BORD GÁIS

Limerick Gasworks
Dock Road, Limerick

Site Investigation Factual Report
Volume 1A

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0.0 EXECUTIVE SUMMARY

Appointment	Parkman Environment were appointed by Bord Gais Eireann in a letter dated 30th May 2000 to provide Engineering Consultancy Services for the decontamination / remediation of the former gasworks sites at Limerick and Waterford. This document comprises Volume 1 (factual information) of the Phase II (intrusive investigation) report for the Limerick Gasworks site.
Location	The site lies to the south-east of the Dock Road in the City of Limerick, approximately 100m from the River Shannon; the approximate National Grid Co-ordinates are E 157600 N 157200.
Site History	A limestone quarry extended over most of the eastern quadrant of the site prior to 1840. The gasworks was established to the north-west of the quarry in the 1830's. Several generations of gasworks producing 'town' gas occupied the site until gas manufacture was converted to oil - gas production in the late 1960's / early 1970's. The arrival of natural gas to Limerick in 1986 made the generating process redundant and most above ground structures were demolished by 1988.
Geology & Hydrogeology	The site is underlain by various thickness of Made Ground, overlying Lower Carboniferous Limestone (Visean Limestone); thin layers of Alluvium deposits have been identified in some locations overlying the bedrock. The Limestone is considered to be a locally important aquifer and due to limited drift cover could be considered vulnerable. The nearest recorded abstraction is 6 km to the south-east of the site.
Previous Site Investigations & Results	Two previous site investigations have been carried out on site in 1990 and 1995 comprising a total of 27 trial pits and 12 boreholes. Visual and olfactory evidence of organic contaminations was noted in a large number of exploratory holes, particularly over the south-western part of the site. Tarry staining was identified in the bedrock joints in four boreholes. Groundwater was contaminated with heavy oils and oozing tarry liquid particularly on the western side of the site. The results of leachate testing showed that the potential for leaching was low.
Recent Site Investigation	A total of 17 trial pits and 4 rotary boreholes were excavated between 26 February and 6 March 2001. Samples of soil and water were selected and sent to City Analytical Services plc (CAS) in Coventry, UK for subsequent chemical analysis. Samples were also taken for geotechnical analysis. Gas/water monitoring standpipes with taps were fitted to all 4 boreholes.
Services	All main services are present in Dock Road, St. Alphonsus Street and O'Curry Street; some gas services enter the site along the north-west boundary of the site and an electricity cable is shown running into the electricity sub-station from O'Curry Street. Private services may also exist on the site.
Development Issues	Three development options have been indicated for the site namely light commercial, residential (excluding townhouses with gardens), or car parking.

1.0 INTRODUCTION

1.1 Terms of Reference

Parkman Environment were appointed by Bord Gáis Éireann in a letter dated 30 May 2000 (ref. No. 00/004) to provide engineering consultancy services for the decontamination/remediation of the former gasworks sites at Limerick and Waterford. These services include the preparation of Phase 1 (Document Review) and Phase II (Intrusive Investigation) reports. This document comprises Volume 1 (factual report) of the the Phase II report for the Limerick gasworks site. Interpretation of the factual information is presented in Volume 2.

Bord Gáis propose to either dispose of the sites in their current condition or alternatively, remediate them ready for development.

The site reviewed in this report is based on the boundaries as defined by Bord Gáis Éireann at the time of the review. Parkman Environment prepared this Report based on the available information obtained during the study period. Every reasonable effort has been made to obtain all relevant information. Sources examined are listed in section 1.2 and particular references are listed at the end of this report.

Further details of statutory consultees, service companies etc can be found in the Phase I Desk Study Report No.25837/OR/01B.

This Report has been prepared and written for the exclusive benefit of Bord Gáis for the purpose of providing environmental information relevant to the existing potential environmental liabilities associated with the site in accordance with the Brief. The Report contents should not be used out of that context. Furthermore, new information, changed practices or new legislation may necessitate revised interpretation of the Report after the date of its submission.

1.2 Methodology

The preparation of the Phase II report involves a review of all current available site information, a review of the information collected during the recent site investigation and discussion of available remediation techniques.

In undertaking the study, the following sources have been consulted: -

Limerick Corporation - Environment, Community & Sport Department
- City Engineer's Department
Environmental Protection Agency
The National Library of Ireland
Geological Survey of Ireland
The Map Library, Trinity College, Dublin
Eircom Ireland
ESB
Bord Gais Eireann
GVA Donal O'Buachalla (Estate Agents)

Other references used in completing this report are provided in Section 4.0.

A walkover survey was undertaken on 13 July 2000 and Mr Michael Shouldice, the Site Manager for Bord Gais was interviewed by Parkman.

Site investigation works were carried out between 26 February 2001 and 6 March 2001.

GVA Donal O' Buachalla (Estate Agents) were also consulted with respect to potential future uses for the site.

1.3 Report Format

This Report (Volume 1) is sub divided into three sections. Following this Introduction [Section 1], the findings of the Phase I Desk Study are reviewed in detail [Section 2]. The information gathered during the recent site investigation is then presented [Section 3]. Finally, any relevant references are collated [Section 4]. All of these sections are summarised in tabular form in the Executive Summary [Section 0].

2.0 DESK STUDY ASSESSMENT

2.1 Site Location and Description

Limerick gasworks lies to the south-east of the Dock Road in the City of Limerick, approximately 100m from the River Shannon. The Shannon Bridge lies approximately 400m to the south-east of the site. The approximate National grid co-ordinates of the site are E157600 N157200.

Access to the site is either from Dock Road, which forms the north-western site boundary, or from O'Curry Street forming the north-eastern boundary.

The site is approximately rectangular, 130m x 110m, and covers an area of 1.4 hectares (3.5 acres), including the "house pound" area in the northern corner, adjacent to the junction of Dock Road and O'Curry Street. Part of the site was a former limestone quarry and rock faces are evident in the north-eastern and south-eastern boundaries.

The main area of the site is generally level at about 5.00m OD [Malin Head Datum] but it rises to approximately 8.00m OD towards the site boundaries to the south and east.

The site is used as a depot for Bord Gais, and includes a two-storey office adjacent to the south-west boundary. Other buildings on site include a derelict former store building constructed of stone in the eastern corner and various other smaller brick buildings including the former No.'s 3 & 4 Store, the former Naphtha Process Control building (two-storey), ESB sub-station and the former Governor House.

In addition, high stone walls remain around the location of the former gasholder No 2 (T12) whilst the concrete bund walls and slab are present around the former Tank No 1 (T31). An above ground installation [AGI] remains towards the north west corner of the site adjacent to the site access from Dock Road.

The north-eastern boundary along O'Curry Street comprises a 2m high limestone block wall that becomes higher (3.5m) halfway along the boundary towards the south-east. The south-eastern boundary comprises a 6m high limestone block wall that retains the adjacent Garda training centre, at a level some 2m above the Bord Gais site level. This wall becomes a 3m high brick retaining wall (which retains limestone fill on the site side) in its south-western end adjacent to residential properties. The south-western boundary comprises a 2.5m high brick wall, which retains fill to 2.5m on the site side. The north-western boundary along Dock Road comprises a 2.5m high limestone block wall.

A recent survey of the boundary walls was undertaken by Parkman in March 2001; the findings are presented in report no.25837/OR/02 (see section 2.6.4).

2.2 Statutory Authorities/Services

Limerick Corporation report that they are not aware of any other substantial sources of contamination within 500m of the gasworks site.

There are no known landfills or cases of statutory nuisance within 500m of the site. Limerick Corporation sewers presently discharge into the River Shannon although a new main drainage scheme is currently being constructed and will subsequently collect all such discharges and route them to a new sewage treatment facility. No other discharges are made into the river. Correspondence with Limerick Corporation is included in Appendix F.

All main services are provided along the Dock Road, St. Alphonsus Street and O'Curry Street. Electricity cables are shown running into the electricity sub-station from O'Curry Street. Bord Gais pipelines are shown entering the AGI in the western corner of the site. Low pressure 180mm PE gas pipes also exist in the site along the eastern end of the Dock Road boundary. Private services may also exist on the site.

Figures 3a-e show the layout of services in relation to the site at a scale of 1:1000

2.3 Geology, Hydrology and Hydrogeology

The Geological Survey of Ireland, Sheet 17, Limerick, 1:100,000 Scale (ref. 7), the "Geology of the Shannon Estuary" (ref. 8) and the local geological memoir were consulted and indicated that the bedrock beneath the site comprises the Visean Limestones of the Lower Carboniferous Period. These limestones are 'oolitic' (small (≤1mm diameter) carbonaceous accretionary bodies cemented together, resembling fish eggs) in places, representing a shallow marine carbonaceous shelf depositional environment. These deposits occasionally contain clay 'wayboards' which formed when the limestone was periodically exposed above sea level. The limestone often contains chert nodules (siliceous concretions) and thin interbedded shales. The Visean Limestone is also known as 'Clean Shelf Limestone'. It is over 800m thick and lies conformably on the Waulsartion Limestone, described as a massive unbedded lime mudstone representing a deeper marine depositional environment.

Beneath the site, the beds dip 8° to the north. The site is located on the southern limb of an east-west trending syncline.

The rockhead is close to the surface with little or no drift cover. Should any be present, it is likely to comprise very recent fill [made ground used as backfill in the construction of the gasworks and infilling of the quarry] or Recent alluvium associated with the River Shannon flood plain.

Previous site investigations (section 2.5) and the recent investigation (section 3.0) identify that Alluvial material is present although its thickness does not exceed 4.4m.

The site is situated on the southern bank of the Shannon River, which flows westwards towards the Atlantic Ocean. The Shannon River will be tidally affected at this point.

The site comprises approximately 60% hard cover and 40% free draining material (with many underground structures that may impinge on the flow of water through

the made ground). There is a slight fall in the site level from the south-east (3m OD) to the north-west (5m OD), and so any surface infiltration that does not enter the surface drainage system will tend to flow in the fill materials towards the north-west corner, i.e. towards the River Shannon. The River Shannon water level is typically 3m OD near the site.

Drainage of the site is to the city's sewers, which discharge directly into the river. The 'Site Investigation Report - Limerick Gasworks Site' (ref 2) records that storm water flooding has occurred in the past along the Dock Road at its junctions with O'Curry Street and Alphonsus Street, i.e. close to the site.

The maximum recorded flood level for the City is reported as 4.25m OD. (Malin Head)

The Groundwater Protection Maps for County Limerick (Maps 1-6) (ref. 6) indicate that the Clean Shelf Limestone is a 'Locally Important Aquifer' that is generally Moderately Productive (40-100m^3/d). The aquifer is controlled by fissure flow and well-developed karst features have been observed in the area. The nearest abstraction well is 6 km to the south-east of the site. The oolitic limestones of the Limerick Syncline are known to have relatively high permeabilities. The aquifer is considered 'Vulnerable' due to the lack of impermeable cover.

The majority of the ground water is hard, containing calcium bicarbonate ($Ca(HCO_3)_2$). Iron and manganese have been found in elevated concentrations west of Limerick. Elevated nitrates have been encountered in some locations due to agricultural activities. Groundwater quality of smaller, shallower sources is generally poorer than the larger, deeper sources.

There are no recorded active wells or boreholes in the vicinity of the site although the historical site plan dated 1977 shows a well 5m to the north west of Gasholder No3 (T11).

It is likely that hydraulic continuity exists between the Made Ground/Alluvial deposits and the bedrock.

The recent investigation has identified that there is a shallow hydraulic gradient to the north west towards the River Shannon.

The proximity of the site to the tidal inlet of the River Shannon would suggest the potential for groundwater on site to be tidally affected. The recent investigation has found little evidence of tidal influence.

2.4 Site History

An extract from the Autumn 1987 Limerick Journal entitled "150 Years of Limerick Gas" (ref.10) provided a background history to the site.

The article states "In 1826, the London-based United General Gas Company took over the Hibernian Gas Company in Dublin and soon began to spread its operations to the large urban areas throughout the country. It set up businesses in Limerick in the 1830's and became the sole manufacturer of gas in the city. But the service

was very poor and the people's patience became so exhausted that in the year 1837 a public protest meeting was convened in the City Courthouse.... shortly afterwards, the newly reformed Corporation purchased premises in Watergate for the manufacture of gas, with the aid of a loan of £24,000. In 1878 following a Parliamentary enquiry and the passing of the Corporation Gas Act, the Local Authority took over the private firm and in 1884 moved from Watergate to the more spacious premises at the Dock Road."

Coal based gas manufacture is reported to have continued on site until the early 1970's and the article also states that "it was only in 1974 that the new catalytic oil-gas plant was finally completed in the city.....in 1986, natural gas was piped to Limerick on a spur line from the main Dublin-Cork pipeline. In early 1987, new natural gas pipelines were laid throughout the city and the change over from 'town' gas was complete. The old manufacturing process has been rendered obsolete and the plant at the Dock Road is nothing more that a relic of industrial archaeology."

The following table overleaf summarises the history of the site:

Table 2.4 - Summary of Historical Site Features

Date of Historical Map

Feature	1840	1844	1872	1902	1919	1938	1943	1954	1977	1982	1988	1991	1995
Lime Stone Quarry	■	■	■	■									
Tank T13	■	■	■										
Tanks T14-T19	■	■											
Tank T23			■	■	■	■	■						
Tank T28			■	■	■	■	■	■	■	■	■		
Lime Kilns (2 no.)			■	■									
Tanks T29 & T30				■	■	■	■	■					
Tank T11				■	■	■	■	■	■	■	■		
Cattle Pens				■	■	■	■	■					
Electricity Station					■	■	■						
Tanks T20-T22				■									
Tank T7					■								
Tank T25						■	■	■					
Tanks T1 & T2									■	■	■		
Tank 31									■	■	■		
Tank T24, T26, T27, T32, T33, T3-T6, T8-T10, (associated with oil-gas plant)									■				
Tank 12 *										■	■		
Bord Gais Offices											■	■	■

- Tank T12 is known to have been constructed in 1978 although it is not shown on the 1982 map.

■ Feature Present

Feature Not Present

2.5 Assessment of Previous Site Investigations

2.5.1 Description of Works Undertaken

Two site investigations have been carried out previously to assess the level of contamination on site.

The first was carried out in 1990 by Gibb Environmental (environmental sampling) and Irish Geotechnical Services Limited (trial pitting and borehole excavation) under the direction of O'Connor Sutton Cronin and Associates Limited (ref.1) and comprised ten trial pits to between 1.4m and 2.3m deep and six boreholes to between 4m and 7.6m depth; the latter to prove rock.

Twenty-one soil samples were analysed for pH, sulphate, sulphide, cyanide (total & free), phenols, and toluene extractable material, with four also analysed for speciated PAH's and calorific value. Four water samples were analysed for pH, ammoniacal nitrogen, sulphate, total organic carbon (T.O.C), total cyanide and total phenols as tar acids. One sample of water and one sludge sample were analysed for speciated PAH's.

The second investigation was carried out by K T Cullen and Company and Glover Site Investigations Limited under the direction of Ove Arup & Partners in 1995 (ref.2) and comprised 17 trial pits to between 0.15 m and 3.7m deep and 6 boreholes to between 5m and 11.8m deep and 5 surface (scraped) samples.

Fifty-five soil samples were analysed for pH, sulphates, total cyanide, toluene extractable material and total phenols. Based on the results obtained, selected samples were then subjected to analysis for dependant options comprising PAH'S, BTEX, free & complex cyanide, thiocyanate and water soluble sulphate.

In addition, selected samples were also analysed in respect of metals, mineral oils and total VOC's and a further two were the subject of a leachability test.

Twenty-three water samples were taken and analysed for a suite comprising total phenols, sulphide, ammoniacal nitrogen, total cyanide, speciated PAH's, pH, temperature and conductivity. Eleven samples were also subjected to a suite of tests including organic and inorganic determinands.

Monitoring was carried out subsequently on two occasions in respect of groundwater levels and gas levels.

The results of both investigations are reported and discussed in Ove Arup's April 1996 Site Investigation Report on Limerick Gasworks Site (ref. 3).

2.5.2 *Details of Ground Conditions*

The following succession of strata was identified from the two previous investigations: -

Table 2.5.2 Summary of ground conditions

Stratum	Thickness (m)	
	Range	Average
Made Ground	0.2 - 7.3	2.6
Alluvium	0.0 - 4.4	1.8
Limestone	4.2m proven	

The Made Ground was found to be variable in nature and consistency. The exploratory holes describe the made ground as variable but predominately granular.

The Made Ground contains sand, gravels, cobbles, clays, brick rubble, spent oxides, ash, concrete etc. and was often contaminated with tarry liquid and occasionally has a strong phenolic odour. The deepest thicknesses of made ground are associated with either the old quarry or former tanks that extended underground.

The Alluvial deposits were found in at least three excavations (BH11, TP7 and TP27) towards the northern end of the site beneath the Made Ground, and were described as soft to firm brown plastic silty clays. Some materials encountered in other excavations, may have also been Alluvial deposits although it was unclear from the descriptions provided.

The top 0.5m to 1.0m of the bedrock was generally weathered and comprised of gravel to boulder size fragments of angular limestone. Below this level the bedrock comprises strong dark to medium grey coarse grained fresh, bedded Limestone. Total Core Recoveries (TCR) were in the range 14% to 100% with an average of 76%. Rock Quality Designation (RQD) values were also in range 14% to 100% with an average of 64%. The rockhead was often described as "stained with black tar" over a depth of upto 3m.

The bedrock surface was found to be very uneven due to previous quarrying activities and excavation for underground tanks and tank foundations. The natural slope of the bedrock is from approximately 7m OD at the southern boundary to 3m OD at the northern boundary.

Groundwater was encountered in all of the trial pits and boreholes at depths between 0.3m and 2.8m in the Made Ground. The general direction of groundwater flow was found to be north/north-west towards the River Shannon from a level of approximately 7m OD on the southern side of the site to approximately 4m OD on the northern side of the site (The River Shannon water level is typically 3m OD near the site).

2.5.3 *Details of Analysis*

Initial screening of the site investigation data has been undertaken using the UK ICRCL Threshold Trigger Values (least sensitive end use), for soils (where available), with the Dutch Intervention Values considered for soil contaminants not covered by the ICRCL list. The only exception to this is in the case of PAH where screening assessment criteria has been set at the Acton Trigger Level for the most sensitive end use.

This screening provides a basic assessment of the areas of site requiring remedial action, although it is recommended that a site specific quantitative risk assessment be carried out to establish remedial action values.

In general, the most significant soil contamination at Limerick gasworks was organic, with evidence of heavy staining by tars and tarry liquid with a phenolic odour being encountered in most of exploratory holes, particularly over the south western part of the site. Tarry staining penetrated into the bedrock joints in BH's 7, 8, 10 and 11. Elevated levels of organic contaminants were encountered in TP's1, 2, 8, 15, 19, 22, 23 and 24, mostly in the vicinity of former tanks. The contamination is most likely due to spillages and leaks from the tanks. Visual evidence of spent oxide ("blue billy") was encountered in the central area of the site (old quarry area).

Elevated sulphate levels occurred throughout the site except in the western part of the site where cleaner fill had been placed in recent years. Elevated cyanide levels occurred mostly along the central strip of the site. Elevated sulphur and sulphide levels occurred randomly but mostly around the central part of the site.

Generally there were no significantly elevated metal levels found at the site with the exception of the area around the chimney of the original gasworks (in the vicinity of T12), the elevated levels apparently being associated with ash from burning.

The groundwater encountered in the trial pits on the western side of the site were contaminated with heavy oils and oozing tarry liquid. Floating product with globules of tarry material was detected in three of sixteen trial pits, these are associated with buried structures (e.g. tar tanks). Tarry liquid was discovered to have penetrated downwards into the joints of the bedrock across the central area of the site.

Elevated levels of contaminants in groundwater occurred in generally the same areas as elevated levels of soil contamination, possibly suggesting that the groundwater is not very mobile. Generally, no significantly high metal concentrations were detected in the ground water except in trial pits in the area of the old gasworks (near T12).

The results of chemical testing on the surface samples scraped from the masonry walls around the site showed elevated levels of sulphates and various organics.

The results of leachate testing showed that the potential for leaching was low, the

measured concentrations being less than 0.1% of the original value. The exception was that 28% of the phenol in TP15 was extractable following leaching.

A second set of groundwater samples were taken about six weeks after the initial sampling. There was no significant difference in the results, one possible exception was BH8, where there was a significant increase in the concentration of phenol and a decrease in the concentration of PAH's. These results were associated with a significant decrease in temperature of the sample.

Elevated levels of methane (>1%) were recorded within borehole monitoring installations during a total of seven visits in BH's 7, 8 and 10 although the most significant levels (upto 90%) were recorded in BH12. The levels of methane recorded were generally significantly higher than the explosive limit (5 - 15%). The velocity of the gas flow was measured and found to be negligible. A tube sample of gas was taken from BH12 and analysed using GCMS. Traces of Kinsale Natural Gas were detected, suggesting that the elevated methane levels may have been due to a leak in a nearby gas main. During the recent site investigation BH33 was drilled approximately 30m from the location of BH12. A methane level of 0.3% was recorded at BH33 during the first monitoring visit.

Levels of carbon dioxide ranged between 1.7 - 3.2% in BH's 7, 8, 10 and 12. Levels of oxygen were reduced significantly in all boreholes and were accompanied by elevated levels of carbon dioxide and methane. No hydrogen sulphide was found in any of the standpipes.

Please refer to Figure 6 in the Desk Study Phase I Report (Report No. 25837/OR/01B) for previous exploratory hole locations.

2.6 Development

2.6.1 Development Options

GVA Donal O'Buachalla have indicated in correspondence that the site may be suitable for three potential uses as listed below: -

i. Commercial offices, retail, leisure, car sales etc.

ii. Residential, but excluding townhouses with gardens.

iii. Car park, either a surface or multi-storey.

It is noted that storm water flooding has occurred in the past along the Dock Road at its junctions with O'Curry Street and Alphonsus Street and consequently Limerick Corporation require a minimum floor level of 4.7m OD for any new development. The maximum recorded flood level for the City is reported as 4.25m OD (Malin Head).

It is likely that the No. 5 Stores building in the eastern corner of the site will remain as a part of any proposed development.

2.6.2 *Access*

Current site access is either via Dock Road, which forms the north-western site boundary, or from O'Curry Street forming the north-eastern boundary. The site access from O'Curry Street was not secured, at the time of the site visit and does not appear to be generally locked. The access gate off Dock Road is the main access to the site for Bord Gais personnel and is kept locked and secure when the site is not in use.

The current site access off Dock Road would be considered most suitable with respect to the proposed uses of the site although the access from O'Curry Street may be appropriate for small vehicles such as cars.

2.6.3 *Services*

All main services (gas, electricity, telecommunications, water and sewerage) are present in the Dock Road and O'Curry Street. Electricity cables are shown running into the electricity sub-station from O'Curry Street. Bord Gais pipelines are shown entering the AGI located in the western corner of the site. Low pressure 180mm PE gas pipes also exist in the site along the eastern end of the Dock Road boundary.

In view of the above and further to initial discussions with the statutory utilities, there should be no problems in providing these services at the site. However, detailed discussions will be required to determine the most appropriate connections to existing services, once the precise requirements of the development are known.

2.6.4 *Boundary Conditions*

Existing site boundaries comprise a 2m high limestone block wall (which becomes higher (3.5m) halfway along the boundary towards the south-east) along the north-eastern boundary along O'Curry Street. The south-eastern boundary comprises a 6m high limestone block wall that retains the adjacent Garda training centre at a level some 2m above the Bord Gais site level. This wall becomes a 3m high brick retaining wall (which retains limestone fill on the site side) along its south-western end, adjacent to residential properties. The south-western boundary comprises a 2.5m high brick wall, which retains fill to 2.5m on the site side. The north-western boundary along Dock Road comprises a 2.5m high limestone block wall. The boundaries are considered generally secure at present, although trespassers can gain access over a low wall along O'Curry Street or via the gates on O'Curry Street which do not appear to be generally locked.

A survey of the boundary walls has been carried out by Parkman (report No. 25837/OR/02) on the 6th and 7th March 2001. The report concludes that in places the walls are in a poor state of repair and it is recommended that they are demolished prior to remediation, especially in areas when excavation is required close to the walls.

3.0 SITE INVESTIGATION

3.1 Field and Laboratory Work

The recent site investigation was planned and supervised full-time by Parkman Environment who also scheduled the analysis of soil, water and leachate samples. The ground investigation was carried out by Geotech Specialists Limited. A total of 17 trial pits and 4 rotary boreholes were excavated between 26 February and 6 March 2001. Trial pitting was conducted using a JCB 3CX excavator. Rotary holes were drilled using a Soil Mech 215 rig. These exploratory holes were set out to identify the location of underground structures associated with building foundations, various former tanks, the depth and nature of made ground and the underlying natural strata and to allow construction of gas/water monitoring installations. The locations of the exploratory holes are shown on Drawing No. 25837/OB/01.

Samples of soil and water were selected and sent to City Analytical Services plc (CAS) in Coventry, UK for subsequent analysis. Analyses were carried out in accordance with British Gas Property "Guidance for Assessing the Potential Contamination on Gasworks Sites" Version 2.4. The results of contamination analyses are included in Appendix A; trial pit and borehole logs are presented in Appendix B, and photographs taken during the investigation are included in Appendix G. Bulk samples were taken for geotechnical analysis. The results of the geotechnical testing carried out are included in Appendix D.

Gas monitoring standpipes with taps were fitted to all four boreholes. These took the form of slotted pipes surrounded with gravel, sealed at the surface with bentonite clay and covered with vandal proof covers.

Monitoring of water levels within all installations (including boreholes from previous investigations that still remain) has been undertaken on one occasion to date, on 5 April 2001.

On-site monitoring of gas by GA-90 infrared detector from the recent installations has been undertaken on one occasion to date, on 2 April 2001.

Groundwater samples were also taken from the gas/water monitoring installations. Samples were sent to CAS plc for analysis.

Details of the water and gas monitoring are included in Appendix C.

Samples were obtained from two local quarries and sent to CAS for analysis. The samples were taken to provide information on potential sources of backfill during any future remediation works. The results of the chemical analysis are included in Appendix A.

3.2 Health and Safety Aspects

With respect to the Ground Investigation Works the site was classified as "Red" in accordance with "Guidelines for the Safe Investigation by Drilling of Landfills and Contaminated Land", published by Thomas Telford. A Health and Safety Hazard

Assessment was prepared by Parkman Environment as part of a Pre-Tender Stage Health and Safety Plan (Report No. 25837/OU/01 dated December 2000) in connection with the site investigation works. The Health and Safety Hazard Assessment is included in Appendix E.

With respect to the planned Site Remediation works, a Safety Plan should be produced including a hazard assessment of the site, a consideration of the management of safety on the site and specific measures to be observed during the works including the following:

* Site development personnel, especially those in direct contact with fills, should observe a reasonable standard of personal hygiene, washing facilities being made available.

* Boots, overalls and gloves should be worn by persons working in close proximity to fill materials (Excavation, trenches etc). In addition to these protective measures, full filter masks should be worn and monitoring of volatile organic compounds should take place wherever tar, ammoniacal liquor etc. is encountered.

* To eliminate any risk of hand to mouth transfer of potentially harmful material, smoking, eating and drinking should be prohibited for on-site personnel.

* It is important that dust should be minimised by utilising appropriate suppression measures. If dust should arise, the wearing of simple dust masks is recommended.

* As with any site containing contaminated fills, no matter how thorough the investigation, there is a finite risk of encountering previously unidentified hot spots of highly contaminated material. Site development personnel should be made aware of this, and any suspect material, tanks, etc be treated with some circumspection. If necessary, the advice of a senior environmental chemist should be sought.

A Project Supervisor (Design) must also be appointed for the Remediation Works in accordance with the Safety Health and Welfare at Work Regulations 1995. It is the responsibility of the Project Supervisor (Design) to co-ordinate Health and Safety aspects of the design and planning phase and for the early stages of both the Safety Plan and Safety and Health File.

3.3 Quality Assurance

3.3.1 General

All site work was specified and carried out in accordance with "Guidance for the Safe Investigation by Drilling on Landfills and Contaminated Land" published by Thomas Telford (Site Designation - Red).

3.3.2 *Chemical Testing*

Samples were taken during the excavation of exploratory holes for chemical analysis. Samples were given identification codes and submitted to the laboratory operated by City Analytical Services (CAS) plc, UK for chemical analysis in accordance with British Gas Property "Guidance for Assessing the Potential Contamination on Gasworks Sites" Version 2.4. CAS is a NAMAS accredited laboratory and is approved by British Gas Property. The following quality assurance procedures were implemented in the laboratory for the analysis of the samples from the Limerick Gasworks site.

i. One in every twenty samples were duplicated.
ii. A reagent blank is included in each batch of samples.
iii. Laboratory standards are run with each batch. If the lab standard fails, all samples in that batch are re-analysed.
iv. Quality control charts are maintained for all parameters.
v. External certified reference materials are analysed at regular intervals, one being from the 'Community Bureau of Reference' (BCR 144), the other from the 'Laboratory of the Government Chemist' (LGC 6138).
vi. The lab participates in the following external proficiency schemes -
    a) CONTEST-soils
    b) LEAP-waters
    c) WASP-filters

3.3.3 *Geotechnical Testing*

Samples were taken during the excavation of the exploratory holes for geotechnical analysis. All samples were taken in accordance with British Standard 5930. Samples were analysed by Geotech Specialists Limited's laboratory in Castlemartyr, Co. Cork. Geotechnical tests included Undrained Multistage 106mm Triaxials, Permeability in Triaxial Cells, Moisture Content, Atterberg Limits, and Particle Size Distribution on soil samples. Testing was conducted in accordance with British Standard 1377.

PARKMAN

4.0 REFERENCES

1. O' Connor Sutton Cronin (1995), "Summary Report on Limerick Site", ref. B87, August 1995.

2. Ove Arup &Partners (1996), "Site Investigation Report - Limerick Gasworks Site", ref. D1078/3, Volumes 1 (Report) and Volume 2 (Factual Site Investigation Data). April 1996.

3. Ove Arup & Partners (1996), "Report on Site Remediation Options", ref. D1078, April 1996.

4. Ove Arup & Partners (1996), "Report on Contamination Guidelines", ref. D1078, April 1996.

5. Charles J.O' Sullivan (1987), The Gasmakers - Historical Perspectives on the Irish Gas Industry", Irish Gas Association.

6. Groundwater Protection Maps For County Limerick (Maps 1-6)

7. Geological Survey of Ireland, Sheet 17, Limerick, 1:100,000 Scale.

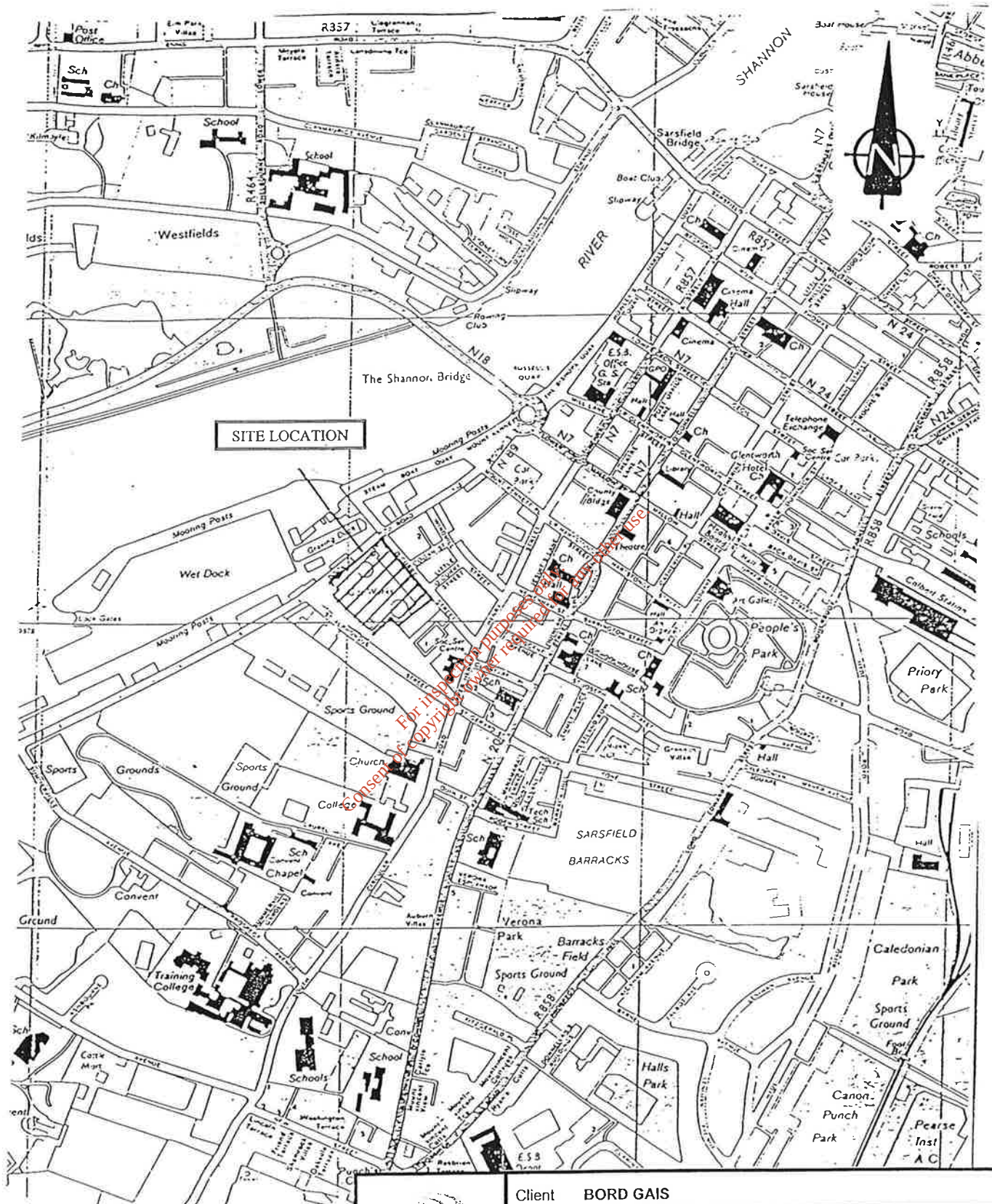
8. Geological Survey of Ireland, "Geology of the Shannon Estuary"

9. British Gas Property Holdings Ltd, "Guidance for Assessing and Managing Potential Contamination on Former Gasworks and Associated Sites (Version 2.5)" (May 2000)

10. Extract from Limerick Journal, Autumn 1987, "150 Years of Limerick Gas".

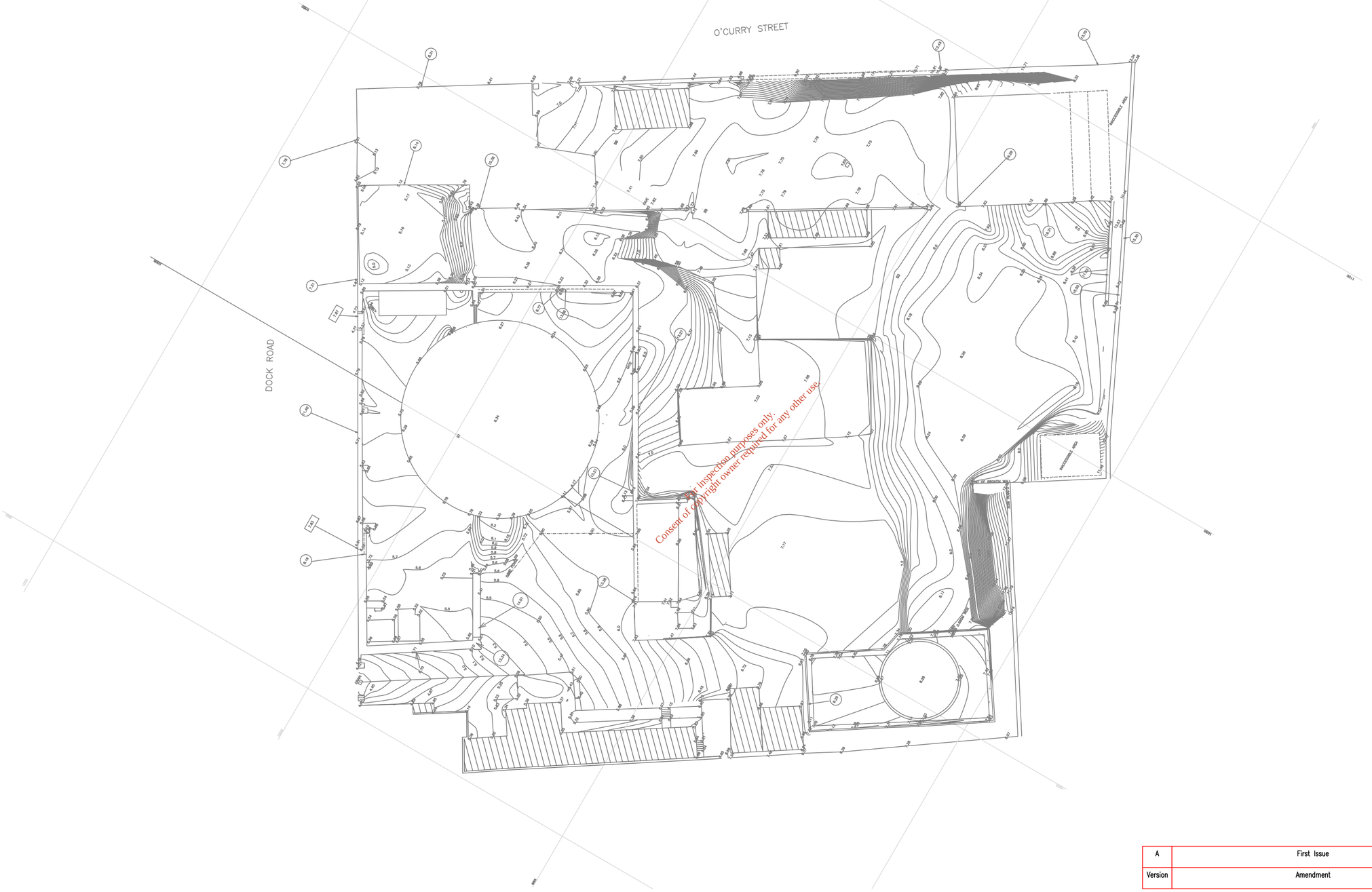
11. Parkman Environment (2000), Limerick Gasworks, Dock Road, Limerick, Preliminary Safety and Health Plan

12. Parkman Environment (2000), Limerick Gasworks, Dock Road, Limerick, Desk Study-Phase I Report



PARKMAN

Client	BORD GAIS		
Project	LIMERICK GASWORKS SITE		
Title	SITE LOCATION		
Purpose REPORT	Draft		Scale 1:10,560
	Issue	•	
Issuing Office CHESTER	Drawing number FIGURE 1		Version A
Telephone 0151 3565555			



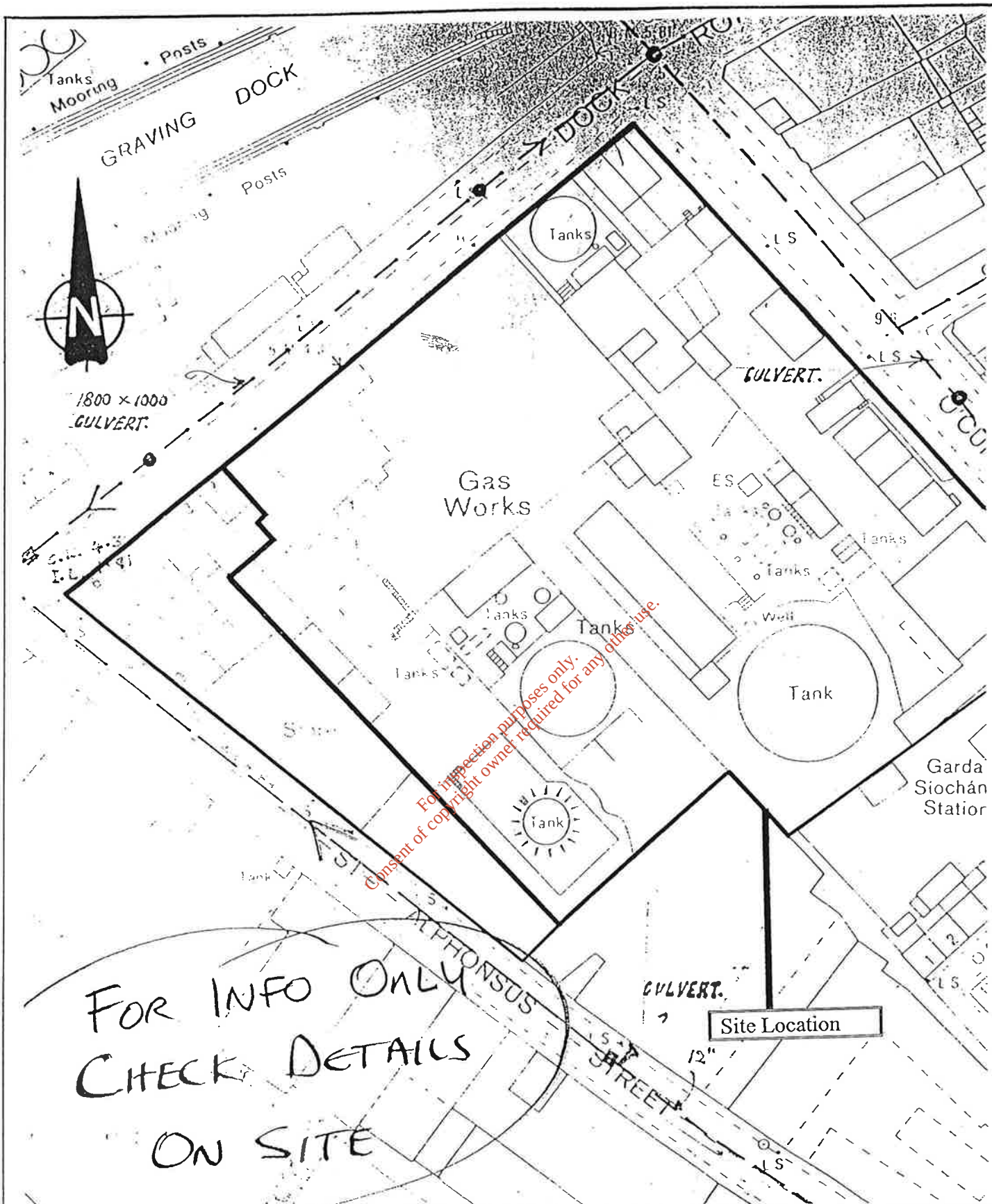
Version	Amendment	Originated by and date	Checked by and date	Approved by and date
A	First Issue	15.10.01	D.H. 15.10.01	T.B. 15.10.01

PARKMAN

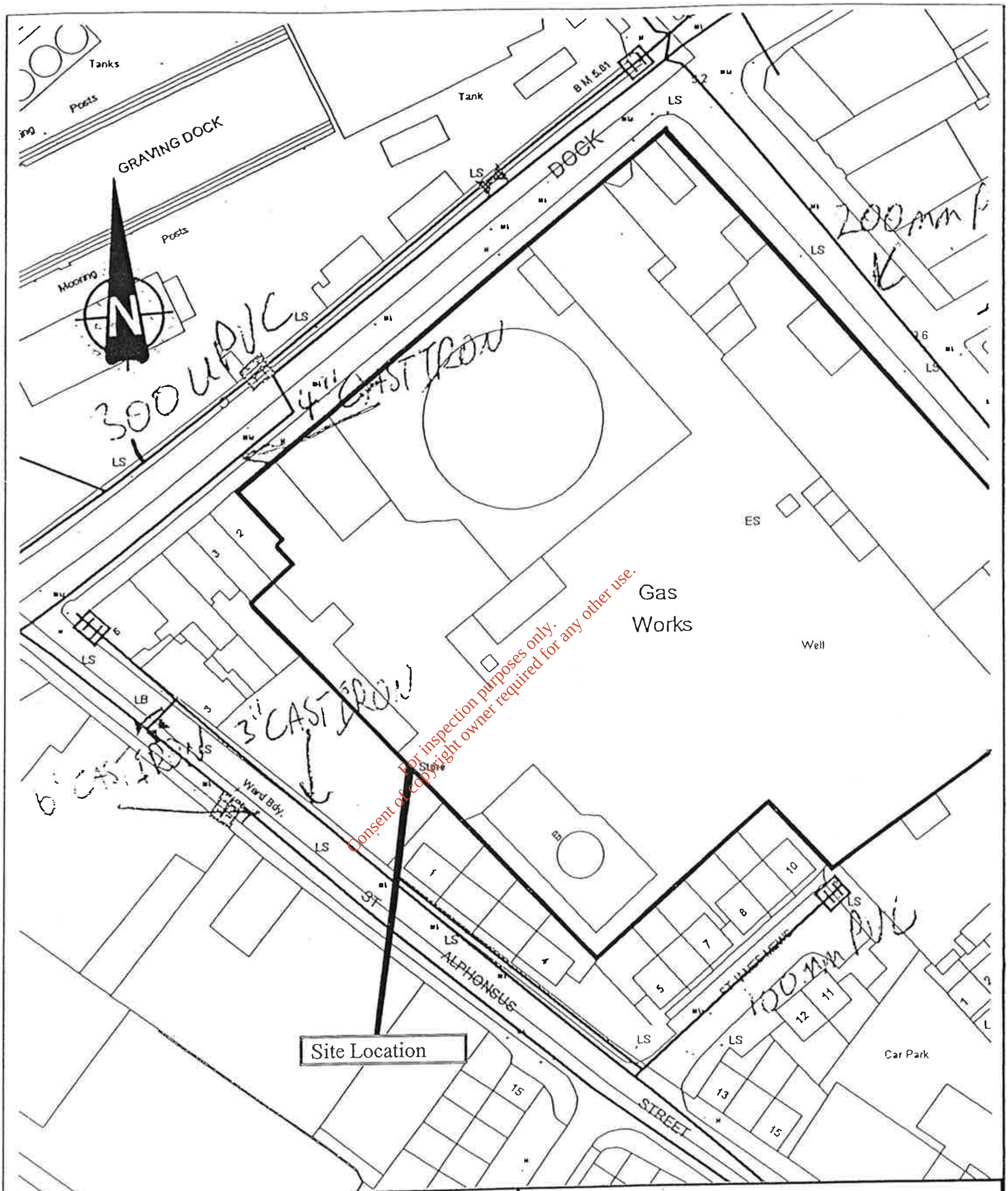
BSI REGISTERED FIRM — Certificate no. FS 15024

NATIONAL ACCREDITATION OF CERTIFICATION BODIES

Client	Bord Gas
Project	Limerick Gasworks
Drawing Title	Topographical Survey
Purpose	Information
Draft	
Issue	●
Scale	1:500(A2)
Issuing Office	Cheshire
Telephone	0151 356 1666
Drawing Number	Figure 2
Version	A

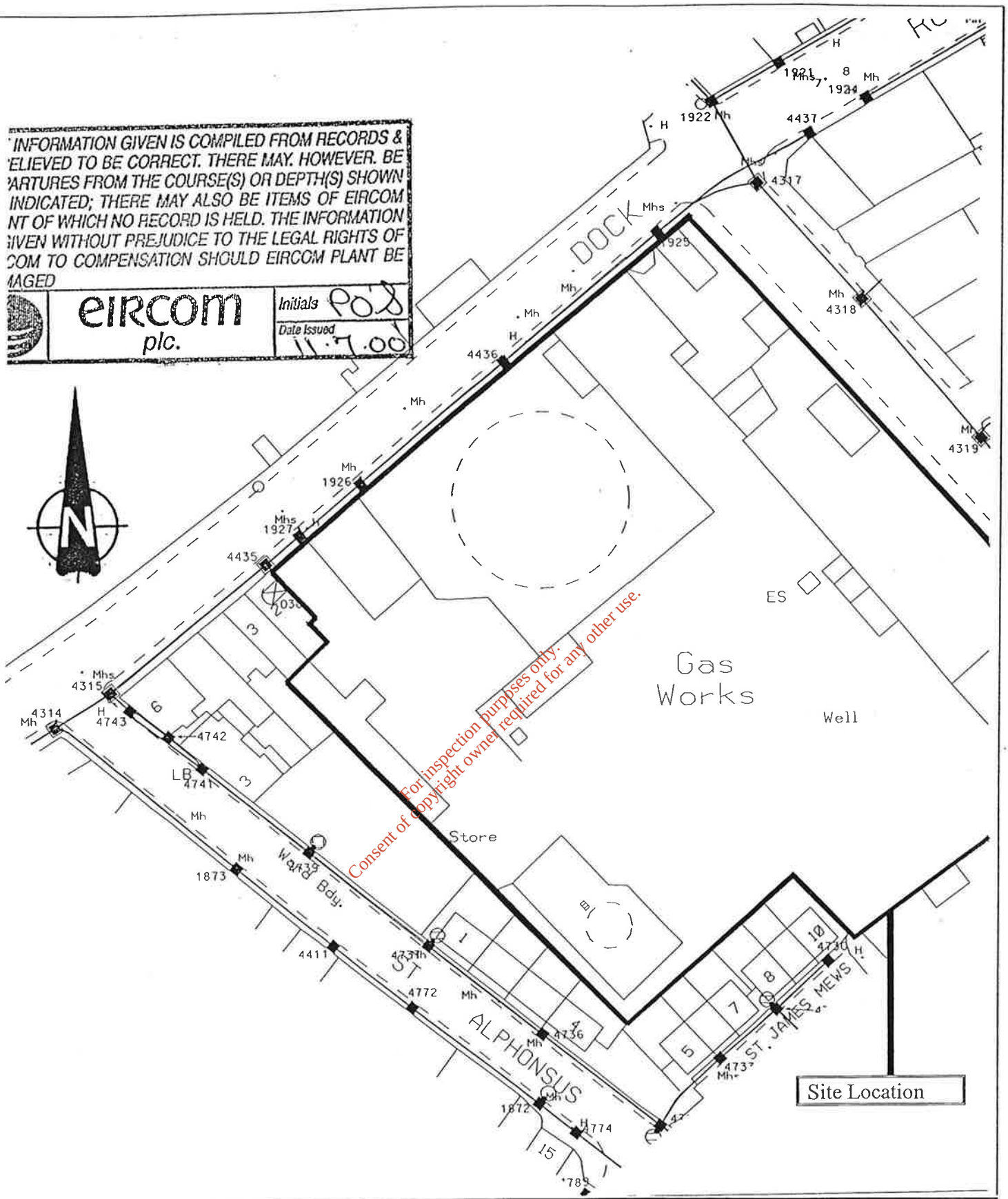


PARKMAN	Client BORD GAIS			
	Project LIMERICK GASWORKS SITE			
	Title SERVICE LOCATION PLAN (SEWERAGE)			
	Purpose REPORT	Draft		Scale 1:1,000
		Issue	•	
	Issuing Office CHESTER	Drawing number FIGURE 3A		Version A
	Telephone 0151 3565555			

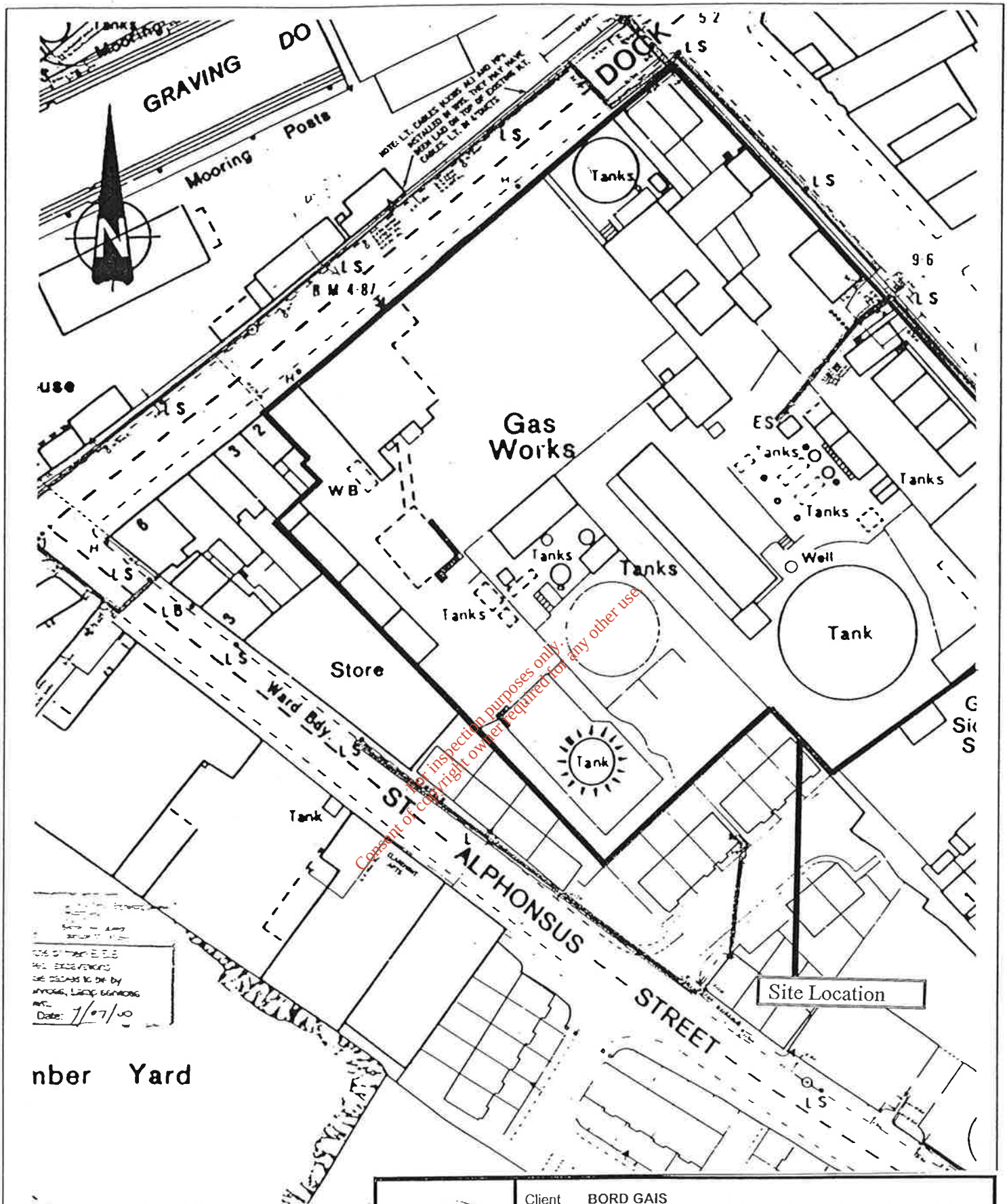


Client	BORD GAIS
Project	LIMERICK GASWORKS SITE
Title	SERVICE LOCATION PLAN (WATER MAINS)
Purpose	REPORT
Draft	
Issue	•
Scale	1:1,000
Issuing Office	CHESTER
Telephone	0151 3565555
Drawing number	FIGURE 3B
Version	A

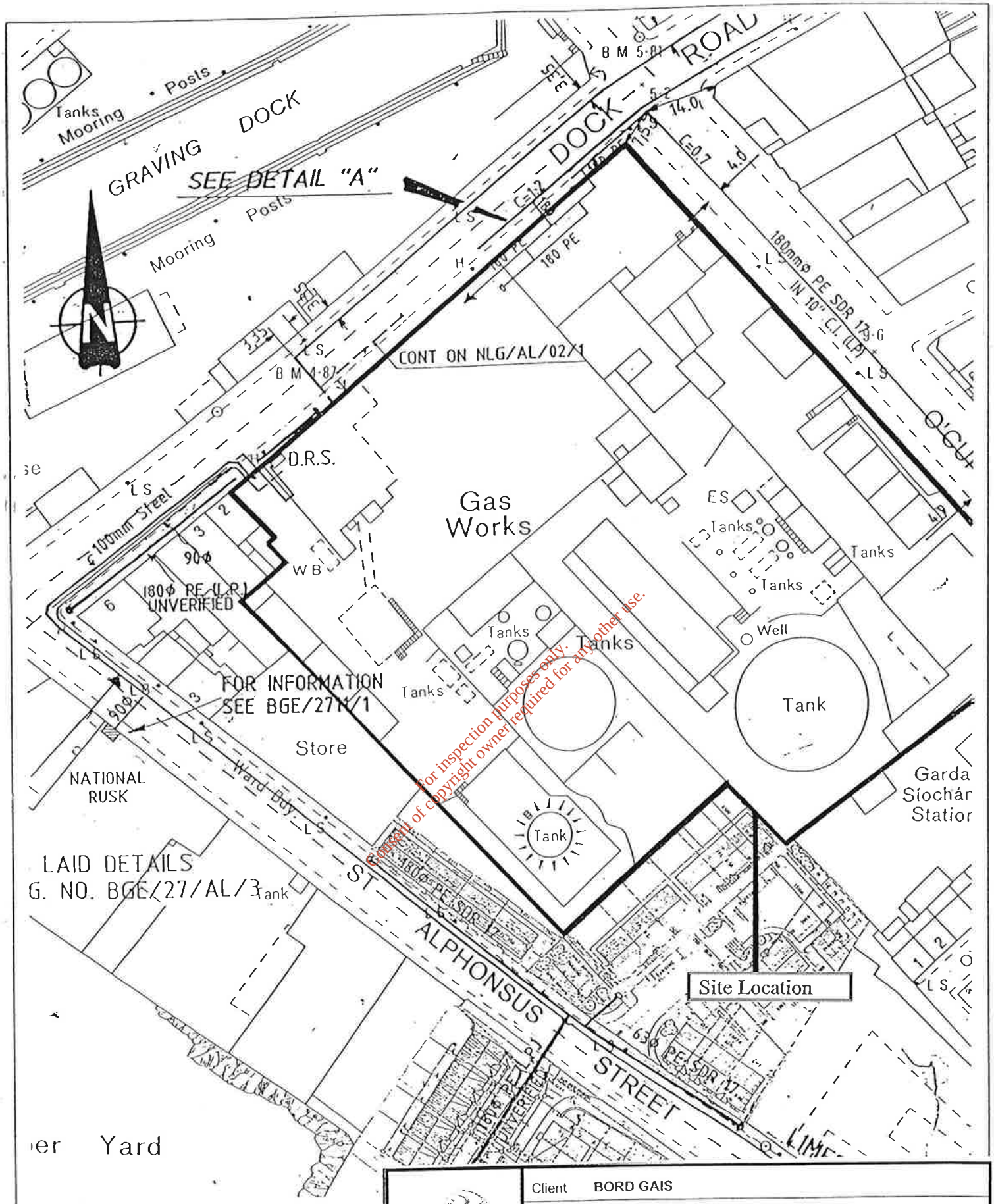
PARKMAN



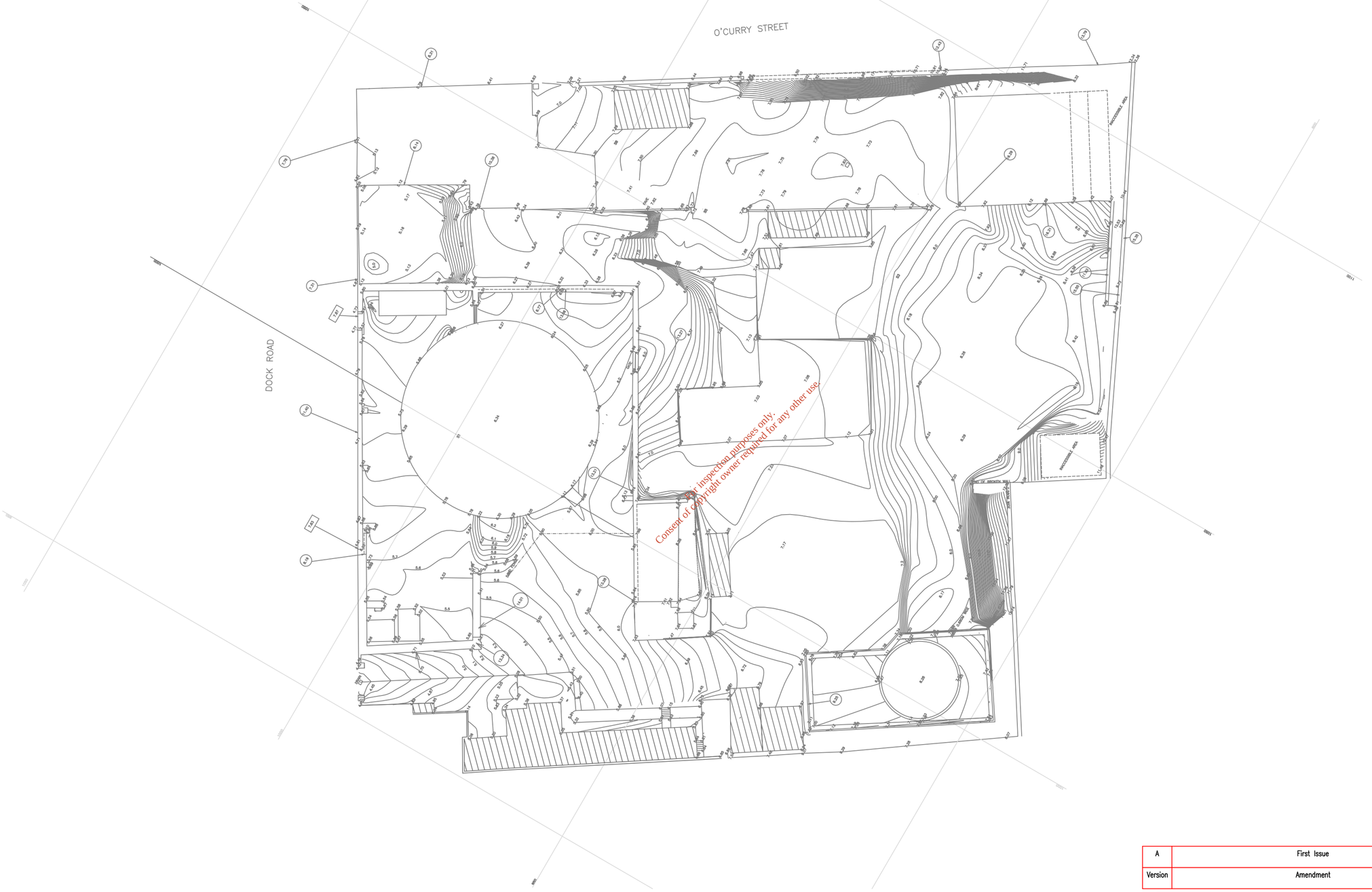
PARKMAN	Client	BORD GAIS		
	Project	LIMERICK GASWORKS SITE		
	Title	SERVICE LOCATION PLAN (TELECOMMUNICATIONS)		
	Purpose REPORT	Draft		Scale 1:1,000
		Issue	•	
	Issuing Office CHESTER	Drawing number FIGURE 3C		Version A
	Telephone 0151 3565555			



PARKMAN	Client BORD GAIS		
	Project LIMERICK GASWORKS SITE		
	Title SERVICE LOCATION PLAN (ELECTRICITY CABLES)		
	Purpose REPORT	Draft / Issue •	Scale 1:1,000
	Issuing Office CHESTER	Drawing number FIGURE 3D	Version A
	Telephone 0151 3565555		



PARKMAN	Client BORD GAIS		
	Project LIMERICK GASWORKS SITE		
	Title SERVICE LOCATION PLAN (GAS MAINS)		
	Purpose REPORT	Draft / Issue •	Scale 1:1,000
	Issuing Office CHESTER	Drawing number FIGURE 3E	Version A
	Telephone 0151 3565555		



Version	Amendment	Originated by and date	Checked by and date	Approved by and date
A	First Issue	15.10.01	D.H. 15.10.01	T.B. 15.10.01

PARKMAN

BSI REGISTERED FIRM — Certificate no. FS 15024

NATIONAL ACCREDITATION OF CERTIFICATION BODIES

Client	Bord Gas
Project	Limerick Gasworks
Drawing Title	Topographical Survey
Purpose	Information
Draft	
Issue	●
Scale	1:500(A2)
Issuing Office	Cheshire
Telephone	0151 356 1666
Drawing Number	Figure 2
Version	A

PARKMAN

Soil

SOIL RESULTS
LIMERICK GASWORKS
Apr-01

All analytical results to be reported as mg/kg ONLY

Laboratory: City Analytical Services Plc

Borehole / Trial Pit Number	BH32	BH32	TP31	TP31	TP31	TP32	TP32	TP32	TP33	TP33	TP33	TP34	TP34
Depth	0.50m	1.20m	0.60m	1.10m	2.20m	0.20m	2.40m	3.40m	0.60m	1.50m	2.40m	0.30m	1.20m
pH	7.2	7.3	7.4	7.4	7.2	6.7	7.2	7.0	7.3	7.2	7.5	6.8	7.1
% Loss on Ignition	3.5	1.7	1.5	2.4	4.2	5.7	7.1	2.1	11	4.0	3.0	9.4	12
% Moisture	9.1	12	9.9	12	11	8.4	13	20	15	13	14	25	18
% Stones	49	54	57	35	44	38	46	38	17	23	21	25	31
Cresols	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	<0.10	< 0.10	< 0.10	0.93	< 0.10	< 0.10	< 0.10	< 0.10
Xylenols & Ethylphenols	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.87	< 0.10	< 0.10	< 0.10	< 0.10
Naphthols													
Phenol	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.32	< 0.10	< 0.10	< 0.10	< 0.10
Trimethylphenol	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.35	< 0.10	< 0.10	< 0.10	< 0.10
Total Phenols	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	2.5	< 0.50	< 0.50	< 0.50	< 0.50
Napthalene	14	1.6	4.1	2.4	18	34	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	5.8	62
Acenaphthylene	5	0.86	0.55	0.61	4.6	76	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	3.4	31
Acenaphthene	4.6	0.82	0.48	0.91	13	12	< 1.0	< 1.0	< 1.0	< 1.0	0.91	1.2	11
Fluorene	1.4	0.47	0.59	0.79	8	70	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.1	10
Phenanthrene	22	1.3	6.6	3.5	6.5	370	< 1.0	< 1.0	5.8	< 1.0	2.1	2.2	33
Anthracene	7.8	0.51	1.5	0.73	2.2	180	< 1.0	< 1.0	2.4	< 1.0	< 1.0	3.2	18
Fluoranthene	50	2	9.2	9.1	3.1	560	< 1.0	< 1.0	19	< 1.0	4.8	6.2	75
Pyrene	45	1.7	8.5	6.7	3.1	480	< 1.0	< 1.0	21	< 1.0	2.3	5.7	62
Benzo(a)anthracene	31	0.9	4.8	3.2	0.85	260	< 1.0	< 1.0	15	< 1.0	1.7	2.4	36
Chrysene	28	1.8	5.9	3.9	2	330	< 1.0	< 1.0	17	< 1.0	1.6	3.2	40
Benzo(b)fluoranthene	21	1.7	4.1	2.6	0.6	250	< 1.0	< 1.0	16	< 1.0	< 1.0	3.8	49
Benzo(k)fluoranthene	22	1.4	4.1	1.7	0.9	150	< 1.0	< 1.0	21	< 1.0	< 1.0	3.3	35
Benzo(a)pyrene	20	1.4	4.1	2.4	0.6	240	< 1.0	< 1.0	16	< 1.0	2.4	4.1	42
Indeno(1,2,3-cd)pyrene	13	< 1.0	3.3	< 1.0	< 1.0	280	< 1.0	< 1.0	16	< 1.0	< 1.0	6.7	31
Di-benz(a,h,)anthracene	1.3	< 1.0	0.85	< 1.0	< 1.0	47	< 1.0	< 1.0	4.6	< 1.0	< 1.0	2.5	12
Benzo(g,h,i)perylene	13	< 1.0	3.5	< 1.0	< 1.0	200	< 1.0	< 1.0	13	< 1.0	< 1.0	5.3	16
Anthanthrene	1.1	< 1.0	< 1.0	< 1.0	< 1.0	27	< 1.0	< 1.0	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzo(e)pyrene	15	1.4	4.1	1.3	0.7	190	< 1.0	< 1.0	14	< 1.0	< 1.0	3.9	35
Cyclopenta(cd)pyrene	18	< 1.0	0.96	1.7	< 1.0	9.3	< 1.0	< 1.0	1.4	< 1.0	< 1.0	<1.0	16
Total PAH	330	18	66	42	65	3800	< 10	< 10	180	< 10	18	65	620
Easily-liberatable Cyanide	0.56	0.53	0.48	1.5	0.63	< 1.0	1.2	<1.0	<1.0	< 1.0	< 1.0	3.0	<1.0
Complex Cyanide	1.1	3.7	1.4	3	2.5	11	1.9	14	120	410	23	10	120
Total Cyanide	1.7	4.2	1.9	4.5	3.1	11	3.1	15	120	410	23	13	120
Thiocyanate													
Elemental Sulphur	< 100	< 100	< 100	100	85	640	150	< 100	< 100	< 100	640	<100	190
Water Soluble Sulphate as SO4	< 25	38	240	27	270	760	89	69	3100	240	55	940	1600
Water Soluble Chloride	0.55	6.6	9.1	10	12	7.6	31	4.0	13	15	11	7.4	9.4
Exchangeable Ammonium	17	6.9	30	34	33	6.5	9.9	<5.0	13	16	21	< 5.0	25
Arsenic	6.9	5.1	9.5	6.7	3.8	8.7	5.2	9.5	6.5	3.2	2.5	26	24
Cadmium	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	<0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Chromium	6.4	5.1	3.7	5.2	4	6.4	6.6	6.9	8.8	5.1	6.2	18	11
Lead	55	8.8	41	91	47	93	8.5	21	34	61	46	180	1100
Mercury	0.55	0.21	0.1	0.21	0.1	0.25	< 0.10	< 0.10	< 0.10	0.42	0.99	0.57	0.39
Selenium	0.26	0.086	< 0.10	0.073	0.085	0.23	<0.10	<0.10	< 0.10	0.20	< 0.10	0.61	0.81
Copper	16	11	13	59	55	19	4.7	13	27	8.1	9.1	94	81
Nickel	13	9	6.3	7.3	6.5	23	7.5	15	11	4.6	6.2	30	17
Zinc	34	22	21	60	41	40	19	27	18	19	17	38	160
Boron	0.13	0.1	< 0.10	< 0.10	0.085	0.44	0.47	0.24	0.47	0.48	0.50	< 0.10	0.26
Analytes below to be determined if their presence on site is suspected.													
Cobalt													
Vanadium													
Molybdenum													
Germanium													
Hex Cr													
Silver													
Antimony													
Beryllium													
Benzene	< 0.10			< 0.10	< 0.10	< 0.10		< 0.10			< 0.10		
Toluene	< 0.10			< 0.10	< 0.10	< 0.10		< 0.10			< 0.10		
Ethylbenzene	< 0.10			< 0.10	< 0.10	< 0.10		< 0.10			< 0.10		
Xylene's	< 0.10			< 0.10	< 0.10	< 0.10		< 0.10			< 0.10		
Mineral Oil													
Asbestos				ND								ND	
ADDITIONAL ANALYTES													
Coal Tar													
Sulphide													
Toluene Extractable Matter													
TPH by GC (C_{10} to C_{20})	< 50			97	300	220		< 50			< 50		
TPH by GC (C_{20} to C_{39})	38			34	50	440		< 50			< 50		
TPH by GC (C_{10} to C_{39})	38			130	350	640		< 50			< 50		
Organic Matter													
Total Sulphate as SO4													

SOIL RESULTS
LIMERICK GASWORKS
Apr-01

All analytical results to be reported as mg/kg ONLY

Laboratory: City Analytical Services Plc

Borehole / Trial Pit Number	TP34	TP34	TP35	TP35	TP35	TP36	TP36	TP37	TP37	TP38	TP38	TP39	TP39
Depth	2.00m	3.00m	1.00m	2.00m	3.00m	0.50m	2.30m	0.20m	1.10m	0.50m	1.50m	0.50m	1.50m
pH	7.4	7.7	8.2	7.3	7.7	8.1	7.8	7.9	7.8	7.2	7.6	6.3	12.0
% Loss on Ignition	3.8	1.6	8.5	6.6	4.9	0.14	0.050	1.0	0.081	9.0	3.1	28	3.8
% Moisture	23	15	12	19	15	3.6	3.5	5.0	2.9	11	11	17	23
% Stones	34	36	41	27	22	82	87	66	87	27	43	32	22
Cresols	0.11	< 0.10	210	< 0.10	0.16	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	12	< 0.10
Xylenols & Ethylphenols	0.20	0.50	250	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	46	< 0.10
Naphthols													
Phenol	< 0.10	< 0.10	60	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	2.8	< 0.10
Trimethylphenol	0.20	0.23	110	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	24	< 0.10
Total Phenols	0.56	0.76	620	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	90	< 0.50
Napthalene	15	<1.0	1400	5.5	8.8	< 1.0	< 1.0	< 1.0	< 1.0	12	4.9	370	3.9
Acenaphthylene	5.6	< 1.0	490	6.1	2.4	< 1.0	< 1.0	< 1.0	< 1.0	23	3.2	140	2.0
Acenaphthene	5.1	< 1.0	130	1.8	1.3	< 1.0	< 1.0	< 1.0	< 1.0	6.0	< 1.0	48	< 1.0
Fluorene	8.5	< 1.0	430	2.9	1.9	< 1.0	< 1.0	< 1.0	< 1.0	11	1.1	100	< 1.0
Phenanthrene	9.6	< 1.0	960	9.3	7.4	< 1.0	< 1.0	< 1.0	< 1.0	40	7.3	620	3.6
Anthracene	5.6	< 1.0	370	4.1	1.9	< 1.0	< 1.0	< 1.0	< 1.0	14	2.4	150	1.1
Fluoranthene	16	< 1.0	690	28	5.2	0.22	0.11	< 1.0	< 1.0	61	15	510	5.7
Pyrene	13	< 1.0	530	24	5.2	< 1.0	< 1.0	< 1.0	< 1.0	50	13	360	4.9
Benzo(a)anthracene	6.2	< 1.0	300	15	2.9	< 1.0	< 1.0	< 1.0	< 1.0	27	7.8	150	2.6
Chrysene	6.8	< 1.0	290	19	4.7	< 1.0	< 1.0	< 1.0	< 1.0	36	9.3	200	4.1
Benzo(b)fluoranthene	5.4	< 1.0	150	17	1.8	< 1.0	< 1.0	< 1.0	< 1.0	41	7.3	92	5.6
Benzo(k)fluoranthene	5.6	< 1.0	140	16	2.0	< 1.0	< 1.0	< 1.0	< 1.0	30	7.8	100	4.4
Benzo(a)pyrene	6.8	< 1.0	180	13	2.7	< 1.0	< 1.0	< 1.0	< 1.0	29	6.7	74	5.7
Indeno(1,2,3-cd)pyrene	9.6	< 1.0	210	11	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	35	4.1	49	6.4
Di-benz(a,h,)anthracene	2.0	< 1.0	35	2.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	4.8	1.3	13	1.6
Benzo(g,h,i)perylene	6.8	< 1.0	170	10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	25	3.4	36	7.0
Anthanthrene	< 1.0	< 1.0	19	1.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.5	< 1.0	< 1.0	< 1.0
Benzo(e)pyrene	6.2	< 1.0	130	12	2.7	< 1.0	< 1.0	< 1.0	< 1.0	32	5.2	62	6.0
Cyclopenta(cd)pyrene	1.0	< 1.0	15	<1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	12	< 1.0	6.0	1.9
Total PAH	140	< 10	6900	200	52	< 10	< 10	< 10	< 10	500	99	3100	68
Easily-liberatable Cyanide	<1.0	<1.0	1.3	7.3	1.8	0.19	0.14	< 1.0	0.14	0.82	0.64	470	2.0
Complex Cyanide	6.9	1.5	45	170	3.7	0.56	0.42	2.5	0.14	51	45	15000	200
Total Cyanide	7.7	2.3	46	180	5.5	0.74	0.56	2.5	0.27	52	45	15000	200
Thiocyanate													
Elemental Sulphur	1500	120	1300	540	640	< 100	< 100	< 100	< 100	690	160	2200	79
Water Soluble Sulphate as SO4	150	25	2000	4100	170	< 25	6.3	< 25	5.5	1700	830	31	1200
Water Soluble Chloride	4.3	5.2	13	9.3	27	2.5	5.9	3.6	4.1	9.0	6.2	28	26
Exchangeable Ammonium	24	67	25	33	43	2.2	3.8	3.3	3.8	5.2	7.7	140	41
Arsenic	8.5	3.6	8.0	13	2.8	0.9	0.55	2.7	0.32	11	5.1	21	12
Cadmium	<0.50	< 0.50	< 0.50	< 0.50	< 0.50	0.16	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Chromium	7.9	20	8.0	11	<5.0	< 5.0	< 5.0	3.6	< 5.0	25	36	5.1	7.2
Lead	96	81	130	160	38	3.4	0.84	26	1	110	38	260	34
Mercury	0.12	0.46	0.64	0.50	0.18	< 0.10	< 0.10	0.054	< 0.10	0.39	0.078	1.0	< 0.10
Selenium	0.35	< 0.10	0.20	0.49	0.11	< 0.10	< 0.10	< 0.10	< 0.10	0.39	< 0.10	0.61	0.27
Copper	15	16	18	18	5.5	0.86	0.44	5.7	0.34	41	27	1.2	21
Nickel	11	23	12	6.4	5.6	1.8	1	7.8	0.73	29	25	< 1.0	13
Zinc	23	33	49	64	23	7.8	2.4	30	1.6	76	47	74	47
Boron	0.14	0.26	0.16	<0.10	0.16	< 0.10	< 0.10	< 0.10	< 0.10	0.32	0.16	< 0.10	< 0.10
Analytes below to be determined if their presence on site is suspected.													
Cobalt													
Vanadium													
Molybdenum													
Germanium													
Hex Cr													
Silver													
Antimony													
Beryllium													
Benzene	0.46	"	62	"	0.24	"	< 0.10	"	< 0.10		"	"	
Toluene	0.25	"	110	"	< 0.10	"	< 0.10	"	< 0.10		"	"	
Ethylbenzene	0.65	"	23	"	< 0.10	"	< 0.10	"	< 0.10		"	"	
Xylene's	0.95	"	260	"	0.26	"	< 0.10	"	< 0.10		"	"	
Mineral Oil	"	"	"	"	"	ND	"	"	"		ND	"	
Asbestos													
ADDITIONAL ANALYTES													
Coal Tar													
Sulphide													
Toluene Extractable Matter													
TPH by GC (C_{10} to C_{20})	960	"	12000	"	49	"	38	"	< 50		"	"	
TPH by GC (C_{20} to C_{39})	230	"	4000	"	< 50	"	15	"	< 50		"	"	
TPH by GC (C_{10} to C_{39})	1200	"	16000	"	49	"	54	"	< 50		"	"	
Organic Matter													
Total Sulphate as SO4													

SOIL RESULTS
LIMERICK GASWORKS
Apr-01

All analytical results to be reported as mg/kg ONLY

Laboratory: City Analytical Services Plc

Borehole / Trial Pit Number	TP39	TP40	TP40	TP41	TP41	TP42	TP43	TP47	TP47	TP48	TP48	TP49	TP49
Depth	2.80m	0.70m	2.20m	0.50m	0.80m	0.30m	0.40m	1.00m	2.00m	1.50m	2.50m	0.30m	1.50m
pH	8.9	7.0	6.9	8.6	7.0	7.5	7.5	7.6	6.8	7.2	8.3	6.9	7.5
% Loss on Ignition	8.0	1.6	1.2	4.5	2.9	0.63	1.0	4.3	1.7	3.4	37	3.3	3.6
% Moisture	31	9.0	8.8	17	22	6.3	11	8.6	11	14	13	20	19
% Stones	32	44	52	38	49	76	36	45	43	42	0	34	43
Cresols	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	140	< 0.10	67	590	< 0.10	< 0.10
Xylenols & Ethylphenols	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.22	170	< 0.10	170	790	< 0.10	< 0.10
Naphthols													
Phenol	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	41	< 0.10	12	230	< 0.10	< 0.10
Trimethylphenol	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	52	< 0.10	120	290	< 0.10	< 0.10
Total Phenols	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	400	< 0.50	370	1800	< 0.50	< 0.50
Napthalene	37	0.78	2.2	< 1.0	1.4	0.8	1.7	660	17	280	7600	5.0	6.6
Acenaphthylene	53	< 1.0	1.8	< 1.0	1.5	1.4	1.4	240	8.8	110	1900	2.8	6.1
Acenaphthene	45	< 1.0	0.69	1.6	1.3	0.19	< 1.0	43	4.1	21	280	0.92	1.1
Fluorene	86	< 1.0	0.78	1.5	2.2	0.53	2.4	170	7.2	81	1400	0.69	0.85
Phenanthrene	170	< 1.0	1.7	6	4.7	1.7	7.7	380	18	190	3300	2.5	2.7
Anthracene	59	< 1.0	1.3	1.9	1.2	0.78	1.6	150	5.7	76	1200	1.1	1.9
Fluoranthene	130	0.57	9.9	4.6	6.6	4.2	5.2	280	16	140	2500	6.9	14
Pyrene	97	< 1.0	9.0	4.3	6.9	3.8	4.3	210	14	120	1800	7.4	14
Benzo(a)anthracene	50	< 1.0	3.7	2.4	3.3	2.3	1.6	120	6.2	27	1000	5.1	12
Chrysene	43	< 1.0	4.7	2.1	3.5	2.1	3.6	130	7.8	41	940	6.3	14
Benzo(b)fluoranthene	31	< 1.0	3.7	1.5	2.5	2.7	1.1	61	4.7	14	610	9.2	19
Benzo(k)fluoranthene	24	< 1.0	3.3	0.92	1.9	1.9	1	56	4.6	16	630	8.0	17
Benzo(a)pyrene	30	< 1.0	3.8	1.2	3.5	2.7	0.77	71	4.6	15	770	11	21
Indeno(1,2,3-cd)pyrene	11	< 1.0	2.6	< 1.0	2.3	1.3	< 1.0	61	2.3	9.1	800	4.6	14
Dl-benz(a,h,)anthracene	3.8	< 1.0	0.60	< 1.0	< 1.0	0.32	< 1.0	20	< 1.0	1.9	270	1.0	5.7
Benzo(g,h,l)perylene	11	< 1.0	2.8	< 1.0	2.5	1.4	< 1.0	49	1.8	9.7	700	4.2	18
Anthanthrene	2.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	7.1	< 1.0	1.8	130	0.63	3.3
Benzo(e)pyrene	19	< 1.0	3.0	0.76	2.1	1.7	1	56	3.5	11	570	9.7	17
Cyclopenta(cd)pyrene	8.6	< 1.0	< 1.0	< 1.0	1.2	0.84	< 1.0	9.6	0.67	0.56	210	2.6	5.7
Total PAH	910	< 10	56	30	51	31	34	2700	130	1200	27000	92	190
Easily-liberatable Cyanide	0.98	< 1.0	0.53	< 1.0	0.65	< 1.0	0.72	0.60	< 1.0	< 1.0	1.2	1.6	5.6
Complex Cyanide	120	4.9	2.6	1.5	3.9	0.77	2.2	4.8	5.1	1.3	38	150	390
Total Cyanide	120	4.9	3.2	1.5	4.6	0.77	2.9	5.4	5.1	1.3	39	150	400
Thiocyanate													
Elemental Sulphur	340	< 100	< 100	54	290	< 100	< 100	< 100	< 100	< 100	340	< 100	130
Water Soluble Sulphate as SO4	250	88	210	87	51	6.3	65	61	47	86	110	740	300
Water Soluble Chloride	5.9	8.3	17	8.7	4.4	2.9	14	15	14	42	110	6.9	5.7
Exchangeable Ammonium	38	21	70	11	14	4.9	72	19	7.7	15	210	4.8	18
Arsenic	5.9	4.8	9.2	3.9	2.7	1.8	6.5	4.8	4.8	6.6	25	7.4	10
Cadmium	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	0.32	< 0.50	< 0.50	0.35	< 0.50	< 0.50	0.27
Chromium	4.8	5.2	4.7	7.6	2.9	1.1	5.8	6.6	6.2	7.1	8.4	9.2	14
Lead	48	18	26	41	40	9.9	11	30	26	37	1100	92	280
Mercury	0.19	< 0.10	0.056	< 0.10	0.04	0.025	< 0.10	0.14	0.072	0.24	1.3	0.18	0.46
Selenium	0.54	< 0.10	0.047	< 0.10	0.051	< 0.10	< 0.10	0.056	0.19	0.15	0.73	0.20	0.31
Copper	11	5.7	5.6	12	6.2	2.5	8.3	8.6	10	18	49	17	29
Nickel	9.1	9.3	7.8	15	5.1	1.9	13	10	10	13	19	13	26
Zinc	14	22	29	26	12	5	19	22	33	29	160	32	71
Boron	< 0.10	< 0.10	0.22	0.12	0.047	< 0.10	< 0.10	0.24	0.19	0.18	0.22	0.19	0.25
Analytes below to be determined if their presence on site is suspected.													
Cobalt													
Vanadium													
Molybdenum													
Germanium													
Hex Cr													
Silver													
Antimony													
Beryllium													
Benzene	0.25		< 0.10		< 0.10			23		11	200		
Toluene	0.33		< 0.10		< 0.10			50		23	240		
Ethylbenzene	0.37		< 0.10		< 0.10			11		4.4	37		
Xylene's	3.5		< 0.10		< 0.10			130		50	450		
Mineral Oil													
Asbestos		ND		ND		ND				ND		ND	
ADDITIONAL ANALYTES													
Coal Tar													
Sulphide													
Toluene Extractable Matter													
TPH by GC (C_{10} to C_{20})	1400		130		110			11000		110	80000	97	
TPH by GC (C_{20} to C_{39})	350		170		340			4500		130	38000	300	
TPH by GC (C_{10} to C_{39})	1700		300		440			16000		240	120000	390	
Organic Matter													
Total Sulphate as SO4													

SOIL RESULTS
LIMERICK GASWORKS
Apr-01

All analytical results to be reported as mg/kg ONLY

Laboratory: City Analytical Services Plc

Borehole / Trial Pit Number	TP49	TP49WELL	TP51	TP51	Barrigone	Ballyneety
Depth	2.60m	0.50m	0.30m	1.00m	Quarry	Quarry
pH	7.3	8.3	8.2	9.3	7.1	7.2
% Loss on Ignition	14	10	45	4.7	0.17	0.25
% Moisture	36	19	8.2	16	2.9	1.9
% Stones	21	54	0	51	69	59
Cresols	0.17	68	900	4.6	< 0.10	< 0.10
Xylenols & Ethylphenols	< 0.10	57	1500	9.8	< 0.10	< 0.10
Naphthols						
Phenol	0.21	25	160	1.2	< 0.10	< 0.10
Trimethylphenol	< 0.10	27	1000	7.5	< 0.10	< 0.10
Total Phenols	< 0.50	180	3700	23	< 0.50	< 0.50
Napthalene	1.9	310	380	90	< 1.0	< 1.0
Acenaphthylene	2.7	68	140	31	< 1.0	< 1.0
Acenaphthene	2.5	51	32	12	< 1.0	< 1.0
Fluorene	4.1	68	110	29	< 1.0	< 1.0
Phenanthrene	3.4	140	210	58	< 1.0	0.64
Anthracene	1.1	47	86	23	< 1.0	< 1.0
Fluoranthene	22	98	150	43	< 1.0	0.89
Pyrene	22	81	120	33	< 1.0	0.52
Benzo(a)anthracene	20	37	66	18	< 1.0	0.44
Chrysene	26	34	74	19	< 1.0	0.48
Benzo(b)fluoranthene	19	20	31	12	< 1.0	< 1.0
Benzo(k)fluoranthene	17	16	30	11	< 1.0	< 1.0
Benzo(a)pyrene	20	20	29	14	< 1.0	< 1.0
Indeno(1,2,3-cd)pyrene	< 1.0	10	18	15	< 1.0	< 1.0
Di-benz(a,h,)anthracene	< 1.0	1.7	4.4	1.9	< 1.0	< 1.0
Benzo(g,h,i)perylene	< 1.0	11	17	13	< 1.0	< 1.0
Anthanthrene	< 1.0	0.78	4.7	1.3	< 1.0	< 1.0
Benzo(e)pyrene	11	11	19	10	< 1.0	< 1.0
Cyclopenta(cd)pyrene	8.8	16	4.9	3.3	< 1.0	< 1.0
Total PAH	180	1000	1500	430	< 10	< 10
Easily-liberatable Cyanide	3.7	5.7	1.1	0.58	0.64	0.84
Complex Cyanide	640	25	11	9.3	0.64	0.84
Total Cyanide	640	31	12	9.8	1.3	1.7
Thiocyanate						
Elemental Sulphur	140	20000	< 100	430	< 100	< 100
Water Soluble Sulphate as SO4	430	1300	31	46	87	< 25
Water Soluble Chloride	6.6	16	66	23	4.4	6.0
Exchangeable Ammonium	26	19	23	13	10	5.5
Arsenic	16	4.4	16	4.3	0.82	1.7
Cadmium	< 0.50	0.25	< 0.50	< 0.50	< 0.50	< 0.50
Chromium	20	5.7	8.9	5.1	< 5.0	< 5.0
Lead	390	21	48	30	< 5.0	13
Mercury	0.52	1.4	0.86	0.082	< 0.10	< 0.10
Selenium	0.32	0.57	0.46	0.078	< 0.10	< 0.10
Copper	41	9.8	60	9.7	0.35	2.1
Nickel	32	6.1	27	7.4	0.96	3.5
Zinc	110	27	59	21	1.2	6.8
Boron	0.35	0.041	0.64	0.16	< 0.10	< 0.10
Analytes below to be determined if their presence on site is suspected.						
Cobalt						
Vanadium						
Molybdenum						
Germanium						
Hex Cr						
Silver						
Antimony						
Beryllium						
Benzene	.	15	150	1.9	< 0.10	< 0.10
Toluene	.	19	200	4.6	< 0.10	< 0.10
Ethylbenzene	.	3.5	38	1.7	< 0.10	< 0.10
Xylene's	.	37	410	16	< 0.10	< 0.10
Mineral Oil						
Asbestos	.	.	.	ND	.	.
ADDITIONAL ANALYTES						
Coal Tar						
Sulphide						
Toluene Extractable Matter						
TPH by GC (C_{10} to C_{20})	.	20000	87000	1200	< 50	< 50
TPH by GC (C_{20} to C_{39})	.	6400	48000	350	< 50	< 50
TPH by GC (C_{10} to C_{39})	.	26000	140000	1500	< 50	< 50
Organic Matter						
Total Sulphate as SO4						

PARKMAN

Water

WATER RESULTS
LIMERICK GASWORKS
Apr-01

All analytical results to be reported as stated units.

Laboratory: City Analytical Services Plc

Borehole / Trial Pit Number		**BH 7**	**BH10**	**TP33**	**TP34**	**TP35**	**TP35**	**TP36**	**TP37**	**TP38**	**TP39**	**TP42**	**TP47**
Depth		**1.00m**	**2.00m**	**2.50m**	**2.05m**	**1.50m**	**3.00m**	**2.20m**	**1.00m**	**1.55m**	**2.60m**	**0.40m**	**2.75m**
Hardstanding at surface (Y/N)													
	Units												
pH	pH Units	11	9.5	7.8	7.2	9.9	6.7	7.6	7.9	7.5	8	7.7	8.9
Suspended Solids	mg/l	240	6900	20000	620	530	280	20000	2600	3900	790	160000	14000
Conductivity (µs/cm)	µs/cm	530	2300	1300	1700	1100	2400	1200	680	1500	1600	380	5100
Cresols	µg/l	11000	130000	63	24	380000	11	15000	35	< 0.50	3600	3.1	550000
Xylenols & Ethylphenols	µg/l	8200	66000	31	520	200000	89	520	370	< 0.50	13000	580	270000
Catechol	µg/l	620	7900	< 0.50	< 0.50	13000	< 0.50	270	< 0.50	< 0.50	110	5.4	27000
Phenol	µg/l	3300	110000	31	23	190000	12	1500	4.1	< 0.50	950	4.1	360000
Trimethylphenol	µg/l	7600	38000	< 0.50	730	71000	77	1800	220	< 0.50	5100	540	67000
Total Phenols	µg/l	31000	350000	120	1300	850000	190	19000	620	< 2.5	22000	1100	130000
Napthalene	ng/l	330000	360000	190	40000	360000	3400	140000	99000	2000	470000	89000	340000
Acenaphthylene	ng/l												
Acenaphthene	ng/l	22000	< 20	160	12000	2900	460	1900	5200	470	16000	12000	7400
Fluorene	ng/l	6900	3400	59	5100	4300	230	18000	3800	2200	43000	3800	3700
Phenanthrene	ng/l	6600	7300	62	6300	8400	730	59000	4100	6500	140000	4600	6000
Anthracene	ng/l	1300	25	23	2000	73	300	1400	1200	510	860	1200	260
Fluoranthene	ng/l	1200	570	67	6500	500	340	11000	1300	5200	22000	1300	230
Pyrene	ng/l	1100	2000	71	5400	1300	350	36000	1300	17000	54000	1100	670
Benzo(a)anthracene	ng/l	210	450	30	1600	250	110	8700	340	27000	1700	180	80
Chrysene	ng/l	230	470	31	1900	290	130	9500	390	27000	16000	240	71
Benzo(b)fluoranthene	ng/l	150	370	40	1500	140	140	10000	280	30000	11000	220	66
Benzo(k)fluoranthene	ng/l	91	270	23	780	130	77	7200	160	19000	10000	100	51
Benzo(a)pyrene	ng/l	< 20	630	26	1500	330	110	13000	620	32000	23000	390	69
Indeno(1,2,3-cd)pyrene	ng/l	200	280	76	2200	340	250	6400	< 20	23000	11000	330	< 20
DI-benz(a,h,)anthracene	ng/l	43	47	< 20	550	26	45	< 20	130	< 20	1900	65	< 20
Benzo(g,h,i)perylene	ng/l	94	340	24	880	240	74	5600	240	21000	11000	130	< 20
Anthanthrene	ng/l	62	< 20	< 20	250	< 20	< 20	5100	< 20	13000	13000	57	< 20
Benzo(e)pyrene	ng/l	410	340	52	2000	< 20	250	5400	480	22000	15000	440	< 20
Cyclopenta(cd)pyrene	ng/l												
Total PAH	ng/l	370000	370000	950	90000	380000	7000	330000	120000	250000	870000	120000	350000
Easily-liberatable Cyanide	mg/l	0.4	0.2	< 0.10	0.20	0.80	0.10	0.1	< 0.10	0.20	< 0.10	0.1	0.10
Complex Cyanide	mg/l	0.9	1	0.70	0.60	270	1.8	0.2	0.2	5.3	4.7	0.5	2.9
Total Cyanide	mg/l	1.3	1.2	0.70	0.80	270	1.9	0.3	0.2	5.5	4.7	0.6	3.0
Thiocyanate	mg/l												
Sulphate	mg/l	1000	280	480	400	1100	1000	110	61	840	390	8.2	1300
Sulphide	µg/l			< 50	< 50		< 50	< 50	< 50	< 50	< 50	< 50	< 50
Chloride	mg/l												
Total Ammonium	mg/l	32	150	9.6	23	13	9.6	7.5	2.1	< 0.64	3.9	2.6	490
Arsenic	mg/l	< 0.01	0.02	0.020	0.020	0.050	0.020	< 0.01	< 0.01	0.020	< 0.01	< 0.01	0.090
Cadmium	mg/l	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Chromium	mg/l	< 0.01	0.08	0.030	0.010	0.060	0.010	< 0.01	< 0.01	< 0.01	0.020	< 0.01	0.050
Lead	mg/l	< 0.01	0.03	< 0.01	0.19	0.90	0.12	< 0.01	< 0.01	< 0.01	0.020	< 0.01	0.020
Mercury	mg/l	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Selenium	mg/l	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	0.027
Copper	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Nickel	mg/l	< 0.01	0.06	0.020	0.030	0.13	0.040	0.28	0.07	0.030	0.030	0.04	0.10
Zinc	mg/l	< 0.01	0.78	0.060	0.070	0.30	0.21	< 0.01	< 0.01	0.19	0.030	< 0.01	0.15
Iron	mg/l	5.7	40	21	16	70	64	0.29	0.07	2.0	21	0.09	68
Analytes below to be determined if their presence on site is suspected.													
Cobalt	mg/l												
Vanadium	mg/l												
Molybdenum	mg/l												
Germanium	mg/l												
Hex Cr	mg/l												
Benzene	µg/l	1600	17000	< 10	1600	13000	13	490	310	< 10	1100	330	18000
Toluene	µg/l	360	7500	< 10	81	4400	< 10	120	150	< 10	250	320	5200
Ethylbenzene	µg/l	24	320	< 10	93	210	< 10	15	18	< 10	54	36	210
Xylene's	µg/l	300	3800	< 10	230	2100	< 10	140	220	< 10	420	410	2500
TPH by GC (C_{10} to C_{20})	µg/l	7000	13000	< 100	4500	22000	250	63000	1800	< 100	6300	4000	27000
TPH by GC (C_{20} to C_{39})	µg/l	250	730	< 100	530	240	< 100	14000	< 100	< 100	890	670	260
TPH by GC (C_{10} to C_{39})	µg/l	7200	14000	< 100	5100	22000	250	77000	1800	< 100	7200	4700	27000
ADDITIONAL ANALYTES													
BOD	mg/l												
COD (filtered	mg/l												
Boron (B)	mg/l												
Total Organic Carbon	mg/l	74	570	25	100	2600	100	87	53	110	61	75	2000
Toluene Extractable Matter	mg/l												

WATER RESULTS
LIMERICK GASWORKS
Apr-01

All analytical results to be reported as stated units.

Laboratory: City Analytical Services Plc

Borehole / Trial Pit Number		TP48	TP49	TP49	TP51
Depth		3.50m	2.40m	WELLW	1.25m
Hardstanding at surface (Y/N)					
	Units				
pH	pH Units	9.8	7.5	11	> 12.0
Suspended Solids	mg/l	1800	140000	36000	30000
Conductivity (µs/cm)	µs/cm	4200	960	1300	1800
Cresols	µg/l	170000	4500	1200000	18000
Xylenols & Ethylphenols	µg/l	100000	3000	670000	26000
Catechol	µg/l	31000	87	33000	3500
Phenol	µg/l	87000	2600	440000	9800
Trimethylphenol	µg/l	34000	820	120000	27000
Total Phenols	µg/l	420000	11000	2400000	84000
Napthalene	ng/l	340000	5800	690000	620000
Acenaphthylene	ng/l				
Acenaphthene	ng/l	3500	3300	< 20	6300
Fluorene	ng/l	4300	2000	110000	13000
Phenanthrene	ng/l	7000	5400	210000	35000
Anthracene	ng/l	41	2900	1200	710
Fluoranthene	ng/l	290	20000	81000	11000
Pyrene	ng/l	920	19000	160000	11000
Benzo(a)anthracene	ng/l	130	6700	50000	3400
Chrysene	ng/l	120	7400	50000	4300
Benzo(b)fluoranthene	ng/l	69	3700	38000	2600
Benzo(k)fluoranthene	ng/l	66	360	33000	1300
Benzo(a)pyrene	ng/l	150	< 20	74000	110
Indeno(1,2,3-cd)pyrene	ng/l	59	27000	43000	2000
Di-benz(a,h,)anthracene	ng/l	< 20	< 20	6200	96
Benzo(g,h,i)perylene	ng/l	59	8300	39000	1100
Anthanthrene	ng/l	< 20	1400	40000	570
Benzo(e)pyrene	ng/l	< 20	4600	63000	5100
Cyclopenta(cd)pyrene	ng/l				
Total PAH	ng/l	350000	120000	1700000	710000
Easily-liberatable Cyanide	mg/l	0.1	0.20	0.20	< 0.10
Complex Cyanide	mg/l	2.9	540	15	7
Total Cyanide	mg/l	3	540	15	7
Thiocyanate	mg/l				
Sulphate	mg/l	340	740	490	58
Sulphide	µg/l	.	< 50	.	.
Chloride	mg/l				
Total Ammonium	mg/l	140	7.1	220	15
Arsenic	mg/l	0.04	< 0.01	0.42	< 0.01
Cadmium	mg/l	< 0.0050	< 0.0050	0.0054	< 0.0050
Chromium	mg/l	0.01	< 0.01	< 0.01	< 0.01
Lead	mg/l	< 0.01	< 0.01	< 0.01	< 0.01
Mercury	mg/l	< 0.0010	< 0.0010	0.0020	< 0.0010
Selenium	mg/l	0.006	0.0030	0.0020	< 0.0020
Copper	mg/l	0.03	< 0.01	0.020	< 0.01
Nickel	mg/l	0.02	0.070	0.030	0.02
Zinc	mg/l	0.08	< 0.01	< 0.01	< 0.01
Iron	mg/l	12	1.3	29	0.45
Analytes below to be determined if their presence on site is suspected.					
Cobalt	mg/l				
Vanadium	mg/l				
Molybdenum	mg/l				
Germanium	mg/l				
Hex Cr	mg/l				
Benzene	µg/l	7300	66	30000	1600
Toluene	µg/l	3100	23	7800	1800
Ethylbenzene	µg/l	190	< 10	300	240
Xylene's	µg/l	2100	18	3000	2200
TPH by GC (C_{10} to C_{20})	µg/l	16000	1000	410000	71000
TPH by GC (C_{20} to C_{39})	µg/l	160	330	36000	15000
TPH by GC (C_{10} to C_{39})	µg/l	16000	1300	440000	86000
ADDITIONAL ANALYTES					
BOD	mg/l				
COD (filtered	mg/l				
Boron (B)	mg/l				
Total Organic Carbon	mg/l	480	95	1200	170
Toluene Extractable Matter	mg/l				

PARKMAN

Leachate

LEACHATE RESULTS
LIMERICK GASWORKS
Apr-01

All analytical results to be reported as stated units.

Laboratory: City Analytical Services Plc

Borehole / Trial Pit Number		BH32	TP31	TP31	TP32	TP32	TP34	TP34	TP35	TP35	TP36	TP37
Depth		0.50m	1.10m	2.20m	0.20m	3.40m	0.30m	2.00m	2.00m	3.00m	2.30m	1.10m
	Units											
pH	pH Units	9.2	8.9	8.7	7.1	8	7.5	8.3	7.8	8.8	9.5	9.6
Suspended Solids	mg/l	.	.	.			.	.	.	.	.	.
Conductivity	µs/cm	130	42	50	320	85	3100	500	1100	76	40	31
Cresols	µg/l	< 0.50	< 0.50	1.5	< 0.50	< 0.50	< 0.50	2.5	< 0.50	< 0.50	3	1.2
Xylenols & Ethylphenols	µg/l	< 0.50	< 0.50	3.1	< 0.50	< 0.50	< 0.50	11	< 0.50	< 0.50	5.2	< 0.50
Catechol	µg/l	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Phenol	µg/l	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	0.82	< 0.50	< 0.50	1.7	< 0.50
Trimethylphenol	µg/l	< 0.50	< 0.50	11	< 0.50	< 0.50	< 0.50	36	< 0.50	< 0.50	40	< 0.50
Total Phenols	µg/l	< 2.5	< 2.5	16	< 2.5	< 2.5	< 2.5	51	< 2.5	< 2.5	49	< 2.5
Napthalene	ng/l	130	43	280	20000	210	150	350	260	39	1300	180
Acenaphthylene	ng/l											
Acenaphthene	ng/l	< 20	< 20	< 20	1900	28	< 20	250	< 20	< 20	< 20	26
Fluorene	ng/l	< 20	< 20	< 20	1600	30	26	150	< 20	< 20	130	36
Phenanthrene	ng/l	< 20	57	< 20	1600	52	< 20	58	< 20	< 20	49	58
Anthracene	ng/l	< 20	< 20	21	280	< 20	28	59	< 20	< 20	120	< 20
Fluoranthene	ng/l	< 20	54	77	400	31	130	280	74	30	350	58
Pyrene	ng/l	100	180	420	300	41	530	530	210	< 20	580	78
Benzo(a)anthracene	ng/l	< 20	37	30	< 20	< 20	< 20	69	< 20	< 20	33	< 20
Chrysene	ng/l	< 20	44	38	< 20	< 20	27	71	< 20	< 20	32	< 20
Benzo(b)fluoranthene	ng/l	< 20	26	< 20	< 20	< 20	< 20	74	< 20	< 20	< 20	< 20
Benzo(k)fluoranthene	ng/l	< 20	< 20	< 20	< 20	< 20	< 20	31	< 20	< 20	< 20	< 20
Benzo(a)pyrene	ng/l	< 20	22	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Indeno(1,2,3-cd)pyrene	ng/l	< 20	< 20	54	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Di-benz(a,h,)anthracene	ng/l	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Benzo(g,h,i)perylene	ng/l	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Anthanthrene	ng/l	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Benzo(e)pyrene	ng/l	< 20	59	57	< 20	< 20	25	99	< 20	< 20	42	< 20
Cyclopenta(cd)pyrene	ng/l											
Total PAH	ng/l	280	580	1100	26000	420	950	2000	560	< 200	2700	480
Easily-liberatable Cyanide	mg/l	0.2	0.2	0.1	0.20	0.30	0.20	0.20	0.10	0.10	0.1	0.3
Complex Cyanide	mg/l	0.2	0.2	0.3	0.60	0.60	0.40	0.50	1.2	0.40	0.3	0.3
Total Cyanide	mg/l	0.4	0.4	0.4	0.80	0.90	0.60	0.70	1.3	0.50	0.4	0.6
Sulphate	mg/l	.	.	.			.	.	.	.	.	.
Total Ammonium	mg/l	< 0.64	< 0.64	< 0.64	< 0.64	< 0.64	< 0.71	1.9	< 0.64	1.3	< 0.64	< 0.64
Arsenic	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Cadmium	mg/l	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Chromium	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Lead	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Mercury	mg/l	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Selenium	mg/l	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020
Copper	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Nickel	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Zinc	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.010	< 0.01	0.020	0.010	< 0.01	< 0.01
Iron	mg/l	< 0.01	< 0.01	< 0.01	0.030	0.10	0.13	0.040	0.80	< 0.01	< 0.01	< 0.01
Analytes below to be determined if their presence on site is suspected.												
Cobalt	mg/l											
Vanadium	mg/l											
Molybdenum	mg/l											
Germanium	mg/l											
Uranium	mg/l											
Benzene	µg/l	.	.	.			.	.	.	.	.	.
Toluene	µg/l	.	.	.			.	.	.	.	.	.
Ethylbenzene	µg/l	.	.	.			.	.	.	.	.	.
Xylene's	µg/l	.	.	.			.	.	.	.	.	.
TPH by GC (C_{10} to C_{20})	µg/l	.	.	.			.	.	.	.	.	.
TPH by GC (C_{20} to C_{39})	µg/l	.	.	.			.	.	.	.	.	.
TPH by GC (C_{10} to C_{39})	µg/l	.	.	.			.	.	.	.	.	.
ADDITIONAL ANALYTES												
BOD	mg/l											
COD (filtered	mg/l											
Boron (B)	mg/l											
Total Organic Carbon	mg/l	6.6	4.3	8.1	3.9	6.0	9.0	8.6	9.9	8.6	5.1	2.4
Toluene Extractable Matter	mg/l											
Thiocyanate	mg/l											
Sulphide	µg/l	.	.	.			.	.	.	.	.	.
Chloride	mg/l											

LEACHATE RESULTS
LIMERICK GASWORKS
Apr-01

All analytical results to be reported as stated units.

Laboratory: City Analytical Services Plc

Borehole / Trial Pit Number		TP39	TP39	TP40	TP41	TP47	TP47	TP48	TP51	TP51
Depth		0.50m	2.80m	2.20m	0.80m	1.00m	3.00m	2.50m	0.30m	1.00m
	Units									
pH	pH Units	7.5	8.4	8.6	9.2	8.9	8.4	8.9	9.6	11
Suspended Solids	mg/l	-	-	-	-			-	-	-
Conductivity	µs/cm	730	120	120	62	94	130	210	87	130
Cresols	µg/l	110	< 0.50	< 0.50	< 0.50	53000	16000	85000	92000	3000
Xylenols & Ethylphenols	µg/l	310	< 0.50	< 0.50	< 0.50	44000	8300	68000	87000	2700
Catechol	µg/l	24	< 0.50	< 0.50	< 0.50	2800	< 0.50	13000	1900	150
Phenol	µg/l	20	< 0.50	< 0.50	< 0.50	20000	4600	46000	20000	1200
Trimethylphenol	µg/l	210	< 0.50	< 0.50	< 0.50	23000	5800	41000	40000	7600
Total Phenols	µg/l	680	< 2.5	< 2.5	< 2.5	140000	34000	250000	240000	15000
Napthalene	ng/l	97	6300	80	350	650000	52000	550000	260000	10000
Acenaphthylene	ng/l									
Acenaphthene	ng/l	2200	13000	65	310	2400	< 20	10000	2100	11000
Fluorene	ng/l	170	8500	45	72	15000	8900	14000	4200	4400
Phenanthrene	ng/l	3200	2400	46	23	16000	13000	19000	5300	5900
Anthracene	ng/l	99	2400	< 20	32	460	340	73	28	1100
Fluoranthene	ng/l	310	2300	110	160	450	430	690	270	780
Pyrene	ng/l	< 20	1600	110	270	< 20	< 20	2200	470	690
Benzo(a)anthracene	ng/l	44	120	< 20	22	100	88	210	34	51
Chrysene	ng/l	< 20	140	< 20	20	78	73	210	30	64
Benzo(b)fluoranthene	ng/l	< 20	51	< 20	< 20	57	27	56	< 20	< 20
Benzo(k)fluoranthene	ng/l	< 20	33	< 20	< 20	28	< 20	46	< 20	< 20
Benzo(a)pyrene	ng/l	< 20	< 20	< 20	< 20	59	33	120	< 20	20
Indeno(1,2,3-cd)pyrene	ng/l	< 20	< 20	< 20	< 20	41	< 20	44	28	< 20
Di-benz(a,h,)anthracene	ng/l	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Benzo(g,h,i)perylene	ng/l	< 20	< 20	< 20	< 20	30	< 20	< 20	22	< 20
Anthanthrene	ng/l	< 20	< 20	< 20	< 20	62	< 20	< 20	< 20	< 20
Benzo(e)pyrene	ng/l	22	120	< 20	< 20	74	30	< 20	32	52
Cyclopenta(cd)pyrene	ng/l									
Total PAH	ng/l	6200	37000	480	1300	690000	75000	600000	270000	34000
Easily-liberatable Cyanide	mg/l	0.20	0.30	< 0.10	0.2	0.10	0.10	0.3	0.3	0.2
Complex Cyanide	mg/l	3.6	2.5	0.30	0.2	1.3	0.70	0.3	0.3	0.8
Total Cyanide	mg/l	3.8	0.5	0.30	0.4	1.4	0.80	0.6	0.6	1
Sulphate	mg/l	-	-	-	-			-	-	-
Total Ammonium	mg/l	< 0.64	< 0.64	< 0.64	< 0.64	3.2	3.1	14	2.4	2.6
Arsenic	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Cadmium	mg/l	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Chromium	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Lead	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Mercury	mg/l	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Selenium	mg/l	< 0.0020	< 0.0020	< 0.0020	0.003	< 0.0020	< 0.0020	< 0.0020	< 0.0020	< 0.0020
Copper	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Nickel	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Zinc	mg/l	0.020	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Iron	mg/l	2.7	0.71	0.030	0.05	0.040	0.040	0.17	< 0.01	0.28
Analytes below to be determined if their presence on site is suspected.										
Cobalt	mg/l									
Vanadium	mg/l									
Molybdenum	mg/l									
Germanium	mg/l									
Uranium	mg/l									
Benzene	µg/l	-	-	-	-			-	-	-
Toluene	µg/l	-	-	-	-			-	-	-
Ethylbenzene	µg/l	-	-	-	-			-	-	-
Xylene's	µg/l	-	-	-	-			-	-	-
TPH by GC (C_{10} to C_{20})	µg/l	-	-	-	-			-	-	-
TPH by GC (C_{20} to C_{39})	µg/l	-	-	-	-			-	-	-
TPH by GC (C_{10} to C_{39})	µg/l	-	-	-	-			-	-	-
ADDITIONAL ANALYTES										
BOD	mg/l									
COD (filtered	mg/l									
Boron (B)	mg/l									
Total Organic Carbon	mg/l	44	12	5.5	4.5	200	70	320	270	38
Toluene Extractable Matter	mg/l									
Thiocyanate	mg/l									
Sulphide	µg/l	-	-	-	-			-	-	-
Chloride	mg/l									

PARKMAN

Water Monitoring

WATER MONITORING RESULTS
LIMERICK GASWORKS
Apr-01

All analytical results to be reported as stated units.

Laboratory: City Analytical Services Plc

Laboratory Sample Reference		133041	133042	133043	133044	133045
Sample ID		BH31	BH32	BH33	BH34	BH 7
Other ID	Units					
pH	pH Units	6.7	7	7.3	7.2	9.8
Suspended Solids	mg/l	210	340	62	130	37
Conductivity (µs/cm)	µs/cm	780	400	820	900	1500
Cresols	µg/l	< 0.50	< 0.50	31000	18	12000
Xylenols & Ethylphenols	µg/l	< 0.50	< 0.50	31000	79	8200
Catechol	µg/l	< 0.50	< 0.50	< 0.50	< 0.50	510
Phenol	µg/l	< 0.50	1.5	20000	2.4	3900
Trimethylphenol	µg/l	< 0.50	< 0.50	25000	43	6500
Total Phenols	µg/l	< 2.5	< 2.5	110000	140	31000
Napthalene	ng/l	530	5300	760000	780	390000
Acenaphthylene	ng/l					
Acenaphthene	ng/l	< 20	5700	19000	2100	18000
Fluorene	ng/l	77	1800	7800	980	7300
Phenanthrene	ng/l	630	730	8200	200	21000
Anthracene	ng/l	120	390	1400	37	4700
Fluoranthene	ng/l	200	800	490	69	6300
Pyrene	ng/l	410	830	570	100	8100
Benzo(a)anthracene	ng/l	170	120	55	33	2900
Chrysene	ng/l	150	130	50	35	33000
Benzo(b)fluoranthene	ng/l	130	87	32	39	2800
Benzo(k)fluoranthene	ng/l	71	44	< 20	< 20	1200
Benzo(a)pyrene	ng/l	300	210	70	74	1200
Indeno(1,2,3-cd)pyrene	ng/l	270	94	26	95	2400
Di-benz(a,h,)anthracene	ng/l	21	21	< 20	< 20	300
Benzo(g,h,i)perylene	ng/l	100	43	< 20	32	1100
Anthanthrene	ng/l	43	< 20	< 20	< 20	590
Benzo(e)pyrene	ng/l	300	190	73	67	5500
Cyclopenta(cd)pyrene	ng/l					
Total PAH	ng/l	3500	17000	750000	4700	400000
Easily-liberatable Cyanide	mg/l	0.10	0.10	0.10	0.10	0.30
Complex Cyanide	mg/l	0.40	0.20	0.40	0.20	4.1
Total Cyanide	mg/l	0.50	0.30	0.50	0.30	4.4
Thiocyanate	mg/l	0.26	0.15	15	0.98	46
Sulphate	mg/l	550	51	130	510	1100
Sulphide	µg/l	< 50	< 50	< 50	< 50	< 50
Chloride	mg/l					
Total Ammonium	mg/l	2.1	1.4	57	42	33
Arsenic	mg/l	0.020	< 0.01	< 0.01	< 0.01	< 0.01
Cadmium	mg/l	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Chromium	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Lead	mg/l	0.19	0.11	0.040	0.090	< 0.01
Mercury	mg/l	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Selenium	mg/l	0.0050	< 0.0020	0.010	< 0.0020	0.0040
Copper	mg/l	0.030	0.020	0.020	0.010	< 0.01
Nickel	mg/l	0.020	0.020	0.010	0.020	0.010
Zinc	mg/l	0.15	0.19	0.10	0.10	0.13
Iron	mg/l	3.5	3.3	1.3	2.4	5.7

Analytes below to be determined if their presence on site is suspected.

Cobalt	mg/l					
Vanadium	mg/l					
Molybdenum	mg/l					
Germanium	mg/l					
Hex Cr	mg/l					
Benzene	µg/l	< 10	< 10	16000	18	2700
Toluene	µg/l	< 10	< 10	5500	11	1000
Ethylbenzene	µg/l	< 10	< 10	250	< 10	99
Xylene's	µg/l	< 10	< 10	3000	21	1100
TPH by GC (C_{10} to C_{20})	µg/l	< 100	440	8900	540	12000
TPH by GC (C_{20} to C_{39})	µg/l	< 100	< 100	120	< 100	440
TPH by GC (C_{10} to C_{39})	µg/l	< 100	440	9000	540	13000
ADDITIONAL ANALYTES						
BOD	mg/l					
COD (filtered	mg/l					
Boron (B)	mg/l					
Total Organic Carbon	mg/l	14	5.4	15	15	110
Toluene Extractable Matter	mg/l					

Borehole Log

GEOTECH

Drilled by TB Logged by Checked by	Equipment and Methods Rotary Open Hole 115 mm diameter from 0.00m to 1.85m. Rotary Cored 110 mm diameter from 1.85m to 5.25m.	Ground Level National Grid Coordinates

Samples and Tests

Strata

Depth	TCR SCR RQD	If	Records	Date Casing	Time Water	Description	Depth,Level (Thickness)	Legend
				08/03/2001		MADE GROUND**	(1.85)	
							1.85	
1.85 - 3.65m	0					LIMESTONE**	(3.40pen)	
3.65 - 5.25m				08/03/2001		EXPLORATORY HOLE ENDS AT 5.25 m.	5.25	

Groundwater

No.	Struck	Behaviour
1	1.85m	

Remarks

Hole backfill : 0.00m to 0.50m Concrete (c), 0.50m to 1.85m Bentonite (b). Surface protection : Stop Cock Cover Standpipe installed, 50mm diameter, response zone from 1.85m to 5.25m.

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project LIMERICK GAS WORKS
Project no. 171016/2
Carried out for Messrs. Parkman Environmental

Borehole
BH31
Sheet 1 of 1

14/03/2001 15:14:05 ESGLog v2.04

Borehole Log

GEOTECH

Drilled by TB **Logged by** **Checked by**	**Equipment and Methods** Inspection Pit from 0.00m to 1.20m. Rotary Open Hole 110 mm diameter from 1.40m to 4.85m.	**Ground Level** **National Grid Coordinates**

Samples and Tests

Depth	Type & No.	Records	Date Casing	Time Water
			04/03/2001	
			04/03/2001	

Strata

Description	Depth,Level (Thickness)	Legend
MADE GROUND**	(1.65)	
	1.65	
LIMESTONE**	(3.20pen)	
EXPLORATORY HOLE ENDS AT 4.85 m.	4.85	

Depth	TCR SCR RQD	If	Records	Date Casing	Time Water

Groundwater

No.	Struck	Behaviour
1	1.75m	

Remarks

Hole backfill : 0.00m to 0.85m Concrete (c), 0.85m to 1.85m Bentonite (b). Surface protection : Stop Cock Cover Standpipe installed, 50mm diameter, response zone from 1.85m to 4.85m.

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project LIMERICK GAS WORKS
Project no. 171016/2
Carried out for Messrs. Parkman Environmental

Borehole BH32
Sheet 1 of 1

14/03/2001 15:14:13 ESGLog v2.04

Borehole Log

GEOTECH

Drilled by TB **Logged by** **Checked by**	**Equipment and Methods** Rotary Open Hole 115 mm diameter from 0.00m to 2.85m. Rotary Cored 110 mm diameter from 2.85m to 8.45m.	**Ground Level** **National Grid Coordinates**

Samples and Tests

Strata

Depth	TCR SCR RQD	If	Records	Date Casing	Time Water	Description	Depth,Level (Thickness)	Legend
				04/03/2001				c b
2.85 - 4.00m	***							
						LIMESTONE**	(8.45pen)	
4.00 - 5.80m								
5.80 - 7.40m								
7.40 - 8.45m								
				06/03/2001		EXPLORATORY HOLE ENDS AT 8.45 m	8.45	

Groundwater
No. Struck Behaviour

Remarks
Hole backfill : 0.00m to 0.50m Concrete (c), 0.50m to 1.45m Bentonite (b). Surface protection : Stop Cock Cover
Standpipe installed, 50mm diameter, response zone from 1.45m to 8.45m.

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project LIMERICK GAS WORKS
Project no. 171016/2
Carried out for Messrs. Parkman Environmental

Borehole BH33
Sheet 1 of 1

Borehole Log

GEOTECH

Drilled by TB **Logged by** **Checked by**	**Equipment and Methods** Rotary Open Hole 115 mm diameter from 0.00m to 7.20m. Rotary Cored 110 mm diameter from 7.20m to 10.25m.	**Ground Level** **National Grid Coordinates**

Samples and Tests

Depth	TCR SCR RQD	If	Records	Date Casing	Time Water
				06/03/2001	

Strata

Description	Depth,Level (Thickness)	Legend
MADE GROUND**	(7.15)	
	7.15	
LIMESTONE**	(3.10)	

Groundwater

No.	Struck	Behaviour
1	7.20m	

Remarks

Hole backfill : 0.00m to 0.50m Concrete (c), 0.50m to 7.15m Bentonite (b). Surface protection : Stop Cock Cover Standpipe installed, 50mm diameter, response zone from 7.15m to 10.25m.

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project LIMERICK GAS WORKS
Project no. 171016/2
Carried out for Messrs. Parkman Environmental

Borehole BH34
Sheet 1 of 2

14/03/2001 15:14:33 ESGLog v2.04

Borehole Log

GEOTECH

Drilled by TB	Equipment and Methods	Ground Level
Logged by	See sheet 1	National Grid Coordinates
Checked by		

Samples and Tests

Depth	TCR SCR RQD	If	Records	Date Casing / Time Water
				06/03/2001

Strata

Description	Depth,Level (Thickness)	Legend
As sheet 1		
EXPLORATORY HOLE ENDS AT 10.25 m.	10.25	

Groundwater
No. Struck Behaviour

Remarks

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project LIMERICK GAS WORKS
Project no. 171016/2
Carried out for Messrs. Parkman Environmental

Borehole BH34
Sheet 2 of 2

4/03/2001 15:14:36 ESGLog v2.04

Trial Pit Log

CLIENT:	CONSULTANT:		PROJECT:		TRIAL PIT:
Bord Gàis	Parkman Environment		Limerick Gasworks		TP31
LOGGED BY:	PLANT:	DATE:	ORIENTATION:	PIT DIMENSIONS	JOB NUMBER:
OK	JCB 3CX	01/03/2001	NW-SE	3 x 3 x 2.9m	25837

SAMPLE Depth (m)	SAMPLE No.	WATER	DESCRIPTION	LEGEND	DEPTH (THICKNESS) (m)	LEVEL (m O.D.)
			0.05m - Layer of vegetation (grass and roots with topsoil).			
			0.15m - MADE GROUND - Compact layer of bricks and sand and concrete flooring		0.5m	
0.6	1		0.75m - MADE GROUND - Soft brown sandy gravelly clay with occasional brick debris, slight hydrocarbon odour.			
1.1	2		1.35m - MADE GROUND - Soft dark brown sandy gravelly clay with occasional brick debris and some sub angular to rounded limestone cobbles, hydrocarbon or chemical odour, in particles very sandy and very gravelly.		1.0m	
			MADE GROUND - Soft grey very sandy gravelly clay with many angular sub-rounded cobbles of limestone (in places clayey and gravelly fine to coarse sand), strong hydrocarbon or chemical odour.		1.5m	
2.2	3				2.0m	
					2.5m	
			Trial pit abandoned at 2.9m due to pit collapse.		3.0m	
					3.5m	
					4.0m	
					4.5m	
					5.0m	

ELEVATION:

Orientation

REMARKS (pit stability / water encountered)
Very unstable below 0.75m / water flowing in at 2m in NW end - not enough to sample, pit collapsing constantly.

SAMPLE DESCRIPTION:

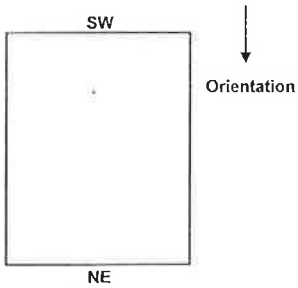
PARKMAN ENVIRONMENT, Parkman House, Lloyd Drive, Ellesmere Port, South Wirral CH65 9HQ
TELEPHONE: 0151 356 5555 FACSIMILE: 0151 356 4225

Trial Pit Log

CLIENT:	CONSULTANT:		PROJECT:		TRIAL PIT:
Bord Gàis	Parkman Environment		Limerick Gasworks		TP 32
LOGGED BY:	PLANT:	DATE:	ORIENTATION:	PIT DIMENSIONS	JOB NUMBER:
OK	JCB 3CX	27/02/2001	SW - NE	1.2 x 2.3 x 3.5m	25837

SAMPLE Depth (m)	SAMPLE No.	WATER	DESCRIPTION	LEGEND	DEPTH (THICKNESS) (m)	LEVEL (m O.D.)
0.2m	1		0.1m - MADE GROUND. Loose grey medium to coarse angular to sub rounded gravel hardcore with some fine angular to rounded gravel of limestone. 0.5m - MADE GROUND. Loose brown/black stained sandy fine to coarse angular to rounded gravel of brick clinker, slate, limestone with a hydrocarbon odour. 0.9m MADE GROUND. Loose light brown/grey medium to coarse lime sand with some fine to coarse angular to rounded gravel of lime.		0.5m	
			1.9m MADE GROUND. Compact dark brown clayey slightly sandy fine to coarse angular to rounded gravel of brick with some angular cobbles of brick (demolition rubble).		1.0m 1.5m	
2.4	2		2.6m MADE GROUND. Soft grey/mottled black silty sandy very gravelly clay with much fine to coarse angular to rounded gravel of brick and limestone.		2.0m 2.5m	
3.4	3		DISTURBED GROUND. Soft grey/mottled black silty gravelly CLAY with slight organic odour and some whole and fragmented shells (disturbed natural ground).		3.0m 3.5m	
			Trial pit ended @ 3.5m		4.0m 4.5m 5.0m	

ELEVATION:



REMARKS (pit stability / water encountered)

Slightly unstable between 0.9 - 1.9m / small amount of water in base of hole.

SAMPLE DESCRIPTION:

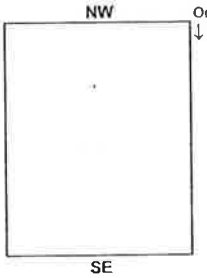
PARKMAN ENVIRONMENT, Parkman House, Lloyd Drive, Ellesmere Port, South Wirral CH65 9HQ
TELEPHONE: 0151 356 5555 FACSIMILE: 0151 356 4225

Trial Pit Log

CLIENT:	CONSULTANT:		PROJECT:		TRIAL PIT:
Bord Gàis	Parkman Environment		Limerick Gasworks		TP 33
LOGGED BY:	PLANT:	DATE:	ORIENTATION:	PIT DIMENSIONS	JOB NUMBER:
OK	JCB - 3CX	27/02/2001	NW - SE	1.4 x 2.8 x 2.7m	25837

SAMPLE Depth (m)	SAMPLE No.	WATER	DESCRIPTION	LEGEND	DEPTH (THICKNESS) (m)	LEVEL (m O.D.)
			0.1m - MADE GROUND. Mass Concrete.			
			0.3m - MADE GROUND - Loose brown sandy fine to coarse angular gravel of brick fragments.			
0.6	1		1.8m - MADE GROUND - Loose light brown/grey with some minty green patches medium to coarse lime sand with some fine to coarse angular to rounded gravel of lime interbedded with soft to firm slightly clayey silt layers with occasional fine angular to rounded gravel of brick, limestone and lime fragments between 0.5 - 0.65m and 1.4 - 1.6m.		0.5m 1.0m	
1.5	2				1.5m	
2.4 2.5	3	4	Soft grey mottled black clayey SILT with some fine to coarse angular to rounded gravel of limestone, some wood debris at top of layers below 2.6m, limestone boulders hindering excavation.	▼	2.0m 2.5m	
			Trial pit ended @ 2.7m due to difficult excavation with boulders - possible rockhead?		3.0m 3.5m 4.0m 4.5m 5.0m	

ELEVATION:



REMARKS (pit stability / water encountered)

Sides unstable below 2m/ grey water filling in pit from 2.5m in west wall; filled to 2.5m in 10 minutes.

SAMPLE DESCRIPTION:

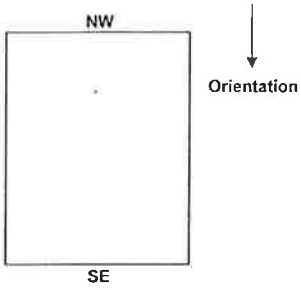
PARKMAN ENVIRONMENT, Parkman House, Lloyd Drive, Ellesmere Port, South Wirral CH65 9HQ
TELEPHONE: 0151 356 5555 FACSIMILE: 0151 356 4225

Trial Pit Log

CLIENT:	CONSULTANT:		PROJECT:		TRIAL PIT:
Bord Gàis	Parkman Environment		Limerick Gasworks		TP 34
LOGGED BY:	PLANT:	DATE:	ORIENTATION:	PIT DIMENSIONS	JOB NUMBER:
OK	JCB 3CX	27-28/02/01	NW - SE	1.1 x 3.1 x 3.1m	25837

SAMPLE Depth (m)	SAMPLE No.	WATER	DESCRIPTION	LEGEND	DEPTH (THICKNESS) (m)	LEVEL (m O.D.)
0.3m	1		0.5m MADE GROUND. Loose brown fine to coarse angular to sub angular gravel of ash, clinker and brick.		0.5m	
			0.75m MADE GROUND. Mass Concrete.			
1.2m	2		1.3m MADE GROUND. Loose brown/dark brown medium to coarse sand with much fine to coarse angular to rounded gravel of brick, limestone and some ash and clinker; occasional large metal pieces and whole bricks, slight hydrocarbon odour in places.		1.0m	
2.0m 2.05m	3	4	2.7m MADE GROUND. Compact dark grey/black fine to coarse angular to sub rounded gravel of clinker ash, and brick with many clay and silt rich patches; tarry odour and appearance.	▼	1.5m 2.0m 2.5m	
3.0m	5		Soft grey clayey slightly sandy SILT with occasional shells, some egg shells found; in places very sandy.		3.0m	
			Trial pit ended @ 3.1m		3.5m 4.0m 4.5m 5.0m	

ELEVATION:



REMARKS (pit stability / water encountered)

Stable/black water with hydrocarbon sheen and odour entering @ 2.05m; settled to 2.65m after 10 mins.

SAMPLE DESCRIPTION:

PARKMAN ENVIRONMENT, Parkman House, Lloyd Drive, Ellesmere Port, South Wirral CH65 9HQ
TELEPHONE: 0151 356 5555 FACSIMILE: 0151 356 4225

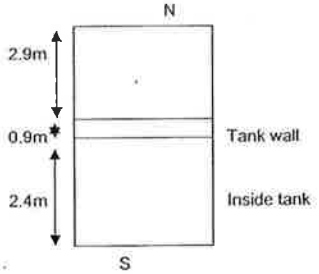
Trial Pit Log

CLIENT:	CONSULTANT:		PROJECT:		TRIAL PIT:
Bord Gàis	Parkman Environment		Limerick Gasworks		TP35
LOGGED BY:	PLANT:	DATE:	ORIENTATION:	PIT DIMENSIONS	JOB NUMBER:
OK	JCB 3CX	28/02/2001	N-S	1.4 x 6.2 x 3.1m	25837

SAMPLE Depth (m)	SAMPLE No.	WATER	DESCRIPTION	LEGEND	DEPTH (THICKNESS) (m)	LEVEL (m O.D.)
			0.5m -MADE GROUND- Loose brown slightly clayey sandy fine to coarse, angular to rounded gravel of brick, ash, tarmac, grass at top of layer.		0.5m	
			2.8m - MADE GROUND - Compact to very compact brown/red m-c a sub a gravel of ash, clinks and brick with iron oxide staining.			
1.0m	1*		MADE GROUND - Loose light brown/grey m-c lime sand with some fine to coarse, angular to rounded gravel of lime. Below 2.6m water contaminating fill.		1.0m	
1.5m		2*	INSIDE TANK: MADE GROUND - Loose to compact dark brown slightly clayey very gravelly medium to coarse sand with many angular cobbles of limestone, strong tarry odour, black tarry water standing at 1.5m - excavation ended at 1.8m within tank.		1.5m	
2.0m	3				2.0m	
					2.5m	
3.0m	4		Soft dark grey clayey slightly sandy SILT with strong hydrogen sulphide odour	▼	3.0m	
			Trial pit ended at 3.1m		3.5m	
					4.0m	
					4.5m	
					5.0m	

* Samples within tank

ELEVATION:



Orientation ↓

REMARKS (pit stability / water encountered)
Unstable/brown water standing @ 3.0m outside tank.

SAMPLE DESCRIPTION:

PARKMAN ENVIRONMENT, Parkman House, Lloyd Drive, Ellesmere Port, South Wirral CH65 9HQ
TELEPHONE: 0151 356 5555 FACSIMILE: 0151 356 4225

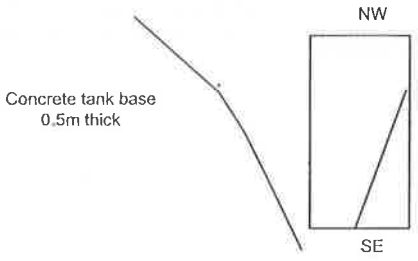
Trial Pit Log

CLIENT:	CONSULTANT:	PROJECT:	TRIAL PIT:
Bord Gàis	Parkman Environment	Limerick Gasworks	TP36

LOGGED BY:	PLANT:	DATE:	ORIENTATION:	PIT DIMENSIONS	JOB NUMBER:
OK	JCB 3CX	02/03/2001	NW-SE	1.5 x 3.5 x 2.4m	25837

SAMPLE Depth (m)	SAMPLE No.	WATER	DESCRIPTION	LEGEND	DEPTH (THICKNESS) (m)	LEVEL (m O.D.)
			0.2m - MADE GROUND - Loose slightly clayey gravelly fine to medium sand with occasional brick fragments and plastic, many rootlets and grass at top of layer.			
0.5m	1		MADE GROUND - Loose to compact light brown/grey sandy medium to coarse angular to sub angular gravel of limestone		0.5m	
					1.0m	
					1.5m	
2.2m		2			2.0m	
2.3m	3		below water line gravel becomes grey with slight hydrocarbon odour	▼		
			Trial pit ended at 2.4m		2.5m	
					3.0m	
					3.5m	
					4.0m	
					4.5m	
					5.0m	

ELEVATION:



REMARKS (pit stability / water encountered)
Unstable below 0.2m/grey water with h/c odour standing @ 2.2m

SAMPLE DESCRIPTION:

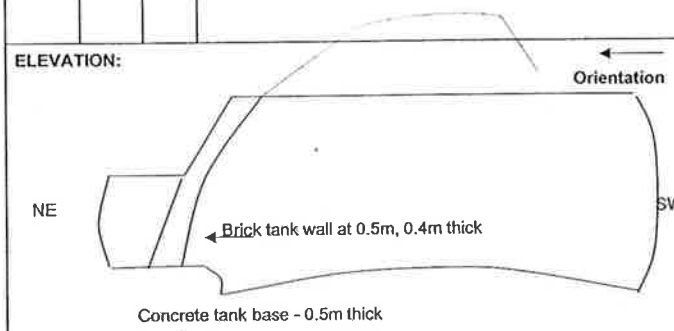
PARKMAN ENVIRONMENT, Parkman House, Lloyd Drive, Ellesmere Port, South Wirral CH65 9HQ
TELEPHONE: 0151 356 5555 FACSIMILE: 0151 356 4225

Trial Pit Log

CLIENT:	CONSULTANT:		PROJECT:		TRIAL PIT:
Bord Gáis	Parkman Environment		Limerick Gasworks		TP37
LOGGED BY:	PLANT:	DATE:	ORIENTATION:	PIT DIMENSIONS	JOB NUMBER:
OK	JCB 3CX	02/03/2001	SW-NE	1.6 x 3.6 x 1.2m	25837

SAMPLE Depth (m)	SAMPLE No.	WATER	DESCRIPTION	LEGEND	DEPTH (THICKNESS) (m)	LEVEL (m O.D.)
0.2	1		0.05 - MADE GROUND - Loose slightly clayey gravelly fine to medium sand with occasional brick fragments and plastic, many rootlets and grass at top of layer.			
			MADE GROUND - Loose to compact light brown/grey sandy medium to coarse angular to sub angular gravel of limestone		0.5m	
1		2		▼	1.0m	
1.1	3		TP abandoned @ 1.2m due to water level and pit collapse		1.5m	
					2.0m	
					2.5m	
					3.0m	
					3.5m	
					4.0m	
					4.5m	
					5.0m	

ELEVATION:



REMARKS (pit stability / water encountered)
Very unstable / light brown water with slight hydrocarbon and sheen standing at 1.0m.

SAMPLE DESCRIPTION:

PARKMAN ENVIRONMENT, Parkman House, Lloyd Drive, Ellesmere Port, South Wirral CH65 9HQ
TELEPHONE: 0151 356 5555 FACSIMILE: 0151 356 4225

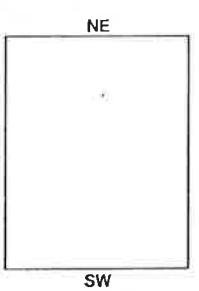
Trial Pit Log

CLIENT:	CONSULTANT:	PROJECT:	TRIAL PIT:
Bord Gàis	Parkman Environment	Limerick Gasworks	TP 38

LOGGED BY:	PLANT:	DATE:	ORIENTATION:	PIT DIMENSIONS	JOB NUMBER:
OK	JCB 3CX	27/02/2001	NE - SW	1.3 x 3.3 x 1.7m	25837

SAMPLE Depth (m)	SAMPLE No.	WATER	DESCRIPTION	LEGEND	DEPTH (THICKNESS) (m)	LEVEL (m O.D.)
			0.2m - MADE GROUND. Reinforced Concrete			
0.5	1		1.3m - MADE GROUND. Loose - medium compact brown sandy gravel of brick and iron oxide fragments with many coarse angular gravel to cobble sized iron oxide fragments.		0.5m 1.0m	
1.5 1.55	2	3	MADE GROUND. Compact to very compact slightly sandy, slightly gravelly angular cobbles of limestone with some demolition rubble.	▼	1.5m	
			Trial pit abondoned @ 1.7m due to pit collapse and water obscuring view.		2.0m 2.5m 3.0m 3.5m 4.0m 4.5m 5.0m	

ELEVATION:



REMARKS (pit stability / water encountered)

Very unstable below 0.2m/brown water standing @ 1.55m.

SAMPLE DESCRIPTION:

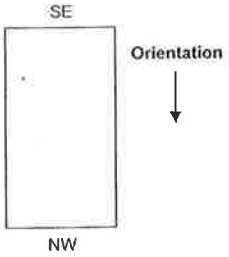
PARKMAN ENVIRONMENT, Parkman House, Lloyd Drive, Ellesmere Port, South Wirral CH65 9HQ
TELEPHONE: 0151 356 5555 FACSIMILE: 0151 356 4225

Trial Pit Log

CLIENT:	CONSULTANT:		PROJECT:		TRIAL PIT:
Bord Gàis	Parkman Environment		Limerick Gasworks		TP 39
LOGGED BY:	PLANT:	DATE:	ORIENTATION:	PIT DIMENSIONS	JOB NUMBER:
OK	JCB 3CX	28/02/2001	SE - NW	1.1 x 3.8 x 3m	25837

SAMPLE Depth (m)	SAMPLE No.	WATER	DESCRIPTION	LEGEND	DEPTH (THICKNESS) (m)	LEVEL (m O.D.)
			0.4m - MADE GROUND. Loose brown clayey sand with some fine to coarse angular to rounded gravel of limestone and brick with many rootlets and grass at the top.			
0.5	1		0.6m - MADE GROUND. Compact dark grey/black with blue staining (especially between 0.4 - 0.6m in south west side) very sandy fine to coarse angular to rounded gravel of ash, brick and limestone: some patches of spent lime.		0.5m	
			1.2 - MADE GROUND - Compact to very compact brown/red medium to coarse, angular to sub angular gravel of ash, clinks and brick with iron oxide staining.		1.0m	
1.5	2		MADE GROUND - Loose light brown/grey medium to coarse lime sand with some fine to coarse, angular to rounded gravel of lime, Below 2.6m water contaminating fill.		1.5m	
					2.0m	
2.6		3		▼	2.5m	
2.8	4					
					3.0m	
			Trial pit ended at 3.0m			
					3.5m	
					4.0m	
					4.5m	
					5.0m	

ELEVATION:



REMARKS (pit stability / water encountered)
Stable/dark grey water with oily sheen and tarry odour standing at 2.6m

SAMPLE DESCRIPTION:

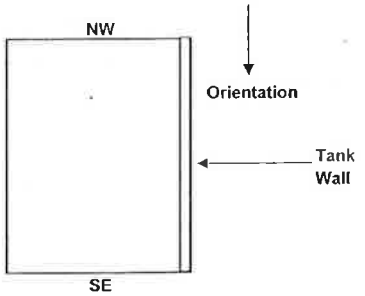
PARKMAN ENVIRONMENT, Parkman House, Lloyd Drive, Ellesmere Port, South Wirral CH65 9HQ
TELEPHONE: 0151 356 5555 FACSIMILE: 0151 356 4225

Trial Pit Log

CLIENT:	CONSULTANT:		PROJECT:		TRIAL PIT:
Bord Gàis	Parkman Environment		Limerick Gasworks		TP40
LOGGED BY:	PLANT:	DATE:	ORIENTATION:	PIT DIMENSIONS	JOB NUMBER:
OK	JCB 3CX	28/02/2001	NW - SE	2.5 x 3.5 x 2.5m	25837

SAMPLE Depth (m)	SAMPLE No.	WATER	DESCRIPTION	LEGEND	DEPTH (THICKNESS) (m)	LEVEL (m O.D.)
			0.5m - MADE GROUND. Loose to moderately compact brown sandy fine to coarse angular to rounded gravel of brick and limestone, with many angular cobbles of tarmac, limestone and brick.		0.5m	
0.7m	1		1.9m - MADE GROUND. Compact light brown / brown sandy gravelly clay with many angular cobbles of limestone.		1.0m 1.5m	
2.2 m	2		MADE GROUND. Very compact grey/black sandy gravelly clay with many angular cobbles of limestone; slightly tarry odour - possible rockhead.		2.0m 2.5m	
			Trial pit abandoned @ 2.5m due to possible rockhead.		3.0m 3.5m 4.0m 4.5m 5.0m	

ELEVATION:



REMARKS (pit stability / water encountered)

Very unstable / no water

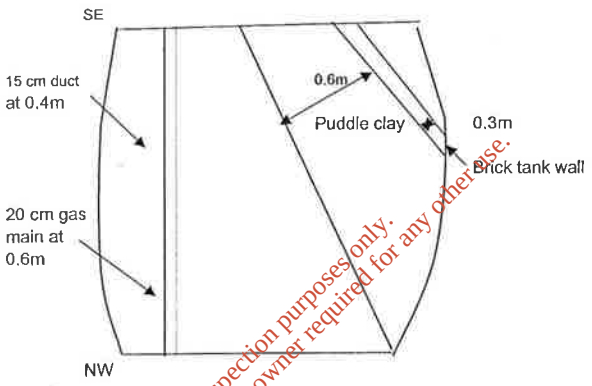
SAMPLE DESCRIPTION:

PARKMAN ENVIRONMENT, Parkman House, Lloyd Drive, Ellesmere Port, South Wirral CH65 9HQ
TELEPHONE: 0151 356 5555 FACSIMILE: 0151 356 4225

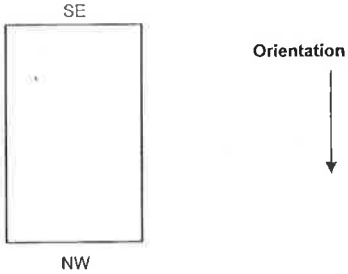
Trial Pit Log

CLIENT:	CONSULTANT:		PROJECT:		TRIAL PIT:
Bord Gàis	**Parkman Environment**		**Limerick Gasworks**		**TP41**
LOGGED BY:	PLANT:	DATE:	ORIENTATION:	PIT DIMENSIONS	JOB NUMBER:
OK	**JCB 3CX**	**02/03/2001**	**SE-NW**	**1.2 x 2.5 x 0.9m**	**25837**

SAMPLE Depth (m)	SAMPLE No.	WATER	DESCRIPTION	LEGEND	DEPTH (THICKNESS) (m)	LEVEL (m O.D.)
			0.05m- MADE GROUND- Loose slightly clayey gravelly fine to medium sand with occasional brick fragments and plastic, many rootlets and grass at top of layer.			
0.5m	1		0.2m - MADE GROUND - Loose slightly clayey gravelly fine to medium sand with occasional brick fragments and plastic, many rootlets and grass at top of layer.		0.5m	
0.8m	2		Unused duct encountered at 0.4m. Gas main encountered @ 0.6m			
			Trial pit abandoned @ 0.9m due to gas main adjacent to excavation		1.0m	
					1.5m	
					2.0m	
					2.5m	
					3.0m	
					3.5m	
					4.0m	
					4.5m	
					5.0m	



ELEVATION:



REMARKS (pit stability / water encountered)

Stable/grey water with hydrocarbon odour and sheen standing at 0.9m

SAMPLE DESCRIPTION:

PARKMAN ENVIRONMENT, Parkman House, Lloyd Drive, Ellesmere Port, South Wirral CH65 9HQ
TELEPHONE: 0151 356 5555 FACSIMILE: 0151 356 4225

Trial Pit Log

CLIENT:	CONSULTANT:		PROJECT:		TRIAL PIT:
Bord Gàis	Parkman Environment		Limerick Gasworks		TP42
LOGGED BY:	PLANT:	DATE:	ORIENTATION:	PIT DIMENSIONS	JOB NUMBER:
OK	JCB 3CX	02/03/2001	NE-SW	1.7 x 3.3 x 0.5m	25837

SAMPLE Depth (m)	SAMPLE No.	WATER	DESCRIPTION	LEGEND	DEPTH (THICKNESS) (m)	LEVEL (m O.D.)
0.3m 0.4m	1 2		0.04m - MADE GROUND - compact dark grey/black sandy silty fine to coarse angular to rounded gravel and limestone 0.5m - compact brown sandy medium to course angular to rounded GRAVEL of limestone with many angular cobbles of limestone (weathered rock), @ 0.5m rockhead encountered, traces of tar within rock. Trial pit ended @ 0.5m due to rockhead		0.5m 1.0m 1.5m 2.0m 2.5m 3.0m 3.5m 4.0m 4.5m 5.0m	

ELEVATION:

NE

Orientation

SW

REMARKS (pit stability / water encountered)
stable/brown water with hydrocarbon sheen, slight odour and a few globules of tar standing @ 0.4m

SAMPLE DESCRIPTION:

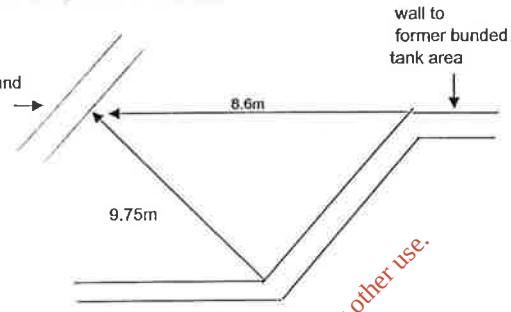
PARKMAN ENVIRONMENT, Parkman House, Lloyd Drive, Ellesmere Port, South Wirral CH65 9HQ
TELEPHONE: 0151 356 5555 FACSIMILE: 0151 356 4225

Trial Pit Log

CLIENT:	CONSULTANT:	PROJECT:	TRIAL PIT:
Bord Gàis	Parkman Environment	Limerick Gasworks	TP43

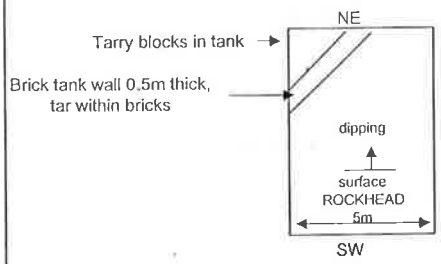
LOGGED BY:	PLANT:	DATE:	ORIENTATION:	PIT DIMENSIONS	JOB NUMBER:
OK	JCB 3CX	01/03/2001	NE-SW	5 x 9 x 0.5m	25837

SAMPLE Depth (m)	SAMPLE No.	WATER	DESCRIPTION	LEGEND	DEPTH (THICKNESS) (m)	LEVEL (m O.D.)
0.4m	1		MADE GROUND - Loose to compact brown sandy, very gravelly clay fill with many angular cobbles of limestone, some patches of brown/ light brown clay, rock head @ 0.5m - tar visible in fissures in the rock.		0.5m	
			Trial pit ended at 0.5m due to rockhead.			



1.0m
1.5m
2.0m
2.5m
3.0m
3.5m
4.0m
4.5m
5.0m

ELEVATION:



Orientation

9m

REMARKS (pit stability / water encountered)
stable/no water

SAMPLE DESCRIPTION:

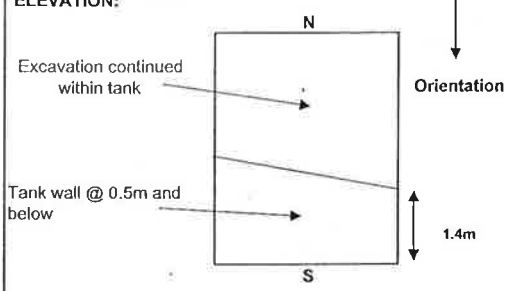
PARKMAN ENVIRONMENT, Parkman House, Lloyd Drive, Ellesmere Port, South Wirral CH65 9HQ
TELEPHONE: 0151 356 5555 FACSIMILE: 0151 356 4225

Trial Pit Log

CLIENT:	CONSULTANT:		PROJECT:		TRIAL PIT:
Bord Gàis	Parkman Environment		Limerick Gasworks		TP 47
LOGGED BY:	PLANT:	DATE:	ORIENTATION:	PIT DIMENSIONS	JOB NUMBER:
OK	JCB 3CX	27/02/2001	N -S	1.4 x 4.4 x 3.5m	25837

SAMPLE Depth (m)	SAMPLE No.	WATER	DESCRIPTION	LEGEND	DEPTH (THICKNESS) (m)	LEVEL (m O.D.)
			0.4m MADE GROUND. Loose brown sandy gravelly clay with some rootlets.			
			1.1m MADE GROUND. Soft silty sand with tarry appearance and odour.		0.5m	
1.0 m	1				1.0m	
			MADE GROUND. Soft brown sandy gravelly clay with some angular cobble to boulder sized limestone fragments and some whole and fragmented bricks; hydrocarbon odour; becoming wet and tarry below 2.5m.		1.5m	
2.0 m	2				2.0m	
					2.5m	
2.75 m		3		▼		
3.0 m	4				3.0m	
			Trial pit ended @ 3.5m		3.5m	
					4.0m	
					4.5m	
					5.0m	

ELEVATION:



REMARKS (pit stability / water encountered)

Unstable throughout / black water standing @ 2.75m in 5 minutes.

SAMPLE DESCRIPTION:

PARKMAN ENVIRONMENT, Parkman House, Lloyd Drive, Ellesmere Port, South Wirral CH65 9HQ
TELEPHONE: 0151 356 5555 FACSIMILE: 0151 356 4225

Trial Pit Log

CLIENT:	CONSULTANT:		PROJECT:		TRIAL PIT:
Bord Gàis	Parkman Environment		Limerick Gasworks		TP48
LOGGED BY:	PLANT:	DATE:	ORIENTATION:	PIT DIMENSIONS	JOB NUMBER:
OK	JCB 3CX	01/03/2001	N-S	1.5 x 3.5 x 3.6m	25837

SAMPLE Depth (m)	SAMPLE No.	WATER	DESCRIPTION	LEGEND	DEPTH (THICKNESS) (m)	LEVEL (m O.D.)
			MADE GROUND - soft slightly sandy very gravelly clay fill with many cobbles of limestone, some pottery frags, brick, pipes and cables, tarry appearance and odour, heavier with depth, liquid tar oozing in places.		0.5m 1.0m	
1.5m	1				1.5m	
					2.0m	
2.5m	2				2.5m	
					3.0m	
3.5m		3			3.5m	
					4.0m	
					4.5m	
					5.0m	

ELEVATION:

N

S

Orientation

REMARKS (pit stability / water encountered)
Unstable/fast, black water entry @ 2.2m in North end, filled to 3.0m in 5 mins / hydrocarbon odour and sheen

SAMPLE DESCRIPTION:

PARKMAN ENVIRONMENT, Parkman House, Lloyd Drive, Ellesmere Port, South Wirral CH65 9HQ
TELEPHONE: 0151 356 5555 FACSIMILE: 0151 356 4225

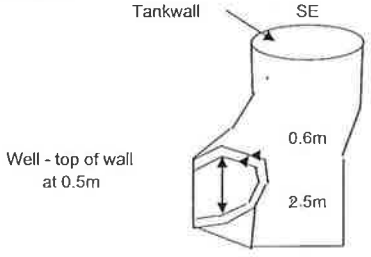
Trial Pit Log

CLIENT:	CONSULTANT:		PROJECT:		TRIAL PIT:
Bord Gàis	Parkman Environment		Limerick Gasworks		TP49
LOGGED BY:	PLANT:	DATE:	ORIENTATION:	PIT DIMENSIONS	JOB NUMBER:
OK	JCB 3CX	28/02/2001	SE-NW	3.5 x 5.5 x 2.7m	25837

SAMPLE Depth (m)	SAMPLE No.	WATER	DESCRIPTION	LEGEND	DEPTH (THICKNESS) (m)	LEVEL (m O.D.)
0.3m	1		0.45m -MADE GROUND- Loose brown slightly clayey sandy fine to coarse, angular to rounded gravel of brick, ash, tarmac, grass at top of layer.		0.5m	
			MADE GROUND - Compact clayey sandy fine to coarse, angular to rounded gravel of brick, limestone and concrete with many angular cobbles of limestone and concrete, very clayey in places.		1.0m	
1.5m	2				1.5m	
					2.0m	
2.4m		3		▼	2.5m	
2.6m	4		TP ended at 2.7m.			
			INSIDE WELL (WELL @ 0.5m): MADE GROUND - Loose grey/dark grey slightly silty sandy fine to coarse, angular to rounded gravel with many angular cobbles of limestone with tarry coating. Water standing @ 0.7m in well with tarry odour, well is at least 1.5m deep. Well is of concrete construction similar to 'Rowley Rag' type in concrete ie. with many angular inclusions.		3.0m	
					3.5m	
					4.0m	
0.5m well water	5*	6*			4.5m	
					5.0m	

* Samples within well

ELEVATION:



REMARKS (pit stability / water encountered)
very unstable/brown water with much silt, slight hydrocarbon odour and sheen standing @ 2.4m

SAMPLE DESCRIPTION:

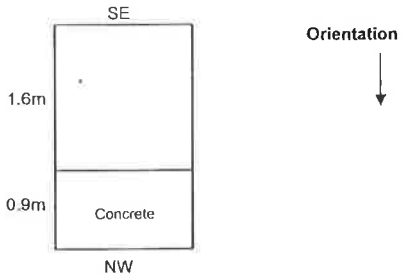
PARKMAN ENVIRONMENT, Parkman House, Lloyd Drive, Ellesmere Port, South Wirral CH65 9HQ
TELEPHONE: 0151 356 5555 FACSIMILE: 0151 356 4225

Trial Pit Log

CLIENT:	CONSULTANT:		PROJECT:		TRIAL PIT:
Bord Gàis	Parkman Environment		Limerick Gasworks		TP51
LOGGED BY:	PLANT:	DATE:	ORIENTATION:	PIT DIMENSIONS	JOB NUMBER:
OK	JCB 3CX	03/03/2001	SE-NW	1.2 x 2.5 x 1.35m	25837

SAMPLE Depth (m)	SAMPLE No.	WATER	DESCRIPTION	LEGEND	DEPTH (THICKNESS) (m)	LEVEL (m O.D.)
0.3m	1		0.45m - MADE GROUND - Compact black/dark brown tarmac surfacing and sandy fine to coarse angular to rounded gravel, becoming tarry towards base with tarry odour.			
1.0m	2		MADE GROUND - Compact black sandy fine to coarse angular to rounded gravel with many angular cobbles of reinforced concrete and reinforcing bar, very tarry odour and appearance, very difficult to excavate.		0.5m, 1.0m	
1.25m		3		▼		
			Trial pit abandoned @ 1.35m due to difficulty of excavation		1.5m, 2.0m, 2.5m, 3.0m, 3.5m, 4.0m, 4.5m, 5.0m	

ELEVATION:



Orientation ↓

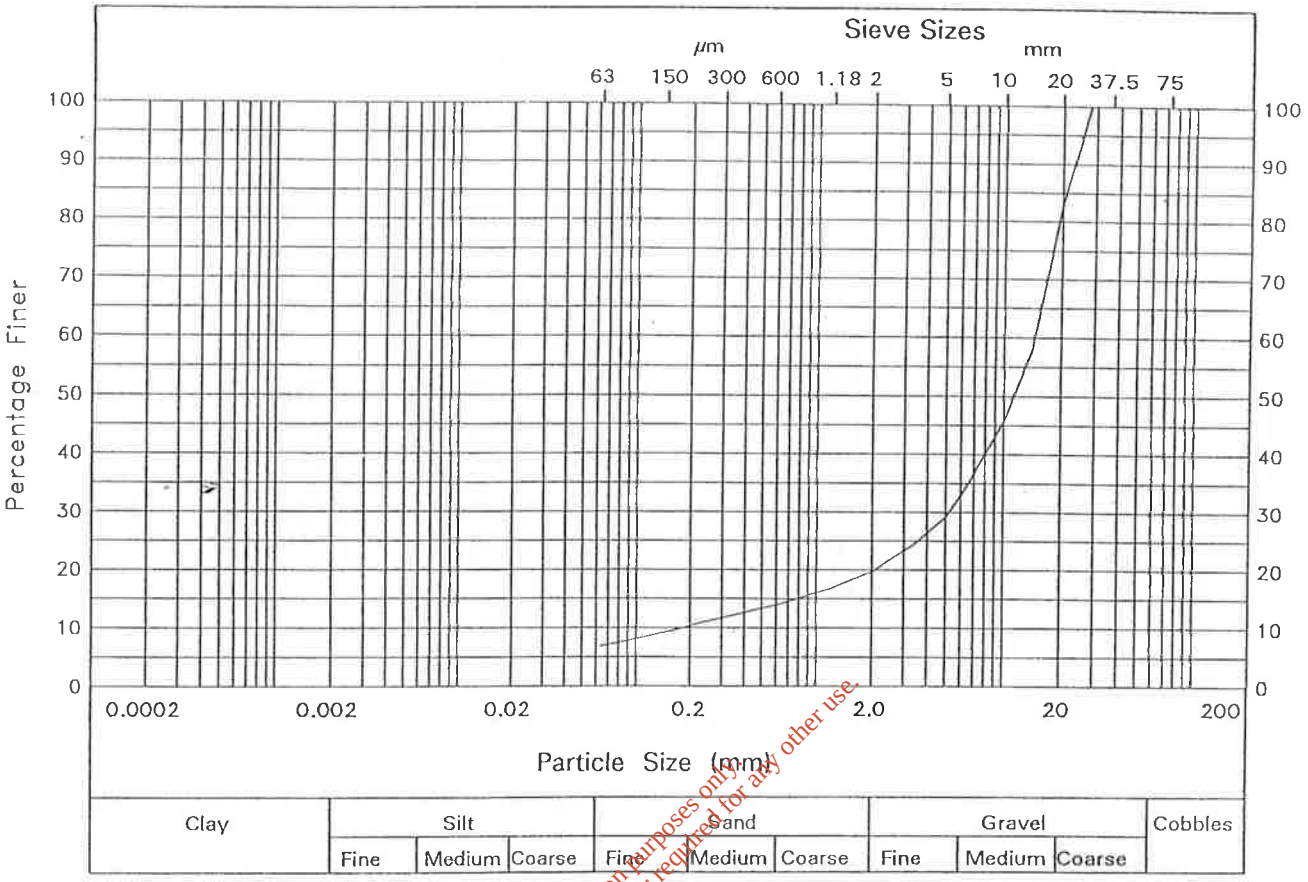
REMARKS (pit stability / water encountered)
Stable/black water with very tarry odour and appearance, and a hydrocarbon sheen standing @ 1.25m

SAMPLE DESCRIPTION:

PARKMAN ENVIRONMENT, Parkman House, Lloyd Drive, Ellesmere Port, South Wirral CH65 9HQ
TELEPHONE: 0151 356 5555 FACSIMILE: 0151 356 4225

GAS MONITORING RESULTS

Sampling Date	05/04/2001				10/05/2001							
Gas Results	CH_4 %	CO_2 %	O_2%	Water Level mbgl	CH_4 %	CO_2%	O_2%	Water Level mbgl	CH_4 %	CO_2%	O_2%	Water Level mbgl
BH31	0	0	20.3	1.9	0	0	20.6	2.8				
BH32	0	0.1	18.3	1.34	0	0	20.5	1.42				
BH33	0.3	0	15.9	0.8	0	0	20.7	0.37				
BH34	0	0.2	19.8	0	0	0	20.6	2.85				
BH11	-	-	-	-	0.2	0	20.2	-				

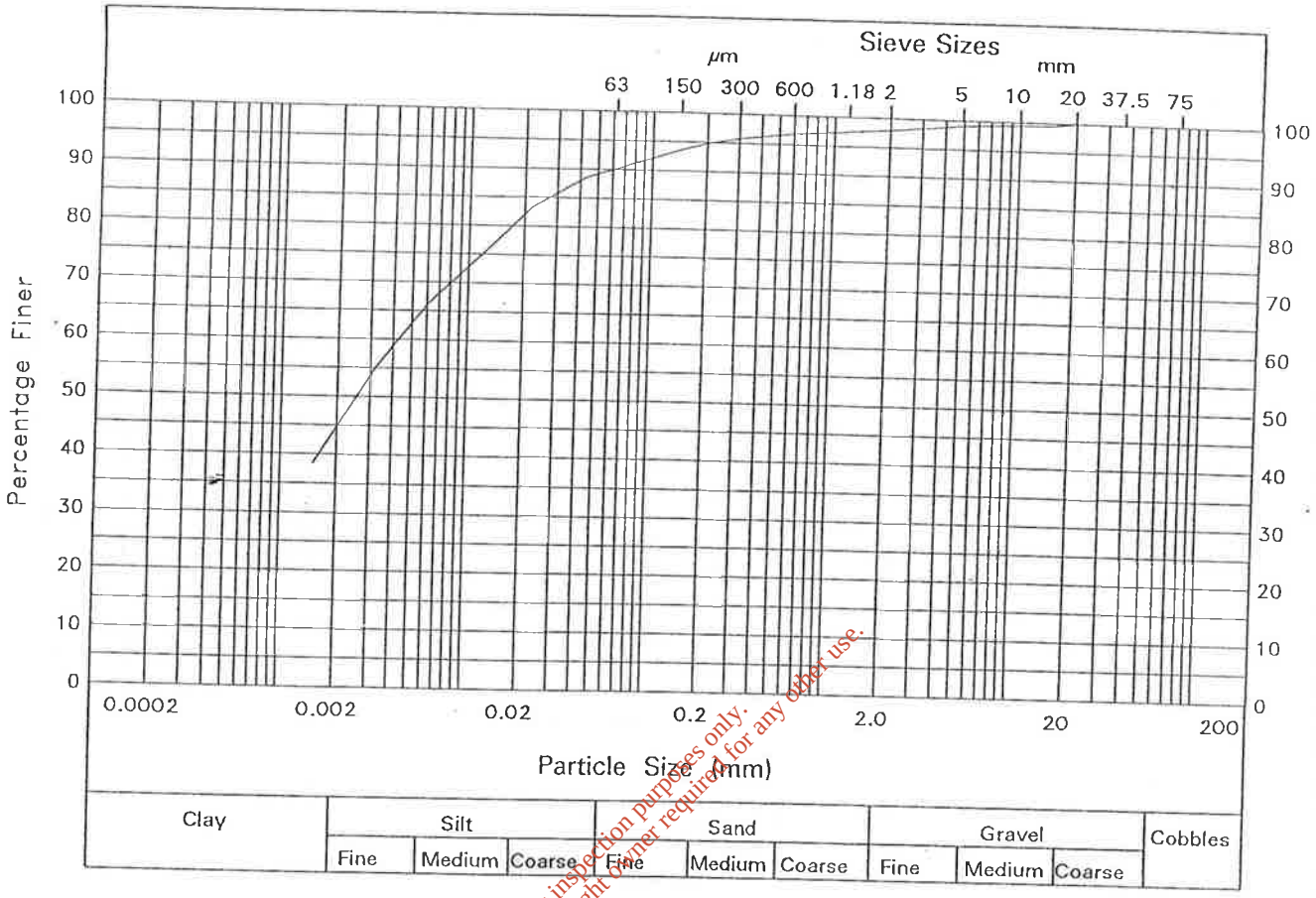


Particle Size	% Passing	Particle Size	% Passing
28 mm	100	150 µm	9
20 mm	83	75 µm	7
14 mm	58	63 µm	7
10 mm	46		
6.3 mm	34		
5 mm	29		
3.35 mm	24		
2 mm	20		
1.18 mm	17		
600 µm	14		
300 µm	12		
212 µm	11		

Hole TP 36	Description *Light brown sl sandy GRAVEL
Depth 0.50 -0.50	
Type B	
Test Performed Wet	Uniformity Coefficient = 77

Form 25/4

Laboratory - Particle Size Plot	**Project** Limerick Gas Works Parkman Environmental	**Contract** 171016/2
GEOTECH		**Sheet**

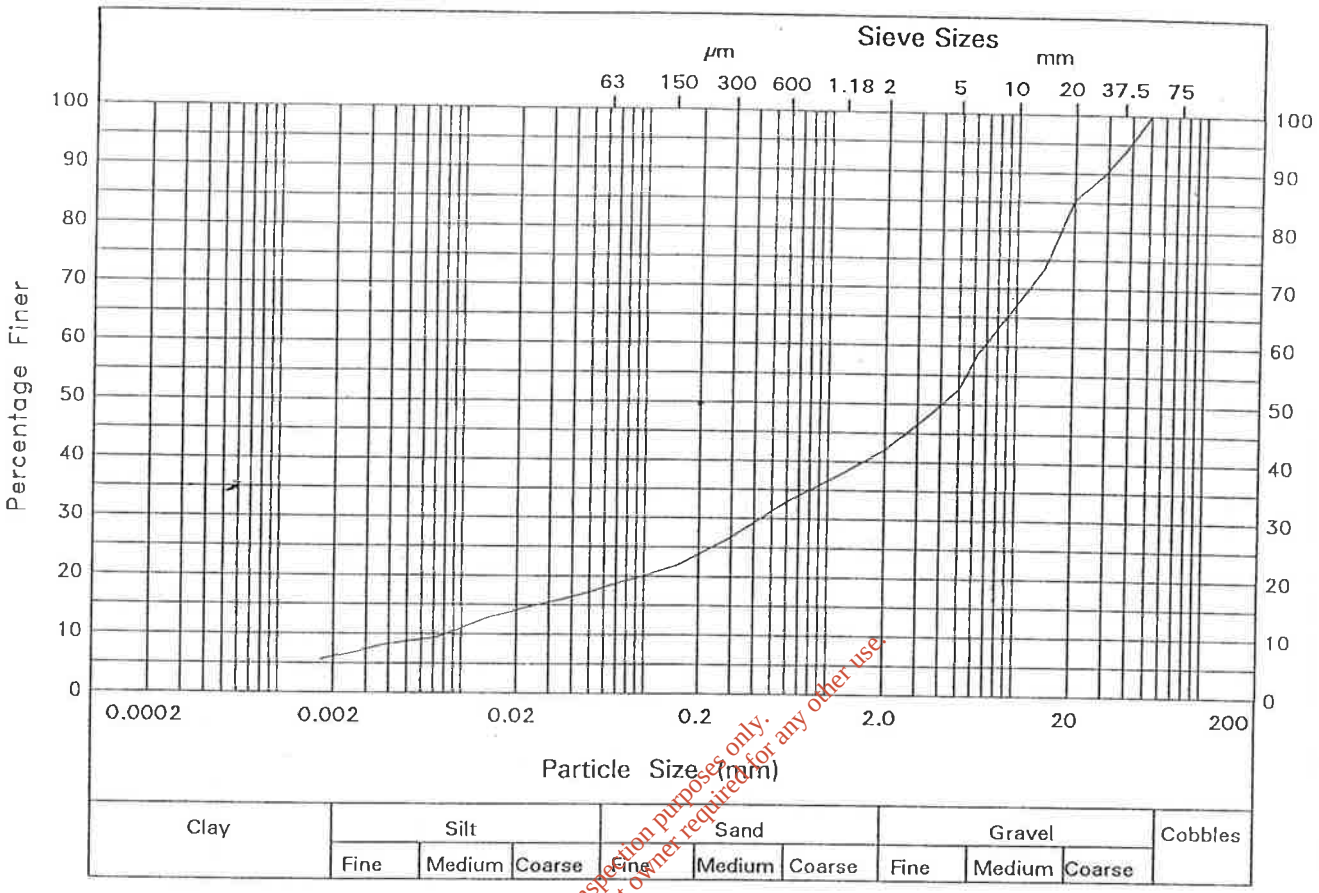


Particle Size	% Passing	Particle Size	% Passing
20 mm	100	75 μm	91
14 mm	99	63 μm	90
10 mm	99	43 μm	88
6.3 mm	99	22 μm	83
5 mm	99	12 μm	75
3.35 mm	99		
2 mm	98		
1.18 mm	97		
600 μm	97		
300 μm	96		
212 μm	95		
150 μm	94		

Hole TP 41	Description *Brown mottled black very sl gravelly stiff CLAY
Depth 0.50 -0.50	
Type B	
Test Performed Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot GEOTECH	**Project** Limerick Gas Works Parkman Environmental	**Contract** 171016/2 **Sheet**



Particle Size	% Passing	Particle Size	% Passing
50 mm	100	300 μm	27
37.5 mm	94	212 μm	24
28 mm	89	150 μm	22
20 mm	85	75 μm	19
14 mm	73	63 μm	18
10 mm	67	50 μm	17
6.3 mm	59	26 μm	15
5 mm	53	14 μm	13
3.35 mm	48		
2 mm	42		
1.18 mm	38		
600 μm	33		

Hole BH 31	Description *Black gravel with pockets of brown CLAY
Depth 0.00 -0.50	
Type B	
Test Performed Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot	**Project** Limerick Gas Works Parkman Environmental	**Contract** 171016/2
GEOTECH		**Sheet**

Samples				Classification					Strength			Other Tests
Hole	Depth	Type	Description	<425 I_P	Prep w_L	w_P	Water %	γ_b Mg/m^3	Test	σ_3 kPa	C kPa	
BH 31	0.00 - 0.50	B	*Black gravel with pockets of brown CLAY									Particle Size analysis
TP 35	2.00 - 2.00	B	*Light brown sl gravelly SAND				30					
TP 36	0.50 - 0.50	B	*Light brown sl sandy GRAVEL									Particle Size analysis
TP 41	0.50 - 0.50	B	*Brown mottled black very sl gravelly stiff CLAY									Particle Size analysis

Remarks

Form 10/2

Laboratory - Results Summary

GEOTECH

Project
Limerick Gas Works
Parkman Environmental

Contract
171016/2

Sheet

Health & Safety Hazard Assessment

Project name	*Limerick Gasworks, Dock Road, Limerick*
Employer	*Bord Gais, Eireann*
Consulting engineer / architect	*Parkman Limited*
Is any of the investigation over land thought / known to contain hazardous materials?	*Yes*

If Yes

1, Do the contract documents define the area thought / known to contain hazardous materials?	*Yes*
2, Give details of where hazardous materials may be found.	
In any fill materials (Made Ground) encountered on site. A degree of contamination may also be encountered in the underlying natural strata (Soils and rock).	
3, Has and hazard assessment been carried out for this site? If so, by whom? *Parkman Limited*	*Yes*
4, Are details of possible hazardous materials contained in the contract documentation?	*Yes*
5, Is a hazard assessment available? *Attached*	*Yes*

Form completed by *T Brown*	
Date *14.12.00*	
On Behalf of *Parkman :Limited*	
Signature	

Specific details of areas where made ground / hazardous materials are expected

The following information is required for each area involved

Project Name	Limerick Gasworks, Dock Road, Limerick
Location	Limerick, Ireland
Exploratory Hole nos. or area	Bord Gais, Eireann
Present owner/tenent/ operator	Bord Gais, Eirean
Prevoius owner	-
Prevoius use of site	Quarry, Coal Gas Manufacturing and Purification, Land Reclamation

Brief description of nature of hazard expected By-products from the production and storage of 'Town Gas' (mainly spent oxides and tars)	
Has the site ever been used for landfill / tipping?	*Yes*
If so give details and materials thought to have been placed on site Backfilling of former underground features such as tar tanks and general raising of ground (including infilling of former quarry)	
Has the site been licensed?	*No*
if so give details	
Is the licence current	*No*

Assessment of this part of the site under SISG Classification	RED
Special Precautions to be taken – as SISG recommendation	
Additional Precautions advised *Designated clean area to be provided. No eating/smoking/drinking to be permitted outside this area. Use of personal VOC. monitoring to be provided for persons working with tar. No lighting of fires. Wear appropriate PPE and RPE for 'Red Category' site.*	

Form completed by *T Brown*
Date *14.12.00*
On Behalf of *Parkman Limited*
Signature

Checklist of hazards expected – tick as appropriate
If asterisked boxes are ticked please give more details

1	Methane	✓	(Upto 90% recorded)
2	Carbon dioxide	✓	
3	Hydrogen sulphide		
4	Other gases	✓	Hydrogen Cyanide, Phenol/Benzene Volatiles
5	Heavy metals	✓	As, Cd, Cr, Hg, S, Pb, Zn, Ni, Cu, etc
6	Polychlorinatedbiphenyls (PCB)	✓	Associated with former sub-station
7	Hydrocarbons	✓	Phenols, PAH's, BTEX
8	Phenol	✓	
9	Pesticides		
10	Asbestos	✓*	
11	Domestic refuse		
12	Industrial waste	✓	Tar may be acidic
13	pH conditions	✓	
14	Coal tars / polynuclear aromatic hydrocarbons (PAH)	✓	
15	Cyanide	✓	(spent oxide)
16	Combustability hazards (e,g, coal dust)	✓	
17	Radioactivity		
18	Weil's Disease (rats)	✓	
19	Other contaminants		

Form completed by *T Brown*	
Date *14.12.00*	
On Behalf of *Parkmead Limited*	
Signature	

Item	Site designation		
	GREEN	YELLOW	RED
Personal Protective Equipment			
Hard hat	*	*	✓
Eye protection		*	✓
Face shield		*	✓
Hand protection	*	*	✓
Overalls	*	*	
Disposable overalls			✓
Waterproof	*	*	
Disposable waterproofs			✓
Industrial boots	*	*	✓
Wellington boots with sole and toe protection	*	*	✓
Respiratory equipment		*	✓
Site equipment/services			
Mobile telephone (outside contaminated area)		*	✓
Ropes, cones and barriers			✓
Safety-warnings signs	*	*	✓
Clean water supply	*	*	✓
Changing room/washing facilities		*	✓
Decontamination unit/washing facilities			✓
Emergency equipment			
Fire extinguisher	*	*	✓
Fire blanket	*	*	✓
First aid kit	*	*	✓

Gasdetection/gas monitoring equipment (where required)
Methane (flammable gas) Hydrogen Sulphide Carbon Dioxide deficiency. Other gases and fumes

Drilling plant/safety equipment (where required)
Spark arrestors and automatic air intake shutdown valves
Air blower
Vertical exhaust stacks and air intakes should be located not less than 1.5m above ground level

RISK ASSESSMENT IN DESIGN SCHEDULE
Job Number:25837 Job Title: Limerick Gasworks

Stage: Ground Investigation

Assessor: Tony Brown 14/12/00 Signature: Date: 14/12/00

Checker: John Crowther 14/12/00 Signature: Date: 14/12/00

Sheet No. 1 of 1

Activity/ Element	Potential Hazards	Population At Risk				Risk Analysis P*S=RF				Risk Evaluation		Describe Control	Residual Risk Evaluation				Residual Risk Description	Refer To Person	Info Destination S&H Plan/ Safety file
		Contractor	Client	Public	Tenant	P	S	R	Cat. L/M/H	Eliminated	Controlled		P	S	U	C.A.T.L.R.			
Trial Pitting and Borehole Excavation	Fall into Pit	√				4	3	12	M		√	Keep away from pit excavation if possible. Stand at end pf pit. Do not enter.	2	3	6	I	Personnel falling or tripping into pit accidentally.	Project Supervisor (Construction)	S&H Plan
	Hit by machinery	√				4	5	20	M		√	Wear high visibility clothing, keep away from machinery.	1	5	5	I	Accident occurring despite controls	Project Supervisor (Construction)	S&H Plan
	Contact with contaminated material	√				6	5	30	H		√	Wear PPE & RPE for red classification site, no eating, drinking or smoking.	1	5	5	I	Damage to clothing	Project Supervisor (Construction)	S&H Plan
	Buried services	√				3	9	27	M		√	CAT scan location, use service location plan, liase with service companies. Dig hand excavated inspection pit (if in doubt).	1	9	9	I	Failure to locate services despite controls	Project Supervisor (Construction)	S&H Plan
Other personnel entering working area.	Contact with contaminated material, injury caused by tripping/ falling.			√	√	6	5	30	H		√	Public excluded from site. Tenants excluded from working areas by Contractors/Parkman Staff.	1	5	5	I	Breach by trespassers	Project Supervisor (Construction)	S&H Plan
Public present on site after completion of works.	Subsidence in area of exploratory holes –physical injury.			√	√	4	3	12	M		√	Good specification of reinstatement.	1	3	3	I	Unexpected consolidation of ground after reinstatement.	Project Supervisor (Construction)	S&H Plan
	Contact with contaminated material disturbed during investigation			√	√	4	5	20	M		√	Most heavily contaminated material to be replaced in excavations. Contaminated water to be stored in tank. Remaining contaminated material to be securely stored on site.	1	5	5	I	Contact with low levels of contamination.	Project Supervisor (Construction)	S&H Plan

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THE ENVIRONMENTAL CONSULTANCY

FAXED

FAX

To	Noel Kiely	Date	12 July 2000
Of	Waterford Corporation	Direct Contact fax/tel/e-mail	
Fax	00353 5 1870813	Job No	25836/2/1
From	Tony Brown		
Re:	Environmental Information		

Noel

I spoke to one of your colleagues this afternoon and understand that you may be able to supply the following information in connection with the site identified on the attached plan. The study area is bounded to the north by John's River and to the south by Johnstown Industrial Estate. The information is required in connection with a desk study which is being currently prepared on the site.

1. Are you aware of any substantial sources of contamination within 500m of the site which could affect the environmental integrity of the site (except for the gasworks themselves)?
2. Are there any known landfills within 500m of the site?
3. Does the Corporation have any data on Water Quality in the vicinity of the site (particularly John's River)?
4. Are there any licenced groundwater abstractions within 500m of the site?
5. Are there any licenced discharges to the river within 500m of the site?
6. Are there any cases of statutory nuisances within 500m of the site which would affect the environmental integrity of the site?

We thank you in advance for your help in this matter. If you have any queries, please do not hesitate to contact me.

Regards

Total number of pages 2	*Please contact Parkman if any pages are missing or unclear.*

Parkman Ltd
Parkman House, Lloyd Drive, Ellesmere Port, South Wirral L65 9HQ
Tel: 0151 356 5555 Fax: 0151 356 4255

1996

Certificate no FS 15024

WATERFORD CORPORATION
BISHOPS PALACE,
THE MALL,
WATERFORD.

FAX NO. 051 - 870813
TEL NO. 051 - 309900

CITY ENGINEERS

PARKMAN - EXPORT
03 AUG 2000

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To: TONY BROWN From: CHRIS O'SULLIVAN

Fax: 0044 1513564255 Pages: 1

Phone: 0044 151 356 5555 Date: 2/8/00

Re: ENVIRONMENTAL INFORMATION CC:
JOB No. 25836/2/1

☐ Urgent [x] For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

• Comments: Regrets for delay but I now confirm hereunder the following (i.e. replies in order of your queries);

(i) No.

(ii) NONE THAT WOULD HAVE BEEN USED WITHIN THE PAST (40-50) YEARS

(iii) YES. ANALYSIS OF JOHN'S RIVER WATER INDICATES SERIOUS POLLUTION. BOD, AMMONIA, PHOSPHATE, IRON LEVELS ARE HIGH. A PROGRAMME FOR IMPROVING THE WATER QUALITY IS BEING IMPLEMENTED.

(iv) NONE KNOWN.

(v) No.

(vi) No.

I trust that the above answers your queries,

Regards,

Chris O Sullivan
EE Sanitary & Environment.

TP 31

TP 31 Spoil

TP 32

TP 32 Spoil

TP 33

TP 33 Spoil

TP 34

TP 34 Spoil

TP 35

TP 35 Looking North at Tank Wall

TP 35 Looking South at Tank Wall

TP 36 Looking North West Showing Brickwall on Rignt Hand Side

TP 36 View of 0.5m Thick Gasholder Base

TP 36 Spoil

TP 37 View North Showing Brick Tank Wall

TP 37 Spoil

TP 38

TP 38 Spoil

TP 39

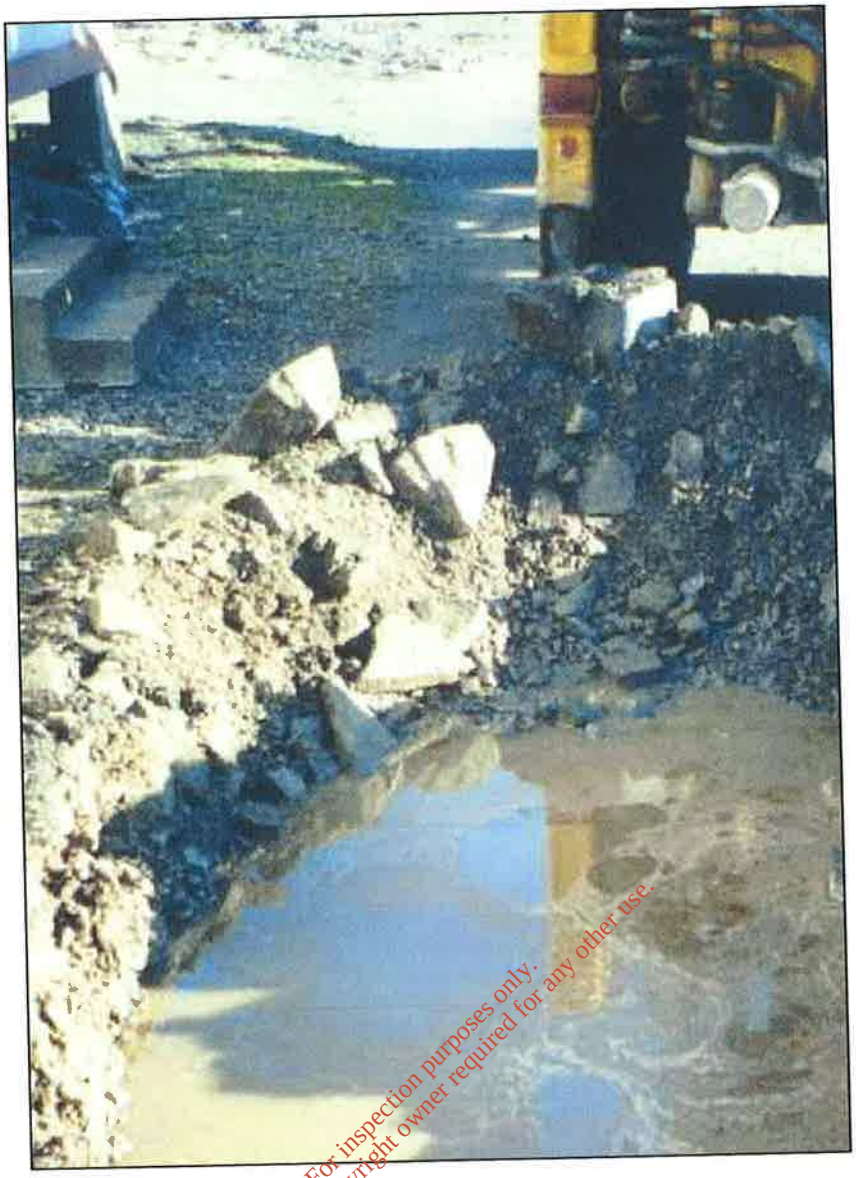
TP 39 Spoil

TP 40

TP 40 Spoil

TP 41 View South East Showing Service Duct and Gas Main in Left Hand Side

TP 41 Spoil



TP 42

TP 42 Spoil

TP 43 View North East

TP 43 View North East

TP 43 View SW

TP 47 Showing Tank Wall

TP 47 Spoil

TP 48 View North into Contents of Tank

TP 48 Spoil

TP 48B View into Contents of Tank

TP 49 View North of Wall

TP 49 View East of Wall

TP 49 View South Towards Tank Wall With Well Shown on Left Hand Side

TP 49 Spoil

TP 51

TP 51 Spoil