13	150	34	75	9	75	3	75	3	75	3	300	18	18	S
	9.00	75	3	75	4	150	7	75	4	75	5	75	4	75	4	300	17	17	S
	10.50	75	2	75	3	150	5	75	7	75	6	75	4	75	4	300	21	21	S
	12.00	75	1	75	2	150	3	75	3	75	3	75	4	75	3	300	13	13	S
	18.50	50	25			50	25	67	50							67	50	-	S
BH-C05	11.00	75	3	75	2	150	5	75	4	75	3	75	3	75	4	300	14	14	S
	21.50	55	25			55	25	66	50							66	50	-	S
BH-C06	9.00	75	11	75	17	150	28	75	7	75	6	75	3	75	3	300	19	19	C
	10.50	75	1	75	2	150	3	75	5	75	8	75	11	75	14	300	38	38	S
	18.50	75	7	75	9	150	16	75	12	75	16	75	17	75	21	300	66	66	S
	20.00	75	5	75	9	150	14	75	11	75	15	75	15	75	20	300	61	61	S

Contract Title:South Tees Industrial Area - Site C - Ground Investigation
Client:Halcrow Crouch
Date of issue:22/11/99
AEG Contract No:1715H

Standard Penetration Test Results
(BS 1377:Part 9:Clause 3.3:1990)

BH No.	Depth (mBGL)	Seating Drive						Test Drive											Shoe or Cone
		Pen (mm)	Blows (No.)	Pen (mm)	Blows (No.)	Total Pen (mm)	Total Blows (No.)	Pen (mm)	Blows (No.)	Pen (mm)	Blows (No.)	Pen (mm)	Blows (No.)	Pen (mm)	Blows (No.)	Total Pen (mm)	Total Blows (No.)	SPT 'N' Value	
BH-C06	21.00	21	25			21	25											-	S
	21.50	39	50			39	50											-	C

Contract Title:South Tees Industrial Area - Site C - Ground Investigation
Client:Halcrow Crouch
Date of issue:22/11/99
AEG Contract No:1715H

LABORATORY ENCLOSURES

ENCLOSURE 0

Laboratory Report Certificate

ALLIED EXPLORATION & GEOTECHNICS LIMITED
Unit 25 Stella Gill Industrial Estate
Pelton Fell
Chester-le-Street
Co.Durham
DH2 2RJ

a NAMAS TESTING Laboratory No 1367 & 1367SI

LABORATORY REPORT CERTIFICATE

Contract Title	South Tees Industrial Area, Site C - Ground Investigation	AEG Reference No	1715H
Client	English Partnerships	Client Reference	
Address	St George's House Kingsway Team Valley Gateshead NE11 0NA		

We certify that Laboratory testing was carried out on [1]samples from the above mentioned contract in accordance with techniques outlined in BS 1377:1990 or other appropriate standards as quoted. The samples were received during October 1999 and the following results, given on the attached enclosures, were obtained.
The tests carried out are indicated in the attached table showing the enclosure number and the total number of pages.

For and on behalf of Allied Exploration & Geotechnics Limited

Signed .... Date 17th November 1999

pp **S.Patterson**
Laboratory Manager

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[1] Please note the material was derived from samples taken outside the control of the laboratory.

LABORATORY REPORT CERTIFICATE

ENCLOSURES

Enclosure Number	DESCRIPTION	NAMAS ACCREDITED	REFERENCE	No. of Pages
0	**Laboratory Report Certificate**	N/A		4
1	**Sample Description Sheets**	N/A		2
2	**Moisture Content**	Yes	BS 1377 Part 2 1990	1
2	**Plastic Index and Moisture Content**	Yes	BS 1377 Part 2 1990	2
-	**Linear Shrinkage**	Yes	BS 1377 Part 2 1990	-
-	**Determination of Density by Linear Measurement**	Yes	BS 1377 Part 2 1990	-
-	**Determination of Particle Density**	Yes	BS 1377 Part 2 1990	-
3	**Particle Size Distribution Sieving**	Yes	BS 1377 Part 2 1990	18
3	**Particle Size Distribution Sedimentation**	No	BS 1377 Part 2 1990	6
4	**Determination of Sulphate & pH Value** (Tested externally)	No	BS 1377 Part 3 1990	2
-	**Determination of Dry Density/Moisture Content Relationship**	Yes	BS 1377 Part 4 1990	-
-	**Determination of Dry Density/Moisture/CBR Relationship**	Yes	BS 1377 Part 4 1990	-
-	**Determination of Moisture Condition Value**	Yes	BS 1377 Part 4 1990	-
-	**Determination of the M C V / Moisture Relationship**	Yes	BS 1377 Part 4 1990	-
5	**Determination of California Bearing Ratio**	Yes	BS 1377 Part 4 1990	4
-	**Determination of One Dimensional Consolidation Properties**	Yes	BS 1377 Part 5 1990	-
-	**Determination of Swelling & Collapse Characteristics**	Yes	BS 1377 Part 5 1990	-
-	**Determination of Permeability (Falling Head)**	Yes	*In-house* Method	-
-	**Determination of Dispersibility**	No	BS 1377 Part 5 1990	-
-	**Consolidation in Hydraulic Cells with P W P Measurement**	No	BS 1377 Part 6 1990	-
-	**Determination of Isotropic Consolidation using a Triaxial Cell**	No	BS 1377 Part 6 1990	-
-	**Determination of Permeability in a Triaxial Cell**	No	BS 1377 Part 6 1990	-
-	**Shear Strength by Laboratory Vane**	Yes	BS 1377 Part 6 1990	-
-	**Shear Strength by Direct Shear**	Yes	BS 1377 Part 7 1990	-
-	**Determination Residual Strength using Ring Shear Apparatus**	No	BS 1377 Part 7 1990	-
6	**Determination of Undrained Shear Strength in Triaxial Cell without Pore Water Pressure Measurement Single and Multistage**	Yes	BS 1377 Part 7 1990	2
-	**Consolidated Undrained Shear Strength in Triaxial Cell with Measurement of Pore Pressure**	No	BS1377 Part 8 1990	-
-	**Consolidated Drained Shear Strength in Triaxial Cell with Measurement of Volume Change**	No	BS 1377 Part 8 1990	-

Enclosure Number	DESCRIPTION	NAMAS ACCREDITED	REFERENCE	No. of Pages
-	*In-situ* Density Sand Replacement Method	Yes	BS 1377 Part 9 1990	-
-	*In-situ* Density by Core Cutter Method	Yes	BS 1377 Part 9 1990	-
-	Dynamic Probe Resistance	No	BS 1377 Part 9 1990	-
-	Determination of the *in-situ* California Bearing Ratio	Yes	BS 1377 Part 9 1990	-
-	Shallow Pad (skip) Load Tests	No	BS 1377 Part 9 1990	-
-	Swelling Pressure and strain index of rock	No	ISRM 1985	-
-	Determination of the Point Load Index	Yes	ISRM 1985	-
-	Determination of Unconfined Compressive Strength	No	ISRM 1985	-

LABORATORY REPORT CERTIFICATE

ABBREVIATIONS

All the abbreviations used on the laboratory certificates are given below:

Br	Brittle	**PSD**	Particle Size Distribution by sieve analysis
C	Compound	**SB**	Shear Box
CBR	California Bearing Ratio	**SED**	Sedimentation Analysis
CDT	Consolidated Drained Triaxial	**SO3**	Sulphate (total, water extract, groundwater)
CL	Chloride content (water or soil)	**SRD**	In-situ density (sand replacement method)
CP2	Dry density/moisture content using 2.5kg rammer	**US**	Unsuitable sample for scheduled test
CP4	As above using 4.5kg rammer	**UUT**	Undrained Unconsolidated Triaxial
CPV	As above using vibrating hammer	**VT**	Vane test
CUT	Consolidated Undrained Triaxial	**HV**	Hand vane Test (using pilcon hand vane)
IS	Insufficient Sample for scheduled test	**R**	Remoulded
LOI	Loss on Ignition	**U**	Undisturbed
M	Multi-stage testing	**HC**	Hydraulic (Rowe) cell
MC	Moisture Content	**LS**	Linear Shrinkage
MCV	Moisture Condition Value	**PL**	Point Load
NAT	Natural preparation method	**DI**	Density By Immersion
NMC	Natural (or as received) Moisture Content	**P**	Plastic
NS	Non Standard (insufficient sample size)	**PFH**	Permeability Falling Head Method
OED	Oedometer	**PTXL**	Permeability In Triaxial Cell
OMC	Optimum Moisture Content	**PHC**	Permeability in Hydraulic Cell
ORG	Organic content	**B**	Large disturbed (Bulk) sample
PD	Particle Density (SG)	**J**	Small disturbed (Jar) Sample
pH	pH determination		
PI	Liquid limit, plastic limit and plasticity index		

ENCLOSURE 1

Sample Description Sheets

ALLIED EXPLORATION & GEOTECHNICS LIMITED
Unit 25 Stella Gill
Industrial Estate
Pelton Fell, Chester-le-Street
DH2 2RJ Tel. (0191) 3874700

SAMPLE DESCRIPTION SHEET

Exploratory Hole No.	Sample m	ID	Description	Remarks/Laboratory Tests
BH-C01	8.51	B11	Dark grey very clayey slightly gravelly SAND.	PSD SED SO3+pH
BH-C01	12.00	U17	Stiff brown sandy gravelly CLAY of low plasticity.	MC PI UUT SO3+pH
BH-C01	13.50	U20	Stiff brown slightly gravelly CLAY.	UUT
BH-C01	16.50	U26	Stiff brown sandy gravelly CLAY of low plasticity.	MC PI SO3+pH IS for UUT
BH-C01	20.80	SJ34	Red/brown/grey highly weathered MUDSTONE.	SO3+pH
BH-C02	8.00	B12	Brown clayey sandy GRAVEL with some cobbles.	PSD SED
BH-C02	11.51	B18	Grey/brown very clayey slightly gravelly SAND.	PSD SED SO3+pH
C02	13.00	U21	Stiff brown sandy slightly gravelly CLAY of low plasticity.	MC PI MUUT
BH-C02	16.00	U27	Firm brown sandy slightly gravelly CLAY of low plasticity.	MC PI SO3+pH IS for UUT
BH-C02	20.50	U35	Firm brown slightly gravelly CLAY.	MUUT
BH-C02	21.10	B37	Red/brown highly weathered MUDSTONE.	SO3+pH
BH-C03	9.01	B15	Brown clayey gravelly SAND.	PSD SO3+pH
BH-C03	11.90	J20	Brown sandy slightly gravelly CLAY of intermediate plasticity.	MC PI SO3+pH
BH-C03	13.50	U24	Firm brown sandy slightly gravelly CLAY of low plasticity.	MC PI MUUT SO3+pH
BH-C03	15.00	U27*B	Brown sandy gravelly CLAY.	MC
BH-C03	16.50	U29*B	Brown silty gravelly CLAY.	MC
BH-C03	17.00	U30	Stiff brown slightly gravelly CLAY.	US for UUT
BH-C04	9.01	B14	Grey/brown clayey SAND.	PSD SO3+pH
BH-C04	13.20	U20	Stiff brown sandy slightly gravelly CLAY of low plasticity.	MC PI MUUT SO3+pH
BH-C04	14.70	U23	Stiff laminated brown slightly gravelly CLAY.	UUT
BH-C04	18.10	J29	Grey/green/brown highly weathered MUDSTONE.	SO3+pH
BH-C05	10.50	J15	Dark brown with orange grey brown mottling sandy CLAY of high plasticity.	MC PI IS for SO3+pH
BH-C05	12.50	U19	Stiff laminated brown CLAY of high plasticity with silt dustings on laminae.	MC PI MUUT

Project Title:- South Tees Industrial Area - Ground Investigation	Client:- English Partnerships	
Signed:-	Name:- M. SELKIRK	Sheet 1 of 2
Date of Issue:- 17/11/99	Certificate No:- SD/1715H/2	AEG Project Number:- 1715H

ALLIED EXPLORATION & GEOTECHNICS LIMITED
Unit 25 Stella Gill
Industrial Estate
Pelton Fell, Chester-le-Street
DH2 2RJ Tel. (0191) 3874700

SAMPLE DESCRIPTION SHEET

Exploratory Hole No.	Sample m	ID	Description	Remarks/Laboratory Tests
BH-C05	14.00	U22	Very stiff brown sandy gravelly CLAY.	MC PI UUT
BH-C05	17.00	U28	Stiff brown sandy gravelly CLAY.	US for UUT
BH-C06	10.50	SJ10	Brown/grey mottling sandy CLAY.	PSD SED
BH-C06	12.00	U13	Soft laminated brown CLAY of intermediate to high plasticity with silt dustings on laminae.	MC PI UUT SO3+pH
BH-C06	13.85	U16	Firm brown sandy slightly gravelly CLAY.	UUT
BH-C06	16.50	U22	Brown sandy SILT of low plasticity.	MC PI UUT
BH-C06	18.40	J26	Brown sandy gravelly CLAY of low plasticity.	MC PI
-C07	0.30	B1	MADE GROUND(Brown sandy gravel including slag and ash and occasional pockets of clay).	PSD IS for CBR
TP-C07	2.30	B4	MADE GROUND(Grey/black sandy gravel including nails, wood and occasional cobbles).	IS for PSD
TP-C08	0.30	B1	MADE GROUND(Brown sandy gravelly silt of intermediate plasticity with ash and coal fragments).	MC PI
TP-C09	0.20		MADE GROUND(Brown clayey very sandy gravel including slag).	PSD IS for CBR
TP-C11	0.40	B1	MADE GROUND(Brown sandy gravel and cobbles of slag).	PSD IS for CBR
TP-C11	2.00	B4	Dark grey slightly gravelly COBBLES.	PSD
TP-C15	1.50	B3	Dark brown/black clayey sandy GRAVEL with occasional cobbles.	PSD IS for CBR
TP-C17	0.50	B2	Dark brown sandy gravelly COBBLES.	PSD IS for CBR
TP-C19	0.40	B2	Dark brown sandy gravelly COBBLES.	PSD IS for CBR
TP-C19	1.00	B3	Black gravelly COBBLES of slag.	PSD
TP-C21	0.50	B1	Brown clayey sandy GRAVEL with occasional cobbles.	IS for PSD and CBR
TP-C24	0.70	B3	Brown very sandy GRAVEL.	PSD CBR
TP-C27	0.20	B1	Brown clayey very sandy GRAVEL.	PSD
TP-C28	1.00	B3	MADE GROUND(Brown clayey/silty sandy gravelly cobbles with occasional metal fragments).	PSD CBR
TP-C32	0.80	B2	Dark brown/black sandy gravelly COBBLES with occasional wood fragments.	PSD CBR

Project Title:- South Tees Industrial Area - Ground Investigation

Client:- English Partnerships

Signed:-

Name:- M. SELKIRK

Sheet 2 of 2

Date of Issue:- 17/11/99

Certificate No:- SD/1715H/2

AEG Project Number:- 1715H

ENCLOSURE 2

Moisture Content and Plastic Index/Moisture Content

ALLIED EXPLORATION & GEOTECHNICS LIMITED
Unit 25 Stella Gill
Pelton Fell
Chester-le-Street, Co. Durham
DH2 2RJ Tel. (0191) 3874700

MOISTURE CONTENT CERTIFICATE

BS 1377: Part 2: Clause 3.2

Exploratory Hole No.	Sample Depth	Sample Type	Moisture Content	Date Tested	Remarks
BH-C03	15.00	U27*B	9.1	08/11/99	
BH-C03	16.50	U29*B	14.5	08/11/99	

For sample description please refer to sample description sheet.

Project Title:- South Tees Industrial Area - Ground Investigation	Client:- English Partnerships

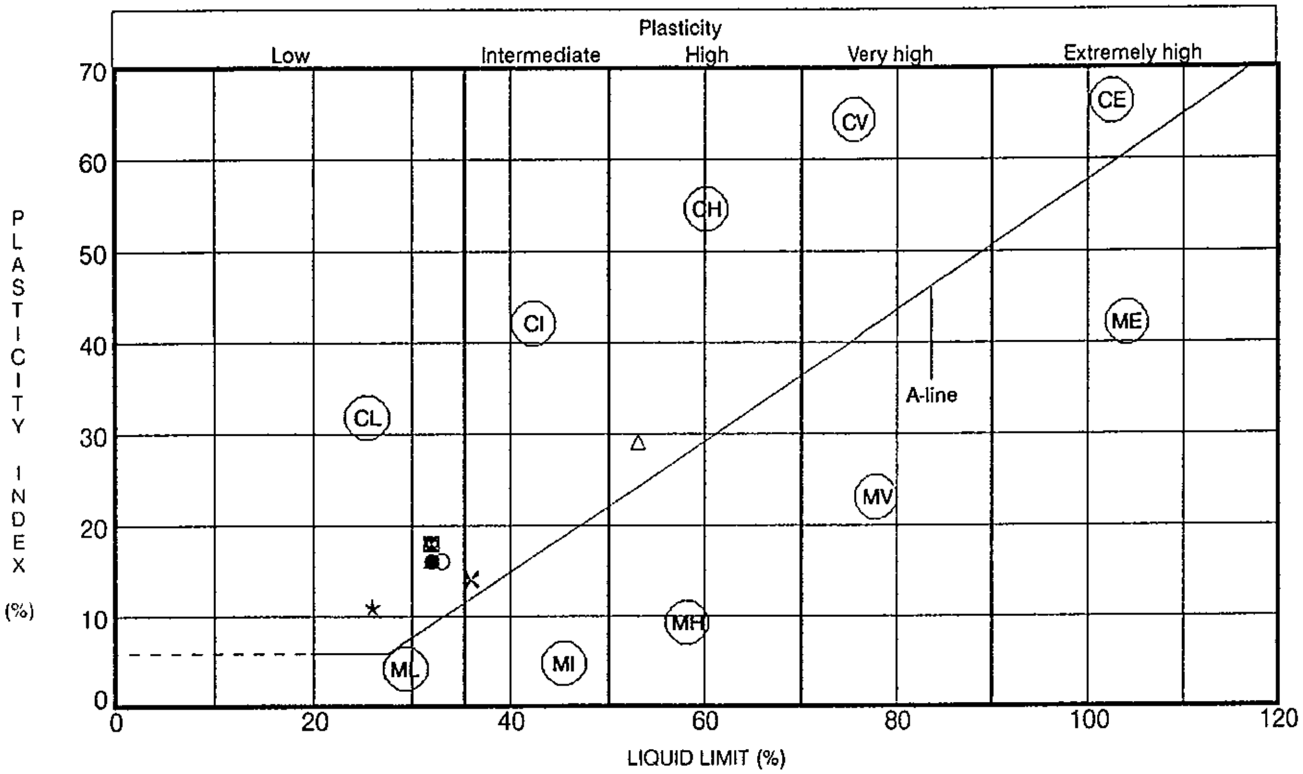
Signed:-
Name:- B. GILHESPY
Sheet 1 of 1

Date of Issue:- 15/11/99
Certificate No:- MC/1715H/1
AEG Project Number:- 1715H

ALLIED EXPLORATION & GEOTECHNICS LIMITED
Unit 25 Stella Gill Ind. Est. Pelton Fell, Chester-le-Street DH2 2RJ
a NAMAS TESTING Laboratory No 1367

ATTERBERG LIMITS & NATURAL MOISTURE CONTENT

Test Method:- BS 1377 : Part 2 : Clause 3.2, 4.3 & 5.3 : 1990



Specimen Identification			LL	PL	PI	< 0.425mm	m/c	Date Tested
● BH-C01	12.00	U17	32	16	16	NAT	24.6	11/11/99
⊠ BH-C01	16.50	U26	32	14	18	NAT	11.7	08/11/99
▲ BH-C02	13.00	U21	32	16	16	NAT	14.0	08/11/99
★ BH-C02	16.00	U27	26	15	11	NAT	10.5	09/11/99
✕ BH-C03	11.90	J20	36	22	14	NAT	15.1	08/11/99
✿ BH-C03	13.50	U24	32	14	18	NAT	19.0	10/11/99
○ BH-C04	13.20	U20	33	17	16	NAT	17.0	10/11/99
△ BH-C05	10.50	J15	53	24	29	NAT	31.6	08/11/99

For description of sample please refer to the Laboratory Sample Description Sheet

Project Title:- South Tees Industrial Area - Ground Investigation

Client:- English Partnerships

Signed:-

Name B. GILHESPY

Sheet 1 of 2

Date of Issue:- 17 November 1999

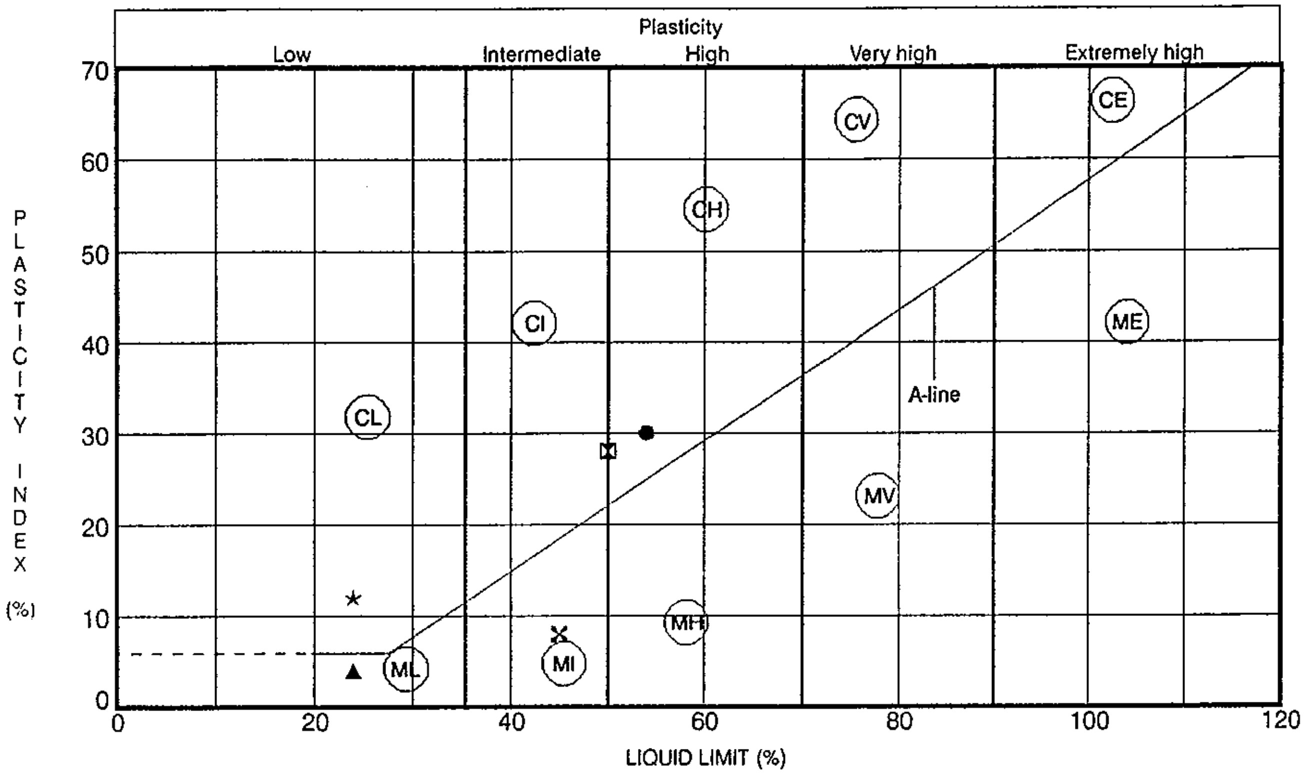
Certificate No:- PI/1715H/2

AEG Project Number:- 1715H

ALLIED EXPLORATION & GEOTECHNICS LIMITED
Unit 25 Stella Gill Ind. Est. Pelton Fell, Chester-le-Street DH2 2RJ
a NAMAS TESTING Laboratory No 1367

ATTERBERG LIMITS & NATURAL MOISTURE CONTENT

Test Method:- BS 1377 : Part 2 : Clause 3.2, 4.3 & 5.3 : 1990



Specimen Identification			LL	PL	PI	< 0.425mm	m/c	Date Tested
● BH-C05	12.50	U19	54	24	30	NAT	30.1	08/11/99
⌧ BH-C06	12.00	U13	50	22	28	NAT	32.3	11/11/99
▲ BH-C06	16.50	U22	24	20	4	NAT	20.3	10/11/99
★ BH-C06	18.40	J26	24	12	12	NAT	13.9	08/11/99
✕ TP-C08	0.30	B1	45	37	8	NAT	22.7	10/11/99

For description of sample please refer to the Laboratory Sample Description Sheet

Project Title:- South Tees Industrial Area - Ground Investigation		Client:- English Partnerships
Signed:-	Name:- B. GILHESPY	Sheet 2 of 2
Date of Issue:- 17 November 1999	Certificate No:- PI/1715H/2	AEG Project Number:- 1715H

ENCLOSURE 3

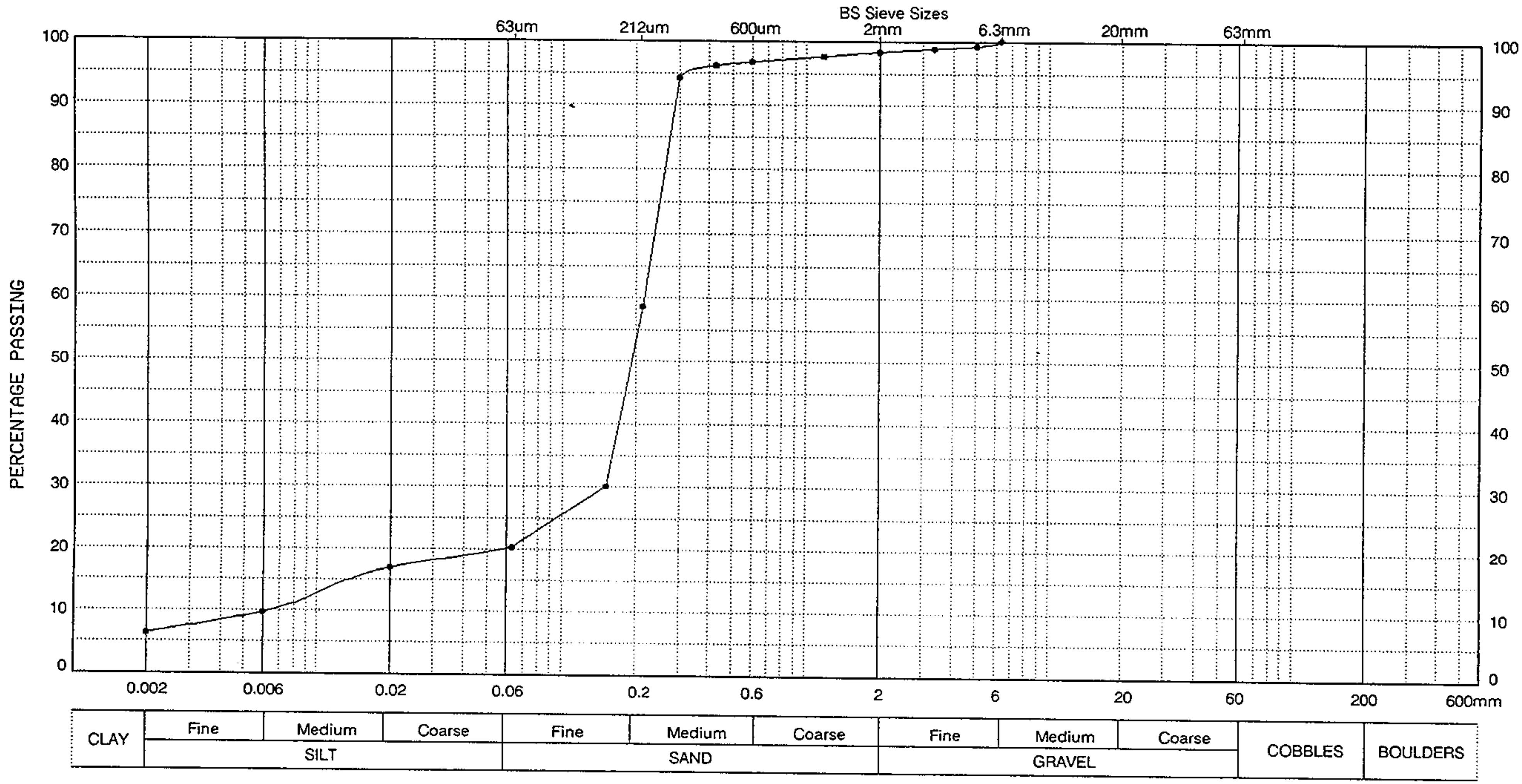
Particle Size Distribution Sieving and Sedimentation

A IED EXPLORATION & GEOTECHNICS L ITED

Unit 25 Stella Gill Ind. Est. Chester-le-Street, DH2 2RJ

Test Method:- BS 1377 : Part 2 : Clause 9.2, 9.4 : 1990	Exploratory Hole No:- BH-C01	Depth:- 8.51m	Sample Type & No.:- B11		Date Tested:- 08/11/99

PARTICLE SIZE DISTRIBUTION CURVE



For description of sample please refer to the Laboratory Sample Description Sheet

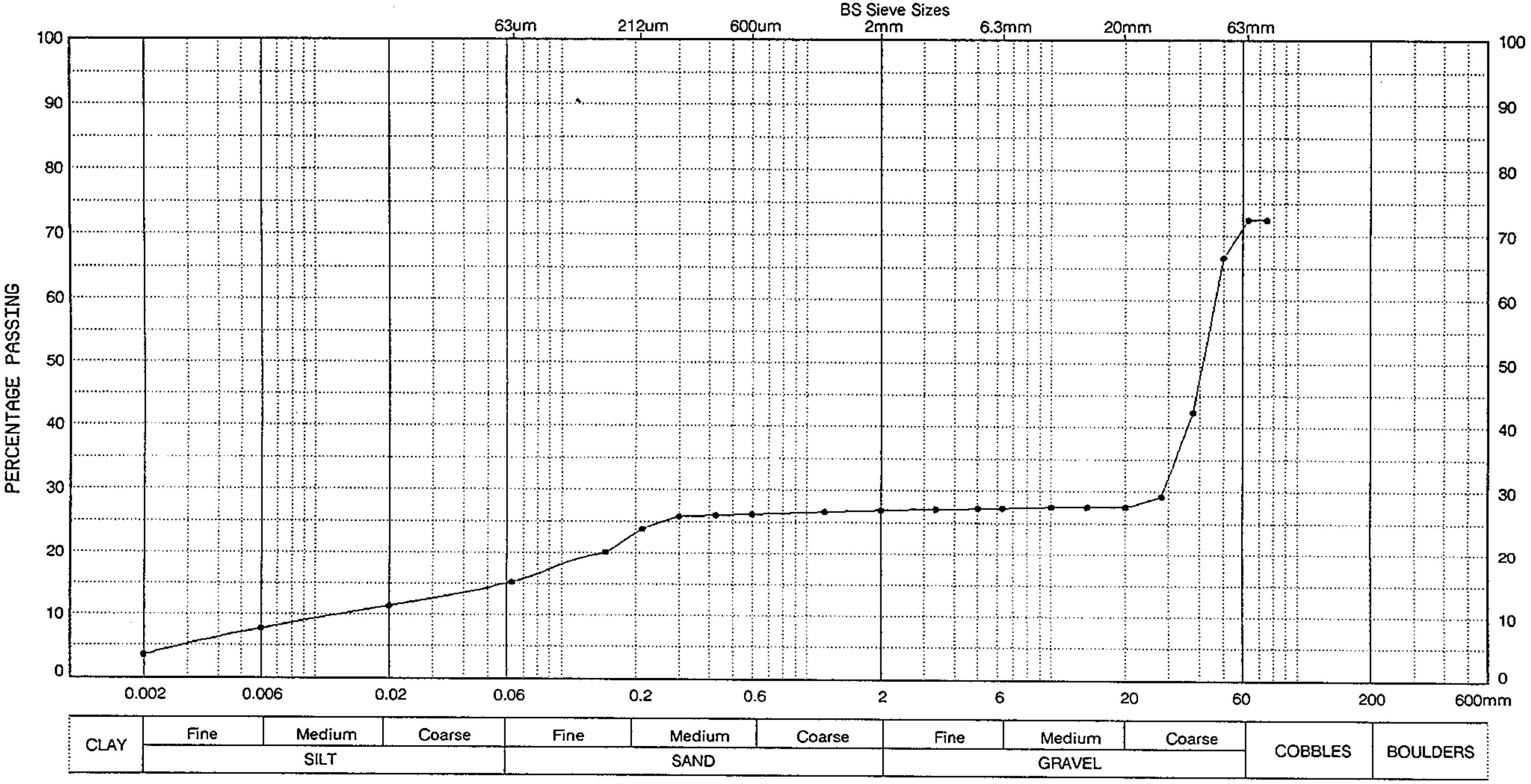
Date of Issue:-15 November 1999	Certificate No:- PSD/1715H/BH-C01/B11/8.51	Signed..........	Name B. GILHESPY	Sheet 1 of 1
Client:- English Partnerships		Project Title:- South Tees Industrial Area - Ground Investigation		AEG Project No:- 1715H

A ED EXPLORATION & GEOTECHNICS L TED

Unit 25.Stella Gill Ind. Est. Chester-le-Street, DH2 2RJ

Test Method:- BS 1377 : Part 2 : Clause 9.2, 9.4 : 1990	Exploratory Hole No:- BH-C02	Depth:- 8.00m	Sample Type & No.:- B12		Date Tested:- 08/11/99

PARTICLE SIZE DISTRIBUTION CURVE



For description of sample please refer to the Laboratory Sample Description Sheet

Date of Issue:-15 November 1999

Certificate No:- PSD/1715H/BH-C02/B12/8.00

Signed...

Name B. GILHESPY

Sheet 1 of 1

Client:- English Partnerships

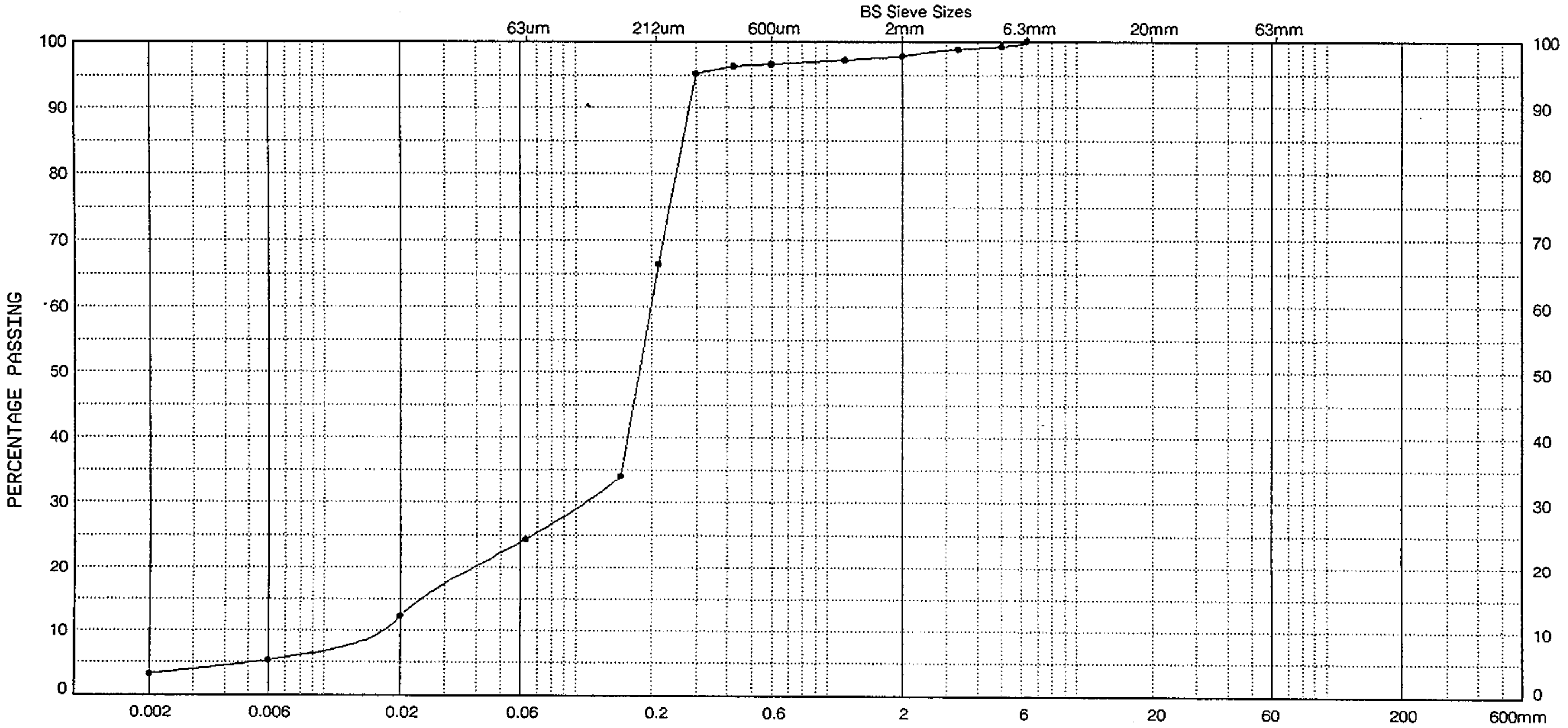
Project Title:- South Tees Industrial Area - Ground Investigation

AEG Project No:- 1715H

A ED EXPLORATION & GEOTECHNICS L ITED
Unit 25 Stella Gill Ind. Est. Chester-le-Street, DH2 2RJ

Test Method:- BS 1377 : Part 2 : Clause 9.2, 9.4 : 1990	Exploratory Hole No:- BH-C02	Depth:- 11.51m	Sample Type & No.:- B18		Date Tested:- 08/11/99

PARTICLE SIZE DISTRIBUTION CURVE



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

For description of sample please refer to the Laboratory Sample Description Sheet

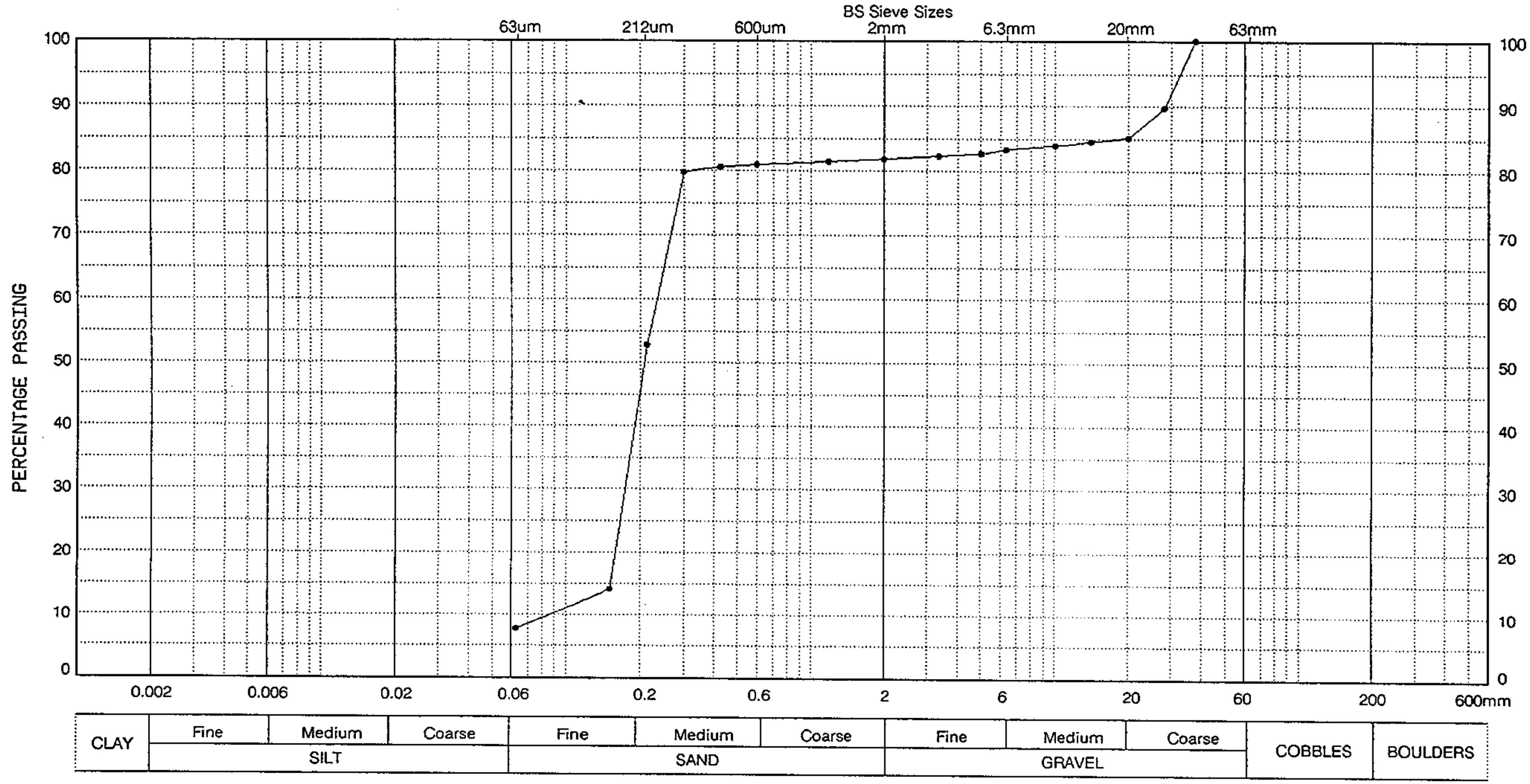
Date of Issue:-15 November 1999	Certificate No:- PSD/1715H/BH-C02/B18/11.51	Signed........................	Name B. GILHESPY	Sheet 1 of 1
Client:- English Partnerships	Project Title:- South Tees Industrial Area - Ground Investigation			AEG Project No:- 1715H

A ED EXPLORATION & GEOTECHNICS L TED

Unit 25 Stella Gill Ind. Est. Chester-le-Street, DH2 2RJ

Test Method:- BS 1377 : Part 2 : Clause 9.2, 9.4 : 1990	Exploratory Hole No:- BH-C03	Depth:- 9.01m	Sample Type & No.:- B15		Date Tested:- 08/11/99

PARTICLE SIZE DISTRIBUTION CURVE



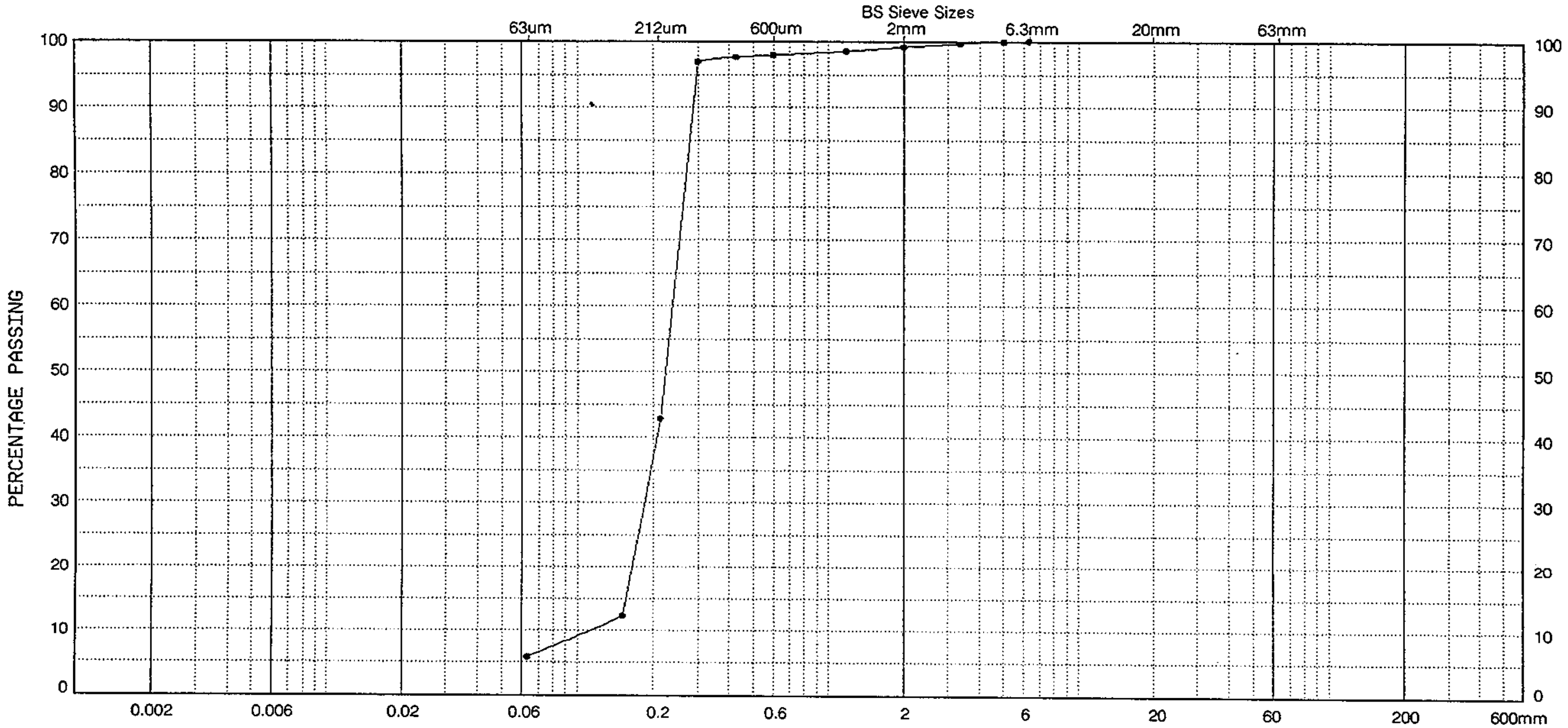
For description of sample please refer to the Laboratory Sample Description Sheet

Date of Issue:-15 November 1999	Certificate No:- PSD/1715H/BH-C03/B15/9.01	Signed........................	Name B. GILHESPY	Sheet 1 of 1
Client:- English Partnerships	Project Title:- South Tees Industrial Area - Ground Investigation			AEG Project No:- 1715H

A[illegible]ED EXPLORATION & GEOTECHNICS L[illegible]TED
Unit 25 Stella Gill Ind. Est. Chester-le-Street, DH2 2RJ

Test Method:- BS 1377 : Part 2 : Clause 9.2, 9.4 : 1990	Exploratory Hole No:- BH-C04	Depth:- 9.01m	Sample Type & No.:- B14		Date Tested:- 08/11/99

PARTICLE SIZE DISTRIBUTION CURVE



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

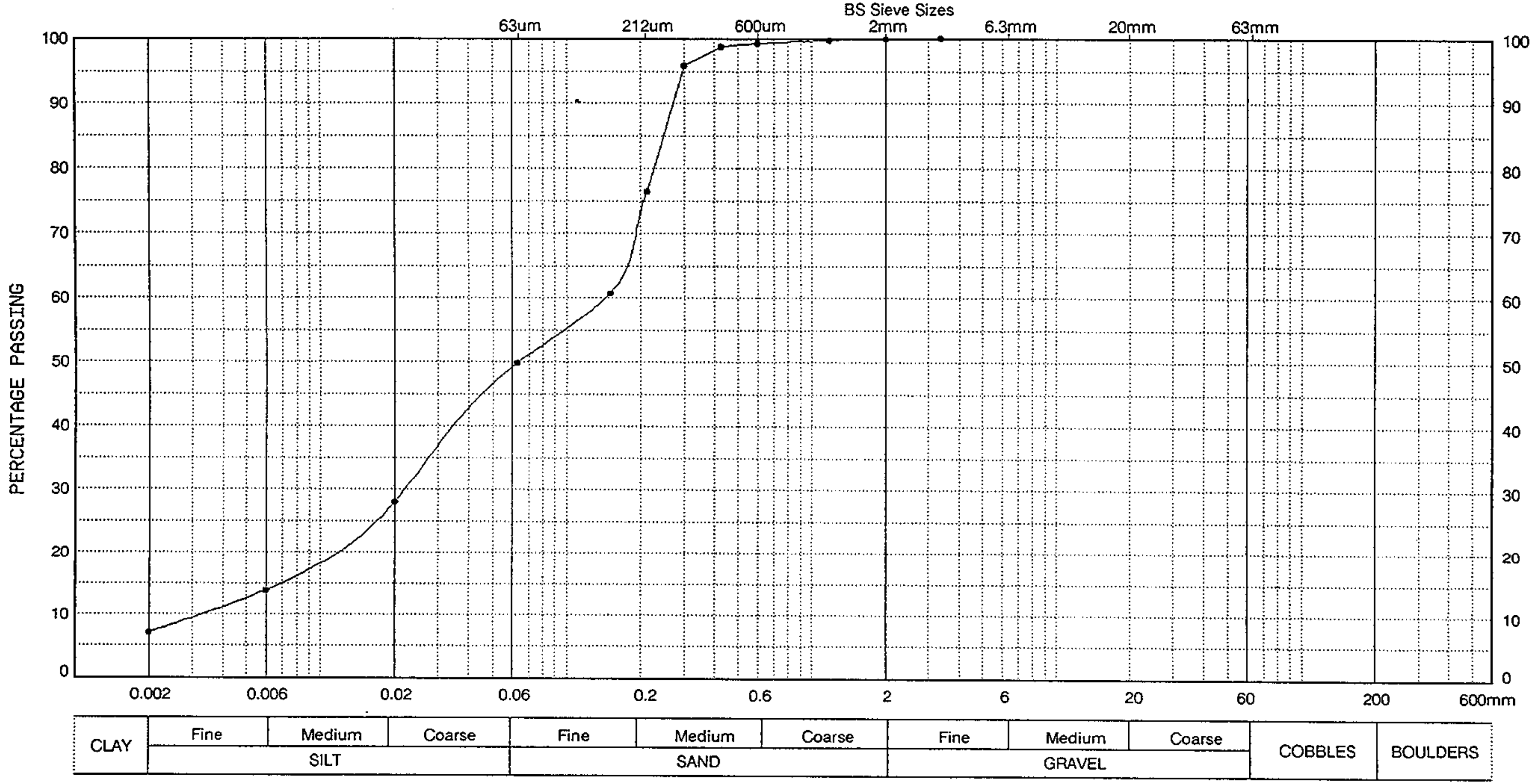
For description of sample please refer to the Laboratory Sample Description Sheet

Date of Issue:-15 November 1999	Certificate No:- PSD/1715H/BH-C04/B14/9.01	Signed....................................	Name B. GILHESPY	Sheet 1 of 1
Client:- English Partnerships	Project Title:- South Tees Industrial Area - Ground Investigation			AEG Project No:- 1715H

A IED EXPLORATION & GEOTECHNICS L ITED
Unit 25 Stella Gill Ind. Est. Chester-le-Street, DH2 2RJ

Test Method:- BS 1377 : Part 2 : Clause 9.2, 9.4 : 1990	Exploratory Hole No:- BH-C06	Depth:- 10.50m	Sample Type & No.:- SJ10		Date Tested:- 08/11/99

PARTICLE SIZE DISTRIBUTION CURVE



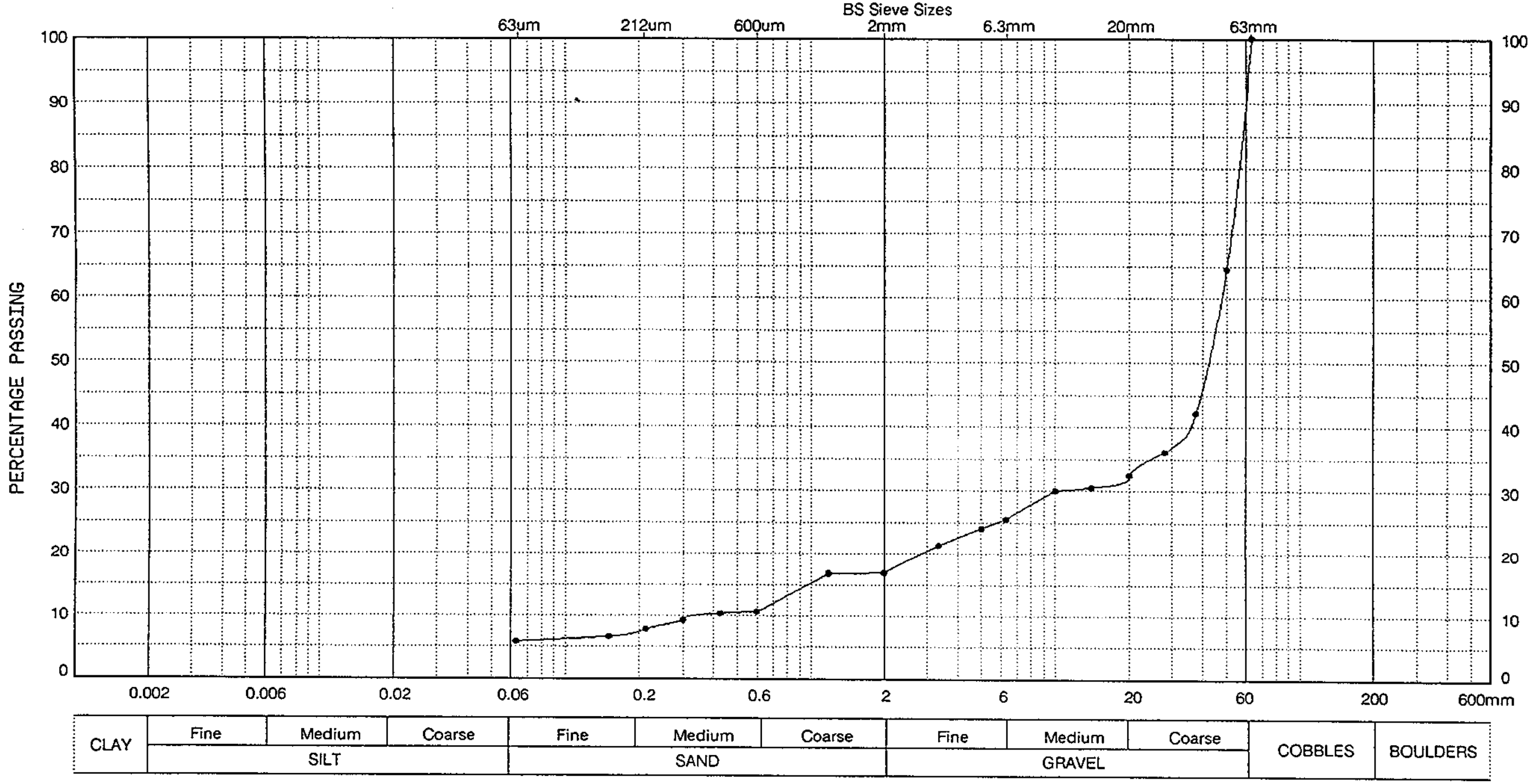
For description of sample please refer to the Laboratory Sample Description Sheet

Date of Issue:-15 November 1999	Certificate No:- PSD/1715H/BH-C06/SJ10/10.50	Signed..............................	Name B. GILHESPY	Sheet 1 of 1
Client:- English Partnerships		Project Title:- South Tees Industrial Area - Ground Investigation		AEG Project No:- 1715H

A IED EXPLORATION & GEOTECHNICS L ITED
Unit 25 Stella Gill Ind. Est. Chester-le-Street. DH2 2RJ

Test Method:- BS 1377 : Part 2 : Clause 9.2, 9.4 : 1990	Exploratory Hole No:- TP-C07	Depth:- 0.30m	Sample Type & No.:- B1		Date Tested:- 08/11/99

PARTICLE SIZE DISTRIBUTION CURVE



For description of sample please refer to the Laboratory Sample Description Sheet

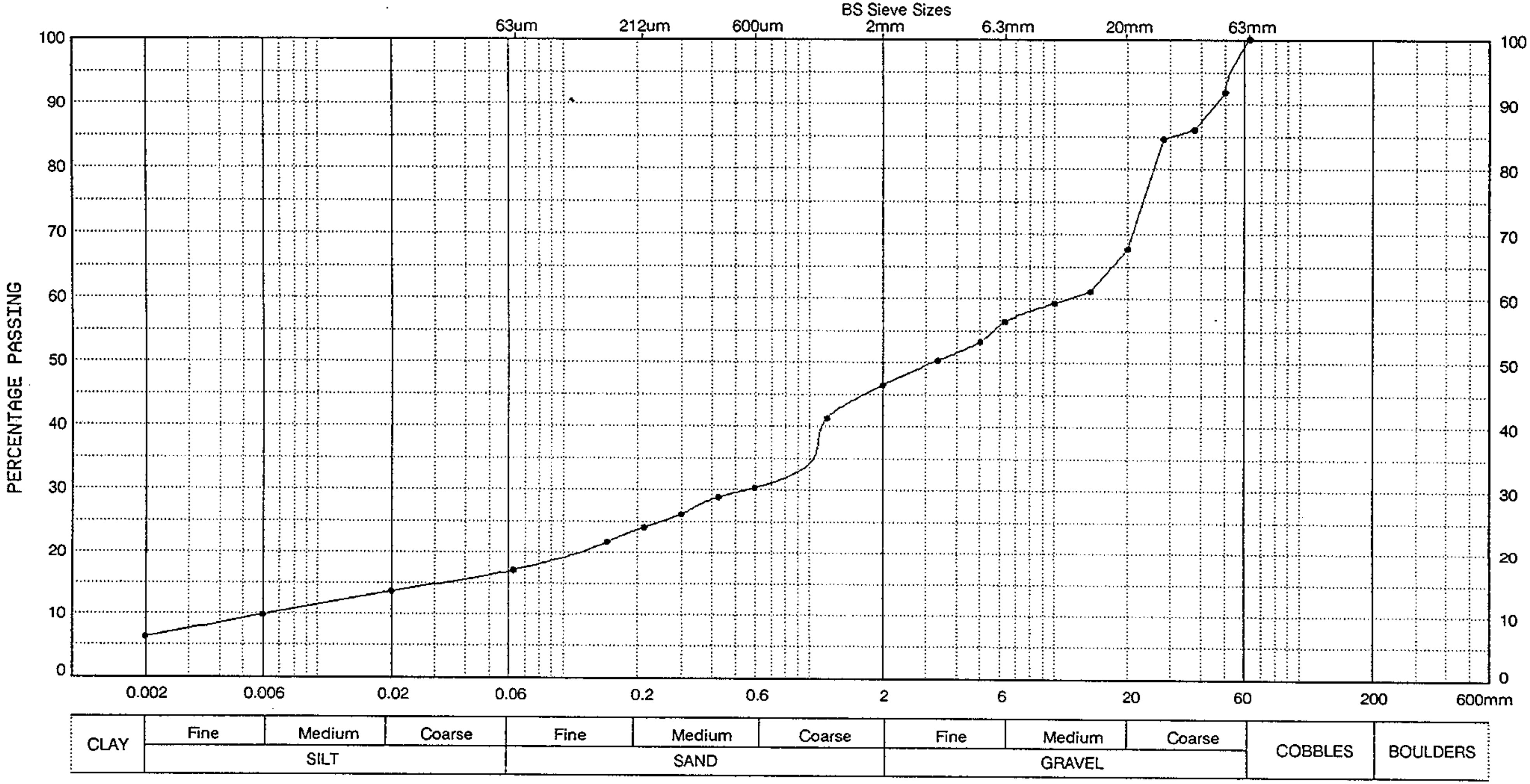
Date of Issue:-15 November 1999	Certificate No:- PSD/1715H/TP-C07/B1/0.30	Signed..	Name B. GILHESPY	Sheet 1 of 1
Client:- English Partnerships	Project Title:- South Tees Industrial Area - Ground Investigation			AEG Project No:- 1715H

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Unit 25 Stella Gill Ind. Est. Chester-le-Street, DH2 2RJ

Test Method:- BS 1377 : Part 2 : Clause 9.2, 9.4 : 1990	Exploratory Hole No:- TP-C09	Depth:- 0.20m	Sample Type & No.:-		Date Tested:- 10/11/99

PARTICLE SIZE DISTRIBUTION CURVE



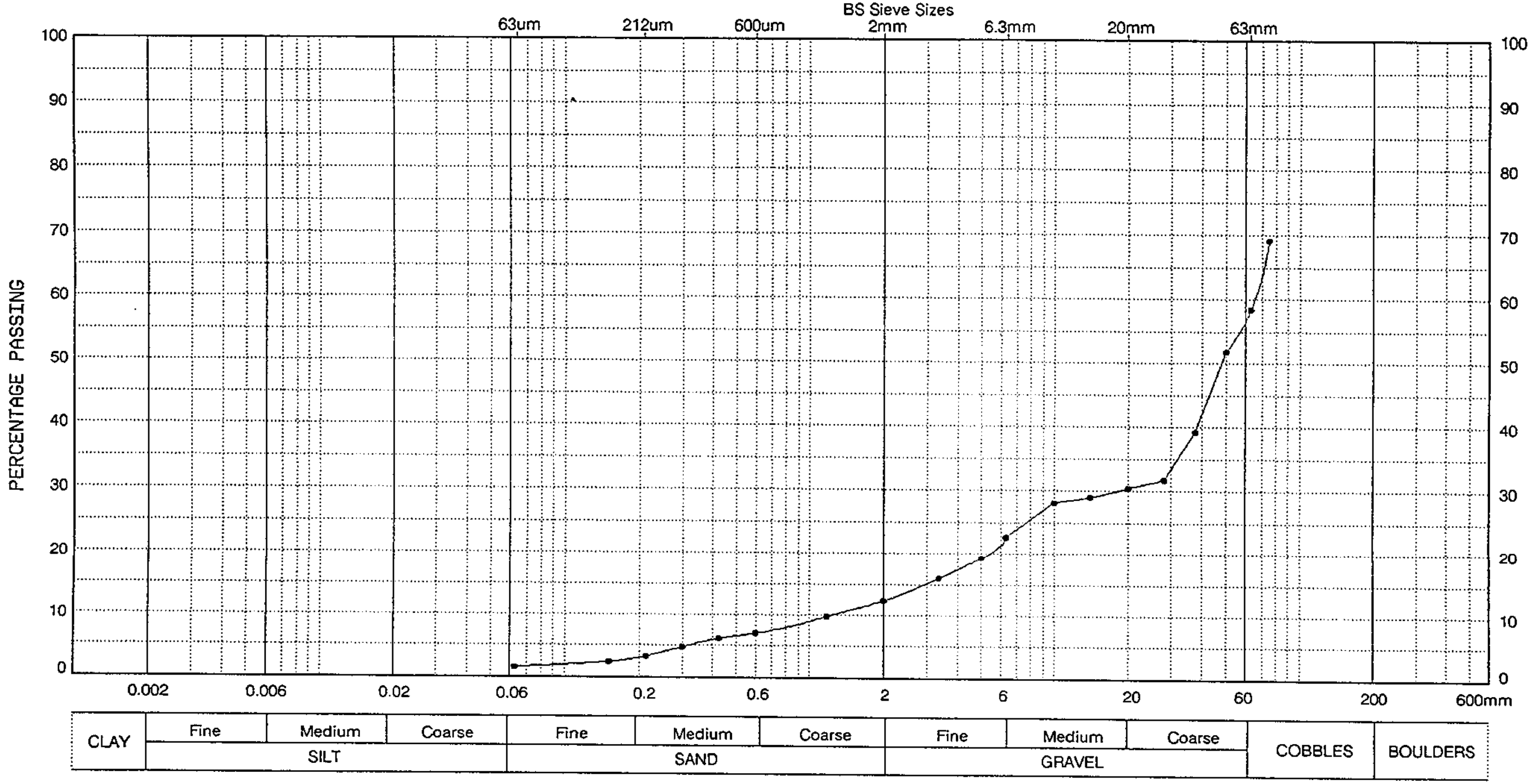
For description of sample please refer to the Laboratory Sample Description Sheet

Date of Issue:-15 November 1999	Certificate No:- PSD/1715H/TP-C09//0.20	Signed..	Name B. GILHESPY	Sheet 1 of 1
Client:- English Partnerships	Project Title:- South Tees Industrial Area - Ground Investigation			AEG Project No:- 1715H

A IED EXPLORATION & GEOTECHNICS L ITED
Unit 25 Stella Gill Ind. Est. Chester-le-Street, DH2 2RJ

Test Method:- BS 1377 : Part 2 : Clause 9.2, 9.4 : 1990	Exploratory Hole No:- TP-C11	Depth:- 0.40m	Sample Type & No.:- B1		Date Tested:- 08/11/99

PARTICLE SIZE DISTRIBUTION CURVE



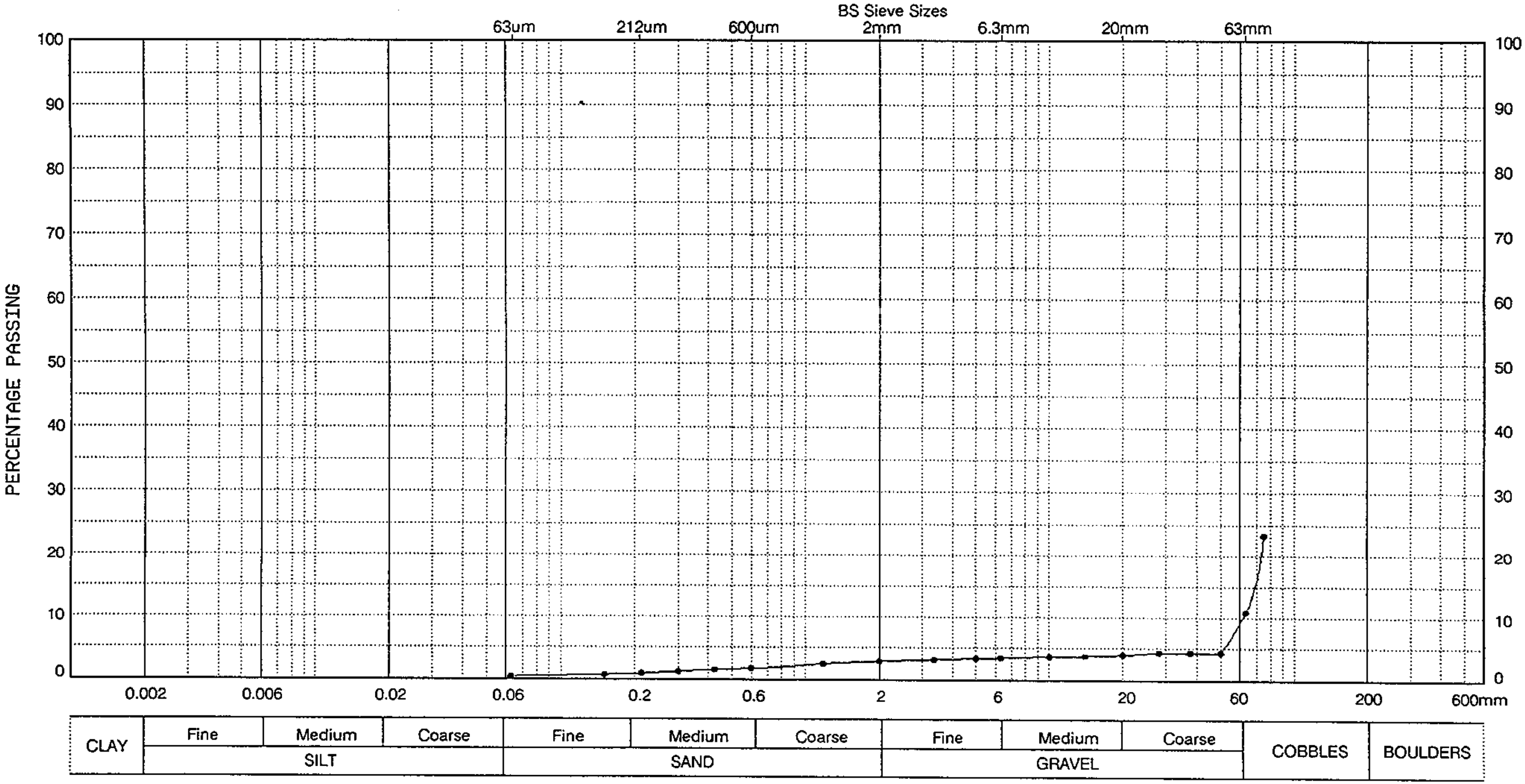
For description of sample please refer to the Laboratory Sample Description Sheet

Date of Issue:-15 November 1999	Certificate No:- PSD/1715H/TP-C11/B1/0.40	Signed................................	Name B. GILHESPY	Sheet 1 of 1
Client:- English Partnerships	Project Title:- South Tees Industrial Area - Ground Investigation			AEG Project No:- 1715H

AL ED EXPLORATION & GEOTECHNICS LI TED
Unit 25 Stella Gill Ind. Est. Chester-le-Street, DH2 2RJ

Test Method:- BS 1377 : Part 2 : Clause 9.2, 9.4 : 1990	Exploratory Hole No:- TP-C11	Depth:- 2.00m	Sample Type & No.:- B4		Date Tested:- 09/11/99

PARTICLE SIZE DISTRIBUTION CURVE



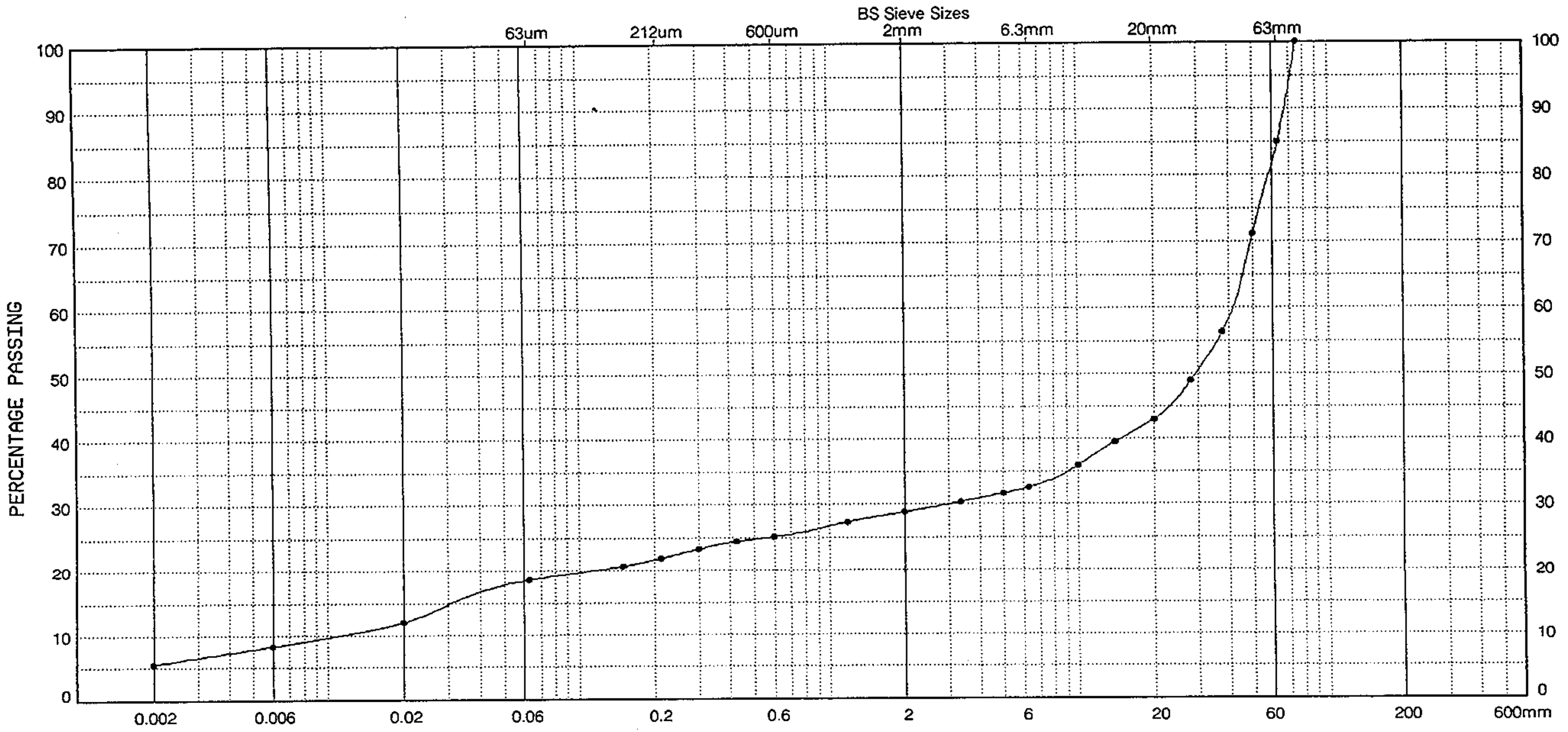
For description of sample please refer to the Laboratory Sample Description Sheet

Date of Issue:-15 November 1999	Certificate No:- PSD/1715H/TP-C11/B4/2.00	Signed............	Name B. GILHESPY	Sheet 1 of 1
Client:- English Partnerships		Project Title:- South Tees Industrial Area - Ground Investigation		AEG Project No:- 1715H

AL ED EXPLORATION & GEOTECHNICS LI TED
Unit 25 Stella Gill Ind. Est. Chester-le-Street, DH2 2RJ

Test Method:- BS 1377 : Part 2 : Clause 9.2, 9.4 : 1990	Exploratory Hole No:- TP-C15	Depth:- 1.50m	Sample Type & No.:- B3		Date Tested:- 09/11/99

PARTICLE SIZE DISTRIBUTION CURVE



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

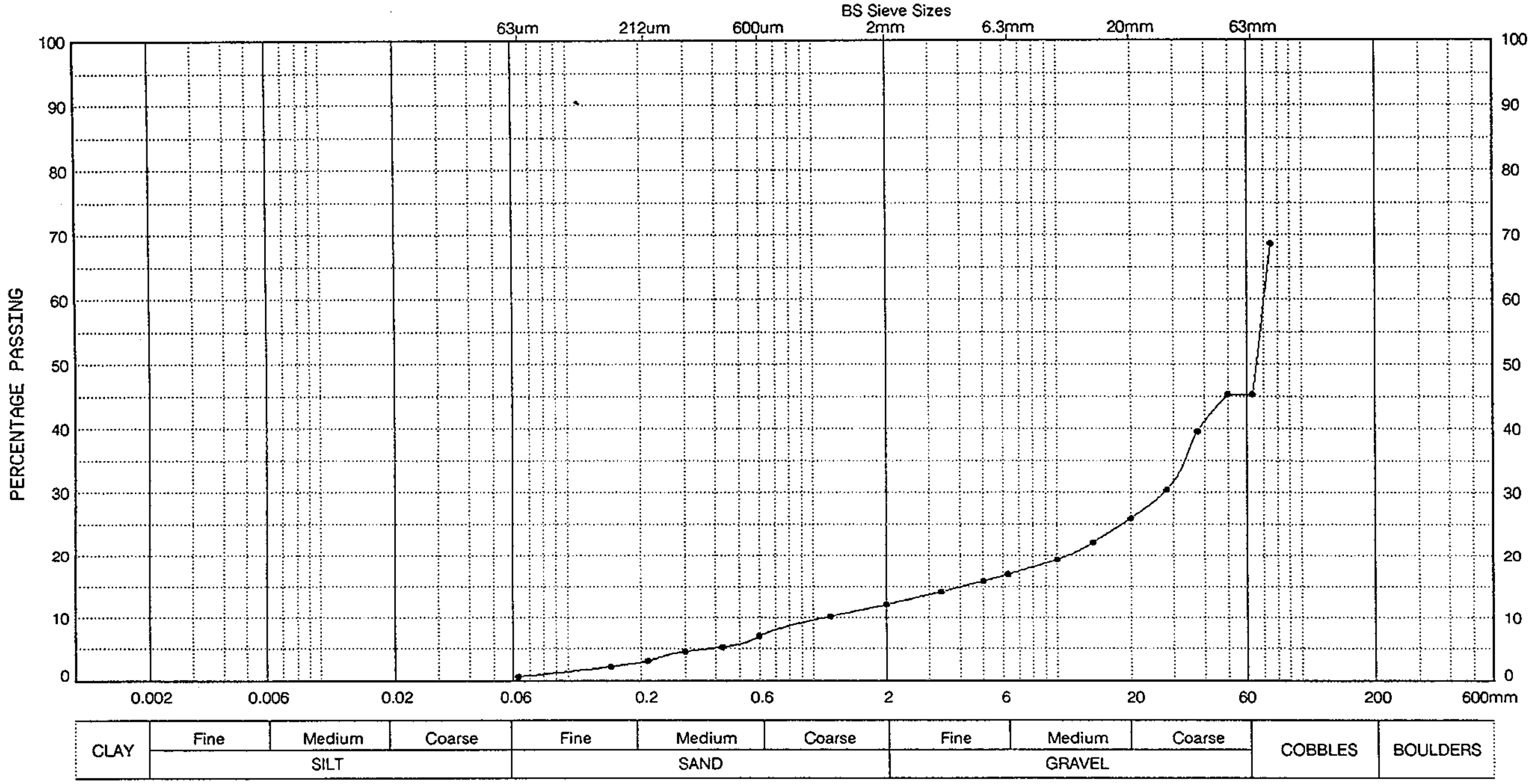
For description of sample please refer to the Laboratory Sample Description Sheet

Date of Issue:-15 November 1999	Certificate No:- PSD/1715H/TP-C15/B3/1.50	Signed.	Name B. GILHESPY	Sheet 1 of 1
Client:- English Partnerships		Project Title:- South Tees Industrial Area - Ground Investigation		AEG Project No:- 1715H

A IED EXPLORATION & GEOTECHNICS L ITED
Unit 25 Stella Gill Ind. Est. Chester-le-Street, DH2 2RJ

Test Method:- BS 1377 : Part 2 : Clause 9.2, 9.4 : 1990	Exploratory Hole No:- TP-C17	Depth:- 0.50m	Sample Type & No.:- B2		Date Tested:- 09/11/99

PARTICLE SIZE DISTRIBUTION CURVE



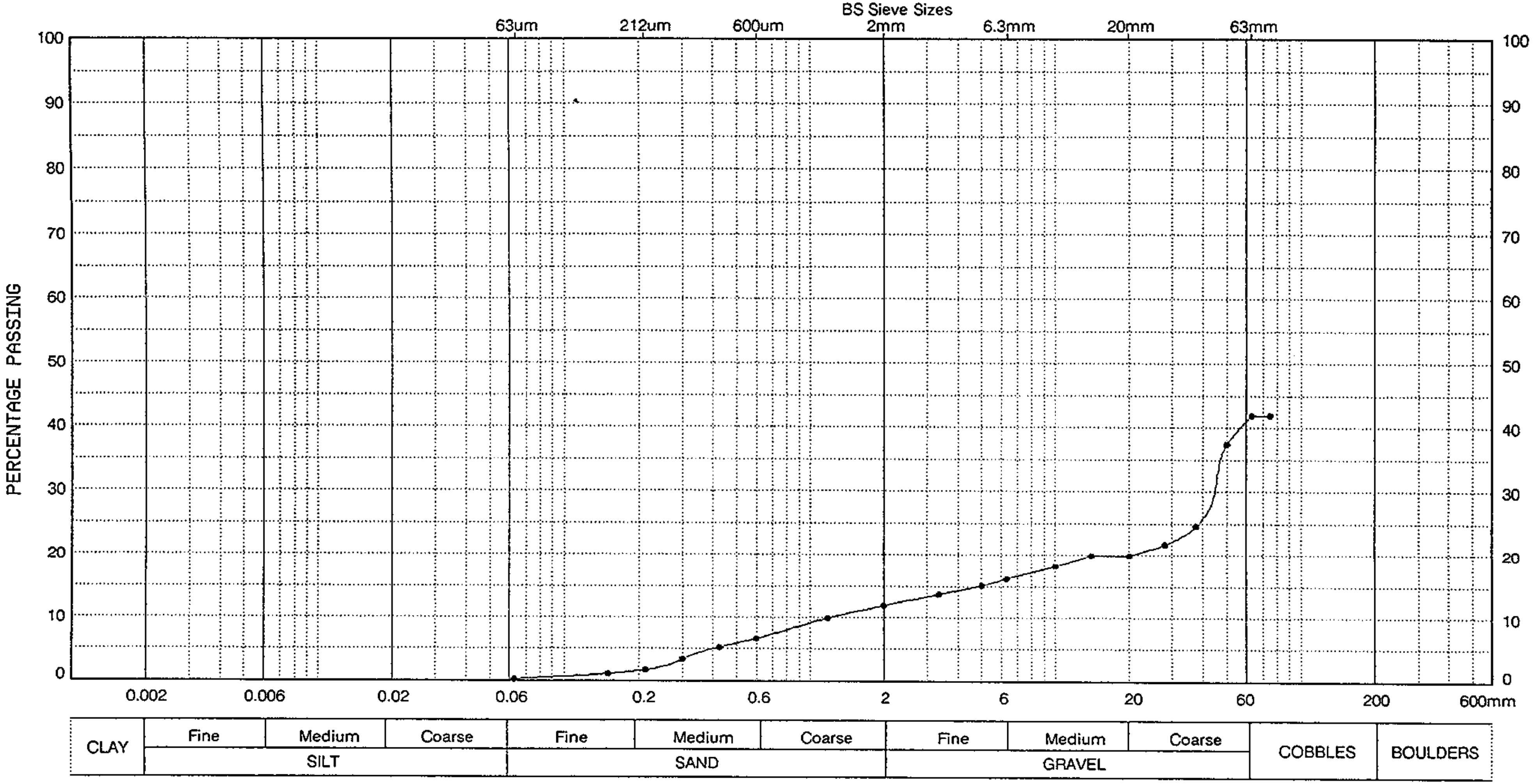
For description of sample please refer to the Laboratory Sample Description Sheet

Date of Issue:-15 November 1999	Certificate No:- PSD/1715H/TP-C17/B2/0.50	Signed..	Name B. GILHESPY	Sheet 1 of 1
Client:- English Partnerships	Project Title:- South Tees Industrial Area - Ground Investigation			AEG Project No:- 1715H

A ED EXPLORATION & GEOTECHNICS L ITED
Unit 25 Stella Gill Ind. Est. Chester-le-Street, DH2 2RJ

Test Method:- BS 1377 : Part 2 : Clause 9.2, 9.4 : 1990	Exploratory Hole No:- TP-C19	Depth:- 0.40m	Sample Type & No.:- B2		Date Tested:- 09/11/99

PARTICLE SIZE DISTRIBUTION CURVE



For description of sample please refer to the Laboratory Sample Description Sheet

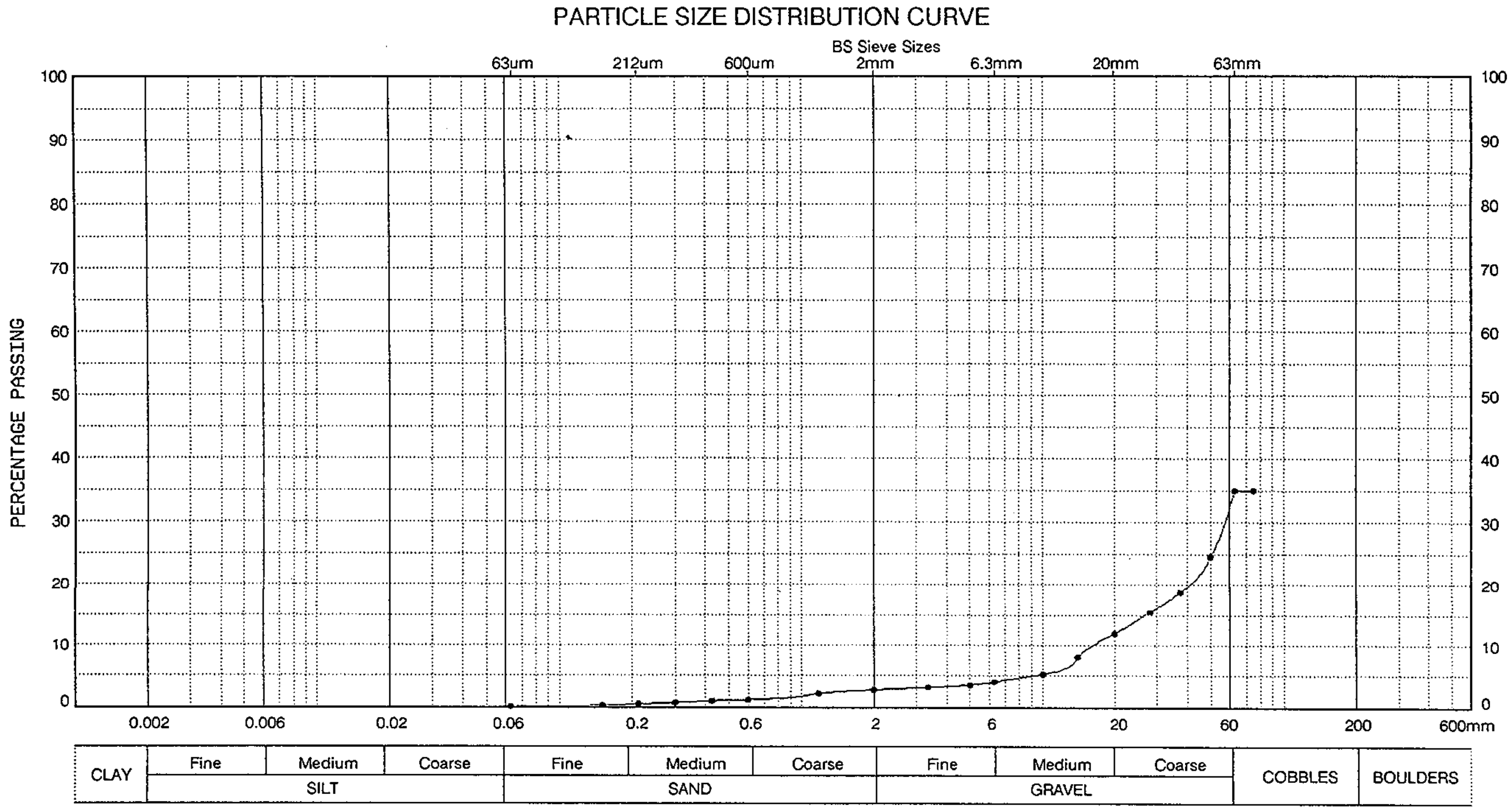
Date of Issue:-15 November 1999	Certificate No:- PSD/1715H/TP-C19/B2/0.40	Signed..	Name B. GILHESPY	Sheet 1 of 1
Client:- English Partnerships	Project Title:- South Tees Industrial Area - Ground Investigation			AEG Project No:- 1715H

A IED EXPLORATION & GEOTECHNICS L ITED

Unit 25 Stella Gill Ind. Est. Chester-le-Street, DH2 2RJ

Test Method:- BS 1377 : Part 2 : Clause 9.2, 9.4 : 1990	Exploratory Hole No:- TP-C19	Depth:- 1.00m	Sample Type & No.:- B3		Date Tested:- 09/11/99

PARTICLE SIZE DISTRIBUTION CURVE



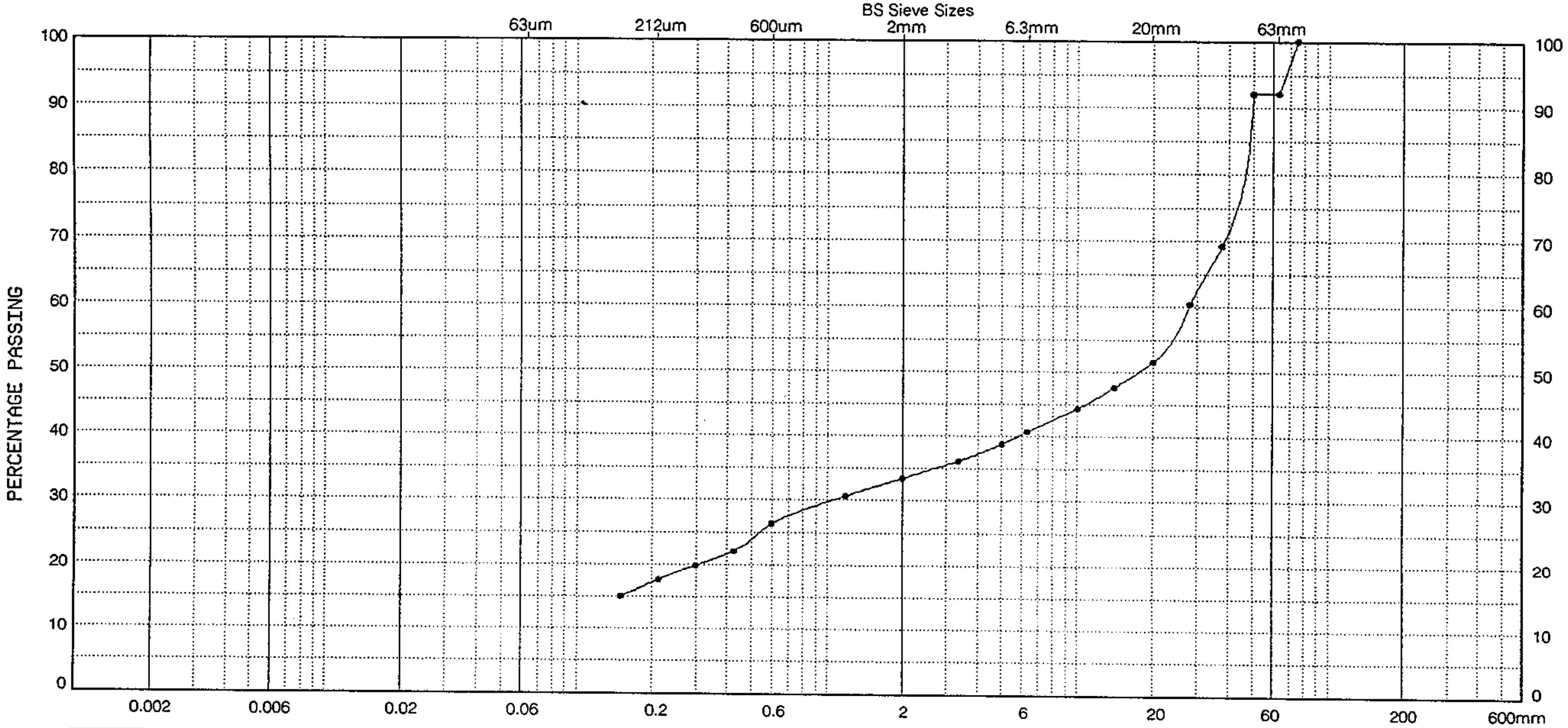
For description of sample please refer to the Laboratory Sample Description Sheet

Date of Issue:-15 November 1999	Certificate No:- PSD/1715H/TP-C19/B3/1.00	Signed..........	Name B. GILHESPY	Sheet 1 of 1
Client:- English Partnerships		Project Title:- South Tees Industrial Area - Ground Investigation		AEG Project No:- 1715H

A IED EXPLORATION & GEOTECHNICS L ITED
Unit 25 Stella Gill Ind. Est. Chester-le-Street. DH2 2RJ

Test Method:- BS 1377 : Part 2 : Clause 9.2, 9.4 : 1990
Exploratory Hole No:- TP-C24
Depth:- 0.70m
Sample Type & No.:- B3
Date Tested:- 09/11/99

PARTICLE SIZE DISTRIBUTION CURVE



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
		SILT			SAND			GRAVEL			

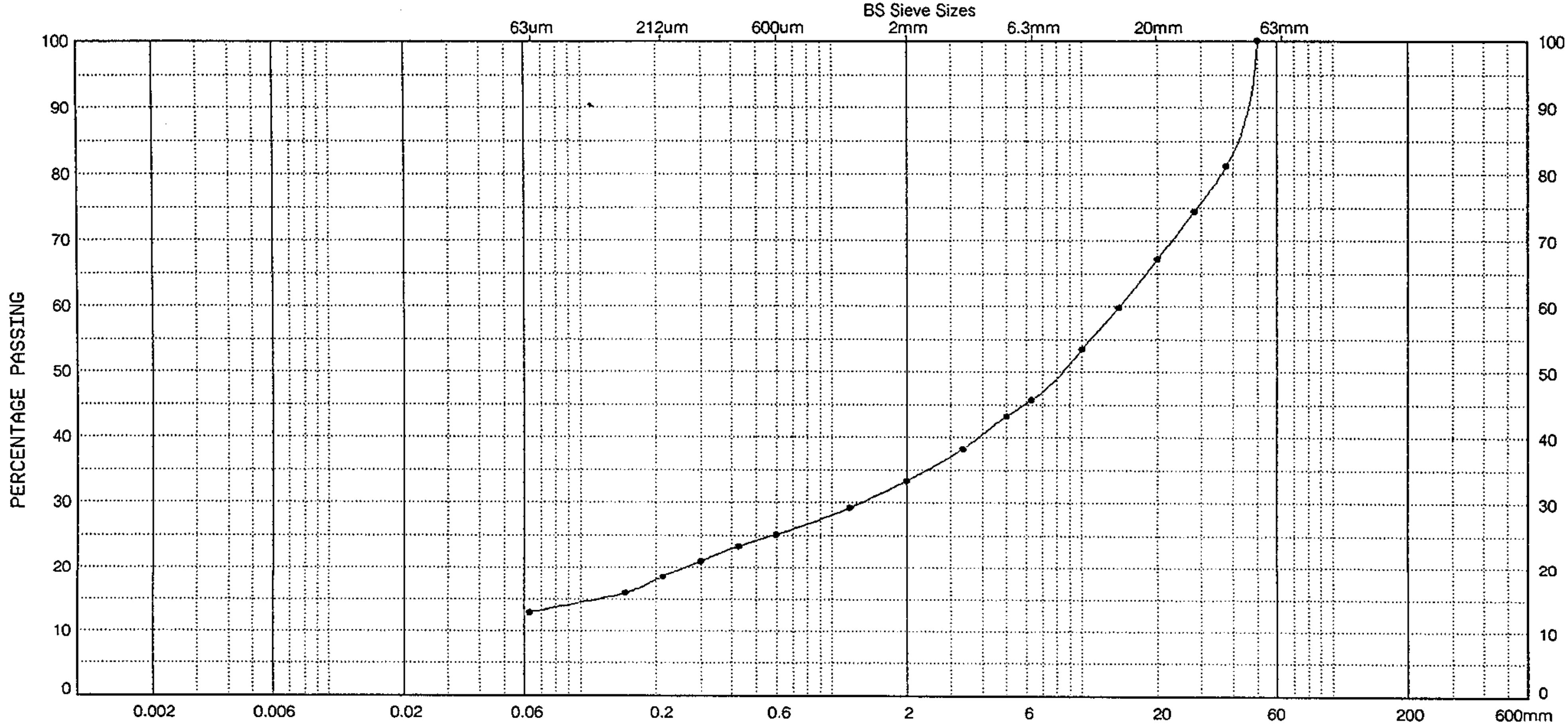
For description of sample please refer to the Laboratory Sample Description Sheet

Date of Issue:-15 November 1999
Certificate No:- PSD/1715H/TP-C24/B3/0.70
Signed..
Name B. GILHESPY
Sheet 1 of 1
Client:- English Partnerships
Project Title:- South Tees Industrial Area - Ground Investigation
AEG Project No:- 1715H

A IED EXPLORATION & GEOTECHNICS L ITED
Unit 25 Stella Gill Ind. Est. Chester-le-Street. DH2 2RJ

Test Method:- BS 1377 : Part 2 : Clause 9.2, 9.4 : 1990	Exploratory Hole No:- TP-C27	Depth:- 0.20m	Sample Type & No.:- B1		Date Tested:- 09/11/99

PARTICLE SIZE DISTRIBUTION CURVE



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

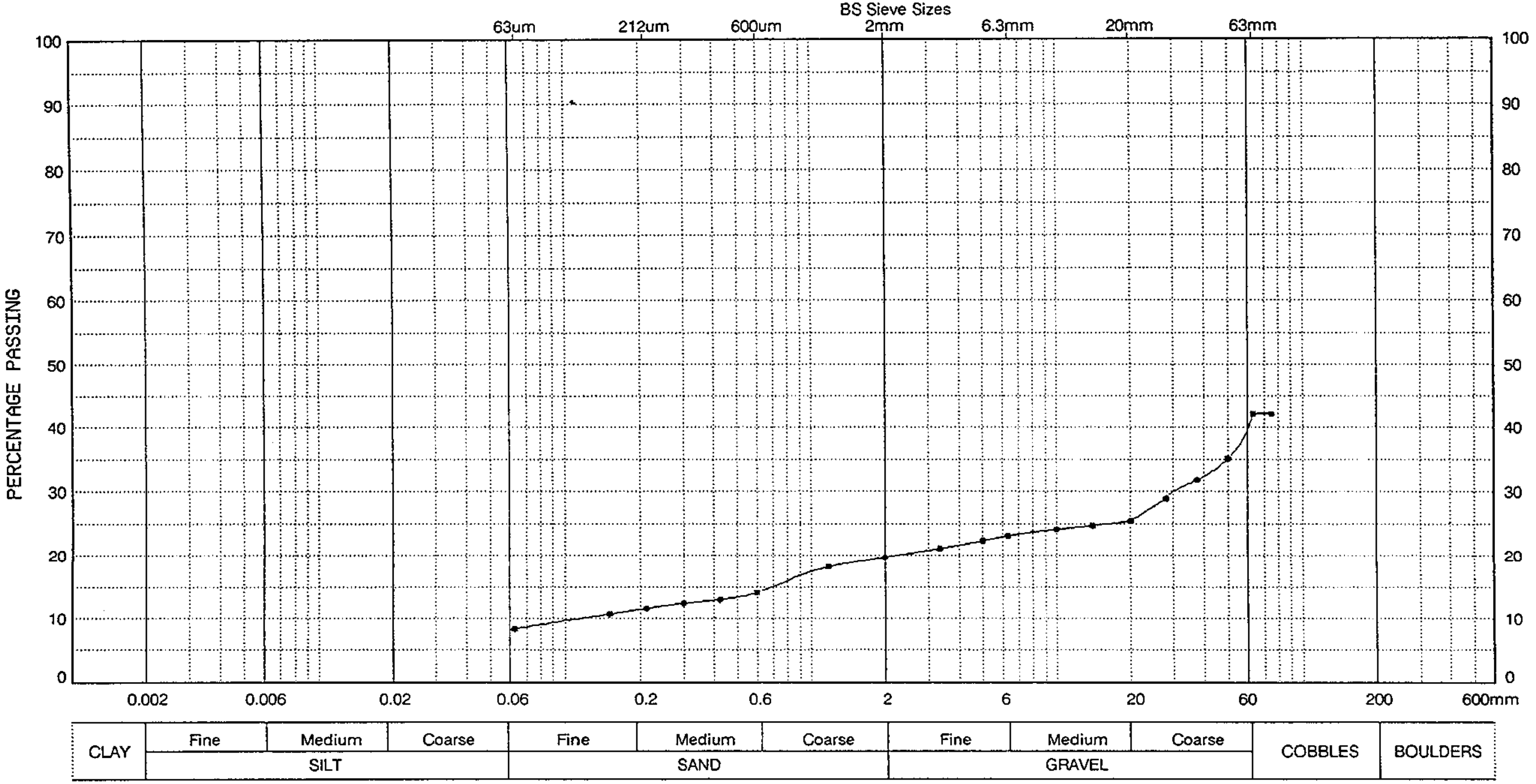
For description of sample please refer to the Laboratory Sample Description Sheet

Date of Issue:-15 November 1999	Certificate No:- PSD/1715H/TP-C27/B1/0.20	Signed........	Name B. GILHESPY	Sheet 1 of 1
Client:- English Partnerships	Project Title:- South Tees Industrial Area - Ground Investigation			AEG Project No:- 1715H

A IED EXPLORATION & GEOTECHNICS L ITED
Unit 25 Stella Gill Ind. Est. Chester-le-Street, DH2 2RJ

Test Method:- BS 1377 : Part 2 : Clause 9.2, 9.4 : 1990	Exploratory Hole No:- TP-C28	Depth:- 1.00m	Sample Type & No.:- B3		Date Tested:- 09/11/99

PARTICLE SIZE DISTRIBUTION CURVE



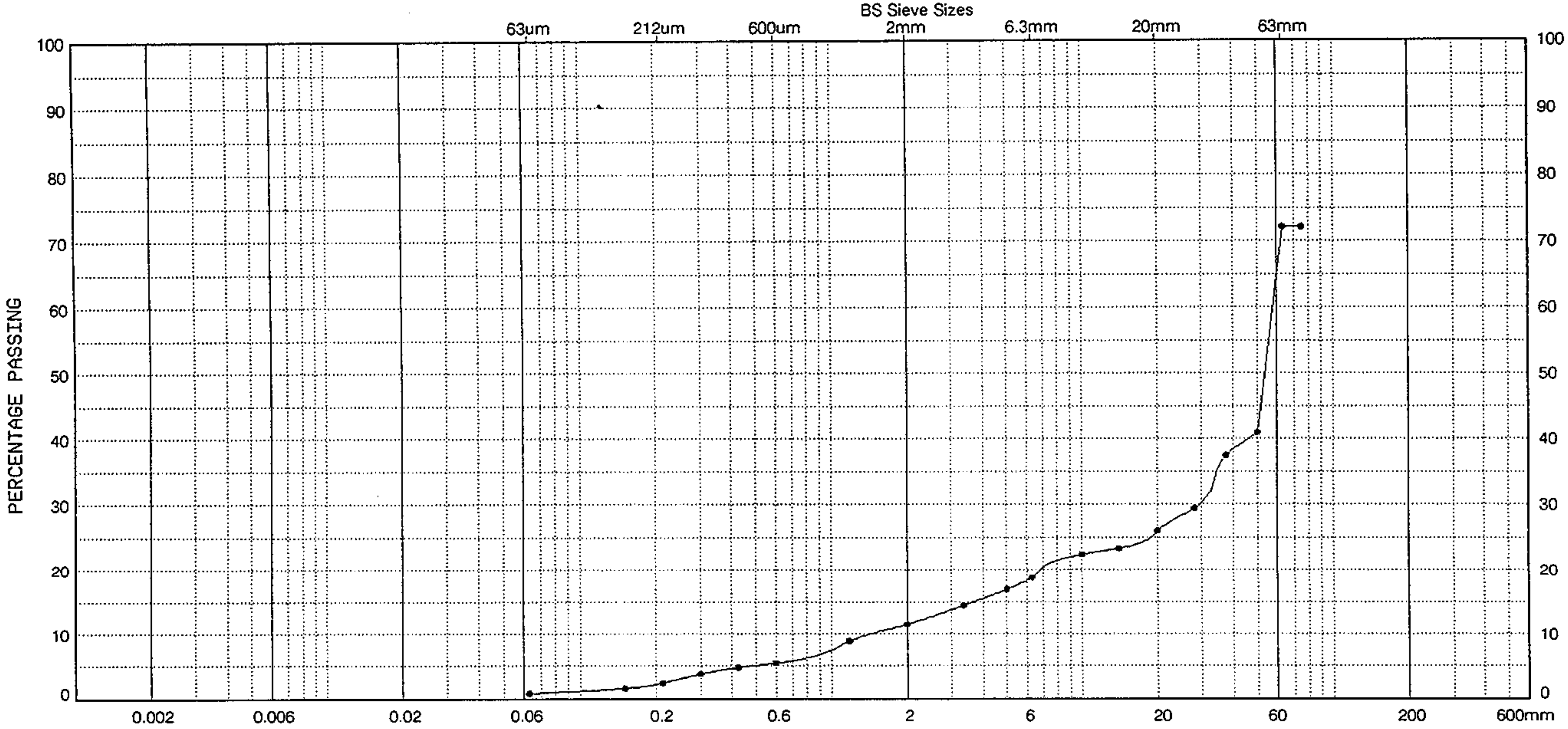
For description of sample please refer to the Laboratory Sample Description Sheet

Date of Issue:-15 November 1999	Certificate No:- PSD/1715H/TP-C28/B3/1.00	Signed............	Name B. GILHESPY	Sheet 1 of 1
Client:- English Partnerships		Project Title:- South Tees Industrial Area - Ground Investigation		AEG Project No:- 1715H

AL ED EXPLORATION & GEOTECHNICS LI TED
Unit 25 Stella Gill Ind. Est. Chester-le-Street, DH2 2RJ

Test Method:- BS 1377 : Part 2 : Clause 9.2, 9.4 : 1990	Exploratory Hole No:- TP-C32	Depth:- 0.80m	Sample Type & No.:- B2		Date Tested:- 09/11/99

PARTICLE SIZE DISTRIBUTION CURVE



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

For description of sample please refer to the Laboratory Sample Description Sheet

Date of Issue:-15 November 1999	Certificate No:- PSD/1715H/TP-C32/B2/0.80	Signed..	Name B. GILHESPY	Sheet 1 of 1
Client:- English Partnerships	Project Title:- South Tees Industrial Area - Ground Investigation			AEG Project No:- 1715H

ENCLOSURE 4

Determination of Sulphate and pH

DERWENTSIDE ENVIRONMENTAL TESTING SERVICES

CERTIFICATE OF ANALYSIS

CERTIFICATE No.99120

Your Ref: 1715H
Our Ref: 99120

17th November 1999

Allied Exploration & Geotechnics Ltd
Unit 25
Stella Gill Industrial Estate
Pelton Fell
Chester Le Street
Co Durham
DH2 2RJ

Location:	South Tees Industrial Area C
Description:	Fourteen Soil Samples
Date Received:	8th November 1999
Date Tested:	10th November 1999
Test Procedures:	In-house method based upon BS 1377 : Part 3 : 1990 Methods of Test for Soils for Civil Engineering Purposes Chemical and Electrochemical Tests
Appended:	Summary of Chemical Analyses

R. Bennett

R S Bennett

For DERWENTSIDE ENVIRONMENTAL TESTING SERVICES LIMITED

Unit 18D
Number One Industrial Estate
Medomsley Road
Consett
Co Durham DH8 6SY
Tel: 01207 582333
Fax: 01207 582444

UKAS TESTING
No. 2139

SOUTH TEES INDUSTRIAL AREA C

Summary of Chemical Analyses

BS 1377 : Part 3 : 1990

Borehole or Trial Pit	Depth (m)	Sample Number	Sample Type	Laboratory Reference Number	Organic Content * Test 3	Loss on Ignition * Test 4	Sulphate Content as SO3(as SO4) Test 5.5			Carbonate Content (as CO2) * Test 6.3 !	Chloride Content (as Cl)		pH Value Test 9	pH Value !!
							Soil *	2:1 Water: Soil Extract(g/l)	Groundwater (g/l)		Soil * Test 7.2/7.3#	Groundwater (g/l) Test 7.2		
BH C1	8.50	11	B	99120/01			0.12 (0.14)						9.1	
BH C1	12.00	17	U	99120/02			0.07 (0.08)						9.4	
BH C1	16.50	26	U	99120/03			0.25 (0.30)	0.90 (1.08)					9.1	
BH C1	20.80	34	J	99123/04			0.08 (0.10)						9.5	
BH C2	11.51	18	B	99123/05			0.18 (0.22)	0.80 (0.96)					9.1	
BH C2	16.00	27	U	99123/06			0.15 (0.18)						9.6	
BH C2	21.10	37	B	99123/07			2.55 (3.06)	1.49 (1.79)					8.6	
BH C3	9.01	15	B	99123/08			0.14 (0.17)						9	
BH C3	11.90	20	J	99123/09			0.10 (0.12)						9.4	
BH C3	13.50	24	U	99123/10			0.06 (0.07)						9.5	
BH C4	9.01	14	B	99123/11			0.07 (0.08)						9.3	
BH C4	13.20	20	U	99123/12			0.29 (0.35)	1.17 (1.40)					9.1	
BH C4	18.10	29	J	99123/13			9.36 (11.23)	1.53 (1.84)					8.9	
BH C6	12.00	13	U	99123/14			0.29 (0.35)	0.93 (1.20)					8.9	

Notes - D: Disturbed Sample B:Bulk Disturbed Sample U: Undisturbed Sample * Result given in % dry mass # Delete as applicable

!! Test Carried out by In-house method on material as received and not dried ground powder

Contract Number:99120

Report Approved by:

Date: 17-11-99

DERWENTSIDE ENVIRONMENTAL TESTING SERVICES LIMITED

ENCLOSURE 5

Determination of California Bearing Ratio

Certificate Number - 1715H/01 Sheet 1 of 1

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Unit 25 Stella Gill Industrial Estate, Pelton Fell,
Chester-le-Street, Co. Durham, DH2 2RJ
a NAMAS testing laboratory No 1367

Determination of The California Bearing Ratio

BS1377 : Part 4 : 1990

Site: **South Tees Industrial Area, Site C - Ground Investigation**

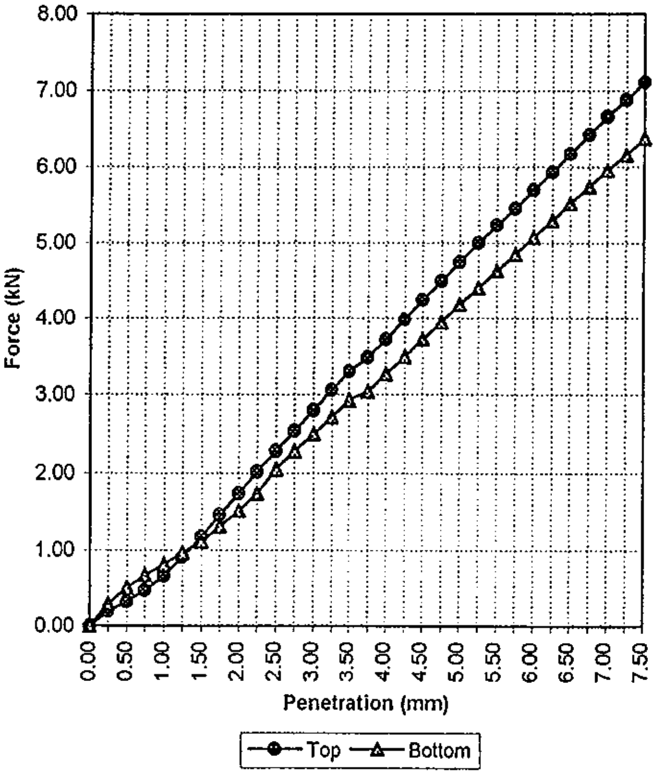
Client: **English Partnerships** **Job No. - 1715H**

Exploratory Hole No.- TP-C24 Sample No. - B3 Depth (m) - 0.70

For sample description please refer to sample description sheet

Bulk Density (Mg/m^3) :	2.83	Retained on 20mm (%) :	30
Moisture Content (%) :	8.55	Soaking Time (Days) :	NA
Dry Density (Mg/m^3) :	2.61	Swelling (mm) :	NA
Preparation Method :	2.5 kg Compaction	Surcharge (kg) :	6
Correction Needed :	No	Seating Load (N) :	250

Penetration	**Force**	
(mm)	(KN)	(KN)
0.00	0.000	0.000
0.25	0.196	0.294
0.50	0.316	0.501
0.75	0.468	0.675
1.00	0.664	0.817
1.25	0.904	0.969
1.50	1.176	1.111
1.75	1.459	1.307
2.00	1.742	1.514
2.25	2.015	1.742
2.50	2.287	2.047
2.75	2.548	2.287
3.00	2.810	2.505
3.25	3.060	2.723
3.50	3.300	2.929
3.75	3.485	3.038
4.00	3.724	3.267
4.25	3.986	3.496
4.50	4.247	3.724
4.75	4.498	3.953
5.00	4.748	4.182
5.25	4.999	4.400
5.50	5.238	4.628
5.75	5.456	4.846
6.00	5.695	5.075
6.25	5.935	5.293
6.50	6.175	5.521
6.75	6.425	5.739
7.00	6.665	5.957
7.25	6.882	6.164
7.50	7.111	6.382



	Moisture (%)	**CBR Value (%)**
Top :	8.5	23.7
Bottom :	8.6	20.9

Date Tested: 09/11/99 Date of Issue: 17/11/99

Approved by: Name: **B. GILHESPY**

Certificate Number - 1715H/02 Sheet 1 of 1

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Unit 25 Stella Gill Industrial Estate, Pelton Fell,
Chester-le-Street, Co. Durham, DH2 2RJ
a NAMAS testing laboratory No 1367

Determination of The California Bearing Ratio

BS1377 : Part 4 : 1990

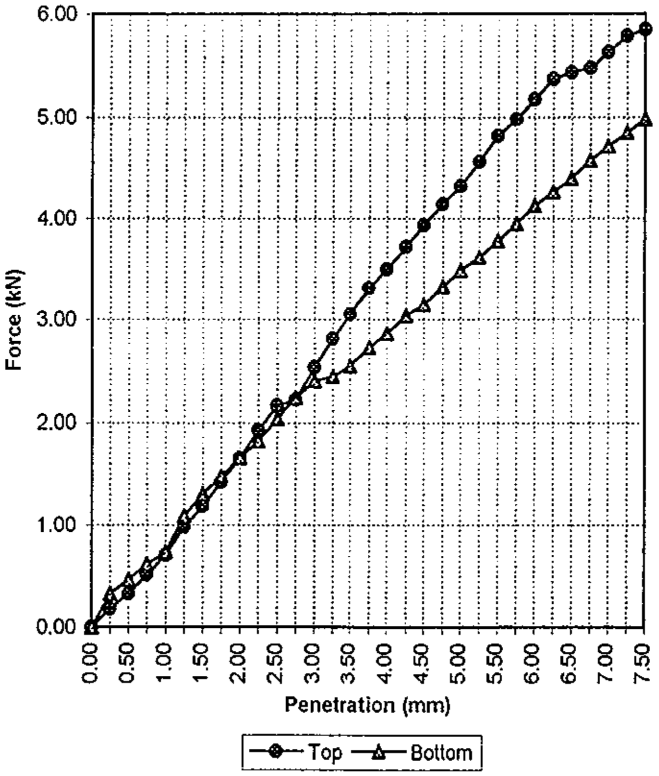
Site: **South Tees Industrial Area, Site C - Ground Investigation**
Client: **English Partnerships** **Job No. - 1715H**

Exploratory Hole No.- TP-C27 Sample No. - B1 Depth (m) - 0.20

For sample description please refer to sample description sheet

Bulk Density (Mg/m^3) :	1.53	Retained on 20mm (%) :	19
Moisture Content (%) :	21.3	Soaking Time (Days) :	NA
Dry Density (Mg/m^3) :	1.26	Swelling (mm) :	NA
Preparation Method :	2.5 kg Compaction	Surcharge (kg) :	6
Correction Needed :	No	Seating Load (N) :	250

Penetration	Force	
(mm)	(KN)	(KN)
0.00	0.000	0.000
0.25	0.185	0.327
0.50	0.327	0.468
0.75	0.512	0.621
1.00	0.708	0.741
1.25	0.980	1.089
1.50	1.187	1.307
1.75	1.427	1.481
2.00	1.655	1.655
2.25	1.928	1.819
2.50	2.156	2.036
2.75	2.211	2.232
3.00	2.526	2.396
3.25	2.810	2.439
3.50	3.049	2.537
3.75	3.311	2.723
4.00	3.496	2.864
4.25	3.724	3.038
4.50	3.942	3.147
4.75	4.149	3.321
5.00	4.323	3.485
5.25	4.563	3.615
5.50	4.813	3.779
5.75	4.977	3.953
6.00	5.173	4.127
6.25	5.369	4.269
6.50	5.434	4.400
6.75	5.478	4.574
7.00	5.630	4.715
7.25	5.783	4.846
7.50	5.848	4.977



	Moisture (%)	CBR Value (%)
Top :	21.1	2.2
Bottom :	21.5	1.7

Date Tested: 09/11/99 Date of Issue: 17/11/99

Approved by: Name B. GILHESPY

Certificate Number - 1715H/03 Sheet 1 of 1

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Unit 25 Stella Gill Industrial Estate, Pelton Fell,
Chester-le-Street, Co. Durham, DH2 2RJ
a NAMAS testing laboratory No 1367

Determination of The California Bearing Ratio

BS1377 : Part 4 : 1990

Site: **South Tees Industrial Area, Site C - Ground Investigation**
Client: **English Partnerships** **Job No. - 1715H**

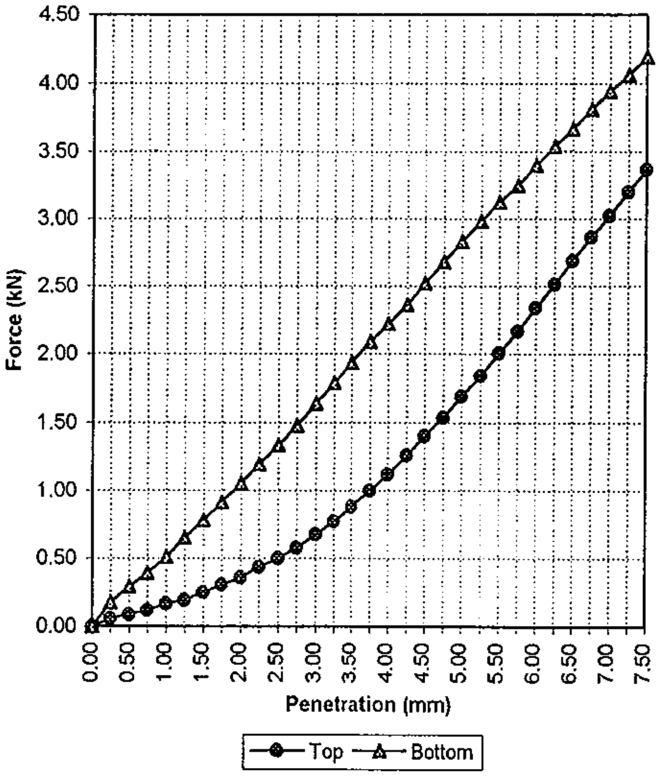
Exploratory Hole No.- TP-C28 Sample No. - B3 Depth (m) - 1.00

For sample description please refer to sample description sheet

Bulk Density (Mg/m^3) : 2.10
Moisture Content (%) : 18.95
Dry Density (Mg/m^3) : 1.77
Preparation Method : 2.5 kg Compaction
Correction Needed : No

Retained on 20mm (%) : 37
Soaking Time (Days) : NA
Swelling (mm) : NA
Surcharge (kg) : 6
Seating Load (N) : 50

Penetration	Force	
(mm)	(KN)	(KN)
0.00	0.000	0.000
0.25	0.054	0.174
0.50	0.087	0.294
0.75	0.120	0.392
1.00	0.163	0.512
1.25	0.196	0.653
1.50	0.250	0.784
1.75	0.305	0.915
2.00	0.359	1.056
2.25	0.436	1.198
2.50	0.501	1.339
2.75	0.577	1.481
3.00	0.675	1.634
3.25	0.773	1.786
3.50	0.882	1.938
3.75	1.002	2.091
4.00	1.122	2.222
4.25	1.263	2.363
4.50	1.405	2.526
4.75	1.535	2.679
5.00	1.688	2.831
5.25	1.840	2.984
5.50	2.004	3.125
5.75	2.167	3.245
6.00	2.341	3.398
6.25	2.516	3.539
6.50	2.690	3.670
6.75	2.864	3.812
7.00	3.027	3.942
7.25	3.202	4.062
7.50	3.365	4.193



	Moisture (%)	CBR Value (%)
Top :	19.1	8.4
Bottom :	18.8	14.2

Date Tested: 09/11/99 Date of Issue: 17/11/99

Approved by: Name: B. GILHESPY

Certificate Number - 1715H/04

Sheet 1 of 1

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Unit 25 Stella Gill Industrial Estate, Pelton Fell,
Chester-le-Street, Co. Durham, DH2 2RJ
a NAMAS testing laboratory No 1367

Determination of The California Bearing Ratio

BS1377 : Part 4 : 1990

Site: **South Tees Industrial Area, Site C - Ground Investigation**

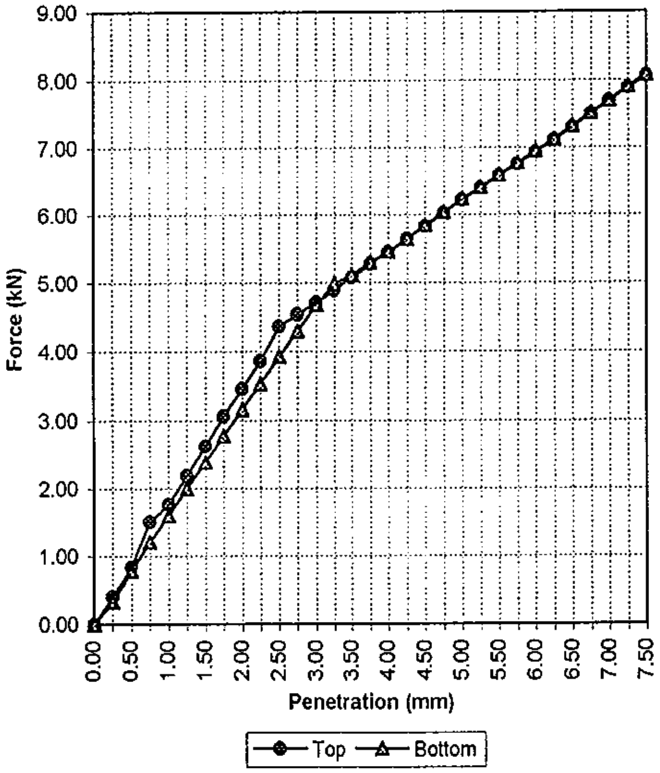
Client: **English Partnerships** **Job No. - 1715H**

Exploratory Hole No.- TP-C32 Sample No. - B2 Depth (m) - 0.80

For sample description please refer to sample description sheet

Bulk Density (Mg/m^3) :	2.08	Retained on 20mm (%) :	49
Moisture Content (%) :	14.35	Soaking Time (Days) :	NA
Dry Density (Mg/m^3) :	1.81	Swelling (mm) :	NA
Preparation Method :	2.5 kg Compaction	Surcharge (kg) :	6
Correction Needed :	No	Seating Load (N) :	250

Penetration (mm)	**Force** (KN)	(KN)
0.00	0.000	0.000
0.25	0.403	0.327
0.50	0.839	0.784
0.75	1.514	1.209
1.00	1.764	1.612
1.25	2.189	2.004
1.50	2.624	2.396
1.75	3.049	2.777
2.00	3.452	3.158
2.25	3.855	3.528
2.50	4.356	3.920
2.75	4.541	4.291
3.00	4.715	4.683
3.25	4.901	4.988
3.50	5.075	5.118
3.75	5.271	5.293
4.00	5.445	5.456
4.25	5.641	5.641
4.50	5.837	5.848
4.75	6.033	6.044
5.00	6.218	6.240
5.25	6.403	6.414
5.50	6.578	6.588
5.75	6.752	6.774
6.00	6.926	6.948
6.25	7.111	7.122
6.50	7.296	7.318
6.75	7.492	7.503
7.00	7.688	7.699
7.25	7.884	7.906
7.50	8.059	8.069



	Moisture (%)	**CBR Value** (%)
Top :	15.8	33
Bottom :	12.9	31.2

Date Tested: 09/11/99 Date of Issue: 17/11/99

Approved by: Name: B. GILHESPY

ENCLOSURE 6

Determination of Undrained Shear Strength in Triaxial Cell without Pore Water Pressure Measurement Single and Multistage

ALLIED EXPLORATION & GEOTECHNICS
Unit 25 Stella Gill Ind. Est. Pelton Fell Chester-le-Street D[illegible] 2RJ

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT MEASUREMENT OF PORE PRESSURE

BS 1377 : 1990 : Part 7 : Clauses 8 & 9

Exploratory Hole	Sample ID Depth (m)	Sample ID Type	Specific Depth (m)	Diameter (mm)	Length (mm)	Prep. Method & Stage No.	Initial Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Membrane Thickness (mm)	Membrane Correction (kPa)	Cell Pressure (kPa)	Corrected Deviator Stress	Failure Strain (%)	Mode of Failure	cu (kPa)	Date Tested
BH-C01	12.00	U17	12.10	103.7	194.9	U 1	16.5	2.16	1.86	0.40	1.46	240	184.0	20.0	P	92	10/11/99
BH-C01	13.50	U20	13.60	101.4	191.5	U 1	17.9	2.16	1.86	0.40	1.47	135	179.8	19.5	C	90	08/11/99
BH-C02	13.00	U21	13.15	103.2	191.4	U 1	15.6	2.20	1.90	0.40	1.20	130	250.7	15.5	C	125	08/11/99
BH-C02	13.01					2					1.31	260	250.0	17.5		125	
BH-C02	13.02					3					1.45	520	253.2	19.5		127	
BH-C02	20.50	U35	20.65	101.9	196.5	U 1	15.8	2.29	1.97	0.40	1.10	205	95.9	13.5	BR	48	08/11/99
BH-C02	20.51					2					1.22	410	98.1	15.5		49	
BH-C02	20.52					3					1.27	820	102.4	16.5		51	
BH-C03	13.50	U24	13.60	103.1	195.7	U 1	18.7	2.16	1.82	0.40	1.31	150	78.7	17.5	P	39	08/11/99
BH-C03	13.51					2					1.41	300	81.1	19.0		41	
BH-C03	13.52					3					1.48	600	101.0	20.0		50	
BH-C04	13.20	U20	13.30	100.9	192.3	U 1	18.1	2.18	1.80	0.40	1.31	130	147.9	17.0	C	74	08/11/99
BH-C04	13.21					2					1.51	260	153.2	20.0		77	
BH-C04	14.70	U23	14.80	101.4	193.6	U 1	16.8	2.22	1.90	0.40	1.50	150	250.9	20.0	C	126	09/11/99
BH-C05	12.50	U19	12.50	102.8	192.3	U 1	31.4	2.18	1.66	0.40	1.01	125	178.8	12.0	BR	89	08/11/99
BH-C05	12.51					2					1.09	250	160.1	13.5		80	
BH-C05	12.52					3					1.16	500	105.7	14.5		53	

For a description of samples please refer to the Sample Description Sheet. Please note the rate of strain was 2% per minute and the orientation of the test specimen was vertical. Latex membrane used.

Date of issue 17 November 1999	Certificate No:-TXL/1715H/17/11/99/2	Signed......................	Name: **B. GILHESPY**	Sheet 1 of 1
Client:- English Partnerships		Project Title:- South Tees Industrial Area - Ground Investigation		AEG Project 1715H

ALLIED EXPLORATION & GEOTECHNICS
Unit 25 Stella Gill Ind. Est. Pelton Fell Chester-le-Street DH2 2RJ

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT MEASUREMENT OF PORE PRESSURE

BS 1377 : 1990 : Part 7 : Clauses 8 & 9

Exploratory Hole	Sample ID Depth (m)	Sample ID Type	Specific Depth (m)	Diameter (mm)	Length (mm)	Prep. Method & Stage No.	Initial Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Membrane Thickness (mm)	Membrane Correction (kPa)	Cell Pressure (kPa)	Corrected Deviator Stress	Failure Strain (%)	Mode of Failure	cu (kPa)	Date Tested
BH-C05	14.00	U22	14.20	102.4	194.0	U 1	16.5	2.16	1.85	0.40	1.48	140	324.5	20.0	C	162	09/11/99
BH-C06	12.00	U13	12.10	100.5	191.6	U 1	32.3	2.02	1.52	0.40	1.04	240	73.5	12.0	BR	37	08/11/99
BH-C06	13.85	U16	13.95	100.9	192.4	U 1	18.3	2.15	1.82	0.40	1.51	140	91.9	20.0	P	46	08/11/99
BH-C06	16.50	U22	16.60	104.6	193.7	U 1	22.0	2.19	1.80	0.40	0.87	330	111.7	9.5	P	57	10/11/99

For a description of samples please refer to the Sample Description Sheet. Please note the rate of strain was 2% per minute and the orientation of the test specimen was vertical. Latex membrane used.

Date of issue 17 November 1999

Certificate No:-TXL/1715H/17/11/99/2

Signed...

Name: B. GILHESPY

Sheet 1 of 1

Client:- English Partnerships

Project Title:- South Tees Industrial Area - Ground Investigation

AEG Project 1715H

APPENDIX I

Specialist Chemical Testing

SOIL

ANALYTE	METHOD OF DETECTION	LIMIT OF DETECTION
Arsenic	ICP-OES	1.0 mg/kg
Cadmium	ICP-OES	0.2 mg/kg
Chromium (hexavalent)	ICP-OES	1.0 mg/kg
Chromium (total)	ICP-OES	0.2 mg/kg
Lead	ICP-OES	0.5 mg/kg
Mercury	ICP-OES	1.0 mg/kg
Selenium	ICP-OES	1.0 mg/kg
Boron (water soluble)	Colorimetry	0.5 mg/kg
Copper	ICP-OES	0.2 mg/kg
Nickel	ICP-OES	0.2 mg/kg
Zinc	ICP-OES	0.2 mg/kg
Phenols	Colorimetry	1.0 mg/kg
Cyanide (total)	Colorimetry	2.0 mg/kg
Sulphate (total)	ICP-OES	30 mg/kg
Sulphide	Colorimetry	2.0 mg/kg
Sulphur (free)	HPLC-UV	100 mg/kg
pH	pH-meter	N/A
TEM	Gravimetry	100 mg/kg

This is an interim report. Dependent options to follow.

Summary Of Results
AEG - South Tees Industrial Area Site C

ANALYTES	UNITS	TPC19 B5 (3.00m)	TPC19 B2 (0.40m)	TPC13 B2 (0.60m)	TPC15 B5 (4.20m)	TPC17 B4 (1.50m)	TPC10 B4 (3.00m)	TPC07 B4 (2.30m)	TPC06 B2 (1.50m)	TPC25 B3 (0.50m)	TPC26 B3 (0.70m)	TPC28 B9 (4.00m)	TPC25 B4 (1.20m)
		S9927064	S9927065	S9927066	S9927067	S9927068	S9927069	S9927070	S9927071	S9927072	S9927074	S9927075	S9927076
Arsenic	mg/kg	13.8	70.7	46.4	7.4	61.0	37.4	10.0	9.1	4.2	19.0	18.7	8.3
Cadmium	mg/kg	1.9	<0.2	3.0	0.2	<0.2	0.4	13.8	0.5	1.4	0.5	2.3	1.7
Chromium (hexavalent)	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium (total)	mg/kg	24.7	230.8	114.7	28.7	174.5	52.3	93.7	34.8	95.6	8.3	24.0	80.4
Lead	mg/kg	20.6	192.5	2952.3	54.6	510.0	63.1	523.5	70.6	532.0	168.2	43.9	583.5
Mercury	mg/kg	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0
Selenium	mg/kg	3.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.5	<1.0
Boron (water soluble)	mg/kg	2.5	1.0	1.5	1.3	1.1	1.3	1.5	1.0	1.1	1.3	1.5	<0.5
Copper	mg/kg	<0.2	55.9	3620.0	28.8	648.1	20.1	548.1	28.3	71.2	39.7	32.0	90.1
Nickel	mg/kg	5.4	10.9	143.9	24.8	10.5	26.7	48.1	30.2	18.4	8.6	3.8	19.3
Zinc	mg/kg	24.5	366.8	21808	192.0	953.6	200.4	1128.1	198.5	5125.8	348.4	410.0	6510.8
Phenols	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cyanide (total)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	55.9	<2.0	2.3	29.4
Sulphate (total)	mg/kg	21824	8552	2074	1772	10151	33914	2873	1778	2845	35339	24224	4231
Sulphide	mg/kg	1237.1	40.6	152.4	100.5	160.1	893.6	30.5	9.7	30.4	382.2	1464.2	3.6
Sulphur (free)	mg/kg	710	<100	<100	<100	188	<100	<100	<100	<100	117	674	<100
pH	N/A	10.4	8.0	8.6	7.9	8.7	8.5	8.5	8.1	8.3	9.4	10.7	9.4
TEM	mg/kg	830	<100	810	<100	620	560	350	<100	520	<100	880	780

Results for soil samples expressed as dry weight
‡ : Analyte not requested

Summary Of Results
AEG - South Tees Industrial Area Site C

ANALYTES	UNITS	TPC31 B3 (1.00m)	TPC28 B5 (2.00m)										
		S9927077	S9927078										
Arsenic	mg/kg	91.7	122.8	#	#	#	#	#	#	#	#	#	#
Cadmium	mg/kg	5.4	<0.2	#	#	#	#	#	#	#	#	#	#
Chromium (hexavalent)	mg/kg	<1.0	<1.0	#	#	#	#	#	#	#	#	#	#
Chromium (total)	mg/kg	86.3	152.7	#	#	#	#	#	#	#	#	#	#
Lead	mg/kg	624.5	419.3	#	#	#	#	#	#	#	#	#	#
Mercury	mg/kg	<1.0	<1.0	#	#	#	#	#	#	#	#	#	#
Selenium	mg/kg	<1.0	<1.0	#	#	#	#	#	#	#	#	#	#
Boron (water soluble)	mg/kg	3.1	1.9	#	#	#	#	#	#	#	#	#	#
Copper	mg/kg	91.9	91.1	#	#	#	#	#	#	#	#	#	#
Nickel	mg/kg	31.4	16.3	#	#	#	#	#	#	#	#	#	#
Zinc	mg/kg	1933.6	1031.1	#	#	#	#	#	#	#	#	#	#
Phenols	mg/kg	<1.0	<1.0	#	#	#	#	#	#	#	#	#	#
Cyanide (total)	mg/kg	3.4	<2.0	#	#	#	#	#	#	#	#	#	#
Sulphate (total)	mg/kg	15224	14989	#	#	#	#	#	#	#	#	#	#
Sulphide	mg/kg	47.5	8.4	#	#	#	#	#	#	#	#	#	#
Sulphur (free)	mg/kg	<100	<100	#	#	#	#	#	#	#	#	#	#
pH	N/A	8.1	8.3	#	#	#	#	#	#	#	#	#	#
TEM	mg/kg	500	270	#	#	#	#	#	#	#	#	#	#

Results for soil samples expressed as dry weight
: Analyte not requested

SOIL

ANALYTE	METHOD OF DETECTION	LIMIT OF DETECTION
Arsenic	ICP-OES	1.0 mg/kg
Cadmium	ICP-OES	0.2 mg/kg
Chromium (hexavalent)	ICP-OES	1.0 mg/kg
Chromium (total)	ICP-OES	0.2 mg/kg
Lead	ICP-OES	0.5 mg/kg
Mercury	ICP-OES	1.0 mg/kg
Selenium	ICP-OES	1.0 mg/kg
Boron (water soluble)	Colorimetry	0.5 mg/kg
Copper	ICP-OES	0.2 mg/kg
Nickel	ICP-OES	0.2 mg/kg
Zinc	ICP-OES	0.2 mg/kg
Phenols	Colorimetry	1.0 mg/kg
Cyanide (total)	Colorimetry	2.0 mg/kg
Sulphate (total)	ICP-OES	30 mg/kg
Sulphide	Colorimetry	2.0 mg/kg
Sulphur (free)	HPLC-UV	100 mg/kg
pH	pH-meter	N/A
TEM	Gravimetry	100 mg/kg

This is an interim report. Dependent options to follow.

Summary Of Results
AEG - South Tees Industrial Area Site C

ANALYTES	UNITS	TPC29 B5 (3.00m)	SP3ii B1	TPBHC5 B4 (6.50m)	TPC22 B4 (2.00m)	TPBHC1 B6 (5.00m)	TPC14 B4 (2.50m)	TPC06 B6 (4.20m)	TPC01 B3 (1.00m)	TPC05 B5 (2.00m)	TPC27 B3 (0.50m)	TPC16 B3 (0.50m)	TPC20 B3 (0.50m)
		S9927350	S9927351	S9927352	S9927353	S9927354	S9927355	S9927356	S9927357	S9927358	S9927360	S9927361	S9927362
Arsenic	mg/kg	342.6	45.3	17.0	77.9	15.6	14.0	11.1	90.0	35.0	9.3	163.3	25.6
Cadmium	mg/kg	<0.2	1.0	1.1	<0.2	1.6	1.6	3.1	0.3	1.7	1.8	<0.2	0.5
Chromium (hexavalent)	mg/kg	8.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium (total)	mg/kg	628.0	106.4	30.4	169.9	32.9	21.6	26.3	100.0	24.4	112.1	348.2	29.4
Lead	mg/kg	85.8	123.7	20.9	73.8	20.6	16.4	159.2	99.3	522.3	32.9	89.5	95.4
Mercury	mg/kg	3.5	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Selenium	mg/kg	<1.0	<1.0	5.5	<1.0	<1.0	2.8	7.2	<1.0	4.4	2.9	<1.0	<1.0
Boron (water soluble)	mg/kg	6.7	1.1	1.3	2.8	3.9	1.2	1.3	1.0	2.6	1.4	1.0	1.7
Copper	mg/kg	87.9	81.1	3.8	4.7	<0.2	<0.2	4.8	106.2	39.9	71.7	63.1	46.5
Nickel	mg/kg	105.5	33.3	12.7	31.4	5.7	7.8	8.1	40.7	30.0	7.6	39.3	18.1
Zinc	mg/kg	51.3	338.0	34.5	62.5	56.6	50.0	584.1	143.8	666.1	76.6	91.8	174.6
Phenols	mg/kg	45.2	<1.0	<1.0	3.1	<1.0	<1.0	3.6	<1.0	2.5	<1.0	<1.0	1.0
Cyanide (total)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Sulphate (total)	mg/kg	11487	10138	42961	21931	16711	16111	23971	7053	17971	11746	22531	20086
Sulphide	mg/kg	128.8	114.7	35.0	34.5	645.9	840.5	34.7	140.5	902.1	615.2	106.3	1427.1
Sulphur (free)	mg/kg	355	152	279	1063	919	641	1191	906	948	767	103	926 †
pH	N/A	5.8	9.2	9.8	8.1	9.5	10.9	10.3	9.5	9.3	10.4	9.3	9.8
TEM	mg/kg	480	340	360	1330	1350	840	3560	1380	2630	660	230	1020 †

Results for soil samples expressed as dry weight
: Analyte not requested

Summary Of Results
AEG - South Tees Industrial Area Site C

ANALYTES	UNITS	TPC2 J2 (0.10m)	TPC2 B5 (3.00m)											
		S9927363	S9927364											
Arsenic	mg/kg	6.7	11.7	#	#	#	#	#	#	#	#	#	#	
Cadmium	mg/kg	1.0	1.0	#	#	#	#	#	#	#	#	#	#	
Chromium (hexavalent)	mg/kg	<1.0	<1.0	#	#	#	#	#	#	#	#	#	#	
Chromium (total)	mg/kg	7.8	18.9	#	#	#	#	#	#	#	#	#	#	
Lead	mg/kg	10.6	11.6	#	#	#	#	#	#	#	#	#	#	
Mercury	mg/kg	<1.0	<1.0	#	#	#	#	#	#	#	#	#	#	
Selenium	mg/kg	5.9	3.9	#	#	#	#	#	#	#	#	#	#	
Boron (water soluble)	mg/kg	0.7	0.6	#	#	#	#	#	#	#	#	#	#	
Copper	mg/kg	<0.2	0.3	#	#	#	#	#	#	#	#	#	#	
Nickel	mg/kg	3.0	5.9	#	#	#	#	#	#	#	#	#	#	
Zinc	mg/kg	23.7	21.2	#	#	#	#	#	#	#	#	#	#	
Phenols	mg/kg	<1.0	<1.0	#	#	#	#	#	#	#	#	#	#	
Cyanide (total)	mg/kg	<2.0	<2.0	#	#	#	#	#	#	#	#	#	#	
Sulphate (total)	mg/kg	26406	21706	#	#	#	#	#	#	#	#	#	#	
Sulphide	mg/kg	198.4	876.9	#	#	#	#	#	#	#	#	#	#	
Sulphur (free)	mg/kg	317	936	#	#	#	#	#	#	#	#	#	#	†
pH	N/A	10.3	11.1	#	#	#	#	#	#	#	#	#	#	
TFM	mg/kg	390	1260	#	#	#	#	#	#	#	#	#	#	†

Results for soil samples expressed as dry weight
: Analyte not requested

SOIL

ANALYTE	METHOD OF DETECTION	LIMIT OF DETECTION
Arsenic	ICP-OES	1.0 mg/kg
Cadmium	ICP-OES	0.2 mg/kg
Chromium (hexavalent)	ICP-OES	1.0 mg/kg
Chromium (total)	ICP-OES	0.2 mg/kg
Lead	ICP-OES	0.5 mg/kg
Mercury	ICP-OES	1.0 mg/kg
Selenium	ICP-OES	1.0 mg/kg
Boron (water soluble)	Colorimetry	0.5 mg/kg
Copper	ICP-OES	0.2 mg/kg
Nickel	ICP-OES	0.2 mg/kg
Zinc	ICP-OES	0.2 mg/kg
Phenols	Colorimetry	1.0 mg/kg
Cyanide (total)	Colorimetry	2.0 mg/kg
Sulphate (total)	ICP-OES	30 mg/kg
Sulphide	Colorimetry	2.0 mg/kg
Sulphur (free)	HPLC-UV	100 mg/kg
pH	pH-meter	N/A
TEM	Gravimetry	100 mg/kg

This is an interim report. Dependent options to follow.

Summary Of Results
AEG - South Tees Industrial Area Site C

ANALYTES	UNITS	TPC23 B6 (3.50m)	TPBHC2 B7 (5.00m)	TPC17 B7 (4.00m)	TPBHC6 B5 (7.00m)	TPC12 B4 (1.20m)	TPC12 B6 (3.00m)	TPC3 B4 (2.00m)	TPC30 B5 (2.00m)	TPBHC4 B6 (4.50m)	TPC18 B3 (1.00m)	TPBHC5 B3 (1.20m)	TPBHC2 B3 (1.00m)
		S9927335	S9927336	S9927337	S9927338	S9927339	S9927340	S9927341	S9927343	S9927344	S9927345	S9927346	S9927347
Arsenic	mg/kg	63.5	18.9	10.7	11.3	13.3	9.5	102.2	11.6	12.1	37.7	11.3	44.0
Cadmium	mg/kg	<0.2	1.7	1.6	1.3	5.7	4.9	1.0	1.3	1.2	<0.2	1.1	1.5
Chromium (hexavalent)	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium (total)	mg/kg	207.9	45.7	25.4	14.8	82.1	31.1	138.7	16.2	28.3	101.5	24.1	91.3
Lead	mg/kg	81.7	37.5	36.9	48.5	475.0	368.0	206.4	28.0	23.3	85.2	22.0	132.8
Mercury	mg/kg	1.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Selenium	mg/kg	<1.0	<1.0	2.8	1.7	9.3	8.5	<1.0	3.1	3.6	<1.0	3.4	<1.0
Boron (water soluble)	mg/kg	1.0	3.4	2.8	5.2	3.2	2.7	2.2	3.3	1.3	1.1	1.0	1.3
Copper	mg/kg	34.8	1.1	<0.2	0.5	17.9	4.3	54.4	<0.2	<0.2	34.6	1.6	6.0
Nickel	mg/kg	42.6	11.4	5.7	5.3	11.2	5.5	80.7	4.7	7.8	28.6	7.1	35.2
Zinc	mg/kg	83.0	100.6	199.8	347.9	1119.3	963.3	1320.8	143.9	52.9	69.1	19.3	1323.3
Phenols	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cyanide (total)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Sulphate (total)	mg/kg	29725	20620	25330	36820	28600	32125	25975	22825	31815	18460	51365	26215
Sulphide	mg/kg	156.3	714.1	1034.1	1171.0	930.7	868.1	295.3	839.5	43.6	223.7	483.4	718.3
Sulphur (free)	mg/kg	367	1104	1691	1305	1136	1921	512	1547	930	465	468	1328
pH	N/A	9.6	9.3	9.7	10.0	9.8	10.5	8.4	9.7	10.0	8.0	9.7	8.1
TEM	mg/kg	610	1460	2040	1710	1610	2630	830	1610	1330	610	530	1640

Results for soil samples expressed as dry weight
: Analyte not requested

SOIL

ANALYTE	METHOD OF DETECTION	LIMIT OF DETECTION
Arsenic	ICP-OES	1.0 mg/kg
Cadmium	ICP-OES	0.2 mg/kg
Chromium (hexavalent)	ICP-OES	1.0 mg/kg
Chromium (total)	ICP-OES	0.2 mg/kg
Lead	ICP-OES	0.5 mg/kg
Mercury	ICP-OES	1.0 mg/kg
Selenium	ICP-OES	1.0 mg/kg
Boron (water soluble)	Colorimetry	0.5 mg/kg
Copper	ICP-OES	0.2 mg/kg
Nickel	ICP-OES	0.2 mg/kg
Zinc	ICP-OES	0.2 mg/kg
Phenols	Colorimetry	1.0 mg/kg
Cyanide (total)	Colorimetry	2.0 mg/kg
Sulphate (total)	ICP-OES	30 mg/kg
Sulphide	Colorimetry	2.0 mg/kg
Sulphur (free)	HPLC-UV	100 mg/kg
pH	pH-meter	N/A
TEM	Gravimetry	100 mg/kg

This is an interim report. Dependent options to follow.

Summary Of Results
AEG - South Tees Industrial Area Site C

ANALYTES	UNITS	SP10(ii-i)	TP8HC4 B8 (6.50m)	TPC8 J2 (0.30m)	BHC6 J9 (10.00m)	TPC9 J6 (2.00m)	TPC32 J3 (0.80m)	TPC33 J3 (0.70m)	TPC28 J2 (0.20m)	TPC8 J5 (2.00m)	TP8HC3 J6 (3.50m)	TPC5 J3 (0.60m)	TPC23 J2 (0.20m)	
		S9927081	S9927082	S9927083	S9927084	S9927085	S9927086	S9927087	S9927089	S9927090	S9927091	S9927092	S9927093	
Arsenic	mg/kg	15.9	55.0	1.3	6.6	10.0	35.5	42.4	10.3	42.7	58.3	<1.0	69.5	
Cadmium	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	0.6	0.6	<0.2	1.2	<0.2	0.3	7.8	
Chromium (hexavalent)	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Chromium (total)	mg/kg	27.4	139.7	18.6	16.7	36.8	396.9	65.5	16.8	97.6	44.3	32.0	173.3	
Lead	mg/kg	73.3	238.1	34.3	25.9	69.9	174.8	174.0	64.7	236.2	115.0	104.6	2948.2	
Mercury	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Selenium	mg/kg	<1.0	7.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	212.5	<1.0	
Boron (water soluble)	mg/kg	0.6	3.0	<0.5	2.4	1.9	<0.5	2.3	0.8	1.6	1.4	<0.5	0.6	
Copper	mg/kg	41.4	115.8	42.6	3.4	20.8	32.9	68.9	30.2	191.9	30.1	94.7	120.7	
Nickel	mg/kg	20.4	24.9	14.6	7.6	29.7	14.4	22.7	18.4	44.6	26.3	26.1	29.8	
Zinc	mg/kg	106.6	883.4	141.4	37.8	133.5	352.8	518.4	144.0	778.9	322.2	60.5	7729.3	
Phenols	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Cyanide (total)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.7	<2.0	<2.0	<2.0	<2.0	
Sulphate (total)	mg/kg	2691	10099	453	1561	1417	9682	3319	1107	4830	12199	8827	3150	
Sulphide	mg/kg	7.6	395.1	10.1	40.6	16.1	86.7	257.5	12.6	57.1	21.4	2.6	207.6	
Sulphur (free)	mg/kg	103	103	<100	<100	<100	<100	208	<100	309	<100	<100	<100	†
pH	N/A	8.8	8.7	8.1	8.5	7.9	12.2	10.0	8.7	9.1	6.1	8.7	10.1	
TEM	mg/kg	1410	770	1080	140	120	1270	330	1210	2520	<100	110	280	†

Results for soil samples expressed as dry weight
: Analyte not requested

Summary Of Results
AEG - South Tees Industrial Area Site C

ANALYTES	UNITS	TPC15 J2 (0.20m)	TPC11 J2 (0.40m)	TPC30 J1 (0.20m)	TPC24 J8 (3.50m)	TPC24 J4 (0.70m)	SP2(iv)	TPBHC7 B6 (4.00m)	TPC21 J2 (0.50m)				
		S9927094	S9927095	S9927096	S9927097	S9927098	S9927099	S9927100	S9927101				
Arsenic	mg/kg	32.5	73.4	40.8	119.8	20.5	43.7	8.7	37.3	#	#	#	#
Cadmium	mg/kg	0.3	<0.2	1.4	2.0	<0.2	0.4	1.0	0.5	#	#	#	#
Chromium (hexavalent)	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	#	#	#	#
Chromium (total)	mg/kg	85.5	188.1	146.0	95.9	283.6	45.5	14.0	50.6	#	#	#	#
Lead	mg/kg	272.4	335.1	655.6	923.8	130.7	377.1	57.8	521.1	#	#	#	#
Mercury	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	#	#	#	#
Selenium	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.9	39.2	#	#	#	#
Boron (water soluble)	mg/kg	1.3	0.6	<0.5	3.3	<0.5	0.5	<0.5	1.1	#	#	#	#
Copper	mg/kg	69.6	177.8	107.1	121.5	71.5	62.7	11.9	160.9	#	#	#	#
Nickel	mg/kg	44.4	25.4	22.5	35.1	2.7	20.8	4.6	42.9	#	#	#	#
Zinc	mg/kg	609.9	599.4	1078.4	1770.9	180.4	670.4	136.3	437.2	#	#	#	#
Phenols	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	#	#	#	#
Cyanide (total)	mg/kg	<2.0	<2.0	<2.0	<2.0	2.8	<2.0	<2.0	<2.0	#	#	#	#
Sulphate (total)	mg/kg	5125	3987	2673	16204	662	1816	56059	5649	#	#	#	#
Sulphide	mg/kg	212.4	14.3	69.5	24.0	2.3	262.1	514.1	79.7	#	#	#	#
Sulphur (free)	mg/kg	207	<100	<100	<100	<100	<100	104	<100	#	#	#	#
pH	N/A	8.4	9.1	10.6	7.7	8.3	9.2	10.3	9.3	#	#	#	#
TEM	mg/kg	303	540	810	330	150	260	160	310	#	#	#	#

Results for soil samples expressed as dry weight
: Analyte not requested

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- The laboratory issuing the test report has been stringently assessed by independent experts.
- You are assured that the agreed or specified methods and procedures have been followed.
- Measurements are traceable to national and international standards.

Comments:

Tests marked † in this report are not included in the NAMAS Accreditation Schedule for the testing laboratory. However, with the continuing development of our QC protocols, these tests will be included in the near future.
Any opinions and interpretations expressed herein are outside the scope of the testing laboratory's NAMAS Accreditation.
Coefficient of Variation (CV_T) is better than 15%

Date submitted for analysis : 10/11/99

Your Job/Order Number : 1715H

Analyst(s) : MRH NB GE NSP ELS DS AW

Approved signatories: J R Brown, G Ewbank, E Sharp

Signature :

Report date : 23 November 1999

QA APPROVED
SIGNED..
DATE.. 23/11/99

WATER

ANALYTE	METHOD OF DETECTION	LIMIT OF DETECTION
Arsenic	AAS-HYDRIDE	1.0 ug/l
Cadmium	GF-AAS	0.1 ug/l
Chromium	ICP-OES	0.01 mg/l
Chromium (hexavalent)	ICP-OES	0.01 mg/l
Lead	ICP-OES	0.03 mg/l
Mercury	AAS-HYDRIDE	0.1 ug/l
Selenium	AAS-HYDRIDE	1.0 ug/l
Copper	ICP-OES	0.01 mg/l
Nickel	ICP-OES	0.01 mg/l
Zinc	ICP-OES	0.01 mg/l
PAH (total)	GC-FID	0.01 mg/l
Phenols	Colorimetry	0.01 mg/l
Cyanide (total)	Colorimetry	0.01 mg/l
Sulphate	HPLC-IC	1 mg/l
Sulphide	Colorimetry	0.1 mg/l
pH	pH-meter	N/A
Mineral Oils	GC-FID	0.01 mg/l

Summary Of Results
AEG - South Tees Industrial Area, Site C

ANALYTES	UNITS	BHC2 W11 (6.30m)	TPBHC5 W13 (6.10m)	BHC3 W12 (6.30m)	BHC5 W26 (8.30m)								
		S9927057	S9927058	S9927059	S9927061								
Arsenic	ug/l	2.8	6.8	1.8	1.3	#	#	#	#	#	#	#	#
Cadmium	ug/l	0.3	<0.1	<0.1	<0.1	#	#	#	#	#	#	#	#
Chromium	mg/l	<0.01	<0.01	<0.01	<0.01	#	#	#	#	#	#	#	#
Chromium (hexavalent)	mg/l	<0.01	<0.01	<0.01	<0.01	#	#	#	#	#	#	#	#
Lead	mg/l	<0.03	<0.03	<0.03	<0.03	#	#	#	#	#	#	#	#
Mercury	ug/l	<0.1	<0.1	<0.1	<0.1	#	#	#	#	#	#	#	#
Selenium	ug/l	3.2	4.3	<1.0	<1.0	#	#	#	#	#	#	#	#
Copper	mg/l	<0.01	<0.01	<0.01	<0.01	#	#	#	#	#	#	#	#
Nickel	mg/l	<0.01	<0.01	<0.01	<0.01	#	#	#	#	#	#	#	#
Zinc	mg/l	<0.01	<0.01	<0.01	0.97	#	#	#	#	#	#	#	#
PAH (total)	mg/l	<0.01	3.32	<0.01	46.18	#	#	#	#	#	#	#	#
Phenols	mg/l	0.01	0.31	0.06	0.14	#	#	#	#	#	#	#	#
Cyanide (total)	mg/l	<0.01	<0.01	<0.01	<0.01	#	#	#	#	#	#	#	#
Sulphate	mg/l	2362	1723	2488	1529	#	#	#	#	#	#	#	#
Sulphide	mg/l	<0.1	<0.1	<0.1	<0.1	#	#	#	#	#	#	#	#
pH	N/A	8.4	8.1	7.5	7.7	#	#	#	#	#	#	#	#
Mineral Oils	mg/l	<0.01	<0.01	<0.01	880.26	#	#	#	#	#	#	#	#

Water samples analysed as received
\# : Analyte not requested

Analytical Test Report
For

AEG
Unit 25
Stella Gill Industrial Estate
Pelton Fell
Chester-le-Street
Co. Durham
DH2 2RJ

PROJECT ID: SOUTH TEES INDUSTRIAL AREA, SITE C

Report No.: R99/2615

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- You are assured that the agreed or specified methods and procedures have been followed.
- Measurements are traceable to national and international standards.

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Any opinions and interpretations expressed herein are outside the scope of the testing laboratory's NAMAS Accreditation.
Coefficient of Variation (CV_T) is better than 15%

Date submitted for analysis : 10/11/99

Your Job/Order Number : 1715H

Analyst(s) : MRH NB GE NSP ELS DS AW

Approved signatories: J R Brown, G Ewbank, E Sharp

Signature :

Report date : 23 November 1999

QA APPROVED
SIGNED..
DATE.. 23/11/99

WATER

ANALYTE	METHOD OF DETECTION	LIMIT OF DETECTION
Arsenic	AAS-HYDRIDE	1.0 ug/l
Cadmium	GF-AAS	0.1 ug/l
Chromium	ICP-OES	0.01 mg/l
Chromium (hexavalent)	ICP-OES	0.01 mg/l
Lead	ICP-OES	0.03 mg/l
Mercury	AAS-HYDRIDE	0.1 ug/l
Selenium	AAS-HYDRIDE	1.0 ug/l
Copper	ICP-OES	0.01 mg/l
Nickel	ICP-OES	0.01 mg/l
Zinc	ICP-OES	0.01 mg/l
PAH (total)	GC-FID	0.01 mg/l
Phenols	Colorimetry	0.01 mg/l
Cyanide (total)	Colorimetry	0.01 mg/l
Sulphate	HPLC-IC	1 mg/l
Sulphide	Colorimetry	0.1 mg/l
pH	pH-meter	N/A
Mineral Oils	GC-FID	0.01 mg/l

Summary Of Results
AEG - South Tees Industrial Area, Site C

ANALYTES	UNITS	BHC2 W11 (6.30m)	TPBHC5 W13 (6.10m)	BHC3 W12 (6.30m)	BHC5 W26 (8.30m)								
		S9927057	S9927058	S9927059	S9927061								
Arsenic	ug/l	2.8	6.8	1.8	1.3	#	#	#	#	#	#	#	#
Cadmium	ug/l	0.3	<0.1	<0.1	<0.1	#	#	#	#	#	#	#	#
Chromium	mg/l	<0.01	<0.01	<0.01	<0.01	#	#	#	#	#	#	#	#
Chromium (hexavalent)	mg/l	<0.01	<0.01	<0.01	<0.01	#	#	#	#	#	#	#	# †
Lead	mg/l	<0.03	<0.03	<0.03	<0.03	#	#	#	#	#	#	#	#
Mercury	ug/l	<0.1	<0.1	<0.1	<0.1	#	#	#	#	#	#	#	#
Selenium	ug/l	3.2	4.3	<1.0	<1.0	#	#	#	#	#	#	#	#
Copper	mg/l	<0.01	<0.01	<0.01	<0.01	#	#	#	#	#	#	#	#
Nickel	mg/l	<0.01	<0.01	<0.01	<0.01	#	#	#	#	#	#	#	#
Zinc	mg/l	<0.01	<0.01	<0.01	0.97	#	#	#	#	#	#	#	#
PAH (total)	mg/l	<0.01	3.32	<0.01	46.18	#	#	#	#	#	#	#	# †
Phenols	mg/l	0.01	0.31	0.06	0.14	#	#	#	#	#	#	#	#
Cyanide (total)	mg/l	<0.01	<0.01	<0.01	<0.01	#	#	#	#	#	#	#	#
Sulphate	mg/l	2362	1723	2488	1529	#	#	#	#	#	#	#	#
Sulphide	mg/l	<0.1	<0.1	<0.1	<0.1	#	#	#	#	#	#	#	#
pH	N/A	8.4	8.1	7.5	7.7	#	#	#	#	#	#	#	#
Mineral Oils	mg/l	<0.01	<0.01	<0.01	880.26	#	#	#	#	#	#	#	# †

Water samples analysed as received
: Analyte not requested

Analytical Test Report
For

AEG
Unit 25
Stella Gill Industrial Estate
Pelton Fell
Chester-le-Street
Co. Durham
DH2 2RJ

PROJECT ID: SOUTH TEES IND. AREA, SITE C-GI

Report No.: R99/2616

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The Coefficient of Variation CV_T (where CV_T = standard deviation/mean*100) is better than 15%

Date submitted for analysis : 10/11/99

Your Job/Order Number : 1715H

Analyst(s) : NB NSP MB ELS AA AW RK DS

Approved signatories: J R Brown, T Smyth, G Ewbank, E Sharp

Signature :

Report date : 26 November 1999

QA APPROVED
SIGNED..
DATE.. 26/11/99

SOIL

ANALYTE	METHOD OF DETECTION	LIMIT OF DETECTION
Arsenic	ICP-OES	1.0 mg/kg
Cadmium	ICP-OES	0.2 mg/kg
Chromium (hexavalent)	ICP-OES	1.0 mg/kg
Chromium (total)	ICP-OES	0.2 mg/kg
Lead	ICP-OES	0.5 mg/kg
Mercury	ICP-OES	1.0 mg/kg
Selenium	ICP-OES	1.0 mg/kg
Boron (water soluble)	Colorimetry	0.5 mg/kg
Copper	ICP-OES	0.2 mg/kg
Nickel	ICP-OES	0.2 mg/kg
Zinc	ICP-OES	0.2 mg/kg
Phenols	Colorimetry	1.0 mg/kg
Cyanide (total)	Colorimetry	2.0 mg/kg
Sulphate (total)	ICP-OES	30 mg/kg
Sulphide	Colorimetry	2.0 mg/kg
Sulphur (free)	HPLC-UV	100 mg/kg
pH	pH-meter	N/A
TEM	Gravimetry	100 mg/kg
Sulphate (water soluble)	HPLC-IC	0.001 g/l
Cyanide (free)	Colorimetry	2.0 mg/kg

Summary Of Results
AEG - South Tees Ind. Area, Site C-GI

ANALYTES	UNITS	TPC19 B5 (3.00m)	TPC19 B2 (0.40m)	TPC13 B2 (0.60m)	TPC15 B5 (4.20m)	TPC17 B4 (1.50m)	TPC10 B4 (3.00m)	TPC07 B4 (2.30m)	TPC06 B2 (1.50m)	TPC25 B3 (0.50m)	TPC26 B3 (0.70m)	TPC28 B9 (4.00m)	TPC25 B4 (1.20m)
		S9927064	S9927065	S9927066	S9927067	S9927068	S9927069	S9927070	S9927071	S9927072	S9927074	S9927075	S9927076
Arsenic	mg/kg	13.8	70.7	46.4	7.4	61.0	37.4	10.0	9.1	4.2	19.0	18.7	8.3
Cadmium	mg/kg	1.9	<0.2	3.0	0.2	<0.2	0.4	13.8	0.5	1.4	0.5	2.3	1.7
Chromium (hexavalent)	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium (total)	mg/kg	24.7	230.8	114.7	28.7	174.5	52.3	93.7	34.8	85.6	8.3	24.0	80.4
Lead	mg/kg	20.6	192.5	2952.3	54.6	510.0	63.1	523.5	70.6	532.0	168.2	43.9	583.5
Mercury	mg/kg	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0
Selenium	mg/kg	3.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.5	<1.0
Boron (water soluble)	mg/kg	2.5	1.0	1.5	1.3	1.1	1.3	1.5	1.0	1.1	1.3	1.5	<0.5
Copper	mg/kg	<0.2	55.9	3620.0	28.8	648.1	20.1	548.1	28.3	71.2	39.7	32.0	90.1
Nickel	mg/kg	5.4	10.9	143.9	24.8	10.5	26.7	48.1	30.2	18.4	8.6	3.8	19.3
Zinc	mg/kg	24.5	366.8	21808	192.0	953.6	200.4	1128.1	198.5	5125.8	348.4	410.0	6510.8
Phenols	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cyanide (total)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	55.9	<2.0	2.3	29.4
Sulphate (total)	mg/kg	21824	8552	2074	1772	10151	33914	2873	1778	2845	35339	24224	4231
Sulphide	mg/kg	1237.1	40.6	152.4	100.5	160.1	893.6	30.5	9.7	30.4	382.2	1464.2	3.6
Sulphur (free)	mg/kg	710	<100	<100	<100	188	<100	<100	<100	<100	117	674	<100 †
pH	N/A	10.4	8.0	8.6	7.9	8.7	8.5	8.5	8.1	8.3	9.4	10.7	9.4
TEM	mg/kg	830	<100	810	<100	620	560	350	<100	520	<100	880	780 †
Sulphate (water soluble)	g/l	1.495	1.997	0.214	#	1.624	1.759	0.508	#	0.470	1.511	1.411	0.754
Cyanide (free)	mg/kg	#	#	#	#	#	#	#	#	<2.0	#	#	<2.0

Results for soil samples expressed as dry weight
: Analyte not requested

Summary Of Results
AEG - South Tees Ind. Area, Site C-GI

ANALYTES	UNITS	TPC31 B3 (1.00m)	TPC28 B5 (2.00m)										
		S9927077	S9927078										
Arsenic	mg/kg	91.7	122.8	#	#	#	#	#	#	#	#	#	#
Cadmium	mg/kg	5.4	<0.2	#	#	#	#	#	#	#	#	#	#
Chromium (hexavalent)	mg/kg	<1.0	<1.0	#	#	#	#	#	#	#	#	#	#
Chromium (total)	mg/kg	86.3	152.7	#	#	#	#	#	#	#	#	#	#
Lead	mg/kg	624.5	419.3	#	#	#	#	#	#	#	#	#	#
Mercury	mg/kg	<1.0	<1.0	#	#	#	#	#	#	#	#	#	#
Selenium	mg/kg	<1.0	<1.0	#	#	#	#	#	#	#	#	#	#
Boron (water soluble)	mg/kg	3.1	1.9	#	#	#	#	#	#	#	#	#	#
Copper	mg/kg	91.9	91.1	#	#	#	#	#	#	#	#	#	#
Nickel	mg/kg	31.4	16.3	#	#	#	#	#	#	#	#	#	#
Zinc	mg/kg	1933.6	1031.1	#	#	#	#	#	#	#	#	#	#
Phenols	mg/kg	<1.0	<1.0	#	#	#	#	#	#	#	#	#	#
Cyanide (total)	mg/kg	3.4	<2.0	#	#	#	#	#	#	#	#	#	#
Sulphate (total)	mg/kg	15224	14989	#	#	#	#	#	#	#	#	#	#
Sulphide	mg/kg	47.5	8.4	#	#	#	#	#	#	#	#	#	#
Sulphur (free)	mg/kg	<100	<100	#	#	#	#	#	#	#	#	#	# †
pH	N/A	8.1	8.3	#	#	#	#	#	#	#	#	#	#
TEM	mg/kg	500	270	#	#	#	#	#	#	#	#	#	# †
Sulphate (water soluble)	g/l	2.028	1.570	#	#	#	#	#	#	#	#	#	#

Results for soil samples expressed as dry weight
: Analyte not requested

Analytical Test Report
For

AEG
Unit 25
Stella Gill Industrial Estate
Pelton Fell
Chester-le-Street
Co. Durham
DH2 2RJ

PROJECT ID: SOUTH TEES INDUSTRIAL AREA, SITE C

Report No.: R99/2617

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- Measurements are traceable to national and international standards.

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The Coefficient of Variation CV_T (where CV_T = standard deviation/mean*100) is better than 15%

Date submitted for analysis : 10/11/99

Your Job/Order Number : 1715H

Analyst(s) : NB NSP AA MB ELS AW RK GE DS

Approved signatories: J R Brown, T Smyth, G Ewbank, E Sharp

Signature : R. Brown

Report date : 1 December 1999

QA APPROVED
SIGNED..
DATE.. 1/12/99

SOIL

ANALYTE	METHOD OF DETECTION	LIMIT OF DETECTION
Arsenic	ICP-OES	1.0 mg/kg
Cadmium	ICP-OES	0.2 mg/kg
Chromium (hexavalent)	ICP-OES	1.0 mg/kg
Chromium (total)	ICP-OES	0.2 mg/kg
Lead	ICP-OES	0.5 mg/kg
Mercury	ICP-OES	1.0 mg/kg
Selenium	ICP-OES	1.0 mg/kg
Boron (water soluble)	Colorimetry	0.5 mg/kg
Copper	ICP-OES	0.2 mg/kg
Nickel	ICP-OES	0.2 mg/kg
Zinc	ICP-OES	0.2 mg/kg
PAH (total)	HPLC-UV	10 mg/kg
Phenols	Colorimetry	1.0 mg/kg
Cyanide (total)	Colorimetry	2.0 mg/kg
Sulphate (total)	ICP-OES	30 mg/kg
Sulphide	Colorimetry	2.0 mg/kg
Sulphur (free)	HPLC-UV	100 mg/kg
pH	pH-meter	N/A
TEM	Gravimetry	100 mg/kg
Mineral Oil	GC-FID	0.1 mg/kg
Sulphate (water soluble)	HPLC-IC	0.001 g/l

Summary Of Results
AEG - South Tees Industrial Area, Site C

ANALYTES	UNITS	SP10 (iii)	TPBHC4 B8 (6.50m)	TPC8 J2 (0.30m)	BHC6 J9 (10.00m)	TPC9 J6 (2.00m)	TPC32 J3 (0.80m)	TPC33 J3 (0.70m)	TPC28 J2 (0.20m)	TPC8 J5 (2.00m)	TPBHC3 J6 (3.50m)	TPC5 J3 (0.60m)	TPC23 J2 (0.20m)	
		S9927081	S9927082	S9927083	S9927084	S9927085	S9927086	S9927087	S9927089	S9927090	S9927091	S9927092	S9927093	
Arsenic	mg/kg	15.9	55.0	1.3	6.6	10.0	35.5	42.4	10.3	42.7	58.3	<1.0	69.5	
Cadmium	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	0.6	0.6	<0.2	1.2	<0.2	0.3	7.8	
Chromium (hexavalent)	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Chromium (total)	mg/kg	27.4	139.7	18.6	16.7	36.8	396.9	65.5	16.8	97.6	44.3	32.0	173.3	
Lead	mg/kg	73.3	238.1	34.3	25.9	69.9	174.8	174.0	64.7	236.2	115.0	104.6	2948.2	
Mercury	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Selenium	mg/kg	<1.0	7.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	212.5	<1.0	
Boron (water soluble)	mg/kg	0.6	3.0	<0.5	2.4	1.9	<0.5	2.3	0.8	1.6	1.4	<0.5	0.6	
Copper	mg/kg	41.4	115.8	42.6	3.4	20.8	32.9	68.9	30.2	191.9	30.1	94.7	120.7	
Nickel	mg/kg	20.4	24.9	14.6	7.6	29.7	14.4	22.7	18.4	44.6	26.3	26.1	29.8	
Zinc	mg/kg	106.6	883.4	141.4	37.8	133.5	352.8	518.4	144.0	778.9	322.2	60.5	7729.3	
PAH (total)	mg/kg	86	#	94	#	#	48	#	89	10	#	#	#	†
Phenols	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Cyanide (total)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.7	<2.0	<2.0	<2.0	<2.0	
Sulphate (total)	mg/kg	2691	10099	453	1561	1417	9682	3319	1107	4830	12199	8827	3150	
Sulphide	mg/kg	7.6	395.1	10.1	40.6	16.1	86.7	257.5	12.6	57.1	21.4	2.6	207.6	
Sulphur (free)	mg/kg	103	103	<100	<100	<100	<100	208	<100	309	<100	<100	<100	†
pH	N/A	8.8	8.7	8.1	8.5	7.9	12.2	10.0	8.7	9.1	6.1	8.7	10.1	
TEM	mg/kg	1410	770	1080	140	120	1270	330	1210	2520	<100	110	280	†
Mineral Oil	mg/kg	51.9	#	167.8	#	#	415.7	#	38.3	6.4	#	#	#	†

Results for soil samples expressed as dry weight
: Analyte not requested

Summary Of Results
AEG - South Tees Industrial Area, Site C

ANALYTES	UNITS	SP10 (iii)	TPBHC4 B8 (6.50m)	TPC8 J2 (0.30m)	BHC6 J9 (10.00m)	TPC9 J6 (2.00m)	TPC32 J3 (0.80m)	TPC33 J3 (0.70m)	TPC28 J2 (0.20m)	TPC8 J5 (2.00m)	TPBHC3 J6 (3.50m)	TPC5 J3 (0.60m)	TPC23 J2 (0.20m)
		S9927081	S9927082	S9927083	S9927084	S9927085	S9927086	S9927087	S9927089	S9927090	S9927091	S9927092	S9927093
Sulphate (water soluble)	g/l	0.515	1.997	#	#	#	0.001	0.566	#	1.034	2.167	0.191	0.188

Results for soil samples expressed as dry weight
: Analyte not requested

Summary Of Results
AEG - South Tees Industrial Area, Site C

ANALYTES	UNITS	TPC15 J2 (0.20m)	TPC11 J2 (0.40m)	TPC30 J1 (0.20m)	TPC24 J8 (3.50m)	TPC24 J4 (0.70m)	SP2 (iv)	TPBHC7 B6 (4.00m)	TPC21 J2 (0.50m)				
		S9927094	S9927095	S9927096	S9927097	S9927098	S9927099	S9927100	S9927101				
Arsenic	mg/kg	32.5	73.4	40.8	119.8	20.6	43.7	8.7	37.3	#	#	#	#
Cadmium	mg/kg	0.3	<0.2	1.4	2.0	<0.2	0.4	1.0	0.5	#	#	#	#
Chromium (hexavalent)	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	#	#	#	#
Chromium (total)	mg/kg	85.5	188.1	146.0	95.9	283.6	45.5	14.0	50.6	#	#	#	#
Lead	mg/kg	272.4	335.1	655.6	923.8	130.7	377.1	57.8	521.1	#	#	#	#
Mercury	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	#	#	#	#
Selenium	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.9	39.2	#	#	#	#
Boron (water soluble)	mg/kg	1.3	0.6	<0.5	3.3	<0.5	0.5	<0.5	1.1	#	#	#	#
Copper	mg/kg	69.6	177.8	107.1	121.5	71.5	62.7	11.9	160.9	#	#	#	#
Nickel	mg/kg	44.4	25.4	22.5	35.1	2.7	20.8	4.6	42.9	#	#	#	#
Zinc	mg/kg	609.9	599.4	1078.4	1770.9	180.4	670.4	136.3	437.2	#	#	#	#
Phenols	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	#	#	#	#
Cyanide (total)	mg/kg	<2.0	<2.0	<2.0	<2.0	2.8	<2.0	<2.0	<2.0	#	#	#	#
Sulphate (total)	mg/kg	5125	3987	2673	16204	662	1816	56059	5649	#	#	#	#
Sulphide	mg/kg	212.4	14.3	69.5	24.0	2.3	262.1	514.1	79.7	#	#	#	#
Sulphur (free)	mg/kg	207	<100	<100	<100	<100	<100	104	<100	#	#	#	# †
pH	N/A	8.4	9.1	10.6	7.7	8.3	9.2	10.3	9.3	#	#	#	#
TEM	mg/kg	303	540	810	330	150	260	160	310	#	#	#	# †
Sulphate (water soluble)	g/l	0.746	0.362	0.113	2.267	#	#	1.459	0.514	#	#	#	#

Results for soil samples expressed as dry weight
\# : Analyte not requested

Analytical Test Report
For

AEG
Unit 25
Stella Gill Industrial Estate
Pelton Fell
Chester-le-Street
Co. Durham
DH2 2RJ

PROJECT ID: SOUTH TEES INDUSTRIAL AREA, SITE C

Report No.: R99/2649

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Mr S Patterson
File

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0618 SI

What's so special about a NAMAS report or certificate?

- NAMAS is the acronym for National Accreditation of Measurement and Sampling.
- Accreditation of NAMAS testing is granted by the United Kingdom Accreditation Service (UKAS).
- It's your assurance that the work has been carried out to the highest standards.
- The laboratory issuing the test report has been stringently assessed by independent experts.
- You are assured that the agreed or specified methods and procedures have been followed.
- Measurements are traceable to national and international standards.

Comments:
Tests marked † in this report are not included in the NAMAS Accreditation Schedule for the testing laboratory. However, with the continuing development of our QC protocols, these tests will be included in the near future.
Any opinions and interpretations expressed herein are outside the scope of the testing laboratory's NAMAS Accreditation.
The Coefficient of Variation CV_T (where CV_T = standard deviation/mean*100) is better than 15%

Date submitted for analysis : 12/11/99

Your Job/Order Number : 1715H

Analyst(s) : NB NSP MB ELS AA AW RK DS GE

Approved signatories: J R Brown, T Smyth, G Ewbank, E Sharp

Signature : R. Brown

Report date : 1 December 1999

QA APPROVED
SIGNED.. Fraser
DATE.. 1/12/99

SOIL

ANALYTE	METHOD OF DETECTION	LIMIT OF DETECTION
Arsenic	ICP-OES	1.0 mg/kg
Cadmium	ICP-OES	0.2 mg/kg
Chromium (hexavalent)	ICP-OES	1.0 mg/kg
Chromium (total)	ICP-OES	0.2 mg/kg
Lead	ICP-OES	0.5 mg/kg
Mercury	ICP-OES	1.0 mg/kg
Selenium	ICP-OES	1.0 mg/kg
Boron (water soluble)	Colorimetry	0.5 mg/kg
Copper	ICP-OES	0.2 mg/kg
Nickel	ICP-OES	0.2 mg/kg
Zinc	ICP-OES	0.2 mg/kg
PAH (total)	HPLC-UV	10 mg/kg
Phenols	Colorimetry	1.0 mg/kg
Cyanide (total)	Colorimetry	2.0 mg/kg
Sulphate (total)	ICP-OES	30 mg/kg
Sulphide	Colorimetry	2.0 mg/kg
Sulphur (free)	HPLC-UV	100 mg/kg
pH	pH-meter	N/A
TEM	Gravimetry	100 mg/kg
Mineral Oil	GC-FID	0.1 mg/kg
Sulphate (water soluble)	HPLC-IC	0.001 g/l

Summary Of Results
AEG - South Tees Industrial Area, Site C

ANALYTES	UNITS	TPC23 B6 (3.50m)	TPBHC2 B7 (5.00m)	TPC17 B7 (4.00m)	TPBHC6 B5 (7.00m)	TPC12 B4 (1.20m)	TPC12 B6 (3.00m)	TPC3 B4 (2.00m)	TPC30 B5 (2.00m)	TPBHC4 B6 (4.50m)	TPC18 B3 (1.00m)	TPBHC5 B3 (1.20m)	TPBHC2 B3 (1.00m)	
		S9927335	S9927336	S9927337	S9927338	S9927339	S9927340	S9927341	S9927343	S9927344	S9927345	S9927346	S9927347	
Arsenic	mg/kg	63.5	18.9	10.7	11.3	13.3	9.5	102.2	11.6	12.1	37.7	11.3	44.0	
Cadmium	mg/kg	<0.2	1.7	1.6	1.3	5.7	4.9	1.0	1.3	1.2	<0.2	1.1	1.5	
Chromium (hexavalent)	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Chromium (total)	mg/kg	207.9	45.7	25.4	14.8	82.1	31.1	138.7	16.2	28.3	101.5	24.1	91.3	
Lead	mg/kg	81.7	37.5	36.9	48.5	475.0	368.0	206.4	28.0	23.3	85.2	22.0	132.8	
Mercury	mg/kg	1.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Selenium	mg/kg	<1.0	<1.0	2.8	1.7	9.3	8.5	<1.0	3.1	3.6	<1.0	3.4	<1.0	
Boron (water soluble)	mg/kg	1.0	3.4	2.8	5.2	3.2	2.7	2.2	3.3	1.3	1.1	1.0	1.3	
Copper	mg/kg	34.8	1.1	<0.2	0.5	17.9	4.3	54.4	<0.2	<0.2	34.6	1.6	6.0	
Nickel	mg/kg	42.6	11.4	5.7	5.3	11.2	5.5	80.7	4.7	7.8	28.6	7.1	35.2	
Zinc	mg/kg	83.0	100.6	199.8	347.9	1119.3	963.3	1320.8	143.9	52.9	69.1	19.3	1323.3	
Phenols	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Cyanide (total)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
Sulphate (total)	mg/kg	29725	20620	25330	36820	28600	32125	25975	22825	31015	18460	51355	26215	
Sulphide	mg/kg	156.3	714.1	1034.1	1121.0	930.7	868.1	295.3	839.5	43.6	223.7	483.4	214.3	
Sulphur (free)	mg/kg	367	1104	1691	1305	1136	1921	512	1547	930	465	468	1328	†
pH	N/A	9.6	9.3	9.7	10.0	9.8	10.5	8.4	9.7	10.0	8.0	9.7	8.1	
TEM	mg/kg	610	1460	2040	1710	1610	2630	830	1610	1330	610	530	1640	†
Sulphate (water soluble)	g/l	1.704	1.925	1.533	1.693	1.557	1.647	1.541	1.702	1.690	1.546	1.622	1.798	
PAH (total)	mg/kg	#	<10	<10	<10	<10	14	#	<10	<10	#	#	<10	†

Results for soil samples expressed as dry weight
: Analyte not requested

Summary Of Results
AEG - South Tees Industrial Area, Site C

ANALYTES	UNITS	TPC23 B6 (3.50m)	TPBHC2 B7 (5.00m)	TPC17 B7 (4.00m)	TPBHC6 B5 (7.00m)	TPC12 B4 (1.20m)	TPC12 B6 (3.00m)	TPC3 B4 (2.00m)	TPC30 B5 (2.00m)	TPBHC4 B6 (4.50m)	TPC18 B3 (1.00m)	TPBHC5 B3 (1.20m)	TPBHC2 B3 (1.00m)
		S9927335	S9927336	S9927337	S9927338	S9927339	S9927340	S9927341	S9927343	S9927344	S9927345	S9927346	S9927347
Mineral Oil	mg/kg	#	0.2	2.1	1.0	3.2	<0.1	#	1.1	0.2	#	#	9.9

Results for soil samples expressed as dry weight
: Analyte not requested

Analytical Test Report
For

AEG
Unit 25
Stella Gill Industrial Estate
Pelton Fell
Chester-le-Street
Co. Durham
DH2 2RJ

PROJECT ID: SOUTH TEES INDUSTRIAL AREA, SITE C

Report No.: R99/2650

Copies To:
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- The laboratory issuing the test report has been stringently assessed by independent experts.
- You are assured that the agreed or specified methods and procedures have been followed.
- Measurements are traceable to national and international standards.

Comments:
Tests marked † in this report are not included in the NAMAS Accreditation Schedule for the testing laboratory. However, with the continuing development of our QC protocols, these tests will be included in the near future.
Any opinions and interpretations expressed herein are outside the scope of the testing laboratory's NAMAS Accreditation.
The Coefficient of Variation CV_T (where CV_T = standard deviation/mean*100) is better than 15%

Date submitted for analysis : 12/11/99

Your Job/Order Number : 1715H

Analyst(s) : NB NSP MB ELS AA AW RK DS GE

Approved signatories: J R Brown, T Smyth, G Ewbank, E Sharp

Signature :

Report date : 1 December 1999

QA APPROVED
SIGNED..
DATE.. 1/12/99

SOIL

ANALYTE	METHOD OF DETECTION	LIMIT OF DETECTION
Arsenic	ICP-OES	1.0 mg/kg
Cadmium	ICP-OES	0.2 mg/kg
Chromium (hexavalent)	ICP-OES	1.0 mg/kg
Chromium (total)	ICP-OES	0.2 mg/kg
Lead	ICP-OES	0.5 mg/kg
Mercury	ICP-OES	1.0 mg/kg
Selenium	ICP-OES	1.0 mg/kg
Boron (water soluble)	Colorimetry	0.5 mg/kg
Copper	ICP-OES	0.2 mg/kg
Nickel	ICP-OES	0.2 mg/kg
Zinc	ICP-OES	0.2 mg/kg
PAH (total)	HPLC-UV	10 mg/kg
Phenols	Colorimetry	1.0 mg/kg
Cyanide (total)	Colorimetry	2.0 mg/kg
Sulphate (total)	ICP-OES	30 mg/kg
Sulphide	Colorimetry	2.0 mg/kg
Sulphur (free)	HPLC-UV	100 mg/kg
pH	pH-meter	N/A
TEM	Gravimetry	100 mg/kg
Sulphate (water soluble)	HPLC-IC	0.001 g/l
Mineral Oil	GC-FID	0.1 mg/kg

Summary Of Results
AEG - South Tees Industrial Area, Site C

ANALYTES	UNITS	TPC29 B5 (3.00m)	SP3ii B1	TPBHC5 B9 (6.50m)	TPC22 B4 (2.00m)	TPBHC1 B6 (5.00m)	TPC14 B4 (2.50m)	TPC06 B6 (4.20m)	TPC01 B3 (1.00m)	TPC05 B5 (2.00m)	TPC27 B3 (0.50m)	TPC16 B3 (0.50m)	TPC20 B3 (0.50m)	
		S9927350	S9927351	S9927352	S9927353	S9927354	S9927355	S9927356	S9927357	S9927358	S9927360	S9927361	S9927362	
Arsenic	mg/kg	342.6	45.3	17.0	77.9	15.6	14.0	11.1	90.0	35.0	9.3	163.3	25.6	
Cadmium	mg/kg	<0.2	1.0	1.1	<0.2	1.6	1.6	3.1	0.3	1.7	1.8	<0.2	0.5	
Chromium (hexavalent)	mg/kg	8.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Chromium (total)	mg/kg	628.0	106.4	30.4	169.9	32.9	21.6	26.3	100.0	24.4	112.1	348.2	29.4	
Lead	mg/kg	85.8	123.7	20.9	73.8	20.6	16.4	159.2	99.3	522.3	32.9	89.5	95.4	
Mercury	mg/kg	3.5	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Selenium	mg/kg	<1.0	<1.0	5.5	<1.0	<1.0	2.8	7.2	<1.0	4.4	2.9	<1.0	<1.0	
Boron (water soluble)	mg/kg	6.7	1.1	1.3	2.8	3.9	1.2	1.3	1.0	2.6	1.4	1.0	1.7	
Copper	mg/kg	87.9	81.1	3.8	4.7	<0.2	<0.2	4.8	106.2	39.9	21.7	63.1	46.5	
Nickel	mg/kg	105.5	33.3	12.7	31.4	5.7	7.8	8.1	40.7	30.0	7.6	39.3	18.1	
Zinc	mg/kg	51.3	338.0	34.5	62.5	56.6	50.0	584.1	143.8	666.1	76.6	91.8	174.6	
Phenols	mg/kg	45.2	<1.0	<1.0	3.1	<1.0	<1.0	3.6	<1.0	2.5	<1.0	<1.0	1.0	
Cyanide (total)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
Sulphate (total)	mg/kg	11487	10138	42961	21931	16711	16111	23971	7053	17971	11746	22531	20086	
Sulphide	mg/kg	128.8	114.7	35.0	34.5	645.9	840.5	34.7	140.5	902.1	615.2	106.3	1427.1	
Sulphur (free)	mg/kg	355	152	279	1063	919	641	1191	906	948	767	103	926	†
pH	N/A	5.8	9.2	9.8	8.1	9.5	10.9	10.3	9.5	9.3	10.4	9.3	9.8	
TEM	mg/kg	480	340	360	1330	1350	840	3560	1380	2630	660	230	1020	†
Sulphate (water soluble)	g/l	1.733	5.954	1.731	1.562	1.751	1.378	1.450	0.961	1.756	1.566	1.921	1.698	
PAH (total)	mg/kg	#	#	#	<10	<10	#	<10	16	<10	#	#	<10	†

Results for soil samples expressed as dry weight
\# : Analyte not requested

Summary Of Results
AEG - South Tees Industrial Area, Site C

ANALYTES	UNITS	TPC29 B5 (3.00m)	SP3ii B1	TPBHC5 B9 (6.50m)	TPC22 B4 (2.00m)	TPBHC1 B6 (5.00m)	TPC14 B4 (2.50m)	TPC06 B6 (4.20m)	TPC01 B3 (1.00m)	TPC05 B5 (2.00m)	TPC27 B3 (0.50m)	TPC16 B3 (0.50m)	TPC20 B3 (0.50m)
		S9927350	S9927351	S9927352	S9927353	S9927354	S9927355	S9927356	S9927357	S9927358	S9927360	S9927361	S9927362
Mineral Oil	mg/kg	#	#	#	5.7	0.7	#	66.8	25.7	79.4	#	#	9.8

Results for soil samples expressed as dry weight
\# : Analyte not requested

Summary Of Results
AEG - South Tees Industrial Area, Site C

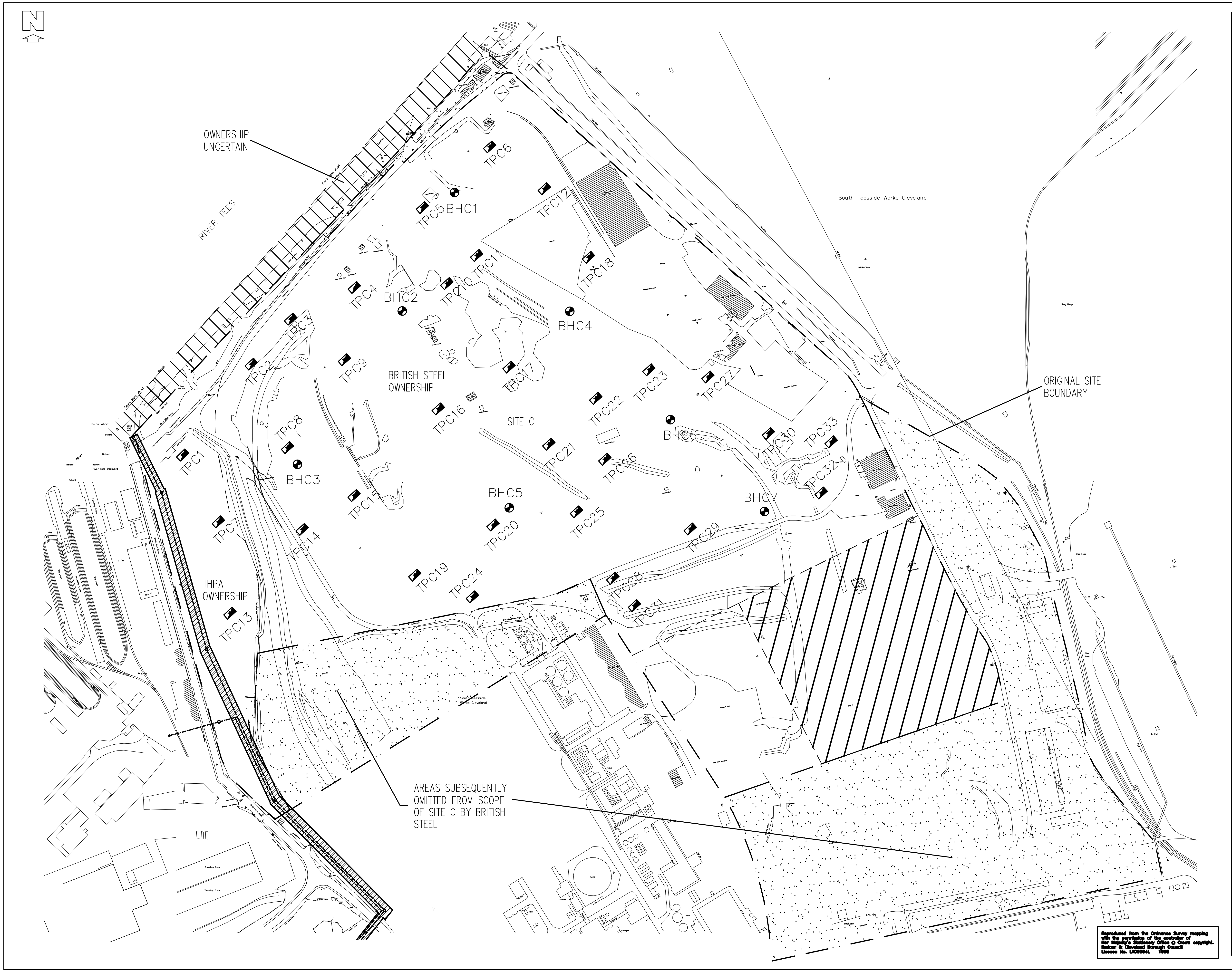
ANALYTES	UNITS	TPC2 J2 (0.10m)	TPC2 B5 (3.00m)											
		S9927363	S9927364											
Arsenic	mg/kg	6.7	11.7	#	#	#	#	#	#	#	#	#	#	
Cadmium	mg/kg	1.0	1.0	#	#	#	#	#	#	#	#	#	#	
Chromium (hexavalent)	mg/kg	<1.0	<1.0	#	#	#	#	#	#	#	#	#	#	
Chromium (total)	mg/kg	7.8	18.9	#	#	#	#	#	#	#	#	#	#	
Lead	mg/kg	10.6	11.6	#	#	#	#	#	#	#	#	#	#	
Mercury	mg/kg	<1.0	<1.0	#	#	#	#	#	#	#	#	#	#	
Selenium	mg/kg	5.9	3.9	#	#	#	#	#	#	#	#	#	#	
Boron (water soluble)	mg/kg	0.7	0.6	#	#	#	#	#	#	#	#	#	#	
Copper	mg/kg	<0.2	0.3	#	#	#	#	#	#	#	#	#	#	
Nickel	mg/kg	3.0	5.9	#	#	#	#	#	#	#	#	#	#	
Zinc	mg/kg	23.7	21.2	#	#	#	#	#	#	#	#	#	#	
Phenols	mg/kg	<1.0	<1.0	#	#	#	#	#	#	#	#	#	#	
Cyanide (total)	mg/kg	<2.0	<2.0	#	#	#	#	#	#	#	#	#	#	
Sulphate (total)	mg/kg	26476	21706	#	#	#	#	#	#	#	#	#	#	
Sulphide	mg/kg	198.4	876.9	#	#	#	#	#	#	#	#	#	#	
Sulphur (free)	mg/kg	317	936	#	#	#	#	#	#	#	#	#	#	†
pH	N/A	10.3	11.1	#	#	#	#	#	#	#	#	#	#	
TEM	mg/kg	390	1260	#	#	#	#	#	#	#	#	#	#	†
Sulphate (water soluble)	g/l	0.909	1.128	#	#	#	#	#	#	#	#	#	#	
PAH (total)	mg/kg	#	<10	#	#	#	#	#	#	#	#	#	#	†

Results for soil samples expressed as dry weight
: Analyte not requested

Summary Of Results
AEG - South Tees Industrial Area, Site C

ANALYTES	UNITS	TPC2 J2 (0.10m)	TPC2 B5 (3.00m)										
		S9927363	S9927364										
Mineral Oil	mg/kg	#	6.4	#	#	#	#	#	#	#	#	#	# †

Results for soil samples expressed as dry weight
: Analyte not requested



Notes:

KEY

▰ TRIAL PIT

◒ BOREHOLE

Revision	By	Checked	Approved	Date	Description

Client

One North East
St George's House
Kingsway
Team Valley
Gateshead
NE11 0NA

The Development Agency for the North East of England

Halcrow UK
Valley House Valley Street North Darlington DL1 1TJ
Tel 01325 365544 Fax 01325 365700
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Halcrow

Project

SOUTH TEES INDUSTRIAL AREA

Drawing

EXPLORATORY HOLE LOCATION PLAN
SITE C

Drawn by CAD/MJ **Date:** JUL 99
Checked by **Date:**
Authorised by **Date:**

Drawing No. SS/EPST/042 **Revision**

Drawing Scale: 1:2500

CAD Filename: EPST040 **Plot Scale:** TO FIT